Section 5

KAVANGO

NoLidep
5.1 INTRODUCTION

5.1.1 Preamble

This section of the report addresses the Kavango Region and selected sites for Nolidep in the region. Key topics include socio-economic issues, vegetation cover and land uses, water resources and soils. These topics are discussed at a regional setting supporting baseline data collected during each community survey.

5.1.2 Organisation of the Section

This section of the report is organised as follows:

- Section 5.2 addresses socio-economic issues in the Kavango region;
- Section 5.3 presents baseline socio-economic issues;
- Section 5.4 gives socio-economic conclusions;
- Section 5.5 discusses vegetation cover and land use in the Kavango region;
- Section 5.6 describes baseline vegetation and land use issues;
- Section 5.7 presents vegetation and land use conclusions;
- Section 5.8 responds to water resources in the Kavango region;
- Section 5.9 outlines baseline water resources;
- Section 5.10 discusses water resource conclusions;
- Section 5.11 gives soils in the Kavango region;
- Section 5.12 describes baseline soil resources;
- Section 5.13 presents soil conclusions.
5.2.1 Historical Background

Kavango has one of the fastest growing regional populations in Namibia, and with an estimated 137,000 people, it constitutes almost 10% of the national population (NPC, 1993). The population of Rundu, the principal town, has more than doubled in the past decade, from 7,300 to 16,000. This increase has in part come about through the settlement, in recent years, of an estimated 30-40,000 refugees from Angola.

These significant increases in the regional population have not been accompanied by any marked progress in development. Despite a favourable rainfall pattern and a viable agricultural resource base, Kavango, perhaps more than any other region in the country, appears to have suffered from administrative neglect. Having avoided most of the independence war, it lacks even the basic infrastructure which the occupying forces installed in former Ovamboland and to a lesser extent in Caprivi.

The communal areas in the Kavango region, like all of the other communal areas in Namibia, are owned by the state. During the years of colonial rule, authority over “native affairs” (which included authority over communal lands) see-sawed back and forth between South Africa and South West African administration, reflecting the changing political relationship between the two. Although the Namibian Constitution clearly transfers ownership of all the communal lands to the Government of Namibia, it also states that all laws which were in force immediately before the date of independence remain in force until repealed or amended by an Act of Parliament, or until declared unconstitutional by a competent court. Hence many aspects of life in Kavango including the allocation of land continue to be governed by laws enacted by the colonial government and by traditional law.

The Kavango region is a large region covering 4.6 million hectares (this includes the Mukwe Constituency for Nolidep, which is now formerly part of Caprivi), but the majority of the population are settled in a narrow 5-10 kilometre strip along the south bank of the Kavango river. The lack of accessible water constrains more extensive settlement to the south. Nonetheless, the region is relatively self-sufficient in agriculture, primarily millet and livestock production, which has tended to limit the role of migrant labour. For reasons given above, Kavango seems dislocated from the rest of Namibia.

5.2.2 Demographic Characteristics

Kavango, including its old Mukwe Constituency, has one of the fastest growing
regional populations in Namibia, and with an estimated 137 000 people, 86% of whom
live in rural communities, it constitutes almost 10% of the national population. The
population of Rundu, the principal town, has more than doubled in the past decade,
from 7 300 to 16 000. This increase has in part come about through the settlement, in
recent years, of an estimated 30-40 000 refugees from Angola.

Some 95% of the population lives along the strip of land bordering the Kavango river
(which includes Rundu). Although it is up to 10 kilometres from the river, this strip of
land constitutes only 5 % of the total area.

The majority of households contain extended families with an average size of 10. Most
of these are male-headed (NPC, 1993). Nuclear families with an average size of six
constitute a large minority of households. They are frequently headed de facto by
women who do not claim to be household head but nevertheless run the household in
the absence of a male household head. The high number of these households reflects a
fairly high rate of migration in search of employment.

The population of Kavango is young - the majority are under 20. There appear to be
"too few" children aged less than five (12% of the population) relative to children aged
two to nine or 10 to 14 (15.7% and 15.6% of the population respectively)(NPC, 1993).
The most likely explanation for this imbalance is that children of primary school age
are being cared for by members of their extended family living in villages (such as the
ones surveyed) with primary schools.

The lower proportion of children reported in the 15 to 19-year-old age group could
partly be explained by the fact that children who have completed their primary
education then return to their original families. But, as primary education is usually
completed before the student is 14, this can only partly explain why the proportion of
men in the five year age groups above 19 is far less than the proportion in the age of
groups below 15 to 19. For women, there is a striking difference in the numbers aged
less than 24 and those older than 25.

Additional explanations could be a sudden jump in the birth rate around 1970 or a
decline in child mortality. However, the fact that the "cut-off point" differs for men
and women suggests that the explanation lies in outward migration. Roughly half of
men aged between 15 and 19 and half of women aged 20 and 24 can be expected to
leave the villages surveyed. For men, the cause is most likely to be job search and for
women, a mixture of job search and patrilocal marriage - where the wife joins the
husband in town.

5.2.3 Settlement Patterns

The population of Kavango comprises of five social (tribal) groups: Mbonza, Kwangali,
Shambyu, Gciriku and Mbukushu, each occupying a distinct traditionally recognised territory (see Figure 5.2a).

Languages used within the region reflect ethnic boundaries, although Kwangali is effectively the “lingua franca” and Gciriku is also spoken fairly widely. Indeed, GTZ (1991) has observed that racial distinctions were once pronounced, they are now minimal.

The people of the Kavango region, in common with the other peoples of northern Namibia, have a matrilineal society. Descent through the mother and the mother’s mother is considered to be the most important line. The five main peoples in the Kavango (including the Mukwe Constituency) from which the South African administration constructed the former five districts in that region are namely, Kwangari, M bunza, Shambyu, Gciriku and Mbukushu which are matrilineal. It cannot be said that matrilineal systems necessarily involve a more equal relationship between man and woman. In Yaron et al. (1992) it was stated that the mother’s brother was considered to be most important in the case of inheritance could be regarded as more important than the father. Yet people often live patrilocally, meaning that the wife joins the husband in his household, where his parents may also live, but other modes of residence have been found, such as avunculocal (with mother’s brother) or uxorilocal (with wife and her relatives).

5.2.4 Land Tenure and Authorities

The traditional leader of each tribal sub-region, the chief (“Hompa”), is elected from within the royal family of the sub-region, where royal descent is matrilineal. Consequently, Hompas can be female although this is relatively unusual. Currently, the traditional leader of the Shambyu region is a woman - Matumbo Angeline. The position of the Hompa can be held for life but a challenge to the incumbent can be made if a significant proportion of the local community demand it.

In making judgements concerning traditional matters, the Hompa is assisted by a council of advisors who are generally elected by the community but, occasionally may be appointed. These advisors are usually well-informed or influential individuals from the local community such as school teachers, church leaders and government officials.

Tribal sub-regions are divided into smaller localities each presided over by a headman (“Timbi”) or, in some areas, headwoman who is elected directly by the people of the locality. The headman is closely linked to the day-to-day running of village life: he arbitrates in disputes concerning land usage and allocation and coordinates cooperative activities for the village (where these occur). Where disputes cannot be satisfactorily resolved, the matter is passed on to the Hompa. However, when the locality presided over by a headman includes a number of villages, each village is likely to have its own
headman and the headman of the locality will be known as a senior or chief headman ("Nkuru Timbi").

In the past, headmen were assisted by sub-headmen who were on the pay-roll of the government, but this is generally no longer the case - only a few sub-headmen remain in this function and on a voluntary basis. In general, headmen work with and lead a village committee which typically comprises elders from the village households. Within each village the unit of social organisation is the homestead of household. Each household may consist of one or more families and generally, the family unit is the extended family. The head of the homestead or household is known as "Ntura Gumbo".

As noted above, the Kavango communal area is divided into five sub-regions. If the applicant is an inhabitant of the area in which he or she seeks land, an allocation can be made by the local headman together with the local inhabitants by way of majority vote, provided sufficient space and grazing grounds are available and the applicant has not been guilty of "undesirable conduct" in the past (Yaron et al, 1992).

If the applicants are outsiders, they will be questioned by headmen and local inhabitants. A recommendation based on the majority view of the local inhabitants is then referred to the chief headman, who may consult with the chief of the sub-region before making a decision on the application.

Yaron et al (1992) noted that a study reported that "no one pays for a land allocation in the Okavango", while another study reported that occupants pay a "tribal tax" for their use of the land, including payments for permission to run commercial undertakings, such as shops or shebeens.

Traditionally, disputes relating to land allotment and use are referred to the appropriate headman. The parties to the dispute and their witnesses appear before a traditional court comprising the headman together with his councillors or the heads of homesteads in the immediate area. The headman then makes a ruling based on the evidence presented and the opinions of the majority of the people present. A dispute which is not resolved is referred to the chief of the sub-region, who has the final say in the matter.

In 1990 the Ministry of Lands, Resettlement and Rehabilitation encouraged the five traditional authorities to set up Land and Farming Committees in each sub-region. Each of these committees has 10 members who are elected by local inhabitants. The role of the committees is to advise the chief of the sub-region on the allocation of large blocks of grazing land and in cases where disputes have arisen.
5.2.5 Rural Economy

The rural economy in Kavango is based on both subsistence production and cash income from goods or services. A typical household has a diversity of income sources provided by members of the family. This reliance on a diversity of incomes could be viewed as a form of risk minimalisation in the rural economy.

Agriculture is the predominant subsistence activity, where 97% of households (Tvedten et al., 1994) are engaged in arable agriculture. Pearl millet (mahangu) followed to a lesser extent by maize and sorghum are the staple crops in the region. Pumpkin, beans, cowpeas and ground nuts are also cultivated. These crops are cultivated on fields with an average size of 4 hectares for a household, though these could be divided into two or more.

Crop farming is wrought with risks and uncertainties associated primarily with the climate. Farmers take account of this with staggered ploughing and planting season. In addition different varieties of crops are grown to maximise upon their different qualities, while spreading the risk for agricultural production.

Livestock contributes to subsistence production. Tvedten et al. (1994) noted that 59% of households own stock, which are principally cattle. These animals provide draught power, mild and meat. Chickens are also common, while donkeys and goats appear to be less prevalent in Kavango.

Subsistence from fish is also a major contributor. This subsistence is significant for mainly inhabitants near the Okavango river. Yaron et al. (1992) reported that approximately 60% of all fish caught in the river, where consumed.

Other sources of subsistence include production of goods for the household e.g. baskets and tools.

Cash income in Kavango is scarce due to the opportunities for the sales of goods or services. Tvedten et al. (1994) noted that 22% of surveyed households have a wage earner, while only 16.5% receive remittences from family members employed outside the district. The Government appears to be the main employer associated with teachers and nurses. Migration of labour is not as widespread in Kavango as elsewhere in Namibia. Absentee household members are located in either Rundu, Windhoek or Namdeb in Oranjemund. However, the latter has been affected recently with retrenchment from the mines, as well as the withdrawal of the South African Defence Forces (SADF) leaving many unemployed.

Approximately 13% of people of Kavango, where reported in a study by Tvedten et al. (1994), to receive cash income from marketing surplus agriculture. A study by Healy
and Keen (1995) noted that this is due to the poor production from crop fields during most years. Meanwhile, the sale of livestock is a more common form of agricultural income.

The sale of traditional beer was cited by cited et al (1994) as an imported source of income. During this study, 17% of households stated this form of cash income as important.

Casual labour, particularly on crop fields, emerged as a significant form of income. Over 54% of households reported an income from this source stated Tvedten et al (1994). The payment in 1994 was approximately N$5 for a full day’s work. However, the payment was often as a form of ‘in kind’ trade for maize or mahangu.

Pensions for seniors are a main source of income for households in Kavango. The payments are paid out every two months. This cash can be a major source of income for many households in the region.
5.3 BASELINE SOCIO-ECONOMIC CONDITIONS

5.3.1 Introduction

The socio-economic issues of communities associated with Nolidep in the Kavango region was dependent upon the participation of its inhabitants, through several focus groups in each community. The results presented in this Section reflect the quality of the discussions, which vary according to the interest and knowledge of the respondents. People were prompted with questions, however, the depth of the answers often varied for different aspects of their socio-economic interests. This Section has formalised the responses into baseline information for each community, while the process for retrieval of this information was not as rigid.

5.3.2 Social Structures and Wealth

Fumbe

Fumbe village is the main village in the community (see Figure 5.3a). Mangundu and Tosha are reported to be attached to Fumbe with 4 and 9 households, respectively. The total population for the Fumbe is approximately 290 person from 31 households with approximately 9 persons in each household (Lux, 1995). The population is mainly Sambyu under the jurisdiction of Headman - Harupe Emil. There are 27 male headed households and 4 female headed households in this community.

The total number of large and small livestock held by this community are 323 cattle and 130 goats, while there are no sheep (Lux, 1995). There are 5 households without any livestock in Fumbe. However, as another indication of wealth there are 14 households without any cattle, 6 households with between 1 and 10 cattle and 11 households with more than 10 cattle.

All households in the community have crop fields. The cohort sizes for the fields with the number of households is given below:

- 1 hectare: 7 households;
- 1-2 hectares: 7 households;
- 2-5 hectares: 7 households;
- 5+ hectares: 10 households.

Crop production appears to be very significant for the wealth of this community compared against the livestock figures.
Kapupaghedi

Kapupaghedi was established over 100 years ago, when the only supply of water came from hand dug wells. Today, the Kapupaghedi community includes the main village - Kapupaghedi with Karukwa, Lilira and Shinunga (see Figure 5.3b). Headman - Mr Likuwa has jurisdiction over this community composed of Giricu, Sambyu and Kwangali tribal groups.

In Kapupaghedi, there are 21 households, while an additional 8 households are found in the other villages. Therefore, the total number is 29 households with a population of 247 people. Seven of the households are headed by women, while 22 are headed by men (Lux, 1995).

Wealth in this community was measured against livestock numbers and ownership. The total number of cattle is 411, while there are 140 goats and no sheep. There are 5 households without livestock, which includes three households without any cattle.

All the households in Kapupaghedi have crop fields, where most fields range between 1-2 hectares. Meanwhile, 8 households have large crop fields up to 10 hectares in size. Some households have a separate field for the wife and husband of the family, if the household has access to ploughs and oxen; while those without draught power have one field managed between themselves.

The main constraints identified by Lux Development in 1995 for cropping in order of severity are as follows:

- poor rainfall;
- availability of seeds
- availability of manure;
- labour requirements;
- oxen for ploughing.

Crop production is regarded as the most important enterprise for the subsistence of people in this community.

Muthinduko

The Muthinduko community is based only in the village, which was established c. 1966 (see Figure 5.3c). Before, the development of a borehole at the settlement, the only water supplies came from nearby wells. Headman - Mbereshu Papula has jurisdiction over this village inhabited by the Mbu Kushu tribal group.
Figure 5.3c  Muthinduko Resource Map
There are 12 homesteads in the village with an average of 10 persons/household. Therefore, the total population is approximately 120 persons.

The total number of livestock held by this village is 400 small stock (goats and sheep) and 350 cattle. In a mixed household, the ownership of livestock usually lies with the male head of the family. There are 2 households without any livestock in this village. However, the distribution for cattle numbers and households is as follows:

- no cattle: 2 households;
- 1-10 cattle: 6 households;
- >10 cattle: 4 households.

Crop fields are owned by every household in this village. Most households have one field of approximately 4 hectares, while the Headman has three field of a similar size.

**Nkutu**

Nkutu community is formed by the main village Nkutu with Mukundu and Mambungu (see Figure 5.3d). Nkutu village was established over 70 years ago, when the only supply of water came from hand dug wells.

Goswin Muduni is the Headman with jurisdiction over these communities. There are 26 households in the main village and Mambungu with an average population of 9 persons/household equating to approximately 235 persons. Mukundu has 25 households with an average 9 persons/household, therefore, it has a population of approximately 225 persons.

Nkutu and Mambungu are an entity, while Mukundu has separate grazing and water rights, which the entire Nkutu community can utilise during periods of need. The population in Mukundu is almost entirely Angolan, who arrived from 1982 onwards. Meanwhile, the population in the main Nkutu community is primarily from the Kwangali tribal group.

Livestock numbers for the Nukutu community are 1200 cattle and 260 small stock. Five households in the community are reported to have no cattle. These poorer families have either never owned cattle or lost them through an outbreak of disease. However, they are assisted by relatives or friends with oxen for ploughing. Most households have between 25 and 30 cattle, while the largest number of cattle owned by one household was estimated at 60-70 cattle.
Crop fields are owned by the poor and wealthy in this community. Several wealthy people have 3 crop fields over 12 hectares. Management of these fields owned by wealthy families is usually done jointly by the husband and wife. The poorest people have only 1 crop field of approximately 1 hectare in size.

**Silikunga**

Silikunga community is composed of the main village - Silikungu with Mukambo and Keni (see Figure 5.3e). The main village was established in 1959 when the only form of water came the hand dug wells.

Paulus Kamaya is the Headman with jurisdiction over for Silikunga, Mukambo and Keni. There are 33 household in Silikunga, 15 households in Mukambo and 21 households in Keni. As the average population in each household is 13, then the population for the village is approximately 900 persons.

The total number of cattle in the community is approximately 1000 with 1000 goats and no sheep. The number of people in Silikunga village without livestock is 8 households. Meanwhile, there are many people with no cattle accounting for 10 households, while 13 households have 1-10 cattle, and 10 households have more than 10 cattle.

Crop fields are important to every household. The size of the fields for most households is approximately 3 hectare, while those without livestock may have only 1 hectare. People without livestock will often have to use hand hoes to till the soil.

**5.3.3 Formal and Informal Markets**

**Fumbe**

Meatco is the only formal market for cattle, as goats are not traded by Meatco. The auction pen for this formal sale is based at Mashare located to the north of Fumbe. Livestock are taken on foot for less than 10km to this market.

The informal market is composed of informal sales at Mashare to private buyers. In addition, livestock are sold alive or slaughtered within the community. Cattle are most commonly sold, as less people own goats. Goats are used as payment to Traditional Healers. Meanwhile, they are consumed by households entertaining guests to indicate their social status. Goats appear to be associated with subsistence living, while cattle are used to generate cash. However, animals are not sold regularly. In 1995, only 24 cattle and 7 goats were sold from the entire community (Lux, 1995)
The main reasons for the sale of livestock (cattle) is as follows:

- generate cash to buy food (maize)
- generate cash for school fees;
- to pay labourers in the fields, ie labourers from 27 of the 31 households.

**Kapupaghedi**

The formal market for this community is based at Ngongo Linena auction, where both Meatco and other private buyers purchase only cattle. This market is important as informal markets are rarely used in this community. Meatco announce these markets with broadcasts on the local NBC Kwangali Service. A relatively high number of 36 cattle were sold in 1995, which may reflect the effectiveness of the market and the needs of the farmers.

Small stock are not marketed in the community as most people do not have enough money to buy a goat. Most people use goats as subsistence food, however, a relative or friend in Rundu may order a goat and pay in cash. People stated that they would like to have a market for goats, which indicates the need for cash generation. This need may be indicated by the low sale figures for goats being 5 for 1995.

The main reasons for the sale of livestock are as follows:

- to generate cash for years of low crop production;
- to purchase food;
- to pay for school fees.

**Muthinduko**

Formal markets for this village include Mukwe and Shadikongoro. Mukwe market is a formal open market managed by the Tribal Council in Mukwe. This market is an outlet for both goats and cattle. The formal market at Shadikongoro is managed by Meatco at the site of a crush pen. This market is for cattle only. This village sells approximately 10 cattle and 5 goats through these formal markets.

The informal markets are dependent on visitors or other people from outside the community buying large or small stock. If an individual wants to sell an animal, they require a written letter to prove the transaction has taken place.
The principal reasons for sale were as follows:

- to pay school fees;
- to purchase food after poor harvests;
- to restock with young goats and calves.

The farmers noted that goats were the principal livestock used to generate cash, however, old cattle were also sold for this purpose.

*Nkutu*

The nearest formal market used by the community at Nkutu is managed by Meatco in Rundu. This market will only accept cattle, while this community sells usually 1 cow/month.

Informal markets occur in Nkutu for the sale of mainly goats. Farmers sell to buyers visiting the community, however, some goats are sold by the roadside (tar road). In addition, animals are slaughtered at the homesteads of some people for sale as bush meat in the villages.

The principal reasons for the sale of both cattle and goats in Nkutu were as follows:

- to pay school fees;
- to buy foods;
- to purchase seeds;
- to pay labourers working in the crop fields.

*Silikunga*

The nearest formal market is located at Mpungu and managed by Meatco. This market will only trade in cattle, which occurs every 2 months of the year.

The informal market is stronger than the formal market, where goats and cattle are traded. The animals are sold for cash or bartered for other goods. The informal 'bush markets' selling slaughtered meat are located at Nkurenku and Mpungu.

The main reasons for the sale of livestock are as follows:

- to purchase maize;
- to buy clothes;
- to pay for school fees.
5.3.4 Local Credit Schemes

Fumbe

Currently, there are no credit systems working in the community. However, 4 households have applied for credit from Agribank, but they have not had a reply. Many people stated that they had not been properly informed about the credit schemes. If credit was available 22 households stated they would use it for crop production purposes ie fencing, pesticides, fertiliser and labour. Meanwhile 7 households would invest in livestock, ie purchasing oxen for ploughing (Lux, 1995).

Other uses of credit include hiring a tractor service, fencing material for kraals, enlargement of crop fields and procurement of implements, eg hoes and ploughs.

Kapupaghedi

There are no credit systems working in Kapupaghedi at present. However, 19 of the 29 households in the community stated that they would like to have a loan (Lux, 1995). The credit would be used for the following in order of priority:

- to purchase livestock for principally ploughing services;
- to expand crop fields requiring fencing and labour costs;
- to buy implements for crop farming.

Muthinduko

There are no credit systems operating in this village, while people in this village had no understanding of credit. However, if they could borrow money, farmers stated that would use it for the following:

- purchasing food;
- purchasing clothes;
- expanding crop fields, ie cash for labour and fencing;
- buying drugs for their livestock.

Nkutu

Currently, there are no credit schemes used in this community, however, people have heard of Agribank broadcast on the local radio service.
If people had access to credit they would invest in the following:

- restocking with goats and cattle;
- purchasing drugs for livestock;
- buying ploughs;
- buying seeds;
- paying for labour in the crop fields.

Farmers understood that the period of the loan would depend upon the institution lending the money. However, most farmers would prefer a long term loan up to five years. People understood that collateral is needed to meet a loan, therefore, they stated poor people will need support from their relatives.

_Silikunga_

Currently, there are no credit schemes operating in Silikunga. However, farmers noted they would be 'happy' to have a scheme. In 1995, some people applied for the Agribank loans, but nobody has had a reply to their request. The purpose of credit was as follows:

- to invest in oxen for ploughing;
- to enlarge crop fields requiring labour and fences.

Farmers stated that they would prefer a long term loan over 5 years, as they would need time to repay the loan. When asked how a poor person would repay a loan after loosing the investment eg oxen, people became confused about credit. Meanwhile, some people stated that neighbours would have to assist by helping with the ploughing.

5.3.5 Institutional and Government Support

_Fumbe_

The Ministry of Health and Social Services established a clinic in 1993, which is linked to the Sambyu Hospital. The Ministry of Education and Culture provided a school in 1973, which has an adult education programme. The DVS provided vaccinations, when its Animal Health Inspectors visit once each year.

There are no NGOs working in this community other than Lux Development (Nolidep), which established links with Fumbe at the end of 1995.
**Kapupaghedi**

There is a clinic at Kapupaghedi providing routine medical services and promoting an AIDS campaign. Meanwhile, a primary school was established before the clinic. Rural Water Supply have provided the community with a new steel water tank, while Lux Development (Nolidep) provided a new plastic tank. Animal Health Inspectors from DVS visit the community once each year to provide vaccinations.

The only NGO working in the community at present is CANAMCO (other than Lux Development), which is based in Rundu and works throughout Kavango. This NGO has supported seed distribution for this community for the 1995/96 season. In addition, CANAMCO in 1995 promised to provide concrete rings to line the hand dug wells in the near future.

All the services stated above, where regarded by the villagers as vitally important.

**Muthinduko**

Currently, Ministry of Health and Social Services are providing an immunisation programme based at the local school. The DVS provide animal health advice and vaccinations. Ministry of Education and Culture have provided one primary school located in the village and RWS maintain the borehole’s engine and pump.

There are no NGOs working with this community.

**Nkutu**

The Ministry of Education and Culture have provided a primary school, which provides also adult education programmes. The Ministry of Health and Social Services visit every month. This Ministry has trained one person from the community to sell drugs and practice primary health care for the community. DVS provide their annual vaccination programme. RWS continue to maintain the borehole at Sisungu.

RWS are working also with an NGO called Cooperation for Development (CD) to line hand dug wells with concrete rings. Another NGO called the Rural Development Support Programme (RDSP) supported by the EC has targeted Nkutu for its project. Villagers stated that its Coordinator had promised to develop vegetable gardens, water supplies and assist farmers with crop production.
Silikunga

The DVS are providing annual vaccinations under their programme. RWS supply erratic maintenance of some borehole facilities. The Ministry of Education and Culture is renovating the school. Currently, the school is in use for primary school children and as an adult education centre.

NGOs in the area include CANAMCO, which tried to initiate a horticultural project nearby in 1993. However, the project did not materialise due to water problems. People in Silikunga would like CANAMCO to attempt the project in this community.
The communities surveyed in Kavango are relatively small compared to other parts of northern Namibia. The communities associated with Nolidep have no more than three villages attached, where the populations range from between 250 persons to 500 persons. Meanwhile, the average number of people in a household ranges from 9 to 12 persons in the three communities.

A single Headman has authority at each community, which have people from Sambyu, Kwangali, Gciriku, Mhukushu, and Nyemba tribal groups. Most villages have a dominant tribal group, while some have a mixed group.

Most households in the communities have at least one oxen and several goats. However, Fumbe appears to be the poorest community with 14 households without cattle. This factor will influence their production from crop fields as draught power could be very scarce. Meanwhile the community at Nkutu is very wealthy, where most households have between 25 and 30 cattle. Therefore, oxen at Nkutu are likely to available for draught purposes. The remaining villages have smaller numbers of oxen in each household, while only a few households are without cattle or any form of livestock.

Cropping fields are usually four hectares in size, while wealthy people can have up to 3 fields over 12 hectares in size and the poorest have one hectare. Again, the size and number of fields is reflected by the oxen available for each household in the community.

Meatco manage most of the formal markets in Kavango for all the communities. These markets are located at Mpungu, Mashare, Ngongo Linena, Shadikongoro and Rundu trading in cattle only. Meanwhile, a Tribal Council manage a formal market at Mukwe trading in goats and cattle. All the formal markets are relatively close to each community, therefore, transportation of stock is not an issue.

Informal markets appear to be the most popular for bartering of goods or services. However, cash is not always available in the communities, so some farmers sell by the roadside. Goats owned by a household are often used for subsistence, which minimises the need for cash in the community. However, when people sell they often need cash for mainly school fees, food, and the development of their crop field with labour and fencing materials. The large crop field owners will barter or pay local labour, which is a form of wealth distribution in these communities.
Vegetation Cover in Kavango
Nobody in these communities were reported to use credit schemes. However, most communities had members who applied for Agribank loans. None of these applicants for loans had a reply. Some people had a good understanding of credit schemes, while many people did not understand. However, people were willing to state a typical investment they might make using credit. Investments were focused on crop implements, labour and seed, as well as livestock improvement. The period for the loan is determined by repayment, so farmers stated they would need long terms with slow crop production.

Most Ministries are active in each community providing schools with adult education, veterinary services and primary health care through clinics. However, Agricultural Extension and Rural Water Supply Extension does not provide many services to these communities, at present. Meanwhile, Donors include Lux Development which initiated Nolidep concepts in Fumbe and Kapupghedi in 1995. CANAMCO is providing support with seed distribution and concrete rings in Kapupagheidi, as well as horticultural, milling and threshing assistance at and near Silikunga. CD is supporting water projects, which have now been absorbed by CANAMCO. RDSP has promised many forms of crop production assistance in Nkutu.
5.5 VEGETATION COVER AND LAND USE ISSUES IN KAVANGO REGION

5.5.1 Description of Vegetation Cover in the Kavango

The vegetation units described in this section are based on Page (1980) and EIS (1993). Figure 5.5a illustrates the boundaries of the vegetation units. The very uniform nature of the sand overburden to a large extent dictates that there are a number of species which are widely distributed within Okavango e.g. *Burkea africana* and as Okavango is largely flat, vegetation units are often defined on the basis of small changes in topography, drainage and soil conditions.

The changes in growth for vegetation in the region begins when the rainfall commences. This year’s growing season (1995/96) began in November, while last year’s season began in October as shown on the NDVI maps for Namibia (see Appendix 4).

The structure (height and density of different strata) is an important descriptive parameter in the outlines of these vegetation types given below.

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

This vegetation unit occurs in south-western 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 3-4m in height with isolated dense stands of larger *Terminalia prunioides* a feature. Characteristic species include *Terminalia sericea*, *Lonchocarpus nelssii*, *Combretum collinum*, *Bauhinia petersiana* and *Baphia massaicensis*. *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 pappophoroides*, *Eragrostis rigidior*, *Aristida stipitata* 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 (>10m) *Baikiaea plurijuga*, *Pterocarpus angolensis*, *Burkea africana*, *Combretum collinum*, *Ricinodendron rautanenii*, *Combretum collinum* and *Guiborbia coleasperma*, with a well defined understorey of shrubs *Bauhinia petersiana* and *Baphia massaicensis*. 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*
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 omarimba. 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 collarum, 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 Schmiditia pappophoroides, 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: Pterocarpus-Burkea-Combretum dry woodland**

This is by far the most extensive vegetation type within Okavango (2 120 000 ha). It is quite variable in the relative abundances of different species, as can be expected. This due to minor changes in topography, soils and patterns of utilisation. However, the main constituent species are largely constant in their occurrence. There is little dune formation in the area covered and soils are mainly poor quality Hutton and Fernwood Forms. The dominant woody species are Pterocarpus angolensis, Burkea africana, Terminalia sericea, Combretum collarum, Ochna pulchra, Baphia massaiensis, Bauhinia petersiana, Guibertia oleosperma, Erythrophleum africanum and Diplorhynchos condylolcarpon. Baikiaea plurijuga is of variable occurrence within this vegetation type. In some areas being completely absent. There is a well developed shrub layer and consequently the basal cover of the grass is low.

**Veld Type 5: The Omatako and Fontine Omarimba and associated areas**

This vegetation type includes the distinct vegetation of the omarimba bottom lands, as well as the surrounding areas which may form part of the catchments for these drainages. Soils are variable as may be expected in an area of changing topography. Hutton and Clovelly Form soils are the most important, but Fernwood and Arcadia Form soils also occur. As can be expected the vegetation on the margin of the omarimba is dominated by species common in Type 4. Common species include
Terminalia sericea, Combretum collinum, Baphia massaiensis, Bauhinia petersiana, with large Burkæ africana being the dominant tree species. The poisonous plant Dichapetalum cymosum is common on the omirimba margins and is particularly noticeable in disturbed areas. Where they are well drained, the omirimba 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 omirimba. 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 00 ha. There is little topographic variation in this area, expect for the poorly developed system of omirimba. Soils are largely Hutton and Fernwood Forms. The vegetation is generally short (<3m) 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, Guib Byzancia cotlerasperma, 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 korokosh.

**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 ventricosa*; and, a number of large tree species. These grasslands are heavily utilised and although they seem to withstand these pressures relatively well there are definite signs of degradation in certain areas. There has been widespread clearing of riverine vegetation along the Okavango River for cultivated land as well as access and some areas are heavily bush encroached where lands have been left fallow.

5.5.2 Land use management issues

**Livestock**

Livestock rearing has an important role in Okavango society in addition to being a sources of agricultural income. Cattle, in particular, are frequently given as lobola (“bride price”), are the main source of wealth and are an indicator of social status. Commercial off-take of cattle is very limited and the major source of livestock income for most people are goats and chickens.

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. However, livestock are always placed in a kraal at night.

Cattle graze on the stubble and stalks of millet and maize after the harvest. During periods of grazing shortage 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 Agriculture, but the grazing potential of the area is far from realized.

Typically, the cattle from an extended household village will herd their cattle together during the period 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 up its cattle amongst a number of family groups in order to reduce the 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 generally registered under the name of one owner when presented for stock control purposes (this practice undoubtedly distorts figures for actual household ownership). Attempts by the local veterinary department to supply extension advice at stock control posts, are frequently frustrated by the fact that herd boys, rather than livestock owners, are generally sent with the cattle.

The regional variation in ownership is principally determined by settlement patterns which, in turn, are largely determined by the availability of water. Riverine community land therefore tends to be overgrazed whereas large areas “inland” which offer potential grazing have very little cattle. The carrying capacity of the land surrounding riverine communities is established (by the DVS in Kavango) to be approximately fifteen hectares per LSU. However, in practice (and for something like the past ten years) the concentration of cattle in this area has led to five hectares of land carrying each LSU. Overgrazing is therefore a serious problem for riverine communities. Nonetheless, an incentive does, exist for owners of large herds of cattle to move away from the riverine areas when this is possible.

The Government has allocated farms in the area bordering the mangetti to families in the Kwangali district, partly to reduce 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 hectares, on communal land. This is likely to help the situation of overgrazing in the short run (particularly for those farmers who get new land) but will not resolve the problem of sustainable range management for the majority of small-scale farmers who will continue to graze their cattle on communal land.

Table 5.5a Livestock numbers in Okavango 1988-1991

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>74 000</td>
<td>79 800</td>
<td>88 000</td>
<td>91 454</td>
</tr>
<tr>
<td>Goats</td>
<td>22 500</td>
<td>23 000</td>
<td>30 000</td>
<td>31 085</td>
</tr>
<tr>
<td>Sheep</td>
<td>203</td>
<td>123</td>
<td>91</td>
<td>70</td>
</tr>
</tbody>
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Source: Adapted from DVS figures

Figures in Table 5.5a imply percentage increases of 5% per annum for cattle, 8% per annum for goats, while sheep are a relatively unimportant form of stock.

A recent report on livestock production in Namibia estimates cattle herd sizes in Okavango to be between 20 and 25. Meanwhile, goats are also fairly widely owned (by 43% of households) and herd sizes are approximately 17.
Carrying capacities (CCs) for the region were estimated for the region in 1966 by the former Government. Then, Kavango with an area of 4,170,050 ha was estimated to have CCs ranging from 7 to 9 ha/LSU. These CCs from 4 agro-ecological zones meant that approximately 522,416 LSUs could be raised in Kavango region (NISER, 1990). These figures only signify that Kavango has space to develop.

The problem most often mentioned with regard to livestock in Kavango is water. For much of the year the only source of water in areas distant from the river are boreholes. The spread of boreholes across the region is clearly limited and the supply of many existing boreholes is often unreliable. Consequently, cattle often have to be moved very large distances from grazing to water. Environmental degradation is also a major problem concerning livestock in Kavango, particularly near the Okavango river, reduced by improved range management. A detailed discussion of alternative stocking methods is provided by GTZ (1991) who conclude that Holistic Resource Management techniques should be applied for communal area grazing. This requires the division of pastures into small grazing areas which are grazed for a short period, followed by long periods of rest. Exclusive rights need to be held by one “management” over small grazing units.

The current cattle off-take rate in the Okavango region is estimated by the DVS to be approximately 3.5%. This is far below the commercial off-take rate of 10% which would imply the slaughter of some 9 000 cattle in 1992. The explanation for this is partly cultural - cattle owners generally have the objective of maximising herd size rather than income from the herd. Nonetheless, there have been significant impediments to livestock marketing in Okavango.

The first of these concerns the Veterinary Cordon Fence (VCF). This prevents cattle from Okavango being moved further south and effectively from access to export markets for fresh meat. The second impediment has been the purchasing practices of the abattoir in Rundu. The low prices offered have resulted in it operating at roughly a quarter of its capacity of 16 cattle per day in 1992. Households utilise the informal sector - the so-called “bush butcheries” - where prices are relatively high and transport costs low. On the basis of figures quoted by the Meat Board of Namibia, the informal sector price is between 25% and 40% more than the Meatco price from which the greater costs of transport must also be subtracted.

Dryland and Irrigated Cropping

Dryland cropping is the most common in Kavango as approximately 600mm of rain allows total crops and vegetables to be grown. The more common crop is millet, which accounts for approximately 75% of the harvest. Maize and sorghum are secondary crops with fewer fields of vegetables e.g. beans, pumpkins and ground nuts.
Crops are usually grown in fields with an average size of 4 hectares. Meanwhile, vegetable are sometimes grown with millet as an inter-cropping system.

The main problems associated with dryland crop production in Kavango are a shortage of available land, i.e. land with water supplies for the farmers; and the growing infertility of the soils in the region. The shortage of land is a result of most fields being located near the Okavango river. Over time, there has led to over-crowding. People have looked further south of the river however, water is often ephemeral or short supply. In the past, farmers moved around several fields using a fallen system.

Today, land is limited so farmers are forced to grow crops on a piece of land until its fertility drops. Then, farmers move to new areas, which is often limited to poor soils and so the process continues.

Another limiting factor for dryland crop production is the shortage of oxen. The oxen were used as draught power to pull ploughs. There are many ploughs in the region, however, the number of oxen suitable for ploughing is limited.

Irrigated production in Kavango is applied on a small scale for vegetables, e.g. cabbage, potatoes and onions. These irrigated gardens are relatively small in number for subsistence farmers. However, NGOs such as CANAMCO have tried to stimulate the form of production in the region.

**Wood Utilisation**

Throughout Kavango there is gradual deforestation as a result of burning for crop fields, as well as significant demands from trees/shrubs for building and firewood have depleted the woodland cover. Yaron et al. (1992) did a survey, which showed 98% of households gather firewood for cooking, while over half of the people use firewood for lighting purposes.

Felling and woodland clearance have been most severe during the last 10 years at principally the environs within 10km of the river. An example of the recent dramatic changes near the river can be seen on an aerial photograph taken in 1990 for the Takwasa to Divundu Rd. The photograph shows a zone of woodland within the Nyangana Mission’s fence, while land immediately outside the fence and along the entire length of the river is devoid of most woodland for between 5-10km from the river. These areas grow each year as people are forced to find new areas to cultivate.

The limitation of soils has driven people to the new sites for crop farming near the roadside between Bagani Bridge and Rundu. At these sites, firewood is exchanged for water supplies from passing motorists (pers. comm. J. Muller) due to the inaccessibility to water from the river or by other means. In addition, people have requested new
boreholes in the forest, however, these can be difficult to locate as the depth of groundwater is very deep (Healy & Keen, 1995).

The burning has limited the regrowth of saplings and maintained only mature timber and fruit trees with limited natural regeneration in crop field areas. This may be an ecological disaster for the future as mature trees reach senescence without replacement.

Deforestation caused by either excessive numbers of livestock, crop farming or wood utilisation is often counter productive for every enterprise or form of utilisation. Then the quest for increased production from one area for more people shifts to less production from the same area for more people.

Wildlife

Wildlife populations are restricted in their distribution within Okavango and as such are largely unimportant in the regional economy. There are three proclaimed reserves within Okavango to which access is restricted - Kaudom, Mahangu, and a small area near Mangetti.

There is considerable conflict between wildlife and farmers around the Mahango Game Reserve, where crop raiding elephant and stock raiding lion are a constant problem in the surrounding villages (EIS, 1993). As people are not able to legally hunt game and have to carry the costs of stock and crop loses without recompense. Wildlife is viewed as a liability, which game reserves are wasted grazing lands and seldom viewed as a positive resource of source of potential income by local farmers.

New legislation like the Conservancy Act may open up new opportunities in tourism related industries associated with wildlife. The tar road east from Rundu links to Maun in Botswana and Victoria Falls in Zimbabwe. Therefore, tourist traffic through eastern Kavango could rise sharply.
5.6 BASELINE VEGETATION COVER AND LAND USE ISSUES

5.6.1 Introduction

The baseline information for both vegetation cover with carrying capacity estimations and land issues were retrieved using the knowledge and experience of local people in Kavango. Assessment of vegetation involved field survey techniques with the participatory assistance of local farmers for both species use and identification. The principal topics for land use were livestock, cropping, woodlands and wildlife in Kavango. These topics have been divided into livestock and land management issues, resources rights, development opportunities, landscape and land use changes and wildlife issues.

5.6.2 Vegetation Cover with Carrying Capacity Estimations

Fumbe

Transect 1 - Dry Season Grazing

The dry season grazing is located around the villages and the crop fields. The crop fields are also used for grazing after harvesting in the dry season. Transect 1 (S17deg57.4’; E20deg10.6’) was located near an abandoned cropping field and across an area of partially closed woodland on white/orange sandy soils.

The area has a herbaceous cover of approximately 20% of which 4% was grass cover, while the total cover including canopy was approximately 60%. The most dominant grass species were Aristida stipitata, Eragrostis echinochloidea and Enneapogon cenchroides. Meanwhile, the habitat is mainly bush cover up to 1m high composed of the species listed below. Dominant canopy cover is provided by Terminalia sericia trees up to 5m and fruit trees up to 1.5m known locally as muhorowa. Other less common shrubs included Acacia fleckii, Baphis massaiensis, Commiphora angloensis, Grewia shinzi, Combretum collinum, Commiphora rhus, and Ozoroa longipes, which ranged between 1m and 2m high.

The carrying capacity (CC) for this area is 27 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included Eragrostis echinochloidea and Enneapogon cenchroides. Palatable browse noted by farmers included Ozoroa longipes, and muhorowa. The area appears to have had minor grazing.
Transect 2 - Wet Season Grazing

The wet season grazing is located south of the village settlements within the denser woodland. The main reason for this location is to ensure that livestock are not near the crop fields. Transect 2 (S18deg02.0'; E20deg11.7') was located in a semi-open woodland with good bush cover on white/grey sandy soils.

The area has a herbaceous cover of approximately 15% of which 7% was grass cover, while the total cover including canopy was 30%. The herbaceous layer and canopy layer were not dense. The dominant grasses included Aristida stipitata and Digitaria seriata. Dominant canopy cover included the trees - Pterocarpus angloensis up to 10m and Burkea africana up to 5m high with bush forms of Strychnos cocculoides up to 5m and Diplorhynchos condylacarpus less than 1m. Other less common species included the tree - Combretum sp. up to 10m, and bush forms of Ochna pulchra, Diasporos chamaethammus, Terminalia sericea and Grewia sp. between 1m an 2m high.

The carrying capacity (CC) for this area is 17 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included Digitaria seriata. Palatable browse noted by farmers included Terminalia sericea, and Pterocarpus angloensis. The area appears not to have been grazed.

Transect 3 - Potential Grazing Area

The potential grazing area is located in the south-east corner of Fumbe. The reason for its potential focuses on the vegetation cover and shortage of water supplies. Currently, there is only one school teacher living in the area with a family of bushmen collecting there water from Tosha. Transect 3 (S18deg04.4'; 20deg14.8') was located in open woodland/scrub habitat on white/grey sandy soils.

The area has a herbaceous cover of approximately 10% of which 5% was grass cover, while the total cover including canopy was 35%. The herbaceous layer and canopy layer were not dense. The dominant grass was Aristida stipitata. The dominant trees included Terminalia sericea up to 5m and Burkea africana up to 10m. Other trees included Dialium engleranum less than 5m and Ochra pulchra between 5m and 10m high. Bush forms included Grewia sp. and Diaspyros chamaethammus less than 1m and Ozoroa longipes up to 2m.

The carrying capacity (CC) for this area is 30 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers were not present. Palatable browse noted by farmers included Terminalia sericea, and Grewia sp. The area appears not to have been grazed.

Kapupaghedi
Transect 1 - Dry Season (Woodland Area)

This dry season area lies in the wooded zone (S18deg06.9'; E20deg22.4') on a rise next the omuramba passing between the villages. This area is north of Kapupaghedi and utilised during the dry season and after the harvest when animals have access to the crop fields to clean away storks.

The area has a relatively sparse tree cover with Terminalia sericea up to 10m and Combretum hereroense up to 5m. The shrub cover is fairly dense with large specimens of Dichrostachys cinerea and Acacia erioloba up to 5m and Diospyros lyciodes up to 1m. The herbaceous layer is sparse with approximately 15% cover, which includes a sparser grass cover of 4%. The most common grass species was Digitaria seriata. Meanwhile, the total cover including tree canopy was approximately 40%.

The carrying capacity (CC) for this area is 35 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers was Digitaria seriata. Palatable browse noted by farmers included Terminalia sericea, and Combretum hereroense. The area appears to have been heavily grazed.

Transect 2 - Dry Season (Omuramba Area)

This dry season area lies in an omuramba depression (S18deg06.9'; E20deg22.4') next to the wooded area discussed above, i.e Transect - 1. This area is north of Kapupaghedi and utilised during the dry season and after the harvest when animals have access to the crop fields.

There was no tree canopy cover on this transect were the herbaceous cover was approximately 25% cover, which included 15% grass coverage, which is relatively good. The most common grass was Cynodon dactylon. In addition, the herbaceous layer had an invasive species - Datura sp. Tree cover in this area was very sparse with Acacia erioloba and A. fleckii up to 10m and Combretum imberbe up to 5m. Shrub cover included Ozora longipes up to 5m.

The carrying capacity (CC) for this area is 44 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers was Cynodon dactylon. Palatable browse noted by farmers included Combretum hereroense. The area appears to have been heavily grazed.
Transect 3 - Wet Season and Potential Development Area for Grazing

This potential development area lies in the wet season area located south-east of Kapupaghedi (S18deg12.4'; E20deg28.5'). This area is used while the crops are growing amongst the dry season areas. In addition, there are several pans located throughout the wet season area, which recharge with rainfall. These pans provide both water an access to grazing for livestock in these areas, as people are not allowed to use water at Karukwa.

The site is a woodland habitat with semi dense cover. The dominant large trees are *Burkea africana* and *Pterocarpus angloensis* between 10m and 15m. The shrub canopy is relatively open and dominated by Terminalia sericea and *Combretum collinum* up to 2m, *Diplorrhynchus condylacarpon* and *Diospyros chamaethamus* up to 3m and *Ozoroa longipes* less than 1m high. This canopy cover is approximately 30%, while the herbaceous cover is approximately 25%, which includes 15% cover for grass species. The most common grass species is *Digitaria seriata*.

The carrying capacity (CC) for this area is 16 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers was *Digitaria seriata*. Palatable browse noted by farmers included *Combretum collinum*, *Terminalia sericea* and *Pterocarpus angloensis*. The area appears not to have been grazed.

*Muthinduko*

Transect 1 - Potential Grazing Area

This site lies south-east of the village (S18deg07.1'; E21deg16.2') bordering onto the grazing of the neighbouring community - Dikundu. The area lies west of the wet season grazing, however, due to a shortage of water points access to grazing is limited.

The site is a very open woodland habitat with signs of fire damage throughout the area lying on white sandy soil. Zones of fire damage appear to have been colonised by young shrub forms of vegetation. The total canopy cover was approximately 40% where tree cover included *Ficus* sp., *Strychnos* sp. up to 10m and *Pterocarpus angloensis* up to 5m. Shrub cover was more dominat with *Combretum* sp., *Diplorrhynchus condylacarpon* and *Bauhinia petersiana* up to 2m high. The herbaceous layer was approximatley 20% with 10% grass species coverage. The most dominant grass species were *Eragrostis pallens* and *Digitaria seriata*.

The carrying capacity (CC) for this area is 12 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers was *Digitaria seriata* and *Eragrostis pallens*. Palatable browse noted by farmers included *Combretum* sp, and *Pterocarpus angloensis*. The area appears not to have been grazed.

Transect 2 - Dry Season Grazing
The dry season grazing area is principally near the settlements and crop fields (S18deg03.7'; E21deg19.8'). Meanwhile there is an additional small area of dry season grazing located on the border between Muthinduko and Dikundu.

This habitat is disturbed woodland with a sparse collection of large tree specimens, which are mainly *Guibourtia coleosperma* up to 20m with some *Terminalia sericea* up to 15m and *Combretum psidioides* up to 10m. On addition, there are less common smaller trees - *Erythrophleum africanum*, *Combretum zeyheri* and *Diplorrhynchus condylocarpon* up to 5m. Bush cover was dominated by *Grewia retovarva* up to 2m high, which is semi-open. This canopy layer had a cover of approximately 45%. Meanwhile, the herbaceous cover was 25%, which includes 10% grass species coverage. The dominant grass was *Schmididia kalahariensis*.

This grazing area lies on a white/grey sandy soil with a thin woody humus layer. There was signs of damage to many of the *Diplorrhynchus condylocarpon* species, which have been felled by outsiders for the collection of worms living on the tree (the Headman stated his disapproval).

The carrying capacity (CC) for this area is 30 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers was *Schmididia kalahariensis*. Palatable browse noted by farmers included *Combretum psidioides*, *Grewia retovarva* and *Terminalia sericea*. The area appears not to have been grazed.

**Transect 3 - Wet Season Grazing**

The wet season area (S18deg06.0'; E21deg19.6') is located south of the village at a distance away from the crop fields. The livestock walk each day between the water point in the village to the border of wet grazing located approximately 5km south of the village.

The habitat is open woodland, where most tree stands are between 15m and 20m high. These species included *Terminalia sericea*, *Baikiaea plurijuga*, *Swarthia madagascariensis*, *Pterocarpus angloensis*, and *Combretum mosambicense*. The shrub layer is relatively open with *Piliostigma thonningii* up to 2m and *Diaspyros chamaethamnus* and *Dialium engleranum* up to 1m high. The total canopy cover for this area is approximately 35% with signs of fire damage through the area. Meanwhile, the herbaceous layer is approximately 15% with 10% grass species cover. The dominant grasses are *Eragrostis pallens* and *Schmididia kalahariensis*. This area lies on white/grey sandy soils.

The carrying capacity (CC) for this area is 12 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers was *Schmididia kalahariensis* and *Eragrostis pallens*. Palatable browse noted by farmers included *Combretum mosambicense*, *Pterocarpus angloensis* and *Terminalia sericea*. The area appears to
have had minor grazing.

*Nkutu*

**Transect - 1 Dry Season Grazing and Potential Development Area**

The dry season area (S18deg01.3'; E19deg34.5") is located in the north-east corner of the village. The location of dry season grazing is associated with the cropping fields in this area. This area is utilised as dry season grazing after the harvesting of crops from the fields. This area was also noted as a potential development area, as it has useful grazing, but there is a shortage of water.

The habitat at this site is semi-dense woodland. The higher stands are dominated by *Pterocarpus angloensis, Terminalia sericea, Combretum sp., Commiphora angloensis,* and *Guibourtia coleosperma* up to 20m. Shrub forms of vegetation included *Terminalia sericea, Lonchocarpus nelsii, Ziziphus sp., Diplorrhynchus condylocarpon* and *Bauhinia petersiana* and *Baikiaea plurijuga* with stories less than 2m high. Dominant grasses at this site included *Schmidia kalihariensis* and *Urochloa brachyura.*

The carrying capacity (CC) was not estimated for this site, however, favourable grass species noted by farmers included *Schmidia kalihariensis.* Palatable browse noted by farmers included *Terminalia sericea.* The area appears to have had minor grazing.

**Transect 2 - Wet Season Grazing**

The wet season area is located around the entire village, where Transect 2 was assessed (S18deg01.2’ E19deg32.2’). The location of wet season grazing is associated with the water point at Sisungu and recharging pans throughout the area. This area is utilised for most of the year until the dry season, when crop fields and the surrounding woodland pasture are utilised.

The habitat is semi-dense woodland with a relatively dense shrub cover. The dominant species located on the transect were *Pterocarpus angloensis* and *Terminalia sericea* up to 10m and *Combretum sp.* less than 1m (see Table 5.6a). Other woody species in the area included *Guibourtia coleosperma* up to 20m, *Croton gratissimus* and *Baphia massalensis* up to 5m, and *Bauhinia petersiana* less than 1m. The herbaceous layer has mainly perennial grasses (see Table 5.6a) with a relatively poor coverage.
Table 5.6a Transect 2

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poaceae sp. (perennial)</td>
<td>8</td>
</tr>
<tr>
<td>Aristida stipitata</td>
<td>3</td>
</tr>
<tr>
<td>Eragrostis palens</td>
<td>1</td>
</tr>
<tr>
<td>Unknown herbs</td>
<td>8</td>
</tr>
<tr>
<td>Bare</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Canopy Layer Species</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminalia prunioides</td>
<td>9</td>
</tr>
<tr>
<td>Combretum sp.</td>
<td>5</td>
</tr>
<tr>
<td>Pterocarpus angloensis</td>
<td>16</td>
</tr>
</tbody>
</table>

The carrying capacity (CC) for this area is 137 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included Eragrostis palens. Palatable browse noted by farmers included Bauhinia petersiana and Terminalia sericea. The area appears not to have been grazed.

**Transect - 3 Potential Grazing Area (Poor Grazing Zone)**

This area has potential for development in Nkutu. It was noted for development as there is hindered access for grazing due to poor water supplies. The grazing at this potential development site is poor, but it has value for the community. Transect 3 was conducted at S18deg00.6'; E19deg31.0').

The habitat is semi-dense woodland with sparse large tree stands. Meanwhile, the shrub cover is relatively open with large bare areas. The dominant tree is Terminalia sericea up to 10m followed by Pterocarpus angloensis up to 20m, and shrub layers of Combretum sp. up to 3m with Bauhinia petersiana less than 1m (see Table 5.6b). The herbaceous layer has a poor grass cover dominated by Aristida stipitata and Schmidti kalihariensis (see Table 5.6b). This habitat is located on a white/light red sandy soil.
Table 5.6b Transect 3

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown herbs</td>
<td>42</td>
<td>6</td>
</tr>
<tr>
<td>Aristida stipitata</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Schmiditia kalahariensis</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Eragrostis palens</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Panicum lanipes</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Bare</td>
<td>-</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Canopy Layer Species</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pterocarpus angloensis</td>
<td>8</td>
</tr>
<tr>
<td>Terminalia sericea</td>
<td>17</td>
</tr>
<tr>
<td>Combretum zeyheri</td>
<td>5</td>
</tr>
<tr>
<td>Bauhinia petersiana</td>
<td>6</td>
</tr>
<tr>
<td>Strychnos sp.</td>
<td>2</td>
</tr>
<tr>
<td>Combretum sp.</td>
<td>3</td>
</tr>
<tr>
<td>Burkea africana</td>
<td>4</td>
</tr>
</tbody>
</table>

The carrying capacity (CC) for this area is 171 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Eragrostis palens* and *Schmiditia kalahariensis*. Palatable browse noted by farmers included *Bauhinia petersiana*, *Combretum zeyheri* and *Terminalia sericea*. The area appears not to have been grazed.

**Silikunga**

**Transect - 1** Wet (South) and Potential Grazing Area

This site lies to the south of the village towards a large omuramba. Currently, the site is used for wet season grazing, however, the village would like to exploit this area in the dry season as a potential development area. Transect - 1 was assessed at S17deg44.1’; E18deg19.6’.

The habitat is composed of sparse tall stands with a thick understorey of bush. The dominant tall stand is *Terminalia sericea* up to 10m with sparser stands of *Acacia erioloba* up to 20m. The shrub cover is dominated by mainly *Commpihora angloensis* and *Bauhinia petersiana* up to 2m high (see Table 5.6c). The herbaceous layer is dominated by herbs followed by a perennial grass known locally as Rusundu and *Urochloa brachyura* (see Table 5.6c).
Table 5.6c Transect -1

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown herbs</td>
<td>44</td>
<td>17</td>
</tr>
<tr>
<td>Poaceae - perennial (*)</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Urochloa brachyura</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>Aristida sp.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Aristida stipitata</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Poaceae - perennial</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Bare</td>
<td></td>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Canopy Layer Species</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia erioloba</td>
<td>-</td>
</tr>
<tr>
<td>Terminalia sericea</td>
<td>-</td>
</tr>
<tr>
<td>Commiphora angloensis</td>
<td>-</td>
</tr>
<tr>
<td>Bauhinia petersiana</td>
<td>-</td>
</tr>
<tr>
<td>Baphia massaiensis</td>
<td>-</td>
</tr>
<tr>
<td>Combretum sp.</td>
<td>-</td>
</tr>
</tbody>
</table>

Note:阮氏 Gal name

The carrying capacity (CC) for this area is 16 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Urochloa brachyura*. Palatable browse noted by farmers included *Bauhinia petersiana, Baphia massaiensis* and *Commiphora angloensis*. The area appears not to have been grazed.

**Transect - 2 Dry Season Grazing**

The dry season area encompasses all the grazing between the crop fields and village settlements. This area is used after the harvest, when animals can feed on the crop fields without their herders. Transect 2 was located at S17deg41.2';E18deg21.2'.

This area is relatively flat lying on alight red sandy soil. The habitat is semi-open woodland with significant shrub cover - *Combretum mossambicense* up to 5m high with *Bauhinia petersiana* and *Baphia massaiensis* up to 1m high. However, there are some tall stands and many shrub forms of *Terminalia sericea* up to 10m high. The herbaceous layer is relatively dense dominated by the grass *Aristida* sp. (see Table 5.6d).
<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown herbs</td>
<td>21</td>
<td>5</td>
</tr>
<tr>
<td>Poaceae - perennial (Rusundu *)</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Aristida sp.</td>
<td>38</td>
<td>26</td>
</tr>
<tr>
<td>Melinus repens grandifolía</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Urochloa brachyura</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Aristida stipitata</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Bare</td>
<td></td>
<td>57</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Canopy Layer Species</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combretum mossambicense</td>
<td>-</td>
</tr>
<tr>
<td>Terminalia sericea</td>
<td>-</td>
</tr>
<tr>
<td>Acacia ataxacantha</td>
<td>-</td>
</tr>
<tr>
<td>Burkea africana</td>
<td>-</td>
</tr>
<tr>
<td>Ochna cinnabarina</td>
<td>-</td>
</tr>
<tr>
<td>Ozoroa shinzi</td>
<td>-</td>
</tr>
<tr>
<td>Bauhinia petersiana</td>
<td>-</td>
</tr>
<tr>
<td>Baphia massaiensis</td>
<td>-</td>
</tr>
<tr>
<td>Combretum sp.</td>
<td>-</td>
</tr>
</tbody>
</table>

The carrying capacity (CC) for this area is 15 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Urochloa brachyura*. Palatable browse noted by farmers included *Bauhinia petersiana*, *Combretum mossambicense* and *Terminalia sericea*. The area appears not to have been grazed.

**Transect - 3 Wet Season (North) and Potential Development Area**

The northern sector of the wet season grazing has a significantly different species composition than the southern area. Therefore, it was important to describe this area with Transect 3 at S17deg43.1'; E18deg19.3'.

The habitat in this area is semi-dense woodland with dominant high canopies of *Terminalia sericea* up to 15m and *Pterocarpus angolensis* up to 20m (see Table 5.6d). Shrub cover is mainly at a height of 5m dominated by *Combretum* sp. with sparser specimens of *Erythrophleum africanum* and *Bauhinia petersiana* (see Table 5.6d). The
herbaceous layer is relatively dense and dominated by herbs and Aristida sp. (see Table 5.6d).

**Table 5.6d Transect 3**

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown herbs</td>
<td>46</td>
<td>17</td>
</tr>
<tr>
<td>Panicum lanipes</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Aristida sp.</td>
<td>37</td>
<td>17</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Schmitia pappophoroides</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Urochloa brachyura</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Bare</td>
<td></td>
<td>62</td>
</tr>
<tr>
<td><strong>Canopy Layer Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combreton sp.</td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>Terminalia sericea</td>
<td>-</td>
<td>29</td>
</tr>
<tr>
<td>Croton gratissimus</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Burkea africana</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Ozoroa longipes</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Pterocarpus angloensis</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>Bauhinia petersiana</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Ricinodendron rautanenii</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Erythrophlem africanum</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>

The carrying capacity (CC) for this area is 86 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included Urochloa brachyura and Panicum lanipes. Palatable browse noted by farmers included Bauhinia petersiana, Combreton sp. and Terminalia sericea. The area appears to have been grazed by 50%.

**5.6.3 Livestock Uses and Management Issues**

**Fumbe**

The importance of livestock in the community is principally for prestige, draught power and when required for the generation of cash eggs foods. Livestock are also important for milk and meat production and slaughtered at ceremonies, eg weddings and funerals.
If an individual has an income outside subsistence agriculture, s/he will invest in cattle to build up their herd. Livestock are perceived by the community as a bank for savings.

Disease for livestock is perceived by the community as a major issue in Fumbe. The main diseases to vaccinate against are botulism and black quarter, as well as worms in both goats and cattle (Lux, 1995). A vaccination programme has been proposed by Nolidep to counter the disease problem as early as possible. Farmers stated that diseases had always been a problem in the village. In 1992 the village suffered with lung disease when people from the riverside moved their livestock into this area. Then, approximately three animals died each day.

Drugs for livestock are bought from the Animal Health Inspectors during their visits or directly from Rundu. Meanwhile, vaccinations are provided by the DVS. Some wealthy farmers will pay for their own vaccines, if they have livestock requiring quick treatment.

**Kapupaghedi**

The most important reasons for livestock are as follows:

- source of cash for school and hospital fees;
- prestige in society;
- milk production;
- payment for traditional crimes;
- slaughtering at weddings and funerals;

Large stock are more significant for major needs such as weddings, funerals and payment for traditional crimes. Small stock are used more often to meet daily needs, eg feeding of visitors and payment in kind for the services of Traditional Healers. Overall, people stated that they own some livestock so they can help themselves without assistance from others.

Supplementary feeding is not practised in this community. People were not aware they could buy supplementary feeds, eg licks. Farmers stated they may try these supplements, since the Nolidep team had informed them.

The main constraints Kapupaghedi is water storage. The villagers stated that the new water tank was too small supplying only one trough, while the round tank is constantly leaking.

Ticks are a major problem for goats, which has escalated to a serious problem since 1993. Lung sickness was worse several years ago, however, the occurrence of the disease has since been reduced. Meanwhile, other diseases have contributed to a high mortality in livestock with 44 cattle and 21 goats dying in 1995 (Lux, 1995).
Presently, farmers cannot identify the diseases, which caused these deaths.

Animal Health Inspectors from DVS visit once each year to vaccinate. Other drugs are bought from the Inspectors in Rundu. However, this is difficult as many people have no transport or not enough money to pay for the journey. Farmers often write letters which are sent through to the DVS requesting drugs to buy. If an individual travels to Rundu for drugs, s/he may not bring drugs back for others with the same disease problems. Often people in the community will not even inform each other that they are travelling through to Rundu.

If farmers have enough money, they stated they would be prepared to buy their own vaccines provided by DVS.

*Muthinduko*

Principally, livestock in this community are a sign of wealth. However, they are also prized for cash generation to meet various demands. Draught for ploughing and transport, ie pulling of sledges are equally important qualities of livestock.

Livestock are taken up to 5km (2 hours) from the village during the wet season for grazing. Later, during the dry season they are left to graze on the old storks in the crop fields and the surrounding woodland pasture. The animals are fed no other form of supplementary feeding, ie fodder. If livestock in this community become weak and/or old they are slaughtered for consumption in the villages or sold to Meatco.

Water is a major problem for farmers in this community. When a borehole is inoperative people have difficulties finding water. Often, the major problem centres upon water in relation to the location for grazing.

A serious problem for livestock in this community is diseases, where the main disease is lung sickness, foot and mouth and an unidentifiable and transmittable disease causing paralysis across the shoulders of stock, during the wet season. Diseases were a major problem in 1971, 1994 and 1995, whereas in the distant past diseases were not a problem. Before, diseases may have been responsible for the mortality of 2 cattle/year. Currently, these diseases can cause up to 20 mortalities each year.

*Nkutu*

During the dry season livestock can go anywhere, which includes the dry season grazing and crop fields in the north-east. In addition, they wander free throughout the wet season grazing. During the wet season animals are herded during the day and kept in kraals during the night to prevent damage to crop fields. Livestock are principally managed by males, however, young boys and women may do the herding if man have formal employment.
Water is a major problem for livestock in this community. The only reliable supply is the borehole at Sisungu. Farmers stated they need a borehole at Nkutu. People stated that they would even sell stock to maintain the borehole.

The main disease for livestock in Nkutu are lung sickness and foot and mouth for cattle, while diarrhoea is serious for goats. Meanwhile, there are no pests, ie wild animals causing problems for livestock in the community.

Drugs including vaccines for livestock are bought by many people in this village from suppliers in Rundu. People would be willing to pay for the vaccines provided by Government, if the policy was to change.

**Silikunga**

Principally, livestock are an investment for this community from which they can generate income. This could be cash or subsistence income eg milk and draught power for ploughing and transport.

Livestock management involves the use of the wet season grazing during the growing season in the crop fields. Livestock are herded throughout the wet period, until they can utilise the crop fields and dry season grazing. Livestock in this community are totally dependent on their grazing and the crop field storks, as there is no supplementary feeding in this community. Ownership of livestock lies usually with the male in a mixed household, while the wife may hold more management responsibilities, when the husband away.

The main issue for livestock in this community is a shortage of water in relation to the grazing areas. The farmers stated that the water is too far from the grazing. When animals have to move long distances to find water, they can be stolen.

This village was also annoyed by the many people who promised assistance with livestock and other issues, but these people never returned.

Presently, the most common diseases in this community are foot and mouth and lung sickness, which have not changed since the past. Before, there used to be many predators for livestock, until many people arrived and caused their dispersal.

Drugs for livestock are only available from the Animal Health Inspectors, who provide some vaccines each year as part of the national vaccination programme. Meanwhile, some farmers pay for additional vaccines against botulism and black quarter. People stated that they are prepared to pay for all the vaccines they require. A farmer noted that some vaccines costing NS1/vaccine are better than those provided by Government. If vaccines are a necessity, farmers argued that poor people should have vaccines/drugs on credit when they are needed. These people can pay later, when their animal has been cured.
5.6.4 Land Management Issues

Fumbe

Grazing management at Fumbe is based on wet and dry season grazing regimes (see Figure 5.6a). The wet season is dependent on woodland pasture located to the south of the village towards the grazing border at Tosha. During the wet season the animals are herded and kept away from the crop fields near Fumbe and Mangundu. After the harvest the animals return to utilise the stocks off the fields and the surrounding dry season grazing. The important grasses (Rukwangali names) utilised by livestock include ruperere, kankumbwe, linghofu, nangondwe, lilyanyatji, and lilarampi-wayi. Important trees (Rukwangali names) include murere, mbunze, and mupanda.

Crop farming is important for all homesteads in the Fumbe community. However, there are several constraints in order of severity as follows:

- poor rainfall;
- availability of oxen;
- limited amount of crop land;
- shortage of implements;
- labour requirements;
- weeding.

Nolidep sold a new variety of millet - Okashana to the villagers for this year's harvest. This new variety is more suitable for areas with poor rainfall, as it responds quickly to the initial rains.

Woodland is still plentiful in this area as fuelwood. However, both timber and fruit tree are more scarce. Fruit trees have been protected in the southern sector of the village amongst the wet season grazing.

The impact of tree felling for crop fields, timber and fuelwood began in 1966, when more people arrived in the village after the installation of a borehole. At that time, more livestock arrived reducing the availability of grazing in the area. By 1990 with the steady increase in population, there has been overgrazing and a major change in tree cover.

Kapupaghedi

Fences for cropland in this community are not common. During the wet season herding of livestock is paramount to avoid damage to crops. Recently, more people are fencing due to increased pressure from livestock near cropland areas. However, most of the cattle proceed to the wet season grazing area, while they are based at various cattle posts.
The most common crops grown near the omurambas on the dark loamy soils are maize intercropped with groundnuts. Meanwhile, on the higher ground usually 1 km from each settlement, millet is grown on the white sandy soils.

Livestock leave the posts and return to the dry season grazing when crop fields are available for livestock to clean off the stocks. Some crop residues are burnt in situ providing ash fertiliser for the soil. People would like to manure their fields, however, they stated the process is too labour demanding to carry manure from the kraals to the fields. If the farmers had enough money, they said they would prefer to buy inorganic fertiliser as less has to be spread over the fields.

Woodland appears to be plentiful in this community. The main sources of fuelwood, timber and fruit trees are all located to the west, south and east of Kapupaghedi. All these wood resources are easily accessible from the villages.

_Muthinduko_

Grazing is managed as stated above using wet and dry season grazing. There are no restrictions for the access of local people or management schemes.

Cropland is protected during the wet season, when livestock are herded in the wet season grazing area. Ownership and management of a crop field is usually the prerogative of the male in a mixed household.

Woodland is usually managed by women in the community as they are often responsible for the collection of veld foods, as well as the prevention of bush fires. Everyone in the community has a right to these woodland resources, while the only restriction relates to the protection of fruit trees.

_Nkutu_

The use of cropland in this community requires permission from the local Headman. Meanwhile, ownership and management is shared by a mixed household between the husband and wife. The wife will normally have more management input, as she does most of the work in the crop fields.

To improve the fertility of crop fields farmers add both organic and inorganic manure to their fields. However, farmers prefer to use inorganic fertiliser as it is easier to apply to the fields, but they complained that inorganic fertiliser is expensive and difficult to buy.

Both grazing and the use of woodland are managed by everyone in the village. Grazing is managed as described above, using wet and dry season grazing systems. Meanwhile, the Headman controls the cutting of any fruit trees.
Silikunga

Cropland is a vital form of subsistence for Silikunga. The fertility is paramount, which requires the ploughing of residues into the soil after the cattle have passed over the area. Ash is also applied with the burning of small bushed in the fields. Kraal manure is also applied, however, this is dependent upon the availability of labour. If manure is applied, it is put on small fields for millet, maize, sorghum, groundnuts, beans, water and sweet melons. Ownership of crop fields is usually shared between husbands and wives, however, they sometimes have separate fields. Men do most of the ploughing, women do moist of the planting, while both sexes do weeding and harvesting in this community.

Grazing management as discussed is divided into wet and dry season. During both seasons kraals are used at night to protect animals from theft, and wild dogs in the past. The animals are often kept in the kraals until midday, as there may not be a herder available at the household, while the owner could be too busy in the fields. Children are often herders but they do not return until after midday.

The people in this community prize their woodland north of the settlements, as it is a bountiful areas for fruit trees. These fruit trees are highly protected from damage, such as felling. In addition, some non-fruit trees Pterocarpus angloensis and Acacia erioloba are protected as they are useful timber tree. These species are usually removed from crop fields as they would attract birds to feed in the area.

Farmers perceive that there are enough trees for this community, but they want to conserve them for their own use. However, if the Tribal Authority gives permission for outsiders to take trees, this community will accept the position.

5.6.5 Resource Rights and Local Bylaws

Fumbe

There are no bylaws applying to grazing areas. Meanwhile both woodland and crop fields are controlled by the Headman in the community. However, many resources are shared with neighbouring communities, eg fuel is shared between communities for borehole engines.

A Water Committee was established in 1995 stimulated by Rural Water Supply (RWS). However, this committee has not had any impact. It appears that the committee is a result of the RWS alone.

Bylaws are limited to the following:

- location and size of crop fields controlled by the Headman;
- cutting of timber trees controlled by the Headman;
• grazing of livestock is prohibited near crop fields during the wet season.

Bylaws for water points include provision against washing near the tanks and troughs. However, these bylaws for the control of water points may have been encouraged by RWS.

**Kapupaghedi**

Neighbours are located at far distances from this community, so there is no issue concerning reciprocal rights for resources. People in this community stated that in drought situation, they may complain if livestock arrived to use their grazing. Meanwhile, farmers had no objection to outsiders coming to the village to utilise trees.

Significant bylaws in this community are as follows:

• outsiders need permission from the Headman before they can graze their livestock in this community;
• outsiders need to fulfil a set of criteria (not stated) held by the Headman, before they can settle in this community;
• fruit trees are protected;
• bush fires are prohibited;
• a farmer needs to inform the Headman if s/he is buying or selling an animal to/from another community, as all livestock movements are monitored by a Traditional Policeman in this community.

**Muthinduko**

In most cases the male in a family is the owner and manager of the crop fields. Sometimes, there may be joint ownership between men and women. Often the woman is does most of the husbandry in the fields, so she has a significant role of the management. Female headed households own and manage their crop fields. Rights over resources are not equal for both poor or wealthy people in the community.

Reciprocal rights of others using resources in this community are the same as for members of Muthinduko. Outsiders can use grazing, water and woodland without any special permission. Crop field establishment is controlled by the Headman. This procedure is important as many people from the riverside area want to move to Muthinduko to establish crop fields.

Bylaws protecting natural resources include the following:

• the distance between the water points and crop fields has to significant to avoid crop damage by livestock;
• felling of fruit trees is prohibited;
• no grazing in or near crop fields during the wet season;
water must not be wasted at the water points, ie turn off taps after use.

*Nkutu*

All people in the community have the right to use grazing and woodland resources. There is no distinction between wealthy people and poor people over their rights to natural resources.

Reciprocal rights between neighbours do not allow free access to all the natural resources in Nkutu and elsewhere. People are not allowed to graze without permission or collect fruit from the woodlands. If too many people came to this community, then the local inhabitants would complain to their Headman and Traditional Authorities.

Bylaws in Nkutu included the following:

- no bush fires are allowed, if the law is broken a fine of up to 5 cows may be charged;
- outsiders are not allowed to fell *Terminalia sericea* or *Pterocarpus angloensis*;
- no fruit trees can be felled;
- no fires must be used on the grazing (people are afraid of bush fires);
- no grazing near crop fields, farmers must herd livestock in wet season grazing areas;
- nobody is allowed to take crops from another person’s crop field (fines can be up to 2 cows).

If a person is accused of breaking the law, they are taken to the Traditional Court, where they are tried and their sentences passed.

*Silikunga*

Both grazing and woodland resources are available to all inhabitants of the Silikunga community. However, there are different grazing regimes for Makambo. People in this village can utilise these resources, if they abide by any appropriate the bylaws.

The ownership of cropland is a serious tenure, where owners of land mark off their field with a plough line to distinguish their plot from others. Wealthier people tend to farm larger crop fields as they have 7-8 ploughs, while poor people have less land with 1-2 ploughs or less.

The reciprocal rights for woodland and grazing resources are open to outsiders to use but this situation must not be abused. Access by livestock can only occur after the harvest, then anyone’s livestock can use the old storks. If too many people arrived to use resources in this village, the inhabitants would complain and ask the outsiders to vacate this community.
Bylaws protecting natural resources in Silikunga are as follows:

- livestock are not allowed to enter or graze near a crop field during the wet season;
- everyone must erect a fence around their field, if this is not done the owners cannot claim damage payments after livestock invade;
- anyone caught burning the forest will be punished as this destroys both trees and the grazing.

5.6.6 Development Opportunities

Fumbe

Development opportunities for Fumbe include the following:

- develop oxen for ploughing services in the community;
- provision of good quality seed with quantity;
- improvement for manuring in fields;
- control of pests and weeds;
- control of diseases in livestock;
- acquisition of more implements for crop farming;
- controlling bush fires;
- water provision in the wet season zone of the southern area.

Kapupaghedi

Development opportunities in Kapupaghedi include the following:

- improve animal health with appropriate responses to vaccination needs;
- develop a small credit fund for poorer people to assist with vaccinations and other drug requirements;
- fence an area to be maintained by the community to improve the grazing, however, poorer farmers acknowledged that larger herd owners dominate the use of water points in this community.

Muthinduko

Development opportunities in Muthinduko are as follows:

- grazing is more limited with more crop fields and livestock. People stated that a grazing area should be developed which excludes any crop fields in its vicinity;
- train local people in animal health skills, ie administration of drugs etc.;
- develop an animal health clinic near this community, as the nearest is too far at Mukwe;
• renovate the existing crush pen;
• establish an auction in the community;
• develop water in the potential grazing area;
• assistance with the transport of diesel between Rundu and this village.

Nkutu

Development opportunities are as follows:

• fencing of grazing area sited for potential development - farmers referred to a village nearby called Kayira-yira, where a large number of households have communally fenced grazing areas to assist management;
• utilise pesticides on their crops to increase production;
• establish a borehole in the village to provide potable water for both humans and animals;
• establish an animal health clinic in the community.

Silikunga

Development opportunities are as follows:

• develop larger herds of cattle and goats to generate cash (applies to those one animal to those with many animals);
• enlarge crop fields to generate cash;

The development of the CANAMCO’s solar pumping irrigation scheme at Mupungu has not been a success. Meanwhile, the soft loans scheme proposed for this area has failed to evolve. Currently the milling project in Mpungu has not been used at Silikunga as they did not produce enough to make it worthwhile using the mill. However, the mobile threshing machine has been used regularly.

5.6.7 Landscape and Land Use Changes

Fumbe

During the 1960s until the mid 1980s, there were many fruit trees near the villages. However, as a result of low rainfall and bush fire, many fruit trees have been lost. Bush fire have been more common with a higher population hunting with fire for honey at bee nests in trees, as well as fire getting out of control near crop fields.

Until the 1980s, livestock were moved around the grazing areas in a rotational fashion. However, since 1990 there has been a rise in both the population with their livestock, which caused the rotational system to collapse. Presently, people can only graze where they find grass.
During the 1970s and 1980s crop production was good, however, since the 1980s production has deteriorated due to low rainfall and poor soils. The cropping has continued for too long on the same soils. Before, people rotated their crops in small fields. Now, good soils are limited, so farmers grow crops in larger fields to supplement for the lower yields from these soils.

*Kapupaghedi*

Rainfall appears to have had a significant impact on both grazing and crop production. Farmers noted that after good rainfall crops would grow favourably, therefore, there has been no significant change in soil fertility.

The water table in their hand dug wells is significant affected by poor rainfall, which limits the availability of water throughout the community.

If the rainfall has been low and crop production is reduced, farmers will forage for wild fruits in the woodland and sell many of their cattle to raise cash.

*Muthinduko*

Since the 1980s forests in the area have had insignificant impacts. However, there has been substantial change from the early 1990s, when low rainfall combined with many bush fires destroyed many hectares of forest. Fruit trees were lost as a result of the fires, which made a notable impact on the community.

Grazing has deteriorated in recent times due to a combination of poor rain and overgrazing. Livestock have not been managed with large numbers and no grazing regimes, which has led to the demise of pasture.

Again, low rainfall was noted for its impact on crop production during recent years. Rainfall was noted as critically low during the late 1960s, 1978 and early 1990s. The response to this low rainfall and poor crop production is as follows:

- utilisation of fruit trees eg *Strychnos* sp. and wild herbs used as green vegetable matter;
- search for employment opportunities outside the village as full-time employment or casual labour in fields;
- develop income generating activities such as selling home-brewed alcoholic drinks (kasipembi), wood carving, selling livestock and byproducts eg milk and meat.

*Nkutu*

Significant changes to the landscape have occurred in the woodland as the population growth led to a higher demand for timber. Timber has been used as building material.
for homes and kraals.

Poor rainfall during the early 1980s and 1990s led to large crop losses, where many households had no harvests. Over the same period, grazing is limited, which results in many animals dying before they can be sold.

The response of people to change, particularly low rainfall, has been as follows:

- collect wild fruit to consume;
- sell some of the wild fruits in Rundu to households near the river;
- sell livestock to raise cash to buy maize etc.

Silikunga

In the past, crop fields produced much more, as production tumbled from the early 1990s. Often, people cannot produce enough food from the land. During good rainfall years, they can grow sufficient crops, therefore, the soil is still fertile.

Woodland is still plentiful, however, the woodland pasture has deteriorated with lower production from existing fruit trees. All this is due to poor rainfall stated the farmers.

An elderly man remember six periods when the rainfall was very poor. He stated that the most recent period of poor rainfall occurred 30 years ago. The response to these periods was as follows:

- collect fruit *Ricinodendron rauianenii* (manketti tree) and other fruit trees;
- collect roots from the nombesi herb (located in M bunze District);
- slaughter cattle to consume;
- consume more milk from livestock.

5.6.8 Wildlife Issues

Wildlife is not an issue at Fumbe, Muthinduku, Nkutu and Silikunga. The rise in population in this region has caused the dispersal of most game species. People can only recall wild game, during the 1960s to 1970s. At Kapupaghedi, there are the occasional problems with hyenas taking goats and young cattle.
5.7 CONCLUSIONS

The principal zones in Kavango are located next to the Okavango River and woodland areas inland from the river zone. All of the communities for the project in Kavango are located inland, at approximately 20km or more from the river.

The systems for grazing in these communities involve a simple form of transhumance from wet season to dry season grazing throughout the year. During the wet season animals will often utilise water in pans as well as major borehole sources used throughout the year. However, the emphasis for the system is to keep the stock away from the cropping areas throughout the growing season. After the harvest animals graze the crop fields and the surrounding grassland, as well as parts of the wet season area without the need for herders.

The carrying capacities for this region were estimated in 1966 by the Government at between 7 and 9 ha/LSU. CC estimations at each village did not correlate with the status as wet, dry or potential development areas for grazing. However, there was a level of consistency at each community for either good moderate or poor grazing potential. The best grazing areas where located at Silikunga with CCs ranging from 15 to 16 ha/LSU followed by Fumbe and Muthinduko ranging from 12 to 30 ha/LSU. Moderate areas were found at Kapupaghedi with 16 to 44 ha/LSU, while the poorest was Nkutu with 137 ha/LSU. This low figure at Nkutu may be explained by the erratic spacial precipitation in the region.

The valuable grasses in this region include *Eragrostis cenchroides*, *E. echinochloidea*, *E. pallens*, *Digitaria seriata*, *Schmidtea kalihariensis*, *Urochloa brachyura*, and *Panicum lapines*. Meanwhile, the important trees/shrubs for browse included muhorowa, *Ozoroa longipes*, *Pterocarpus angloensis*, *Terminalia sericea*, *Grewia sp.*, *Combretum sp.*, *Bauhinia peterisiana*, and *Baphia massaaiensis*.

Livestock are able as prestige tokens in the communities of Kavango, to play a significant role at ceremonies, eg funerals and weddings. However, other important qualities for livestock include cash generation, food production ie milk and meat, and draught power for cultivation purposes. These qualities amount to an investment for many farmers for forthcoming years.

Water is often a problem for farmers in communities. Farmers stated that storage associated with reserve supplies and the location of water points in relation to grazing is a major problem. Grazing areas during the dry season will always be a problem for farmers inland from the river. These areas were only used during the wet season in the past. Farmers want to push the areas further into the woodland, however, water is very deep in this area. Therefore, exploitation of groundwater will require careful siting, if possible.
The major diseases mentioned by the communities included botulism, blackquarter, foot and mouth, and lung sickness, while tick borne diseases are a problem for goats. Animals acting as pests eg jackal are not a problem in these communities, this may be a result of the disturbance caused by many people in these areas. In the past, many predators from jackal to hyena caused many problems.

Drugs for livestock are bought from the Animal Health Inspectors when they visit the communities, or farmers travel directly to the DVS in Rundu for their supplies. Farmers stressed that it is sometimes a problem to get drugs, due to the distance between many of the communities and Rundu. Currently, wealthy farmers buy their vaccines as they are required. Some farmers argued that vaccines and other drugs should be on credit, which would allow a poor farmer to pay after their animal is cured.

Grazing in the region 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. Kraals are important for the protection of animals in the dry season and wet season, to protect animals from theft. Kraals are also a source of manure to fertilise the fields. However, farmers prefer inorganic fertiliser for as it is easier to handle. Grazing is protected from fire under local bylaws, which are usually ignored; while outsiders have to request permission to utilise grazing.

Cropland is often shared by both sexes in a household, however, the women will have more control as they do most of the work in the fields. Men may do most of the ploughing, however, women are also involved as well as doing other duties for crop production. The ownership of cropland is a serious form of tenure with clear boundaries allocated by Headmen. Meanwhile, bylaws protect the cropland and the crops during the wet season.

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 was 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 river.

Development opportunities in these communities focused on crop and livestock production. Animal production schemes include animal health training, credit for drugs, development of crush pens and auction pens, and the location of new water points and fencing to assist with the management of grazing. Meanwhile, crop
production initiatives include investing in implements, pest/weed control, provision of good quality seed and the development of ploughing services.

A significant change to the landscape has been the deforestation of the area with the loss of many trees. However, the situation at each of the communities has not reached the critical level seen near the river. Deforestation is the result of clearances for crop fields. Unfortunately, many fields are not rotated due to the pressure for land which is leading to a fall in the fertility of many soils in this region. People stated that low rainfall has caused the drying of their shallow wells and losses in crop fields. Farmers in the area respond by using wild fruits selling products eg beer, raising cash by selling livestock, and temporary employment.

Unfortunately, the majority of people and the critical problems occur at the river zone. This study did not address these communities, as the Nolidep project did not select a community from this river zone. Therefore, Nolidep cannot learn or address the most serious problems facing most agrarian communities in the region.
5.8  WATER RESOURCES OF THE KAVANGO

5.8.1  Geology of the Kavango

The geological can be described stratigraphically as consisting of basal rocks of the Damara Sequence, followed by the Karoo Sequence sediments overlain and intruded by volcanic of the Karoo in turn covered by the late Cretaceous and Kalahari Group sediments. The Kalahari sediments infill a large basin that deepens to the northwest into the Owanbo Region. There are two structural trends in the region: a strong northeast trend that coincides with the Damara Orogen and a less dominant northwest trend. These trends have been interpreted as tension faults from recent seismic activity that may be associated with the still active East African Rift. The outer limits of the basin may consist of uplifted fault blocks and associated sub-basins suggesting that faulting was a major control in the formation of the Kalahari Basin.

The Kalahari Stratigraphy in any particular area is dependent on the rocks which make up the nearest basement high with these highgs being the source of the Kalahari sediments. The Kalahari Group can be broken up into three formations based on three distinctive erosional cycles (Albat 1978). They are the Tsumkwe, Eiseb and Omatako Formations.

The Tsumkwe Formation is the basal member of the Kalahari Group. It consists of a basal conglomerate lying unconformably on the older rock. The clasts are poorly sorted and generally angular, being contained in a sandy matrix and cemented with calcium carbonate. It is believed that they represent cemented scree on the slopes of the basement highs in the pre-Tsumkwe topography. The cementing material is of a typically reddish colour.

The Eiseb Formation lies unconformably on the Tsumkwe Formation and is composed mainly of alternating silcretes and carbonate rocks. It is believed that this sequence is a result of a fluctuating climate in which periods of higher rainfall are followed by more arid climates. Six units make up this formation representing cycles of deposition. The lowest and the middle carry fossil evidence such as worm tubes and fresh water gastropods that indicate wet depositional environments. Where the base of the Eiseb Formation is exposed it starts of with the bottommost layer silcrete.

The Omatako Formation (so named from good exposure in the Omatako Omuramba) rests unconformably on the Eiseb Formation. It consists mainly of ferricrete and ferrigenous sandstone. In the Omatako exposure rounded and oval pebble-like ferrigenous sandstone fragments are cemented by clastic-free Fe-hydroxide.

The surface sediments of the Kalahari have also been redistributed by aeolian and fluvio-lacustrine processes to form a suite of landforms which reflect past climates that were both wetter and drier than the present. Drier conditions are represented by fields
of linear and transverse dunes, mostly stabilized and occurring south of 12°S. The area is mostly blanketed by fine grained aeolian sand, with the exception of the extreme northwestern portion. The sand is varies from very light shades of yellow, grey and brown, with white being the most common colour. Sand grains are often frosted or opaque and consist almost entirely of quartz. Calcitization of the sand is common with minor occurrences of silcrete and ferricrete. Alluvial deposits occur in the northeast in the region of the confluence of the Kavango and Cuito rivers. The material is typically light grey, pink, green and mauve in colour. The composition is fine grained sand, silt and clay with grains well-rounded. The matrix may contain larger and well-rounded lithic fragments (Namibian Groundwater Development Consultants 1993, Thomas and Shaw 1990).

5.8.2 Climate of the Kavango

The Mean Annual Precipitation ranges from 540 to 600mm with the rainy season starting in September and ending in April. Most of the rainfall occurs as convective rainfall storms during December to March. Rainfall decreases from northeast to southwest (see Figure 3.8a). In relation to the rest of NAMIBIA the Kavango has a high reliability for good rainfall. The average annual temperature is 22.5°C with daily variations of up to 20°C occurring during the winter months and variations of 15°C in the summer months. Evaporation on open water is in the order of 1300mm/a and is noticeably less than the central and southern areas of NAMIBIA where it is 2000mm/a or higher (MAWRD Hydrology Division 1994 & 1995, Burmeister Van Niekerk 1993).

5.8.3 Relief and Drainage of the Kavango

The Kavango Region covers an area of approximately 42000km² and has an average elevation of 1100 metres ams. The area is generally flat with east-west trending dunes that can be quite well defined. The area consists of two main physiographic features that include the River Terrace System of the Okavango River and the Inland Sand Plateau. Paleo-channels and depressions, known as Omurambas, also drain towards the Okavango River although their contribution to runoff is minimal. Within large omurambas such as the Omatako horizontal drainage occurs that can temporarily hold water after heavy rains. The region slopes generally to the north and northeast towards the Okavango River where floodplains can be up to a few kilometres in width on Namibia’s northern border.

The River Terrace System makes up the flood plain, shows evidence of a braided river system and is marked by a gently sloping alluvial terrace (riverwards) at a mean elevation of 6 metres above the river.

The Inland Sand Plateau is a monotonous plain of recently deposited aeolian sand that varies from flat to undulating in areas of dune formation. In south central Kavango a prominent feature are the parallel sand dunes with intervening omurambas.
The headwaters of the Okavango River are in the Highlands of Angola, comprised of two tributaries being the Cubango River and Cuito River. These tributaries originate in the same region as the Kunene and exhibit a similar hydrological regime with good correlation between their annual flows (MAWRD Hydrology Division 1994 and Burmeister van Niekerk 1993).

5.8.4 Surface Water Resources of the Kavango

As suggested by discussion on Drainage systems, the major contributor to surface water is the Okavango River which flows approximately 415 km along the Namibian border. The water resource of the Okavango is markedly different from internal sources in Namibia. The average flow, approximately 1000Mm³/a, carries more than 10 times the combined flow of all Namibia’s internal rivers. Almost all of its runoff contribution originates in Angola with the drainage basin being also shared between Botswana and Namibia. The river sustains a fragile ecosystem in the Okavango Delta in Botswana. It is also the focus of numerous irrigation projects of varying sizes along its course. In design stages is a linkage of the Okavango River with the Eastern National Water Carrier via the Grootfontein-Omatako Canal to provide water for the interior. The interior forests of the inland sand plateau contain numerous pans that can contain water up to 10 months of the year with good seasonal rains (MAWRD Hydrology Division 1994).

5.8.5 Groundwater Resources of the Kavango

The aquifers of the Kavango can be divided into two classes of primary aquifers and secondary aquifers. The primary aquifers occur in the sand and sandstone of the Kalahari Group sediments. The thickness can vary from nil in the east to 350m at the main axis of the basin. Secondary aquifers occur in fractured and weathered pre-Kalahari bedrock and are important as a source of groundwater where the Kalahari sediments are thinly developed or non-existent.

The Kalahari Group of sediments are the most important aquifer in the Kavango Region. Varying regional trends in deposition of sediments result in varying yields in boreholes in the region. Insufficient information and detail have to date prevented drawing up a depositional model from which the prediction of borehole yield could be improved.

In order to intercept the secondary aquifers boreholes are sited along major dislocation structures/discontinuities in the bedrock. The rock type will also influence the potential and water quality of the borehole. Four main lithologies host secondary aquifers in the region:

- Granite and metamorphic rocks of the Grootfontein Complex in which the groundwater locates in fractures, fractured pegmatites and deeply weathered zones. Yields vary up to 3m³/h and quality from very poor to good.
Dolomites and related carbonate rocks of the Otavi Formation in which groundwater moves into lithological contacts and in faults and joints exploited by water with solution weathering. Water quality is generally good but with high alkalinity and hardness.

Quartzites of the Nosib Formation where groundwater is abstracted from weathered faults and fracture zones. Water from quartzites is mostly good quality.

Post-Karoo basalts and dolerites which underlay northern Kavango can yield good water along weathered fault zones. However with weathering clay can develop along the fault zones and result in poor yields. Water quality can be good or poor depending on the influence of overlying sediments (Namibian Groundwater Development Consultants 1993).
5.9 BASELINE WATER RESOURCES

5.9.1 Introduction

The methodology of the Kavango survey is the same as described in section 2.2.3. A total of 5 sites were surveyed, all of them inland from the Okavango River where the focus on water resources was on seasonal pans, ponds and boreholes. For results see Annex on Water Quality Results.

5.9.2 Water Resources at Each Community

Fumbe

The main water points in the area are the borehole at Fumbe, the borehole at Mangundu, the pan to the south at Tosha, the recent borehole at Tosha, the twin Dahousie pans to the east, occasional and restricted access to water points at Mashare Agricultural Farm and the Kavango river during extreme water situations.

Site 1

Fumbe (diesel engine)  
S 17°58.388’
E 20°11.481’

The borehole was drilled in 1966. According to borehole logs the depth of hole is 300 metres with Rest Water Level at 12.2 metres. Yield is light at about 1.8m³/h. In the past, from 1966 to 1977, the Fumbe borehole was equipped with a windpump only. The windpump was destroyed during a heavy storm and was replaced with a diesel engine system. The community prefer the windpump system as it did not break down as often as the diesel engine delivery system. At present the borehole is equipped with a Lister diesel engine on a mono pump system. The engine is under a metal sheeting cover to protect it from weather. The water is first pumped into a plastic tank reservoir on a stand and to a tap for domestic use. From the plastic tank water is gravity fed to a small cement dam/tank for stock watering. The cement tank feeds a circular stock trough about 20 metres away. Water lines also take water to a stand point with metal wash basins and to another community wash stand (cement construction) and stand-pipe system. Adjacent to the cement wash stand system is a garden, with the both stand and garden fenced off from stock.

The garden is intended to watered from runoff water from the wash stand, transferred by buckets or other containers. This is not being done so the water remains in the trap of the washing facility or eventually overflows into a muddy pond below the facility which the stock use for drinking. Although the residents say that the muddy pond is natural from rains there is evidence that significant water is supplied from overflow from the water taps upslope near the reservoir, from overflow from the cement stock
was blamed on children playing with taps and leaving water to run out unchecked from the reservoir.

Water quality tests show the water to be of Class A or Excellent Quality. It is suitable for domestic use, stock watering and irrigation. Medium salinity limits irrigation to plants with moderate salt tolerance provided a moderate leaching of salts from soil occurs.

Site 2

Mangundu (Bushpump/handpump)  
S 17°59.789’
E 20°07.059’

Mangundu is a small village located 11 km west of Fumbe. It sits on the south border of a large cropping field (about 800m x 2500m) cleared from the forest. The water point is located in the village and is equipped with a handpump (Bush Pump design). The borehole depth is 116 metres and the Rest Water Level is 35 metres. The yield is 8.46m³/h, quite strong. The pump is inside a log fence and the site is clean. The water point is used solely for small stock and domestic purposes. Large stock obtain water from Fumbe.

Water quality analyses show the water to be of Class A or Excellent Quality water. It is suitable for domestic, stock, and irrigation use. Medium salinity limits irrigation to plants with moderate salt tolerance provided a moderate leaching of salts from soil occurs. The water is non-corrosive.

Site 3

Tosha Pan (diesel engine)  
(open pan)  
S 18°04.357’
E 20°11.857’

Tosha Pan is located approximately 10 kilometres south of Fumbe in the forest. The borehole, drilled in 1993, sits next to a household (7 huts) 50 metres west of the pan. The area around the pan and water point are under cropping. The borehole is serviced by a Mono Pump and powered by a Lister diesel engine. According to borehole records the depth of borehole is 50 metres. No other information is available. It fills a concrete reservoir 50 metres north of the borehole. Water is used for stock and domestic. The senior resident of Tosha is a school teacher who used to reside in Fumbe but now resides at Tosha. The teacher ensures that the diesel is supplied for the engine. The Tosha residents perform light maintenance on the engine (ie oil and filter changes, tightening of bolts).

Water quality analysis of Tosha Pan show the water to be Class A or Excellent Water Quality. It is suitable for domestic, stock and irrigation use. It is corrosive to steel. Water quality analysis of the borehole yields the same quality of water. The borehole
has slightly higher salinity that will affect irrigation potential of the water.

Site 4

Dahousie Pan

S 17° 58.270' 
E 20° 14.270'

Dahousie Pan is actually two small pans located approximately 5 kilometres west of Fumbe. This area is used for wet season grazing/stock watering when rain brings water to the pan. This year there was a small amount of muddy water in one of the set of pans due to low rainfall, but due to the proximity of the area to Fumbe dry season grazing will continue.

Summary

The system of the plastic reservoir and stand pipes is a first step to overcome the problems of water borne illness, isolating the water resource as much as possible from the outside environment. However, this is nullified by the standing water within the washing facility and the pond below, mixed with livestock traffic and waste. These problems can be overcome by protecting all domestic water sources from stock, arranging a workable system to take away standing water from the wash stand and trying to minimize water wastage resulting the overflow that fills the muddy pond. Two sources of water exist nearby, namely Tosha Pan and and Mangundu. Records suggest they have good yields. To take stress off of Fumbe water point Mangundu could be upgraded in equipment from a handpump and Tosha could be opened for access to its neighbours.

Kapupaghedi

Site 1

Shinunga (diesel engine)

S 18° 08.378' 
E 20° 17.969'

The site is a borehole equipped with a diesel engine driving a monostream pump. The system feeds a galvanized reservoir which in turn feeds a domestic takeoff and a stock trough. The trough is balanced on logs. According to borehole logs the depth of borehole is 58 metres with Rest Water Level at 28.7 metres. The yield is strong at 7m³/h.

Water quality analysis shows the water to be of Class A or Excellent Quality. The water is suitable for domestic, stock and irrigation purposes. Medium salinity limits irrigation to plants with moderate salt tolerance provided a moderate leaching of salts form soil occurs. The water is non-corrosive.
Site 2

Kapupaghedi (hand dug well)  

S 18° 08.971'  
E 20° 21.661'

The site is one of two hand dug wells in the Omatako Omuramba just south of Kapupaghedi. One well is open and of concrete ring construction set in with the help of Canamco. The Rest Water Level is 1.6 metres. The well is sunk into a black peaty soil type that has a clay-like water holding capacity. People do not use a bucket and line but rather use a log as a ladder and go into the open unlined well with a bucket for water. They are not using the concrete ring well as they cannot get down to the water easily.

Water quality analysis shows the water to be of Class A or Excellent Quality. It is suitable for domestic use, stock and irrigation application. The water is of medium salinity limiting irrigation to plants with moderate salt tolerance with moderate leaching of soils occurring. The water is non-corrosive.

Site 3

Karokwe (handpump)  

S 18° 14.136'  
E 20° 28.442'

The site is a borehole equipped with a handpump (Bushpump design) for a community that is near the south eastern boundary of the community.

Water quality analysis shows that the water is Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. The water is corrosive to steel.

Site 4

Nlilira (hand dug well)  

S 18° 5.696'  
E 20° 23.086'

A new well was being constructed by the community during the site visit. Concrete rings were being set with the aid of Canamco supervision. Sample was taken from older hand dug open pit 50 metres up the river valley. The well is sunk into the black surface peaty soil which changes to sand after 1 metre. The Rest Water Level is about 1 metre.

Water quality analysis shows that the water is Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. Medium salinity limits irrigation to plants with moderate tolerance to salt and in soils that provide moderate leaching of the salts. The water is corrosive to steel.
The borehole was established in 1993. It is equipped with a diesel engine powering a monostream pump. The system services the community needs, including a school, and a nearby clinic that is being reconstructed. The pump delivers to a tank stand reservoir which overflows into an adjacent galvanized reservoir. Water is then gravity fed to a stock trough nearby. There is no domestic takeoff. The stock trough is temporarily being fed by a plastic hose which is being damaged by stock. There is standing water around the stock trough. No borehole record was available.

Water quality analysis shows the water to be Class B or Good Quality water. It is suitable for domestic, stock and irrigation purposes. Medium salinity limits irrigation to plants with moderate salt tolerance and a moderated drainage of soils. There is high sodium content that can cause harmful concentrations in soil. The water is corrosive.

**Summary**

Water supply for the are are adequate in quantity and quality. Pressure can occur at points where heavy use is focused (stock related) at a given time. There a number of hand dug wells in the omuramba that appear to provide good water and could be improved upon in terms of delivery systems (eg windlass system) to make them more attractive to locals. Concern was expressed on digging through the black peat soil when deepening hand dug wells and whether this may cause a loss of the resource. The well at Nilliira has been dug through this horizon into the sandy layer below with no apparent ill-effects. It would be good to observe the two types of wells (those in the black horizon and those below) during the dry season to see if their hydraulic capacities differ or water quality alters.

**Muthinduko**

The community has very local water resources, utilizing pans during the rainy season. Besides a main borehole at the school two areas of the community are serviced by hand dug wells.

**Site 1**

Hand dug well(shaduf)  
S 18° 05.434'  
E 21° 19.734'

The well is located south of the village next to a large cropped field. It was dug in May of 1995. The well took 3 months to dig as the owner dug it into a termite mound to maintain the structure. Rest Water Level is at 13 metres, occurring at an interface.
between upper dark soils and underlying white to yellow sands. The bottom of the well is 3 metres into the white sand. The delivery system is a shaduf, very unusual in the Caprivi. One of the local older residents brought in the technology from outside the area.

Water quality analysis show the water to be of Class A or Excellent Quality. It is suitable for domestic, stock and irrigation purposes. Medium salinity limits irrigation to plants with moderate salt tolerance and moderate leaching in soils. The water is non-corrosive.

Site 2

Hand dug well (windlass)  
S 18° 04.508'  
E 21° 18.584'

This well was dug in 1995 in dark brown sand top cover. It penetrates into the lighter white/yellow soils where water occurs. Rest Water Level is 16 metres. This well took only 5 weeks to dig in much softer ground. However the owner has to dig a new well almost every year due to collapse during the rainy season. The delivery system is a windlass.

Water quality analysis shows that the water is of Class A or Excellent Quality. It is suitable for domestic, stock and irrigation purposes. Medium salinity occurs again, with the same constraints on irrigation as site 2 analysis.

Site 3

Muthinduko (diesel engine)  
S 18° 08.915'  
E 21° 21.741'

The hole was drilled in 1987 and is 47 metres deep. Rest Water Level is 17 metres. The yield is not clear from the report. The system is equipped with a diesel engine powering a monostream pump. Water is pumped to a galvanized reservoir, with a stand pipe adjacent for domestic water. A stock trough is set between the pump and the reservoir. The water appears to cause oxygenation and rusting of the metal fittings of the system. This apparent at the pump and at the dam. There is a seasonal pan just north of the pan also used for stock watering.

Water quality analysis shows that the water is Class A or Excellent Quality, suitable for domestic, stock and irrigation. According to the analysis the water is not corrosive, so the detritus on the system may be mineral precipitation.

Summary

Water quality is very good in the area and individuals show initiative in circumventing
their water problems. The water table appears to be consistent within the main east-west channel flow and should be considered as an option for shallow well or jetted well construction if the resource is to be enhanced. Low cost wells could be established as opposed to drilling.

*Nkutu*

The main water resource in the community is shallow hand dug wells and jetted wells. Boreholes are at the northern and southern boundaries of the community area.

**Site 1**

*Nkutu (hand dug well)*

S 18° 01.014’
E 19° 31.427’

The site is a concrete ring lined well with a Blair pump installed on surface. Rest Water Level is 6 metres. The level is just below the bottom rod of the pump so the pump does not deliver. The cover has been pulled off and water is being accessed with bucket and line. The rings were not set in straight or the whole structure has shifted slightly. The well was dug in 1995 with the help of Cooperation for Development (CD). The water is not clean and open to contamination. Since pump installation the pump has broken 3 times. At the time of survey CD had arrived and was jetting a new well. According to the locals recharge is slow. During the dry season the well always has water but the level will drop.

Water quality analysis show the water to be of Class C or Low Risk Quality. It is suitable on margin for domestic consumption and suitable for stock. High nitrate concentrates in the water could be toxic in children under 1 year old. High salinity of the water limits irrigation to plants with a high salt tolerance and in soils with very good drainage. Scaling can occur and water is corrosive towards steel.

**Site 2**

*Sisungu (diesel engine)*

S 18° 02.328’
E 19° 30.881’

The borehole was drilled in 1953 to a depth of approximately 59 metres with Rest xWater Level at about 30 metres. The recorded yield at time of drilling was 7m³/h. In 1993 the hole was installed with a diesel engine on a monostream pump in a pump shed (previous installation was a windpump). The site is very clean and maintained by a caretaker. The pump feeds to a galvanized reservoir which feeds a stock trough and domestic stand point. The trough is of a small round design and appears awkward for stock.
Water quality analysis show the water to be of Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. Medium salinity limits irrigation to plants with moderate salt tolerance with moderate leaching of soils necessary. Scaling can occur but the water is non-corrosive which would account for the long life of this borehole.

Site 3

Nkutu School (handpump)  
S 18° 02.328'  
E 19° 30.881'

The site is a jetted well located near the community school. A hand dug pit is adjacent. The borehole is equipped with a Blair design handpump. The system was installed for the school but is also used for filling a nearby stock trough (palm log). The nearby hand dug pit uses the more difficult ladder and bucket system and is probably used less now.

Water quality analysis show the water to be Class A or Excellent Quality water suitable for domestic, stock and irrigation use. Medium salinity limits irrigation to the same extent described for site 2. The water is non-corrosive but scaling can occur.

Site 4

Mungumba (diesel engine)  
S 17° 42.226'  
E 18° 17.309'

Mungundu is also quite old, having been drilled in 1954 to a depth of 116 metres. The Rest Water Level at time of drilling was 34 metres and the yield 8.5m³/h. The system is equipped with a diesel engine on a monostream pump which delivers to galvanized reservoir and then to a cement stock trough and domestic standpoint. The trough is in disrepair. A sample was not possible due to engine breakdown.

Summary

The area is supplied by good quality water and are quite happy to work with shallow well/handpump technology. There is a preference for a more robust design of pump than the Blair. The Blair umbrella handle is awkward and delivery is low. The Zimbabwe Bush pump design is most requested here. The boreholes appear to be accessing another aquifer which is capable of delivering good quantity and quality water. The fact that they are still intact after more than 40 years is a testimony of good quality and non-corrosive water.
Silikunga

Site 1

Simbugu Pan

S 17° 43.281’
E 18° 18.188’

One of the series of major pans in the omuramba just north of the east-west gravel road. It is used for domestic purposes and has a log fence around the pan to keep livestock away.

Water quality analysis show the water to be Class A or Excellent Quality water, suitable for domestic, stock and irrigation purposes. The water is corrosive towards steel.

Site 2

Keni Pan

S 17° 42.238’
E 18° 17.299’

The pan is the main stock watering point for Silikunga community when their borehole is down. The pan was enlarged in 1967 by the Govt and is likely the biggest in the area (20 x 50 metres).

Water quality analysis show the water to be of Class A or Excellent Quality water, suitable for domestic, stock and irrigation purposes. It is corrosive towards steel.

Site 3

Mungumba (diesel engine)

S 17° 42.226’
E 18° 17.309’

The borehole was drilled in 1955 to a depth of approximately 80 metres with a Rest Water Level of 61 metres. The yield at the time of drilling was 4m³/h. The system is a diesel engine powering a National Pump head. Old struts from a past windpump installation are still evident. The pump takes some minutes to deliver water, suggesting the yield has diminished somewhat in past years. Downhole components may also need replacing.

The water quality analysis show the water to be of Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. Medium salinity limits the water for irrigation purposes to plants with moderate salt tolerance and moderate leaching of salts from soils occurring.

Site 4
Silikonga (diesel engine)  
S 17° 41.499'  
E 18° 19.875'

Stand pipes from two older systems are near the borehole. The site was equipped with a diesel in 1974 and monostream pump (change from National head?) in 1994. The system is secured in a pump shed and is clean. The system delivers to a galvanized reservoir which feeds to a stock trough and a domestic standpoint. No borehole information is available.

Water quality analysis shows that the water is Class B or Good Quality water. It is suitable for domestic, stock and irrigation purposes. The medium salinity limits irrigation to the same restrictions as site 3. The water can produce scaling but it is non-corrosive.
5.9.3 Water Management Issues

Fumbe

Water Management Practices

In September of 1995 Fumbe formed a Water Point Committee with the help of Department of Water Affairs extension services. After the initial meetings in which the committee was formed no further visits occurred from DWA extension and no committee meetings were held. The community was informed that transport of diesel from Rundu to Fumbe must now be arranged for and paid by the Fumbe community. The community/committee is aware of the structure and purpose of a Water Point Committee but have not had any meetings since September of 1995.

Water Resource Sharing

The communities of Fumbe and other communities nearby (such as Mangundu) and the livestock of those villages are regarded as the owners of the water resources. The Govt is not regarded as the owner of the resource. The water resources are shared between the communities of Fumbe and Mangundu. The source of water at Mangundu is a borehole that is used by Fumbe residents for domestic water when their borehole is not functional. The Mangundu water point is equipped with a BushPump handpump and is only used for domestic purposes by residents. Reciprocally Mangundu residents use the borehole at Fumbe on a regular basis for their stock.

When the borehole at Fumbe is not functioning, farmers will use the nearby pans. These pans carry water during the rainy season and are preferred as they are removed from the cropping areas. This deals with the problem of having large stock near the crops around the village during the cropping/rainy season. Some individuals who have relatives working at nearby Mashare Agricultural Farm can arrange to take their stock to the farm and use the water points there. In extreme cases stock owners who do not have this option are forced to go the Kavango river with their stock.

Occasionally some members of the Fumbe community will take care of cattle owned by family members living outside of the community. As payment they usually receive a calf during calving season.

Approximately 10 kilometres south is Tosha Pan which, according to local information was used regularly in the past for stock watering. By moving the cattle at a fast pace they could walk through the forest, be watered and return to Fumbe area within a day period. Fumbe residents do not use the water at Tosha Pan at present.
Water Issues and Problems

When breakdowns occur the Rural Water Supply team are informed of the problem. The message is passed on to Rundu from the village by individuals travelling to the main road or by travelling to Rundu themselves. The RWS team can take up to a week to respond.

Another community issue centres around the Department of Water Affairs Cost Recovery Program. Acquiring diesel for the borehole is now a problem. Since late 1995 (exact month varies) the community has had to arrange for their own transport of diesel to the borehole. Diesel must be transported from Rundu to Fumbe which requires the arranging of a vehicle for transport and collection money for payment of vehicle transport. Trips are necessary on average once every six weeks and the cost of transport is about N$60. Recent fuel delivery has been arranged with Lux Development during their community visits.

A local teacher has moved to Tosha pan and has had a borehole installed (how this was managed is not clear). A result of new residency is that much of the pan is now surrounded with crop fields. Consequently the pan is effectively closed off to stock and locals are reluctant to graze cattle nearby and risk their cattle getting into the crop fields around the pan. Aside from the damage to the crops a cattle owner is liable to a local fine if his stock causes damage in crop fields.

For some of the residents, the distance to the borehole is too far on foot. People usually carry water in 25 litre containers, two at a time. The children go to the borehole and collect or drink their own water.

The diesel engine on the borehole has problems with breakdowns.

Women collect water three times a day: in the morning with and/or for the children, at noon for the lunch time water collection and in the evening for the supper. This water is used for small stock if they live too far away for stock to walk to water. Other sources of water in the area are old springs or shallow wells in the Omuramba.

In the previous years before drought the water was easier to find in the Omuramba well sources. Wells did not dry up as frequently and rains were more abundant.

Although the community stated that they have adequate water resources, they suggested that the water point at Mangundu be upgraded from a handpump to a diesel engine. This would reduce the stress at the Fumbe water point.
Kapupaghedi

Water Management Practices

Management practice takes the form of a Water Point Committee (WPC) formed in 1995 with the help of Department of Water Affairs extension work. After formation of
the committee one meeting was held in December of 1995. Before the WPC formation
a caretaker had been put in place by the previous Govt to help organize the water point.
This did not appear to include any maintenance practices but may have helped to raise
the awareness of the community towards water point management. At the WPC meeting
held in December, 1995 the committee made a rule to try to control good water use (i.e
prevent wastage, taps running needlessly, children playing with taps etc). If persons in
the community default consistently then the problem is taken to the headman of the
community for discipline. There are no set times for stock watering or domestic water
collection, but people tend to collect water in the mornings and stock in the afternoons.
Breakdowns of the water point are dealt with by the caretaker who reports to the
committee. It also his his task to report breakdowns to DWA in Rundu, which requires
sending messages via vehicles to Rundu or hitching to Rundu to report the breakdown.
Repairs have been delayed up to 3 months after the breakdown has been reported.

The Department of Water Affairs Cost Recovery Program is dealt with by the WPC.
The community is required to organize transport of diesel for their engine from Rundu
to Kapupaghedi. This requires paying for transport, which costs from N$80 to N$120
per trip. The plan is for the committee to collect N$5 from each household (27
households were mentioned during discussions). A trip is made every 2 to 3 months for
fuel, with money collected before each trip. DWA extension advised the committee that
each household should be assessed for cost payments on the basis of how much stock
each household owns. No suggestion of how payment collection was to be organized
was given or where the community was to obtain money. The community sell mahangu
and brewed beer on a seasonal basis for small cash but do not sell stock on a regular
basis. From discussions with stock owners it appears that stock numbers are low for the
individual and they are extremely reluctant to sell even one animal (that being a high
percentage of the ‘herd’)

At the time of survey a stock owner from nearby Karokwa was transporting diesel for
the community for free, thus postponing a difficult situation for Kapupaghedi. The
water point at Karokwa was insufficient for stock watering so cattle were being watered
at Kapupaghedi in exchange for diesel transport. With the Water Point Committee and
Cost Recovery Program being relatively new (late 1995) the concept and practice of
collecting money for fuel transport may require extension support and community
meetings to maintain it, especially after Karokwa stock owners stop transporting diesel.
Water Resource Sharing

The water point committee owns and controls the water at the borehole. Hand dug wells in the omuramba appear to be private, belonging to the families who dig them. However, asking permission for outsiders to use the wells is not usually necessary. People living closer to the omuramba use the hand dug wells as often as they use the borehole. During periods when there is a water point breakdown at Kapupaghedi, the stock is taken to Shinunga water point. These two communities share their water resources, with Shinunga using the water point at Kapupaghedi when their system is down. Stock owners bring their stock from Nlilira on a daily basis to water at Kapupaghedi. The livestock from Karokwa take water at Kapupaghedi every other day, grazing as they move in between communities. At present a clinic is being constructed at Kapupaghedi which requires the pumping of more water than normal. The clinic is an important change for the community, providing regular health services for adults and especially children.

Water Issues and Problems

The community view is that there is insufficient water at the Kapupaghedi water point to accommodate all of the stock. In the past, with better rains, it was possible to find water in pans in the Omatako Omuramba. During past water shortages the communities were forced to go the Kavango river for water. With the boreholes introduced in the area the situation has improved for water. Domestic needs are adequate. They are aware that too much cattle cause erosion around the water point as well as the destruction of shrubs and grasses. Consequently, grazing around the community area has diminished. The community requested that the development of water points at locations further away from Kapupaghedi would solve their grazing and water resource problems.

Muthinduko

Water Management Practices

The original water point at the community consisted of a hand dug well sited by the headman. A borehole was later drilled and equipped with a handpump. Around this water point a new community developed, but it was still a regular practice to walk cattle to the river for water during the dry season when the local pan dried up. When the borehole and handpump stopped working an new borehole was drilled and equipped with a diesel engine and Mono Stream pump. The community regard themselves as owners of all of the local water resources except for the recently dug well to the west.

There are no specified times for stock watering or accessing domestic water. In terms of daily practice, members of a household will spend the day working in the fields and will collect water from the water point on their way home. Those members of the household not working in the fields, such as children and elderly family members, will
collect water during the day.

During the previous Govt a caretaker appointed by the community attended to the original hand pump and site, reporting the need for repairs to the Govt administration. After Independence the Department of Water Affairs installed a new borehole equipped with diesel and Mono Stream pump. The community was required to form a Water Point Committee and appoint a caretaker. The committee broke up when they became aware that the caretaker was not going to get paid by the Govt. When questioned, the women in the community stated they had no knowledge of a Water Point Committee and did not recall any visits from DWA extension officers.

At the time of the survey the DWA was supplying spares and service of the water point. Diesel was still being delivered for free to the community, but after the most recent delivery in December 1995 the community was informed that they would have to start paying for transport of diesel and for the diesel as well. This is an aberration to other areas in the Kavango and may be a result of confusion over a system that had yet to be implemented. When questioned about their ability to provide payment for water services the community stated they had made no plans for payment.

Water Resource Sharing

The water from Muthinduko is shared with neighbouring Hairungu community which lies approximately 12 km to the west and is also equipped with a borehole. This is a reciprocal agreement for both communities that comes into effect when either community has a borehole breakdown. Of the two hand dug wells to the south and west of Muthinduko the western well is used only by the household that dug the well (for domestic use). The Muthinduko community also utilizes the well south of their borehole for domestic use, possibly because it is closer to the larger community body. These two household groups use the Muthinduko borehole for large stock watering. During the dry season communities north and near the Kavango River (by Shadikongoro) move south to graze. They will also access water for stock from the Muthinduko borehole. If the borehole breaks down and Hairungu is not available, the community would also consider walking their cattle to river every other day for stock water.

Water Issues and Problems

Borehole breakdowns are reported to the Govt offices at Mukwe, with repairs taking from a week to 3 months to be affected. There are complaints of the borehole going dry but this is more likely a breakdown they are referring to. They have experienced problems with the repairs, with the borehole system breaking down one week after repairs. It was not possible to pinpoint what problems were occurring. There is concern about regular breakdowns of the borehole system, forcing the community to water their stock at other sources. They requested another borehole for the community to deal with the breakdown problem or another borehole to be drilled in the southeastern grazing area.
Nkutu

Water Management Practices

The water from the nearby hand dug well in the Omuramba is used for domestic and small stock. Nkutu community contributed labour to the digging of the hand dug well in 1995. Nkutu has a Water Point Committee, recently formed in January 1996 with the help of Cooperation for Development extension work. The WPC is to collect funds to pay CD for some of the costs of setting in their community well and effecting repairs. Breakdowns on the hand dug well and hand pump are reported to CD in Rundu. Large stock is taken to the borehole a Sissungu (engine equipped) or to a borehole at the school (hand pump equipped). The users from Nkutu contribute money to Sissungu (organized via their WPC) for the transport of diesel (with new DWA policy). Stated contributions vary from N$8 per user/household to N$10 per herd/person on a monthly basis. Diesel supply trips for Sissungu cost about N$250 every two months.

Water Resources Sharing

Due to the poor water supply during the time of survey at the Nkutu hand dug well, women and children were also accessing domestic water from the school borehole and hand pump to the south. As previously stated Nkutu uses the borehole at Sissungu for large stock watering on a regular basis, contributing to the cost of diesel transport. They also use the hand pump and open hand dug well at the school for stock but to a lesser degree due to the labour required. One individual at Sissungu pays for the diesel transport at present and the surrounding community reimburses him. The Sissungu pump system is under lock and key with the water point caretaker. If the Sissungu borehole is down the people from Nkutu will take their stock north to Mungundu borehole.

Water Issues and Problems

At the start of the survey the main problem was the water quantity and quality in the hand dug well near Nkutu. The concrete rings were shifting (not in itself a serious problem) but recharge was slow and/or the water table appeared to have dropped. The pump rods from the handpump (a Blair design) stopped just short of the rest water level. With the well-top removed for bucket access, water has become dirty and likely contaminated. This problem may have been alleviated with the arrival of a CD well-jetting team which set in a well on the second day of our survey. It was not equipped at that time.

There is interest within the community to change from the Blair design hand pump (at Nkutu and at the school) to a Bush Pump design. The 'walking stick' discharge of the Blair is viewed as awkward compared to the Bush pump lever-style handle, and it is thought that the Bush Pump is able to pump larger volumes of water. CD has agreed to
supply/replace the Blair pumps with Bush pumps if the community pays for the new pump. Their was also interest in equipping the open hand dug well at the school (used for stock) with a handpump, but the community stated that it would need outside help to deal with this project. At present it takes 3 to 4 men inside the well to lift water out to the surface.

The community also requested a new borehole for Nkutu equipped with a diesel engine. This request is not really based on water shortage but more to cut down on the long distances required to move stock to water. On discussion of community payment for diesel transport they suggested that a windpump would be the best choice although they also could not agree whether there was enough wind to run a windpump year round. If Nkutu was given a new borehole (diesel equipped) they state they would share water with their neighbours but would also charge for the use of their resource (suggested charge of N$10/herd per person)

Silikunga

Water Resources

It is important to note that at all of the water discussions the Headman, his advisors and the Regional Counsellor’s assistant were present. They had a tendency to direct information received.

Water Management Practices

There is no functioning Water Point Committee at Silikunga. A committee was formed in April of 1995 and one followup meeting was held later that year. No meetings have been held in 1996. Breakdowns of the borehole are reported to Rundu. To pass this message can take up to a week unless direct transport can be arranged. Repairs can take up to 3 or 4 months. There is no management of the borehole or any user practices according to the community (headman and advisor). People or stock take water when it is available from the reservoir (ie. when diesel is available). However some control of the borehole is evident with the headman and advisor. During the survey the system was not pumping and the reservoir was dry. A check showed that there was diesel in the system but was being used for pumping water as there was not enough to pump for all of the people. Diesel had been delivered to the community up to the end of 1995 but the Govt has not delivered since the New Year. As a stop-gap the Headman and advisor collect N$1.50 from each household and will buy 20 to 25 litres of fuel from the petrol station at nearby Nkurenkuru. This solution is temporary as much of the stock at present is being watered at the nearby rainfilled pans. When there is sufficient diesel, water is pumped daily, but due to the stock and human population the reservoir is also emptied daily.

Water Resource Sharing
The nearest large water resource is about 2.5 km south of Silikungu at Keni Pans where the community waters their stock during the rainy season. One pan is used for stock and a smaller pan is for domestic use. Stock must be constantly kept aside from the domestic pan. Two other pans located within the east to west omuramba, Nguru and Simbungu, are also used for water sources. They will be used year round in a good rainy season. When the borehole is down at Silikungu, especially during the dry season, the community will move to the boreholes at Mungomba, Kaguni and Mukambo. In extreme instances, when water from the above sources is limited or unavailable, water will be taken from Mpungu centre for stock and water brought back to the village in drums. Water from Mpungu will be taken from the pans or local hand dug wells and not from the boreholes servicing the hospital or school. Water from Silikungu borehole is shared with Kaguni, Mongambo and Mukambo when they experience water problems. Mukambo, however, tends to take its water from the omuramba pans which are closer than Silikungu. The pans, for those communities who are close to them, appear to be a first option rather than travelling to neighbouring boreholes. With the confusion of dealing with diesel transport so far from Rundu it is likely the most reliable option at present.

**Water Issues and Problem**

One concern by the community was that now Silikungu was on the list as having a Water Point Committee the Central Govt may be under the impression that all of their water problems were under control. Their is a strong impression that Rural Communities are not serviced as regularly as Urban Communities and that they are a lesser priority.

With expanding population of people and stock around Silikungu the issue of water shortages was a constant issue. A new borehole for the village centre was requested to deal with the problem. A new borehole was also perceived necessary in order to develop Silikungu into a new and growing centre with schools and hospital similar to Mpungu (these issues were strongly put forth by the Headman and his advisors). Also requested was a piping system to take water to the households from the water points. With the seasonal use of the pans for domestic water (as well as stock) concerns were expressed on water quality from these open sources. Again a reason for another borehole. For improving the resources of the region of communities it was suggested that the pans at Keni could be cleaned or rehabilitated to extend their carrying time beyond June. Discussion on this issue suggested that the improvement of the dam was preferred to a new borehole, suggesting more interest on stock water than on domestic water.

The DWA Cost Recovery Plan, requiring payment for diesel transport is a serious issue at present, with transport of a load of diesel costing up to N$350 per trip. The community state they require a trip each month, but this is difficult to arrange with no transport. The collection of this amount of money on a monthly basis is also difficult without any form of organization to deal with their water point. It was requested that
the Govt could set up supply depots for diesel in the regions to make it easier for communities living distant from Rundu to access fuel for their water points. Using a filling station within each constituency was suggested. Apparently this had been suggested to the Ministry of Agriculture already but had been refused.

Much interest was expressed in the rehabilitation of the dam. The discussion group stated that the community would be willing to supply labour for any rehabilitation work. They would also like to set up fences around the pans, especially those they are trying to control for domestic use, and will supply the labour if materials could be provided.
5.10 CONCLUSIONS

Water resources at all sites are almost of Class A or Class B water quality. The main issue in the whole region is water quantity. Areas within the community will have marginalized water sources, thus bringing pressure on existing water points. In the communities of Fumbe and Kapupaghedi the infrastructure is intact to deal with this problem. At these sites engine equipped boreholes are usually the focus of stock use for the local region because the outlying area are only equipped with handpumps. If the boreholes are adequate the delivery system could be upgraded to windpump or engine at these outlying sites. Drilling of holes in these areas should not be necessary.

Drilling jetted wells are also a less expensive option to increasing access to water. This is being done at the moment in Nkutu area where the water table is shallow and the top ground cover is soft alluvial material that will allow for jetted wells.

Hand dug wells are used effectively in all sites surveyed except for Silikunga. Except for one site at Nkutu, they all produce good quality water. The system of using concrete rings equipped with handpumps is effective and can be done with the aid of the community. It also acts as a good focusing activity for promoting organizational capacity within the community. Most of the wells use the bucket system. Of the handpumps observed the preferred model appeared to be the Bushpump design and not the umbrella handle Blair pump design. In the eastern community of Muthinduko the technology of windlass was being used and, for the first time in the region, the shaduf. The communities of Muthinduko, Nkutu and Kapupaghedi use shallow wells improve their water access. The water table at Fumbe is possibly too deep for shallow operations. There was no information on current water table at Silikunga, but the lack of hand dug wells in the area suggest the water table may also be too deep outside of the omurambas. The omurambas at Silikunga should still be considered for shallow wells to supply residents in the omuramba with a safe water option. At the moment the pans are the main source.

The site where surface water is a major source is in the omuramba at Muthinduko. There are a series of pans in the omuramba, the largest of which is Keni Pan, which was opened up in 1967. These pans carry water far into the dry season and are likely supplied for a portion of that time by shallow sub-surface flow in the omuramba. These pans have good potential for development of surface water resources and could be expanded. After almost 30 years Keni pan could be cleaned at low water season.

In terms of community issues, the common problem appears to be dealing with payment for diesel transport. The point that some communities living on the border of the regions must pay more for transport is often raised. All communities have difficulty in raising money on an effective and organized basis and some organizational coaching is necessary. Water Point Committees have been formed but they are not operational due to lack of extension work.
5.11 SOILS OF THE KAVANGO

5.11.1 General Description of the Soils of the Kavango

The Kavango region falls into the Northern Kahalari Sandveld Region of terrain (Loxton and Assoc. 1971) which can be broken down into two sub-regions: the River Terrace System of the Okavango River and the large Inland Sand Plateau. The Plateau is in turn characterised by the two features of the longitudinal sand dunes and a large featureless plain (Burmeister Van Niekerk). The distribution of these soils is a function of two interactive factors of the depth of the aeolian sand mantle and the degree of relief or landform. After the Kalahari Sands were deposited on the Tertiary calcretes and sediments they were reworked by wind and water to form the flat plains and sand dunes of the present day. With changing relief in the basement of deposition and the surface relief (plains and dunes) the depth of the surface sands can vary considerably.

Where the sand mantle is deep with a flat plain surface (and minimal drainage features) the sands tend to be loose grey sands. In the Kavango they will appear white on surface due to ash deposits from continuous veld fires. The soils and soil parent material are of aeolian origin.

Where the sand mantle is deep and relief and drainage features are more pronounced the following sequence is observed: red sands on elevation, yellowish brown sands on mid-slope and grey or heavier dark soils in the bottomlands.

Red sands will occur on such relief features as edges of omurambas and longitudinal dunes. Flat areas with shallow mantles are usually associated at the bottom of the above sequence in sites such as omuramba floors, pans and old flood plains. In these areas the weathering and deposition of calcretes and silcretes contribute to the darker colour.

The most utilizable soils in this region consist of the aeolian sands and the bottomland soils (Burmeister Van Niekerk 1993, Loxton et al 1971).
5.12 BASELINE SOIL SURVEY

5.12.1 Introduction

Sites were surveyed at each community in order to obtain representative sample of the major soils types as defined by the community. Sample analysis numbers are included beside site numbers for reference.

5.12.2 Description and Analysis of Community’s Soils

Fumbe

Site 1 (5838)

The soil sample was taken adjacent to the Mashare fence. The soil is a brown/orange sandy soil of low pH. The soil has poor water retention characteristics. There was no measurable P content. The ratios of K, Ca and Mg are favourable but levels are quite low. The soil has low potential.

Site 2 (5839)

The site is in the woodland pasture of the wet season grazing area and has sandy texture. It has low water retention characteristics and is slightly acidic. As with site 1 all nutrient concentrations are low. The soil has low potential.

Site 3 (5840)

The site is in the dry season grazing area. The soil is a sandy soil, slightly acidic to neutral with poor water retention characteristics. All nutrient levels are low but the neutral pH will not interfere with nutrient uptake or nitrification of organic matter. The soil has low potential.

Site 4 (5841)

The site is in the cropland around Fumbe site. The soil, in a low lying valley or omuramba is a sandy clay loam with good water retention capacity. The pH is neutral to mildly alkaline. The soil nutrient is very high although ratios of K, Ca and Mg are not prohibitive to each other. The soil has high a high N and has good potential.

Summary

The soils in the area are low in potential except for the cropping soils near Fumbe. The soils in the dry season grazing area have a favourable balance but low nutrient content and will not likely sustain intensive cropping.
Kapupaghedi

Site 1 (5842)

The site is in woodland pasture near Karokwe. The soil is a white sandy soil of slightly acidic pH. It has poor water retention characteristics. Low K concentrations and nor recordable P will affect the quality of forage. Except for Ca, soil nutrient content is low. The area has low potential.

Site 2 (5843)

The site is in the omuramba in the dark soils near the hand dug wells. The soil is sandy but on site has good water retention, probably due to organic content. The soil is alkaline and has a high Na content, suggesting sodicity. Drainage is poor and the soil structure unstable. The soil has low potential.

Site 3 (5844)

The site is from a crop field in the omuramba. The soil is a sandy loam with moderate water retention characteristics. It is alkaline and has high nutrient levels, especially Na, again suggesting sodic soils. The soil has a good N content but Na could be a problem. The soil has good potential.

Summary

The soils in the forest area have low potential. Optimum soils occur in the bottom lands or on the break-of-slope, but not in the areas of that appear to be semi-saturated with shallow water tables.

Silikunga

Site 1 (5845)

The site is near the Silikunga borehole. The soil is a dark loamy sand with good water retention characteristics. The soil is slightly alkaline but with a good nutrient balance and level of K, Ca and Mg. Nitrogen content is good and the soil has good potential.

Site 2 (5846)

The site is from a cropping area near the village. The soil is light brown and of sandy texture with poor water retention characteristics. It is acidic and has low nutrient concentrations. The soil has low to moderate potential.

Site 3 (5847)
The soil is a white soil from the wet season grazing area and has a sandy texture with low water retention characteristics. The soil is acidic with low nutrient content except for Ca and has a low to moderate fertility.

**Summary**

The soils have low to moderate potential. The optimum soils in the area are the darker soils located around the village area. These soils are not as acidic and will not limit the nitrification of organic material.

**Nkutu**

**Site 1 (5848)**

The soil is from the cropping area up from the omuramba towards the woodland. The texture is sandy with poor water retention characteristics. The pH is neutral with the nutrient balance low to optimal. The soil has good potential.

**Site 2 (5849)**

The soil is from the omuramba bottom near the well point. The texture is loamy sand, with moderate water retention characteristics. The pH is neutral and the nutrient balance is good. Nutrients occur high amounts with high nitrogen content. A high EC and high Na content suggest a tendency towards salinity. The soil has good potential.

**Site 3 (5850)**

The soil is from a dark cropping soil in the omuramba and is a loamy sand with moderate water retention characteristics. The soil is alkaline and has high calcium levels. Nutrient levels of P, K and Mg are slightly below optimum. The soil has moderate to good potential.

**Site 4(5851)**

The soil is from the wet season grazing area and is a sandy soil with poor water retention characteristics. The pH is neutral and should not inhibit uptake from low nutrient levels (except for Ca). The nitrogen content is high. The soil has moderate to good potential.

**Summary**

The soils in Nkutu area have moderate to good potential, with the darker soils in the region being the most optimum.
**Muthinduko**

Site 1 (5852)

The soil is a dark sandy clay loam taken near the Muthinduko pan. The soil is alkaline and has high levels of Ca. Levels of K and Mg are low to optimum and nitrogen content is high. The soil has moderate to good potential.

Site 2 (5853)

The soil is a dark loamy sand from the cropping area in the woodland pasture north of the village. The soil is alkaline but, except for no levels of P, has a good nutrient balance of optimum levels. Nitrogen content is high and the soil has good potential.

Site 3 (5853)

The soil is from the cropping area in the woodland pasture. It is a dark loamy sand with moderate water retention characteristics. The soil is alkaline but has a good balance of K, Ca and Mg soil nutrients. Nitrogen content is high. The soil has good potential.

Site 4 (5854)

The soil is a light coloured sandy soil from the potential grazing area that poor water retention characteristics. The soil is slightly acidic, soil nutrients (P,K,Ca and Mg) are in low concentration but nitrogen content is good. The soil has low potential.

**Summary**

Except for the light coloured soils in the potential grazing area, the soils in the Muthinduko area are of moderate to good potential.
In general the soils that are darker and in the bottom lands of omurambas and have better potential. This is not always the case as can be seen at site 2 in Kapupaghedi area which has low potential. At this site the dark soils have a high organic content, are alkaline and have high levels of Na. Shallow bottom soils that are semi-saturated should be avoided for cropping activity. Dark soils out of omurambas have good potential as can be seen by site 1 at Silikunga and at site 2 at Muthinduko.

Forest/woodland soils vary in potential. At Fumbe, Silikunga and Kapupaghedi and Muthinduko they are all sandy soils and have low potential. Soils in the wet season grazing area have higher potential.

There does not seem to be any problem with structural breakdown as in areas such as Kunene. Rules of thumb regarding bottom lands and forested areas should not be applied and any decisions relating to soil quality should involve follow-up and site specific soil studies.
Section 6

CAPRIVI
6.1 INTRODUCTION

6.1.1 Preamble

This section of the report addresses the Caprivi Region and selected sites for Nolidep in the region. Key topics include socio-economic issues, vegetation cover and land uses, water resources and soils. These topics are discussed at a regional setting supporting baseline data collected during each community survey.

6.1.2 Organisation of the Section

This section of the report is organised as follows:

- Section 6.2 addresses socio-economic issues in the Caprivi region;
- Section 6.3 presents baseline socio-economic issues;
- Section 6.4 gives socio-economic conclusions;
- Section 6.5 discusses vegetation cover and land use in the Caprivi region;
- Section 6.6 describes baseline vegetation and land use issues;
- Section 6.7 presents vegetation and land use conclusions;
- Section 6.8 responds to water resources in the Caprivi region;
- Section 6.9 outlines baseline water resources;
- Section 6.10 discusses water resource conclusions;
- Section 6.11 gives soils in the Caprivi region;
- Section 6.12 describes baseline soil resources;
- Section 6.13 presents soil conclusions.
6.2.1 Historical Background

Caprivi was incorporated into Namibia as a result of German demands for access to the Zambezi. In 1914 Southern Rhodesian troops occupied the area and it was then administered as part of the Bechuanalnd Protectorate. From 1930, Caprivi was taken over by the South West African Protectorate and effectively administered from Pretoria (which is closer to Caprivi than Windhoek as the crow flies). Its status as a South African “Bantustan” terminated in 1980 when a new system of government was introduced into Namibia (Naeraa et al. 1993). Until this time, Caprivi was not part of Namibia in a practical sense. Even to this day, Caprivi’s proximity to Angola, Zambia, Botswana and Zimbabwe, its remoteness from Windhoek, and the distinctiveness of its peoples, present a challenge to the process of nation-building in independent Namibia.

One manifestation of Caprivi’s separate history is that English is the lingua franca, whereas it is still Afrikaans in the rest of Namibia, though English is now the official language. Although, Caprivi did not suffer the same degree of economic dislocation associated with the war as did the other communal areas bordering Angola, the present regional economic situation appears to be depressed. This is largely a result of the withdrawal of the SADF and its concomitant boost to the local economy during its stay. Today, the influence of employment opportunities, services, market outlets and pay packets of the occupying troops have all gone. However, the subsequent presence of the United Nations Transition Assistance Group (UNTAG) mitigated this withdrawal for a short time.

Caprivi has undergone great social change in the last 20 years, largely as a result of its greater exposure to outside influences, but has retained a relatively high level of political cohesion with the Tribal Authorities still commanding a respect, which has been eroded in many other parts of Namibia. The most urgent development needs are improvements in the infrastructure and marketing systems. Road networks outside of the Kongola-Katima Mulilo-Linyanti-Ngoma axis are almost non-existent, and infrastructural links between Caprivi and the rest of Namibia are poor. Currently, the road across the Caprivi Strip is being tarred.

6.2.2 Demographic Characteristics

Caprivi’s population, according to preliminary figures from the 1991 National Population and Housing Census, stands at approximately 92 000 (National Planning Commission [NPC], 1992). It should be noted that illegal immigrants from surrounding countries, especially Zambia, possibly constitute a significant omission from the official figures (during the census 4 033 Zambians were counted). The total of 92 000 includes the westernmost part of Caprivi which was formerly in Kavango and
is home to about 20 000 people. The population in the Caprivi Strip and eastern Caprivi was 71 027. The Caprivi Strip is sparsely populated as it is officially a game reserve. Eastern Caprivi (the study area) is the most populous part of the region, with about 70 000 people. Most of this population is concentrated on the main rivers and roads, with about 20 000 people living in Katima Mulilo, the regional capital (Fosse, 1992).

The age structure of the population is skewed, with 52.6% below 19 years old (NPC, 1992). This skew is likely to be reinforced in the future as the study area’s annual population growth is as high as 4.8% (NPC, 1992).

The study area has a balanced gender distribution, with a sex ration (number of males per 100 females) at approximately 97% (NPC, 1992). The fact that this region has a more balanced gender distribution than is found in other Namibian communal areas is due to the relatively low level of emigration found in eastern Caprivi. Of the 53 households interviewed in the study area, only nine (17%) were female-headed. Even though the sampling in the study area was not intended to be representative of the area’s population, this figure supports the findings of the 1991 census.

Caprivi is unusual in that the high level of migration out of the 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. In fact, independence has brought about the first exodus of Caprivians to the rest of Namibia, as the adoption of English as the national language has given them an advantage in the national job market at a time when the withdrawal of the SADF has resulted in a reduction in employment opportunities in Caprivi. Educational opportunities, especially in Windhoek, have also enticed many Caprivians away from their region, but Caprivi’s distinctive cultural identity has played a role in the return of a disproportionately high number (for Namibia) of students once their education is complete.

6.2.3 Settlement Patterns

Katima Mulilo is the only urban centre in Caprivi. The rest of the study 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 Mafa tribes respectively. The Basubia, in the east of the study area, 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 Mafa tribes, however, tend to the needs of their cattle by moving into the interior of the region, away from the heavily grazed areas near rivers and roads (see Figure 6.2a).

The last 25 years have seen 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
Figure 6.2a  Human Population Distribution in Eastern Caprivi
areas of settlement. Katima Mulilo itself has also grown rapidly during this period, being the main focus for the monetisation of the local economy by virtue of the SADF presence. 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 in Katima Mulilo to maintain two homes: one in Katima Mulilo for use during the week, and one in the village containing the bulk of family members, which is visited at 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.

However, one should note that many people are in Katima Mulilo as a result of poverty, such as many of the 3 000 people who formerly made a living around the shores of the (now dry) Lake Liambizi. These people, and others, are found in the many informal settlements which have grown up around Katima Mulilo in the last ten years or so. Indeed, Katima Mulilo has increased from a population of 292 in 1959 to 14 000 in 1982 (Adams & Werner, 1990) and is now estimated to be in the region of 20 000 (Fosse, 1992). Rural villages, on the other hand, have by and large seen their populations drastically reduced. For example, Sibinda’s population dropped from 2 350 in 1959 to 800 in 1982, while Sangwali’s population fell from 1 402 to 360 over the same period (Adams & Werner, 1990).

6.2.4 Land Tenure and Authorities

Eastern Caprivi is dominated by two ethnic groups, the Mafwe and Basubia. The former are in the majority and broadly inhabit the western part of the region, whereas the latter inhabit the east. Both these tribes in their own way maintain a relatively high presence (compared with other areas in Namibia) in local decision-making, with their traditional lines of authority basically intact. It remains to be seen how the first post-independence local and regional elections will impinge on this structure.

These traditional lines of authority emanate from the khuta (tribal parliament) of the two tribes. These consist of mulena or hereditary chief who only attends the khuta for especially important cases, the ngambela or chief’s deputy who can be described as the Prime Minister of khuta, as well as a number of induna (village headman) who act as the representatives of the various districts.

There is little difference in the customs and structures of both these tribes, but nevertheless they maintain a keen rivalry as shown by long-standing disputes over the jurisdiction of land (rendering it impossible to delineate the border between them). The reason why the more populous Mafwe have failed to turn their superior numbers into greater political clout is probably explained by the fact that they are less homogenous than the Basubia, being instead an association of five or more smaller tribes.

Land tenure, as in other communal areas, is based on the premise that every person has the right to the use of land to feed their family, with individual tenure give for the purpose of crop farming. Disputes are generally settled by the village induna, who also
determines the distribution of land to the landless or newcomers to the area. More contentious cases may be referred to higher levels in the tribal authority, at district or regional level. The exception to this process is Katima Mulilo where the land is under government control. Inheritance of land is generally attended to by the family concerned, and is at present generally patrilineal in nature, with any matrilineal inheritance (once the dominant mode of social organisation among the Mafwe) being eroded by the passage of time.

6.2.5 Rural Economy

The rural economy of Caprivi is primarily focused on agricultural work. Meanwhile, a variety of small-scale non-agricultural activities (services, handicrafts, trade) provide an important supplement to agricultural production/income. Agriculture in Caprivi is dominated by a combination of arable farming, typically maize and millet, and livestock production.

The economy has a higher formal section than most parts of Namibia. This figure has been estimated at approximately 28% based on survey results (Naeraa, 1993) for households with a fixed, regular income.

In the formal agricultural sector there are some elite groups farming crops on communal land. Production from these farmers is planned for the market which is either formal or informal. With the expansion of non-agricultural work, so the demand for maize increased on the market place. These farmers often employ local people, who may otherwise be unemployed (Adams & Werner, 1990; and SA Farm Consultants, 1989)

The major source of formal non-agricultural income derives from the Government. Naeraa et al. (1993) estimated that approximately 73% of those formally employed to the civil service. These position include a significant number of teachers, nurses and cleaners.

Urban employment in Katima Mulilo can offer people from rural areas with employment. However, these opportunities are not labour intensive. Therefore, their contribution to formal employment is limited.

Periods of low rainfall (drought) have inhibited the purchasing power of farmers in Caprivi. The result has been a decrease in the demand for non-necessities, i.e. non-food goods.

The informal sector of Caprivi is well developed though seasonal and non-seasonal work. This work may include ploughing before the wet season and construction of kraals in middle of the dry season.

More than 60% of the rural population of Caprivi is engaged subsistence agriculture
producing maize, millet and sorghum for their own consumption. This production occurs on small plots less than 10 hectares (Fosse, 1992).

Cattle are owned individually, but grazed in communal land. These animals provide meat, milk and drought power as well as a store of wealth. The latter factor can act as insurance against episodic crop failures, as well as cash for special needs. Naeraa et al. (1993) found that 70% of households owned cattle.

Fishing is a major activity for people in Caprivi, as the region is bordered by perennial rivers. Fish are seen as a supplement for the daily diet, as well as a source of nutrition during years of poor rainfall (drought). Tvedte et al. (1994) reported that 20% of households in Caprivi are involved in fishing. This percentage being much higher on and near the floodplains and perennial rivers.

Other forms of informal income generation include beer brewing, casual labour, taxi services, handicraft, wood and reed sales, and cross-border trading. Significant income includes beer sales as an important form of income for women. Naeraa et al. (1993) noted that approximately 20% of households use this process to generate some income. Casual labour is also important with approximately 25% of households having at least one man undertaking casual labour (Naeraa et al., 1993).

The rural economy in Caprivi is generally good and potentially affluent. The informal support structure, associated with principally traditional cultures, have maintained economic security in rural Caprivi.
6.3 BASELINE SOCIO-ECONOMIC CONDITIONS

6.3.1 Introduction

The socio-economic issues of communities associated with Nolidep in the Caprivi region was dependent upon the participation of its inhabitants, through several focus groups in each community. The results presented in this Section reflect the quality of the discussions, which vary according to the interest and knowledge of the respondents. People were prompted with questions, however, the depth of the answers often varied for different aspects of their socio-economic interests. This Section has formalised the responses into baseline information for each community, while the process for retrieval of this information was not as rigid.

6.3.2 Social Structures and Wealth

Kabbe

Kabbe community is composed of 18 villages named after the village Old Kabbe (see Figure 6.3a). The main village Old Kabbe was established over 50 years ago, when the water supplies came from either the swamp or hand dug wells. Senior Headman Marala Milinga has jurisdiction over the community, which is inhabited by the Subia tribal group under Chief Moraliswani.

Most of the 18 villages in Kabbe community have between 6 an 8 households, while Mudaniko has 21, Lindandelö has 14, Limbel I has 42, and Limbela II has 14. The exact number of households in the community is 177. As the average population in each household is approximately 7 persons, the population is approximately 1300 persons.

The number of people without any livestock is unclear for all the villages. However, it appears to be approximately 15% or less for several of the villages in the community. The total number of livestock was difficult to ascertain, however, some figures for several village were retrieved (C-cattle; G-goats). Demani - 181 C; Kabula - 46 C; Musumpanko - 129 C and 10 G; Kazauli - 700 C; and Idobe - 80 C. It appears from these figures, there is a disparity in the community with some villages and/or households having high numbers of cattle, while others have low numbers. At New Look I, Musumpauko, Limbela I and Limbela II approximate 50% of the households have between 1-10 cattle, while the remainder have more than 10 cattle.

Crop fields in this community are important for the subsistence of each household. The average household has one field of approximately two hectares, while the wealthier households can have up to two fields covering up to 5 hectares each.

Lisikili
Lisikili community is very large composed of 37 villages (see Table 6.3b). The main village - Lisikili was established in the early 1930s, when the main sources of water came from the swamps and river. The Senior Headman with jurisdiction over this community is called Mr Imukusi Kakambi based at Nfoma. The community is inhabited by mainly the Bafwe tribal group under Chief Mamili.

Most villages in the community have less than 10 households, while the larger villages include Nfoma - 20 households, Lisikili - 39 households, Saili - 26 households, Mafengu II - 31 households, and Libula - 46 households. The total number of households in the Lisikili community is approximately 350. As the average number in each household is 8 persons, this would give an approximate population of 2,800 persons in the community.

The total number of livestock in Lisikili is not known. Meanwhile, the number of households without livestock is 214 household (2 villages not recorded) representing 61% of the community, which is a relatively high figure. At the main village - Lisikili 29 households have no cattle, while 7 (18%) households have 1-10 cattle and 3 (8%) households have more than 10 cattle. These figures may be representative for the remaining households in the community.

Crop fields are owned by every household in this community. An average household has one field, which is between 2-3 hectares in size. Wealthier households have usually one field up to 5 hectares. The poorer people may have only 0.5 hectare, if they have no access to oxen for ploughing.

Cincinimani

This community is relatively large with 21 villages (see Figure 6.3c). Meanwhile, the main village is Simasiku. Cincinimani was established in the 1890s, when water for livestock came from a nearby stream, which is now dry. Then, people collected their water from wells near the river. The Senior Headman with jurisdiction over this community is Mr Barnard Muketela. The Headman for Cincinimani village is George Simusiku who has recently replaced the former Headman - however, this elderly former Headman appeared to have the influence of a ruling Headman in this community. The village is composed of mainly people from the Simbalangwe tribal group under Chief Mamili.

Most villages in this community have between 3 an 8 households, whereas the larger villages are as follows - 30 households at Sibobo and 41 at Simasiku. The total number of households in Cincinimani is 147 households. As the average number of people/household is 7, the population for Cincinimani is approximately 1000 persons in the community.

Based on the results of 16 villages, the farmers estimated that 70 households had no livestock representing at least 48% of the community. The total number of cattle is
approximately 1160, while there are less goats at approximately 250 head. Figures for the distribution of cattle numbers in households showed that owners usually had 1-10 cattle, while fewer people had more than 10. However, some of those with more than 10, probably had significantly large numbers of stock.

Crop fields were owned and managed by every household in Cincinimani. The average household has between 1 to 10 hectares as one field, while a wealthier household may have more than 10 hectares over two fields.

6.3.3 Formal and Informal Markets

Kabbe

The formal markets are located at Sifuha and Bukalo for this community. These markets are managed by Meatco for only cattle. Meanwhile, there are no formal markets in the vicinity of Kabbe marketing goats. However, many animals are bought by villagers at this market to slaughter or retain in their herd. The nearest quarantine area is at Katima Mulilo. Some farmers take their animals through to this area, as Meatco has an auction next to quarantine area.

Before the sale at a Meatco auction, the animals have to be registered on a list prepared by the Likwama Farmers Association. Many farmers object to the Association drawing up the list. Farmers thought that the list should be compiled by the Government eg DVS. In addition, farmers thought that the prices should be reviewed, as they are too low. If the prices were better, then farmers stated they would sell more commercially.

Farmers in Kabbe would like to have a formal auction held at their crush pen. This pen was used as an auction several years ago, then it ceased to function.

The informal market or 'bush market' is located in Kabbe at a well known tree near the school. This market caters for the entire community. Large stock are the main animals sold at the informal market. The market is conveniently placed near the school, as teachers have more cash than most inhabitants in the community to buy meat.

The slaughtering of meat in the village requires a veterinary certificate with supervision, before the meat can be sold in sections at the bush market.

The marketing of small stock is usually more informal between, when goats and chickens are sold or exchanged for other goods/services. However, goats are not common in this community, so chickens are more often moved amongst neighbouring households.

The principal reasons for sales are as follows:

- to buy food after poor harvests;
to pay school fees;
to purchase seeds for cropping.

**Lisikili**

The formal market is only found in Katima Mulilo, however, it appears that most farmer do not use this market. Many farmers stated that the prices were too low to sell to Meatco.

The use of the informal market or 'bush market' under a well known tree is commonly used by farmers in the community. Only cattle are sold at this bush market, while goats are sold privately between individuals. In addition, some farmers slaughter themselves and sell throughout the area. When an animal is sold to a private buyer, the price will always be negotiable.

The main reasons for the sale of livestock is as follows:

- payment of school fees;
- to pay for the treatment of diseases (drugs);
- to purchase food (maize) after poor harvests;
- to pay traditional fines;
- to purchase agricultural implements and tools.

**Cincinimani**

The only formal market used by inhabitants of Cincinimani is located at Linyanti and operated by Meatco. Farmers reported that Meatco used to have an auction at Cincinimani, but this was closed. People complained that the market at Linyanti was too far at 15km by road. This market is only for the sale of cattle, which are walked by road to the market. There is no formal market for small stock, while farmers are keen for a small stock market.

Informal markets include one 'bush market' for the sale of slaughtered cattle only. Small stock are sold on a private basis from household to household. Some large stock are sold live within the community, as farmers develop their own herds.

The significant reason for the sale of livestock are as follows:

- to pay school fees;
- to supplement food after poor harvests;
- to pay for hospital fees and drugs;
- as payment for crimes (fines).

### 6.3.4 Local Credit Schemes
In Kabbe, there are no credit schemes being used by its inhabitants. However, several people in the community have applied for loans from Agribank, but nobody has had a response from the institution.

The most important uses for the loans are as follows:

- improvement of herds, ie bulls, oxen, heifers and calves;
- irrigation equipment (wealthier farmers);
- to purchase ploughs;
- to purchase or hire tractors.

Farmers stated that these loans should be available for between 3-5 years. If the period of the loan was too short, farmers would not be able to repay. However, they stressed that the loan should not be more than 10 years, as the farmer would be trapped by the loan for too long. If a loan continues for a long period, there is a higher risk for the repayments. People may take a 5 year loan then extend it when they are confident about repayments.

**Lisikili**

There are no credit schemes operating in the Lisikili community. Some people have applied to Agribank, but they have had no reply, as yet. If credit was available, they would invest in the following:

- draught animals;
- breeding stock (large and small stock);
- ploughs and chains;
- seeds for cropping;
- labour to clear bush for cropping;
- fencing material for crop fields
- tractors.

Farmers stated they would prefer long term loans over short term, as they would find repayment too difficult with short terms. However, if they had a good harvest, repayment could be secured promptly. Farmers understand that short term loans are more preferable for them, if they can be repaid. The emphasis of choice for the loan was based on the repayments and time period.

**Cincinimani**

There are no credit schemes operating in this community. Some farmers had filled in applications for Agribank loans, but they have had no reply. If they get their loans the priorities for investment will include the following:
- labour for the management of crop fields;
- draught power for ploughing and tilling;
- tractors for crop production;
- cultivation equipment;
- livestock improvement, ie new stock.

Farmers stated that they would prefer long term loans to allow time for the generation of income to repay the loans. They recognised that the return from the investment will determine the repayment - where a poor harvest could damage the investment. Therefore, longer periods for loan repayments are preferable for unpredictable crop yields.

6.3.5 Institutional and Government Support

Kabbe

The Ministry of Education and Culture has a significant impact on this community. This Ministry has provided a primary and secondary school, which serve as Adult Education Centres. The Ministry of Health and Social Services have provided a clinic at Kabbe. Agricultural Extension and Animal Health Inspectors visit this site, while the DVS provides vaccinations for livestock each year. RWS has provided rings for wells and a solar pump near the school and clinic.

There are no NGOs working in this community, while none were reported to have worked at Kabbe in the past.

Lisikili

The Ministry of Health and Social Services has provided one clinic for the community. Ministry of Education and Culture built a school for pupils up to Grade 10. The church is active in this community, however, the details were not specified.

Likwama Farmers Association is working with farmers throughout the community. However, there are no other NGOs working in this community, while none were reported to have worked at Lisikili in the past.

Cincinimani

There are many active institutions working in Cincinimani. Extension Officers from the ADC located at Cincinimani provide advice for both livestock production, as well as a significant amount of advice for crop production. RWS has provided a series of boreholes supplying a communal water tank and pipe scheme (see Water Resources Section). Telecommunication is available through phones at several buildings in the community. The Ministry of Education and Culture have provided secondary and primary schools for the children, where adult education is also available. Ministry of
Roads and Works maintain a good road which passes through the community leading to Katima Mulilo. Finally, the Ministry of Health and Social Services have provided the community with a clinic.

NGOs in this community include the Likwama Farmers Association, which may be attached to the Farmers Support Programme operating in Cincinimani. In addition, the church plays a major role in this community, however, the farmers did not elaborate on this issue.
All the communities associated with Nolidep in Caprivi are relatively old and established. Ages range for the establishment of the main villages from over 50 to 100 years. All the communities established at suitable sites for hand dug water supplies or swamp water. The communities at Kabbe, Lisikili, and Cincinimani are all large ranging from 18 to 37 villages in each community with approximately 1000 persons at Kabbe and Cincinimani, while there is approximately 3000 persons at Lisikili. All these communities have a Senior Headman with jurisdiction over each community, while each village has its own Headman. The main tribal groups in these communities include Subia under Chief Moraliswani, and Bafwe and Simbalangwe under Chief Mamili.

Livestock are important for people in this region, however, the communities do not appear to rich in livestock. The poorest communities are Cincinimani and Lisikili were 61% and 48% of these communities have no livestock, respectively. Meanwhile, Kabbe appear to be wealthier with a potential 15% of its population without livestock. However, there is a large disparity between households and/or villages, which have high or low numbers of livestock. This position may place pressure on some household in a poorer village if there is not enough cooperation throughout Kabbe. Meanwhile, Cincinimani and Lisikili will have constant problems due to a shortage of livestock throughout these communities.

Crop farming is vital for the subsistence of these communities. Poor households appear have less than 0.5 hectares, if they have no draught support. Most people have between 2 and 3 hectares, however, the figure was much higher in Cincinimani with up to 10 hectares being the norm. Wealthy households have proportionally more hectares in potentially two fields within each community.

Formal markets operated by Meatco and used by these communities are located at Sifua, Bukalo, Katima Mulilo, and Linyanti for cattle only. Farmers in every community stated that the prices are too low. While some farmers refused to take their animals to these markets due to the low prices. Farmers stated they would increase their offtake from their herds if the prices improved. Most communities would like to have a formal auction site in their own community. These auctions would be open to everyone, as it appears farmers want a larger audience of buyers. The informal market appears to be more vibrant. Bush markets are common at every village where slaughtered cattle are sold. Meanwhile, goats are usually consumed by the owners or sold/bartered between neighbours in the community. The important reasons for selling livestock were for cash to pay school fees, buy food, and purchase agricultural supplies eg implements, seeds and drugs.

No credit schemes are operating in these communities, however, many people had an understanding of credit. All the communities had members who applied last year for
Agribank loans. However, nobody has received a reply from Agribank. Common investments from loans would include livestock improvement, oxen for draught and crop production implements eg ploughs. The emphasis appears to lie with cropping supported by livestock for draught. People were cautious about the period of time for a loan. However, most people though 5 years was needed to gain a significant return from a loan.

The Ministry of Health and Social Services has been active with the provision of clinics at all the communities. Ministry of Education and Culture have established schools in all the communities, where adult education occurs in two of the communities. Extension services from Agriculture and the DVS are active in most communities with the NGO - Likwama Farmers Association working in Lisikili and Cincinimani. Meanwhile, the church is active at two communities, however, its activities were not specified.
6.5 VEGETATION COVER AND LAND USE ISSUES IN THE CAPRIVI REGION

6.5.1 Description of Vegetation Cover in Caprivi

The region is endowed with a rich diversity of plant and animal life. As the climate is fairly uniform through the territory, the variety of vegetation is a product of these edaphic conditions interacting with several other factors which exercise a strong influence upon the vegetation, such as fire, shifting cultivation and grazing.

The changes in growth for vegetation in the region begins when the rainfall commences. This year’s growing season (1995/96) began in December, while last year’s season began in November as shown on the NDVI maps for Namibia (see Appendix 4).

In accordance with the order of topographical areas and soil zones, the following major units and types of vegetation may be distinguished (see Figure 6.5a).

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 defoliants. 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 thonninii* are also characteristic of the riverine forest on islands and river banks particularly in the flood areas west and south of Eastern Caprivi.

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*,...
Figure 6.5a  Vegetation Cover Map for Caprivi
including their use in clearing and ploughing arable land. Women perform the rest of the work in the fields, so that 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 responsibility to migrate with them to areas of grazing. The use of the milk and a percentage of the calves born during this period (usually half), as well as the opportunity to rent out the oxen for ploughing, is regarded as payment for this.

Of the 53 households interviewed in November 1992, 38 (70%) owned cattle. A more recent study of 100 households revealed that 66% of all households owned cattle. The average number per household was 44, while the median number of cattle per household was 14. 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. None of the 100 households recorded owning donkeys or sheep.

The figures in Table 6.5a show a recent rising trend in the stock numbers for both cattle and sheep. However, annual figures from the DVS are not accurate.

Table 6.5a Livestock numbers in Caprivi East 1992-1994

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Source: Adapted from DVS figures

Carrying capacities (CCs) for the region were estimated in 1966 by the former Government. Then, Eastern Caprivi with an area of 1,153,387 ha was estimated to have a CC of 6 ha/LSU. This CC meant that approximately 192,231 LSUs could be raised in the Eastern Caprivi region (NISER, 1990). These figures only signify that Eastern Caprivi has space to develop.

The potential for beef production is well beyond the needs of local consumption and the potential for export to the rest of Namibia is strong. Restrictions pertaining to deease control, limit the external market to processed meat products, which in turn will be influenced by market considerations.

The effects of the drought on the health and number of cattle in Caprivian households appears to be much less marked compared to other areas of Namibia. Figures for
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The effects of the drought on the health and number of cattle in Caprivian households appears to be much less marked compared to other areas of Namibia. Figures for
December 1992 indicate that the number of cattle have increased to 95,000 despite the impact of a severe drought. During a sample survey of households in November 1992, 5% of the cattle and 9% of the goats had died as a result the drought in Eastern Caprivi (Naeraa et al, 1992).

The formal market is provided by Meatco in Katima Mulilo. According to Meatco representatives between 1991 and 1993, the number of cattle slaughtered rose by 60%, averaging between 15 and 30 per day in 1993. All cattle are bought from local producers who are “communal farmers”. There are no commercial cattle farmers in Caprivi selling to Meatco. In the past, FNDC production varied considerably, whereas output today is relatively consistent. FNDC slaughtered an average of 15 cattle per day. When the army became a significant population group, production rose an extra 5-10 per day.

Poor road access seriously affects the collection and the distribution of live and processed carcasses in the region. Thus, both buyers (Meatco) and producers look forward to the completion of the tarring of the Trans Caprivi Highway.

The Likwama Farmers Union (LFU) is an organisation comprised of ‘communal farmers’ from Eastern Caprivi. The principal objective of the LFU is to improve incomes for communal farmers by establishing formal markets for local cattle and crop producers, by providing farmers with credit and technical assistance. Each member pays an annual fee. The LFU provides three important services to rural farmers living in the area given below.

- The LFU is the sole agent for Meatco (see above) linking cattle producers directly with cattle buyers, in this case Meatco. The LFU, in partnership with local producers and Meatco, have established a network of local agents throughout East Caprivi. These LFU agents organise the registration of cattle in rural areas so they can be transferred to the abattoir in Katima Mulilo. Meatco are responsible for the transportation of cattle. This is achieved by herding them on foot, sometimes over considerable distances. The objectives of the LFU marketing operation in the future is to liaise more closely with the Directorate of Veterinary Services and arrange collection points where cattle can be assembled into larger groups and then transported using Meatco trucks. Meatco replied by saying that this idea is unlikely to happen because the deferentially high cost of travelling on gravel roads in rural areas and the poor access to many settlements.

Cattle prices are ‘fixed’ based on the grade of weight of each animal which, in turn, is determined by the Meat Board of Namibia. Unfortunately the Namibian price is strongly influenced by South African beef prices. In 1992, the drought in South Africa caused huge stock losses and a subsequent rise in price. Then, the Government of Namibia awarded a R120 per head drought relief subsidy to all farmers as an incentive for them to sell cattle and to compensate them for
losses in income.

- The LFU buys seed from producers and then sells it to buyers. The three grain crops marketed are millet, maize and sorghum. No fruits or vegetables are marketed. In most years the LFU negotiates a price with the Agronomic Board (a Namibian parastatal organisation) representing local producers. The LFU then buys seed from these communal farmers and sells it to the Agronomic Board. This year the LFU plans to buy the sorghum and millet harvest themselves if sufficient funds allow and sell only the maize crop to the Agronomic Board.

- LFU offer credit to farmers. Typical examples include a farmer who wishes to purchase additional seed stock or some farm implements. Local LFU agents provide seed or tools to local farmers at half the price. Thus, farmers pay what they term a “deposit”, calculated at 50% of the cost. At the end of the harvest when the farmer has sufficient funds he repays the remaining 50% of the loan.

**Dryland and Irrigated Cropping**

Arable production is largely subsistence in Caprivi. However, more farmers are now moving into the marketing of their grain. This process of marketing has been assisted by the Likwama Farmers' Union (L FU). This market focuses on maize, sorghum and millet (EAN, 1993).

Dryland cropping is the most common technique for crop production in the subsistence sector, where the main crops are millet, maize and sorghum, while secondary crops include white cabbage and pumpkins. The cultivation of crops is more extensive in the west part of East Caprivi, as much of the east is flooded every year. Due to the rise in flood waters, crops in the east are grown earlier than crops in the western sector. However, in the 1970s severe rainfall led to the harvesting of crops in dugout canoes across the flooded western sector (NISER, 1993).

Floodplain agriculture is practices in the eastern sector, where farmers plant vegetables and other crops as the floodwaters recede. However, most crop production is favoured on the higher ground.

Irrigation is practised on part of NDC's land located 5 km west of Katima Mulilo. This irrigation of vegetables is managed by several small scale farmers growing vegetables for sale at local markets in Katima Mulilo. The main forms of irrigation are for sugarcane at Lonrho's nursery and the NDC's farm for tobacco and cotton. Small gardens are irrigated from the pipeline between Kongolo and Katima Mulilo. However, this is causing severe problems for those at the centre of the pipeline due to a lowering of water pressure.
Wood Utilisation

The forests supply many basic human needs such as low-cost construction materials, food supplements, fuelwood, household utensils and traditional medicines. In addition, a significant number of the population earn income and are employed through the use of materials to make carvings, baskets and other products for sale. A variety of wild plant foods provide important nutrients which supplement the staple diet of sorghum and maize. The largest timber concessions and sawmills in Namibia are located in the region. Together with a thriving carpentry industry in the region they offer opportunities for employment. Forests are also important in that they provide a land for shifting cultivation and free access to grazing. The mix of agriculture, crafts and food products constitute an important subsistence economy in the Caprivi region.

The principal causes of deforestation are over-exploitation resulting from shifting cultivation, high demand for construction materials, exploitation for firewood and socio-cultural practices which encourage the wasteful use of forest products. Overgrazing is also a major contributor to deforestation in the region. The large number of livestock limit the natural regeneration capacity of main tree species. The consequences of deforestation have been land degradation resulting from soil erosion and frequent flooding. In addition, the expansion of cropland in the region takes place at a pace which more or less corresponds to demographic growth rate of 3 per cent per year. The continuation of this trend means that the area of denuded cropland will double in little more than 20 years.

Although fire has been known to be an important factor in the ecology of African woodlands and savannas, late fires have also been known to cause tree mortality and poor form as well as soil impoverishment in some forest types that are less fire-tolerant. Such forest types include those dominated by *Terminalia sericea* and *Burkea africana*. On the other hand, where the primary objective is timber production, late fires have also been found to be beneficial in upland forests comprised primarily of fire-sensitive species such as *B. Plurijuga* and *Angolensis*. The growth of these species is stimulated by fire. However, repeated late fires can have long-term negative impacts on forest ecosystems by killing the emergent regeneration and fauna, as well as removal of top soil thereby exposing the soil to both wind and water erosion. The forests of Eastern Caprivi have been subjected to repeated annual late fires caused by local people and those from neighbouring countries of Botswana and Zambia. Such uncontrolled fires have in the past reduced areas available for livestock grazing, destroyed critical wildlife habitats, and resulted in poor stocking of principal tree species. It has been estimated that more than 75% of the forests in Eastern Caprivi are subjected to repeated late fires every year.

Traditional systems of forest management in Caprivi follow the same structures of traditional authorities (Kutas) which determine policy. Prior to German occupation of Caprivi in 1890, the Barotse Forest Act administered form first, Mwandi Kuta in Sesheke and later Leaului Kuta in Mongu, applied to Caprivi. The Act provided for
the establishment of several forest reserves, protection of several indigenous tree species including all fruit trees, and rights as well as obligations of individuals. The Act also reserved for the chiefs special tree species of the construction of their Canoes. Coordination of forest policy was not voluntary; After the Mwandi on Lealui Kutas (Parliaments) set the policy, lower Kutas of the district (lilalo) and village levels enforced the policy.

Individual villagers obtained cutting permits from the Village headmen; the village being the lowest unit of tribal organisation. Illegal cutting of trees was punishable under the law and was dealt with by the district/ward Kutas; and failing that, by the main Kutas. When fires broke out, these were fought on a communal basis. Fire camps were set up where individual villages donated food and other supplies for the fire fighters. Present day traditional management systems in Eastern Caprivi, like many indigenous management systems across the world, have been undermined by colonial governments and modern political economies.

However, the core structures of the traditional forest management systems in Eastern Caprivi are still there. These structure require support, encouragement and empowerment. Given sufficient decision making authority and financial resources, traditional authorities in Eastern Caprivi may provide the answer for sustainable forest management in the region.

Since the involvement of communities in forest management is contained in forest policy, the current review of forest legislation should consider ways to devolving authority to traditional leadership systems to help manage and protect our forest resources. A policy analysis and review may also be necessary especially in cases where incentives to resource management are important.

**Wildlife**

The East Caprivi is approximately 12 000 km² in size, where originally, there were four areas known to hold abundant wildlife: The Northern Forestry area, Mudumu N.P. area, Mamili swamp area, and the Eastern Floodplains (see Figure 6.5b). It was noted in 1968, that of these areas, the Eastern Floodplains had particularly high concentrations of wildlife along the road from Katima Mulilo to the Botswana border (Logan 1968). Of these high density wildlife areas, parts of Mudumu and Mamili were proclaimed as National Parks before Independence in 1990, and the Eastern Floodplains and areas surrounding the East Caprivi national parks were identified by the MET and IRDNC as areas of focus for community-based conservation programmes.
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Not a great deal of recent information is available on the Forestry area in East Caprivi, but negative trends in this area, in all species, were confirmed by a low intensity census (approximately 7% coverage) of the East Caprivi in September 1994 during cooperation with Botswana Census Team (Gibson 1994). No elephant or buffalo were seen at that time, but human settlements and cattle were found in this region. It is evident from reports that the majority of the elephants reported in East Caprivi up until 1988 were seen in the forestry area, but these herds have all but disappeared since then. There is evidence from satellite tracking of elephants that there are still north/south Movements from Mudumu N.P. through the Forestry area to Zambia, but these movements are reversed in a few weeks and the elephants return to Mudumu N.P. (T.C. Rodwell unpublished).

Probably the most notable of all trends in the East Caprivi can be seen in the lechwe populations. The massive decrease in numbers from over 10 000 in the early 1980s, to a few hundred in 1994 has been attributed mostly to over utilization, but the effect of substantial changes in habitat in these regions should not be underestimated. The Linyanti Swamps area and Lake Liambezi to the north east of Mamili N.P. have been almost completely dry for over a decade, and Mamili N.P. itself has far less water coverage in the wet season than it did in the late 1970's.
Another important negative trend to note is the local “extinction” of giraffe and wildebeest from East Caprivi somewhere in the mid 1980’s. No giraffe or wildebeest have been seen in East Caprivi since then, and the chances of them naturally recolonizing Mudumu or Mamili N.P. is small as a result of the rivers between these protected areas and Botswana, and the large, human settled area between Zambia and Mudumu and Mamili N.P.

While all wildlife populations (excluding elephants) seemed to have declined in number between 1980 and 1990, there have been indications on the ground over the past couple of years that Mudumu N.P. is stabilizing (MET, 1995). Herds of impala and kudu are being observed more often. Small herds of buffalos which in the past only inhabited Mudumu N.P. temporarily, seem to be remaining permanently, and the herds of elephants seen in Mudumu N.P. are observed less in large herds clumped together (a sign of stress), and more in small family herds. These indicators are monitored, the greater is the chance that meaningful distribution and growth trends can be extracted from the surveys over time.

Wildlife - human relations are an important land use issue in western and southern parts of East Caprivi. Elephant damage to crops is a key concern and has led to pilot efforts by IRDNC to erect electric fences and install alarms. Numerous elephants come into cultivated areas from West Caprivi, Mudumu and Mamili national Parks and the Chobe National Park in Botswana. Lion and other predation of livestock also causes economic losses (Turner, 1995).

Comprehensive land use planning has not been undertaken in East Caprivi, either for the whole area or for parts thereof. South western areas around the two National Parks are prime candidates for such coordinated initiatives. A small scale land use planning effort is likely to emerge from current community/IRDNC initiatives to develop a conservancy for the 17,000 hectare Salambala area near Bukalo. The annual Caprivi planning meetings undertaken by IRDNC for their Community Based Natural Resource Management (CBNRM) (Turner, 1995) activities have begun to serve a valuable coordination function, with increasing participation by local MET staff and community representatives.

Currently, about ten Community Game Guards now work in the west of the area, north of Mudumu Park. South of Mudumu and north (east) of Mamili park thee are nine. Five more work in the Bukalo - Ikumwe area and in the south eastern flood plains. So far only two women Community Resource Monitors have been appointed, both along the Kwando at Sauzuwo (Hupula) and Nongozi.
6.6 BASELINE VEGETATION COVER AND LAND USE ISSUES

6.6.1 Introduction

The baseline information for both vegetation cover with carrying capacity estimations and land issues were retrieved using the knowledge and experience of local people in Caprivi. Assessment of vegetation involved field survey techniques with the participatory assistance of local farmers for both species use and identification. The principal topics for land use were livestock, cropping, woodlands and wildlife in Caprivi. These topics have been divided into livestock and land management issues, resources rights, development opportunities, landscape and land use changes and wildlife issues.

6.6.2 Vegetation Cover with Carrying Capacity Estimations

Kabbe

Transect - 1 Wet Season and Potential Grazing Areas

The wet season zone is located south of Old Kabbe. The boundary to the south of this zone is the main road to Katima Mulilo. A transect was completed at a representative point in the centre of this zone at a point 5km south of Old Kabbe (S17deg44.7'; E24deg38.1').

The habitat is a semi-open woodland based on a flat plain. The dominant tree and shrub cover is *Colophospermum mopane* from 3m up to 15m high (see Table 6.6a). There was only one other very sparse species *Acacia erubescens* up to 20m high. The herbaceous layer has complete cover dominated by sedges and grasses. The dominant grasses include two *Brachiaria* species and *Eragrostis biflora* (see Table 6.6a).

Table 6.6a Transect 1

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aristida effusa</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Brachiaria humidicola</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Chloris virgata</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Brachiaria sp.</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Eragrostis biflora</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Bare</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Canopy Layer Species</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colophospermum</td>
<td>38</td>
</tr>
</tbody>
</table>
The carrying capacity (CC) for this area is 5 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Aristida effusa* and *Brachiaria* sp. Palatable browse noted by farmers was not present. The area appears not to have been grazed.

**Transect - 2 Dry Season Area**

The dry season zone is within the vicinity of all the settlements at Kabbe and the Kasai located north-east of Kabbe. A representative area 13km north of Old Kabbe was chosen at S17deg39.8'; E24deg44.4'.

The habitat is an open area of pasture lying on a flat plain with grey loamy soils. There is no significant tree canopy layer in this zone. However, there are sparse stands of *Acacia albida* and *Trichilia emetica* up to 5m high with *Diospyros mespiliformis* up to 15m. The habitat is dominated by grasses, where the most common included *Themeda triandra*, *Heteropogon contortus* and two other unknown perennial grasses.

**Table 6.6b Transect 2**

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Themeda triandra</em></td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td><em>Heteropogon contortus</em></td>
<td>31</td>
<td>10</td>
</tr>
<tr>
<td>Poaceae sp. (perennial)</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td><em>Vetiver nigritana</em></td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Unknown herbs</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Bare</td>
<td>-</td>
<td>51</td>
</tr>
</tbody>
</table>

The carrying capacity (CC) for this area is 9 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Themeda triandara* and a *Poaceae* sp. Palatable browse noted by farmers was not present. The area appears not to have been grazed.

**Lisikili**

**Transect - 1 Dry Season Area**

The dry season area is located near the Zambezi River, which is north of Lisikili, where grazing is based on the floodplains. A representative area was located at S17deg30.1'; E24deg27.4'.

The habitat is typical floodplain grasslands amongst several river channels. The
herbaceous layer is significantly covered in sedges and grasses. Many of the grasses are dried, as they were formed during the early rains in November/December. The most dominant species in this area are *Digitaria* sp. followed by *Heteropogon contortus* (see Table 6.6c). The area is surrounded by patches of woodland composed of mainly *Terminalia sericea* and *Syzygium cordatum* up to 10m, *Acacia albida* up to 15m and a shrub cover from *Diospyros lycioides* and *Trichilia emetica* less than 1m.

**Table 6.6c Transect 1**

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Digitaria</em> sp.</td>
<td>73</td>
<td>42</td>
</tr>
<tr>
<td><em>Brachiaria humedicola</em></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><em>Spororobolus schinzii</em></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><em>Themeda triandara</em></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><em>Heteropogon contortus</em></td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Unknown herbs</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Bare</td>
<td>-</td>
<td>39</td>
</tr>
</tbody>
</table>

The carrying capacity (CC) for this area is 13 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Themeda triandara* and *Digitaria* sp. Palatable browse noted by farmers included *Terminalia sericea* and *Acacia albida*. The area appears not to have been grazed.

**Transect - 2 Wet Season Area (Open Plain) and Potential Grazing Area**

The wet season area is mainly located to the south of the main road. This area is mainly wooded, however, there are several significant open plains composed of grassland in this area. A representative area was assessed with Transect 2 at S17deg35.6';E24deg26.7'. This area is also a potential development area for the community.

The habitat is open grassland lying on an undulating plain. There are sparse specimens of *Colophospermum mopane* less than 1m high and *Terminalia sericea* up to 10m high. The herbaceous layer is composed of two dominant grasses *Digitaria* sp. and *Cynodon dactylon* (see Table 6.6d). The area is situated amongst wooded composed of species discussed for Transect 3 (see Table 6.6e).
Table 6.6d Transect 2

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitaria sp.</td>
<td>55</td>
<td>32</td>
</tr>
<tr>
<td>Cynodon dactylon</td>
<td>35</td>
<td>23</td>
</tr>
<tr>
<td>Brachiaria humidicola</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Unknown herbs</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bare</td>
<td>-</td>
<td>39</td>
</tr>
</tbody>
</table>

The carrying capacity (CC) for this area is 14 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Cynodon dactylon* and *Digitaria* sp. Palatable browse noted by farmers were not present. The area appears to have been grazed by 50%.

**Transect - 3 Wet Season Area (Woodland) and Potential Grazing Area**

Transect 3 is a representative sample of species in the wet season grazing area under a woodland habitat. The location of the transect was at S17°43'43.135"; E24°23'47.948", which is east of the open plain habitat. This area is also a potential development area for the community.

The habitat is predominantly wooded with small channels running throughout the area and covered in mainly grass species. The woodland is open and composed of *Parinaria curatellifolia* up to 10m, and *Terminalia sericea* and *Colophospermum mopane* up to 15m (see Table 6.6e). Other sparse species include *Tricalysis angloensis* up to 10m and a shrub form of *Terminalia stuhlmani* less than 2m high.

Table 6.6e Transect 3

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitaria sp.</td>
<td>45</td>
<td>23</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Themeda triandra</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Brachiaria humidicola</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Panicum sp.</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Tristachya nodiglumis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Unknown herb</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>
Bare | - | 43
Canopy Layer Species | Abundance %
Parinaria curatellifolia | - | 19
Colophospermum mopane | - | 2
Terminalia sericea | - | 11

The carrying capacity (CC) for this area is 20 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included Cyperaceae, Themeda triandra, Panicum sp. and Digitaria sp. Palatable browse noted by farmers were not present. The area appears to have been heavily grazed.

Cincinimani

Transect 1 Dry Season Area

The dry season area is located amongst crop fields in the a dried floodplain zone. A representative transect was taken for this area at S18deg01.0'; E24deg09.0'.

The habitat in this area can be described as floodplain grasslands, which have changed into grassy plains as the area has dried out since the early 1980s. The floodplains are associated with the former Lake Liambezi, which dried out from the 1980s. The soils are typically rich for floodplains with grey loamy clay soil. The processes on the floodplain have formed a series of old channels on an undulating landscape. Stands of trees are very sparse with Acacia albida up to 15m, A. nigrescens up to 10m with a shrub cover of Grewia avellana less than 2m high. Meanwhile, the herbaceous layer is relatively dense and dominated by the grasses Pennisetum glaucocladium followed by Urochloa tricopus and the reed - Phragmites australis (see Table 6.6f).

Table 6.6f Transect 1

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urochloa tricopus</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Setaria verticilata</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Phragmites australis</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Poaceae sp. (perennial)</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Digitaria eriantha</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pennisetum glaucocladium</td>
<td>34</td>
<td>23</td>
</tr>
<tr>
<td>Eragrostis palens</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
The carrying capacity (CC) for this area is 3 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Pennisetum glaucocladum* and *Phragmites australis* (eaten after it has dried). Palatable browse noted by farmers included *Acacia nigrescens*. The area appears not to have been grazed.

**Transect 2 Wet Season Area**

The wet grazing is located amongst the woodland on the opposite side of the main road. This area is used while the pans are recharged with water. A representative transect was assessed at S17deg56.7’; E24deg04.2’.

The habitat is woodland pasture in a semi dense woodland. The area is relatively flat on light grey sandy soils. The shrub layer is dominant in the woodland with mainly *Colophospermum mopane* followed by *Terminalia sericea* and *Acacia nigrescens* less than 2m high (see Table 6.6g). Taller trees include *Colophospermum mopane* and *Terminalia sericea* between 15m and 20m, with sparse evidence of *Dichrostachys cinerea* up to 5m and *Lonchocarpus capsas* up to 2m. There is a relatively good herbaceous cover dominated by the perennial grass known as *Urochloa tricopus* (see Table 6.6g).

**Table 6.6g Transect 2**

<table>
<thead>
<tr>
<th>Herb Layer Species</th>
<th>Frequency %</th>
<th>Abundance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urochloa tricopus</td>
<td>69</td>
<td>36</td>
</tr>
<tr>
<td>Aristida stipitata</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Poaceae sp. (perennial)</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Digitaria eriantha</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Unknown herbs</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Bare</td>
<td>-</td>
<td>49</td>
</tr>
<tr>
<td><strong>Canopy Layer Species</strong></td>
<td></td>
<td>Abundance %</td>
</tr>
<tr>
<td>Dichrostachys cinerea</td>
<td>-</td>
<td>26</td>
</tr>
<tr>
<td>Colophospermum mopane</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>Terminalia sericea</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Acacia nigrescens</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>
The carrying capacity (CC) for this area is 14 hectares/livestock unit (LSU), where the most favourable grass species noted by farmers included *Urochloa tricopus* and a *Poaceae* sp. Palatable browse noted by farmers included *Dichrostachys cinerea*. The area appears not to have been grazed.

### 6.6.3 Livestock Uses and Management Issues

*Kabbe*

Livestock are very significant in this community for several reasons. Firstly, they represent wealth which can be exchanged for cash when required eg hospital costs. Secondly, they have a functionary role where they are used to provide milk and meat, while they are used for ceremonial occasions such as weddings.

During the dry season, the livestock are taken to the Kasai River. However, many people use these areas, which has lead to overstocking and overgrazing after a short period of time. As farmers can take their livestock to any part of the village, there is no management of the pasture, which causes major problems after poor rainfall. These movements of animals in the dry season include several neighbouring communities.

During both the wet and dry season, women are usually responsible for the movement of livestock as many husbands are working in formal employment. Women will check the status of water points throughout the year before animals are moved, particularly ephemeral pans during the wet season area. Often herd boys are used to control the livestock throughout the day. At night, the animals are kept in the kraals near the homesteads. No supplementary feeding is given to the livestock, other than grazing on crop fields after the harvest.

The main problems for livestock are as follows:

- scarcity of water in relation to grazing;
- ticks and their associated diseases;
- lumpy skin disease;
- black quarter;
- heart water;
- gall sickness;
- eye diseases;
- hygroma.

Presently, there are less diseases since rabies, foot and mouth and worm infestations are not common any more.

Drugs for livestock are bought from DVS and the Caprivi Pharmacy in Katima Mulilo. However, the farmers have problems for the following:
• to pay for the drugs;
• to travel to Katima Mulilo;
• and storage for the drugs.

Pests in the past included lions, hyena, crocodiles, wild dogs and leopard. Due to the disturbance by people most of these animals have dispersed. Presently, there are only hyenas and crocodiles taking livestock in this community.

**Lisikili**

Livestock are an important asset for the community of Lisikili. These animals provide finance for cash needs, such as payment of school and hospital fees (drugs), as well as lobola - a payment given to the parents of a bride. The animals produce milk and meat as a source of food and uses in traditional medicines. Cattle are also prized for their draught power in the fields.

The management of the livestock is based on dry season and wet season grazing. This translates to the lower ground near the floodplains during the dry season and the upper ground during the wet season. Currently, farmers are trying to restrict the number of immigrants using these grazing areas, due to severe overgrazing particularly during the middle of the dry season.

Livestock in this community are not fed any form of supplementary feed, ie fodder or licks. However, grazing is now scarcer so farmers may consider supplements. Due to the lack of grazing animals will sometimes remain in the dry season area during the wet season.

Diseases are a major problem for livestock, which usually occur during the dry season. Farmers stated that the shortage of water on the upper lands aggravates the problem of diseases. A deficiency in pasture has emerged with fires in recent years. Finally, the lack of markets in the area and the poor prices paid by Meatco do not encourage farmers to sell their stock.

The main diseases and disorders in livestock at Lisikili include the following: heart water, gall sickness, pasteurellosis, foot rot, aborting cows, black quarter, foot and mouth, eye infections, intestinal worms and tick borne diseases. The main diseases in the past were lung sickness and blackquarter. Meanwhile, crocodiles were cited as an significant pest. However, thieves are responsible now for the loss of more animals through theft.

Drugs are obtained from the DVS. However, drugs are too scarce to buy, while many people in the community do not have the necessary skills to administer the drugs. Farmers in this community are prepared to buy drugs for their livestock (many buy drugs already). These farmers stated they are not dependent on Government to provide the drugs.
Cincinimani

The significant benefits from livestock for the people are Cincinimani are for income generation and productive use as farm animals. Income generation is regarded as an important form of insurance against poor harvest to pay for food. Cash is also needed each year to pay for school fees, lobola, and fines for communal crimes. The productive qualities of cattle are valued as draught for ploughing and their milk to supplement the local diet.

The livestock are herded in the wet season grazing area for as long as possible, then they are forced to move as the pans become dry. The animals are taken during the dry season (May to October) to the floodplain area. During the dry season, the herders have to take the animals as far as the Linyanti river for water. Throughout the year no fodder is given to the animals other than grazing on the land and crop fields after harvest.

The main livestock issues in this community are as follows:

- grazing is diminished quickly in the dry season zone;
- water points are inadequate for the dry season zone;
- shortage of drugs for cattle.

Currently, diseases amongst livestock in this community include foot and mouth, pasteurellosis, diarrhoea, eye infections, botulism, blackquarter and various skin diseases in goats. In the past, farmers noted that lung sickness, pneumonia and tsetse flies were also a major problem.

Drugs for livestock are obtained from the DVS in Katima Mulilo. However, the farmers mentioned a series of constraints listed below:

- shortage of cash for these purchases;
- distance too far to travel between Cincinimani and Katima Mulilo;
- lack of knowledge for the administration of drugs;
- limited knowledge for animal health care;
- shortage of drug storage facilities in the community.

6.6.4 Land Management Issues

Kabbe

During the wet season, crops are grown in the floodplain area while the water level is low. Later, during the wet season the crops are grown on the upper land areas near the settlements.

The main activities in the crop fields involve preparation of the land followed by
planting. Later there is weeding and bird scaring, then before harvest there is the building storage structures. After the harvest, there is threshing and bagging of the crops. Finally, the land is cleared again with assistance from livestock.

Hippos are dispersed from the crop fields using old engine oil on cloth, which is hung around the fields. This is an important defence measure as hippos can destroy an entire field of crops.

No woodland management is practised by women other than the collection of firewood. Men control the use of trees for timber and carving wood, which is used for building eg schools and homes, and making tools eg handles for hoes and ploughs.

*Lisikili*

During the wet season cattle are kept away from the crop fields near the settlements on the upper land. However, during the dry season farmers grow crops on the floodplain at the edge of the river (mulapos). Livestock are prohibited from drinking near these areas proclaimed for crops.

Cropland is sacred to the owner on the upper and lower lands, where only the owner of a field can cultivate the land. If individuals do not use the land allocated to them, it can be reallocated to another farmer.

Fruit trees are protected in the woodland, however, no improper management is allowed for all trees. Woodland is an important resource which the community conserves for poles and other forms of timber.

*Cincinimani*

The significant land management issues for grazing included guidance for herders, as young boys often need assistance relating to suitable grazing. During the dry season herd boys will often camp with their animals near the River Linyanti. Burning of grassland is practised at Cincinimani, however, this burning must be timed correctly and restricted to small areas.

Cropland management is in the control of both men and women. Ploughing is fulfilled by men and women. Women are usually responsible for the planting of seed, while the weeding of crops is done by both sexes. Women watch over the fields to protect them from livestock and bird damage. Later, both sexes are involved in harvesting, however, women do most of the threshing and winnowing.

Woodlands are the responsibility of men, who protect the fruit trees from being felled. However, there is no other form of management for these resources.
Kabbe

Grazing is open to all inhabitants to graze their livestock in the wet and dry season. No areas have been demarcated, other than the wet season grazing located at a distance from the crop fields.

Woodland can only be exploited by local people if it is a benefit. People should not over exploit the woodland resources, otherwise action will be taken against them by the community.

Cropland is allocated by the Tribal Authority in the community. An individual will report to the Headman. Then, the Headman will acquire permission from the Chief, who will inform the Headman, that the request is granted or not for cropland. The demarcated land can be passed on to a member of the same household.

Reciprocal rights allows anyone to use the land in Kabbe or surrounding communities. However, an outsider must get permission from the Headman to use grazing or woodland, while the use of cropland requires permission from the Chief.

Bylaws in Kabbe include the following:

- it is the duty of an owner of cropland to protect his land from livestock or wild animals eg elephant in Kabbe. If an owner has a serious problem s/he should report the matter to the Senior Headman (Enduna), if the land is not used well a senior member of the family can reclaim the land;
- grazing areas must not be burnt, if a fire starts the whole community are responsible for its extinction, then the Traditional Authority will investigate the fire;
- all water points are protected from damage, eg animals are not allowed to stand in pans with pools of water after they have drank, to avoid puddling of the mud and pollution of the water;
- animals should not use an overgrazed area;
- people are forbidden to cut a fruit (even in a crop field) eg *Parinaria curatellifolia* and *Diopyros mespiliformis* (mubula), and timber trees eg *Pterocarpus angolensis* (mulombe) and *Ricinodendron rautanenii* (mungongo);
- traditional laws protect wildlife (see Wildlife Issues).

Lisikili

Anyone in the community can graze in the wet and dry season areas. However, nobody has the right to burn grazing in this community. People in this community have the right to ask outsider to leave Lisikili’s grazing areas. It is difficult to enforce grazing controls, as there are no official boundaries between neighbouring communities.
Young farmers requiring land for cropping will ask their families for land. If the households have insufficient land, the young farmer will make a request to the Headman for the allocation of land. The Headman judges all issues associated with cropland.

Woodland is conserved for legitimate use by everyone, while fruit trees have full protection against felling and other trees prescribed by the Headman. Meanwhile, the community recognises the restrictions imposed by the Directorate of Forestry controlling the felling of trees.

In this community, wealthy and poor people have the same rights, while they are all under the authority of the Chief. Meanwhile, the men regarded themselves as having more rights over natural resources than women. Women recognised that men have the rights over cropping areas and grazing, while they thought woodland belonged to both sexes.

Neighbours have the right to use resources in this community, while inhabitants of Lisikili can use resources in neighbouring areas. However, everyone needs to have permission through the traditional channels.

Bylaws in this community are as follows:

- fruit trees cannot be cut or felled (including fruit trees in cropland);
- no cultivation must occur in the grazing areas;
- permission is required from the owner of land before an individual can plough (or permission from the Headman);
- no fishing is allowed using poisons;
- no unnecessary hunting of wildlife is allowed;
- burning of woodland is prohibited.

**Cincinimani**

The Headman is responsible for the allocation of cropland to households. Then, the management of the field is the responsibility of the household. If land is not used by a household, the Headman has the right to reclaim the land and pass it to another household. However, if part of the field is being used, the Headman has no right to reclaim the land.

The burning of woodland is strictly prohibited. If people are caught burning the woodland, a charge will be brought against them. The felling of trees is permitted, however, all trees felled must be utilised properly. Permission is required from the Headman for the felling of *Baikiaea plurijuga* (mukushi) used for canoes. Meanwhile, the felling of fruit trees is prohibited eg *Diospyros mespiliformis* (muchenje) and *Berchemia discolor* (muzinzila). Currently, all official felling is charged by the Directorate of Forestry However, the community would like some of the money
charged for permits to return to the community.

Grazing areas are not restricted as the water points control this issue. Neighbours utilising the water points can cause confrontation, particularly people from Lusu, Malundu, and Muketerla communities. During the wet season, there are no problems, as there is normally plenty of grazing and water points.

Outsiders are meant to ask permission from the Headman if they wish to use any natural resources, particularly water points. However, many people from the communities listed above do not ask permission. If there is water scarcity, the Headmen will limit or exclude outsiders from utilising water resources.

Significant bylaws in the community include the following:

- permission is required to utilise grazing by outsiders;
- Headmen are responsible for the allocation of land to outsiders and local inhabitants;
- fruit trees are protected;
- timber tree felling requires permission from the Headman for several species.

6.6.6 Development Opportunities

*Kabbe*

The principal development opportunities for Kabbe are as follows:

- improvement of herds with new bulls, ie livestock improvement programme;
- need for a steady and complete supply of drugs held by the suppliers in Katima Mulilo;
- development of water points across the grazing areas;
- develop a new dipping area (old dip is a poor design) to counter the tick infestations and tick borne diseases;
- training for farmers in animal husbandry to assist with diagnosis and treatment of common diseases and ailments - farmers often think mycin treatments solve all problems.

*Lisikili*

The principal development opportunities for Lisikili are as follows:

- develop crush pens throughout the community for the local treatment of livestock;
- develop cultivation techniques using livestock with Extension trainers;
- management of grazing area.
All initiatives should be locally based to assist the poor stated several farmers. However, the wealthy must not be ignored as they often support the poor.

Cincinimani

The principal development opportunities for Lisikili are as follows:

- development of water points in the wet season area to prolong the use of this area, as grazing is too limited in the dry season zone;
- drug supplies must be made available in the vicinity or within Cincinimani;
- castration equipment is desperately required;
- crush pens are needed, currently there is one pen at Cincinimani but this is damage;
- the dip pen needs to be renovated to counter tick borne diseases;
- the community needs more responsibility of the use of wild animals.

Some members of the community want to develop fences around their grazing to keep neighbours out. However, the former Headman of Cincinimani village pointed out the dangers of fencing during poor rainfall years when, farmers have to search everywhere for grazing and water. Most of the community appeared to agree with the former Headman.

6.6.7 Landscape and Land Use Changes

Kabbe

Farmers have noticed a deterioration of soils in this area, where many fields are now less productive with good rainfall. They noted erosion has taken place involving wind and rainfall agents. Erosion of soils on the floodplains is prominent in October when the winds blow, and during the first rains when soils in the omuramba areas are washed away.

Overgrazed areas are affected in a similar manner with erosion mainly in the dry season zones. In the past, farmers noted that there was plenty of grazing in all areas.

Lisikili

Infrastructure in this community began in the 1940s, after this period the landscape started to change. Initially, there was enough grazing as the livestock numbers were low. The change to lower rainfall with more livestock has led to overgrazing.

Crop fields are more numerous now, as a result of expanding sizes and more fields with the increasing population. The situation is worse in the dry season areas, as more people from outside the community utilise these area. The wet season areas have not changed, since these areas have only been exploited by inhabitants of Lisikili.
Cincinimani

Many changes have occurred in this community due to the rise in the human population. Over 70 years ago, there were only 4 village on the road between Cincinimani and Katima Mulilo, now there are many villages.

Before, many wildlife species eg game, were seen in the woodland areas, while there are very few sightings now. The drying of the river near Cincinimani has also caused many animals to disperse elsewhere. People in this community used to be fed regularly on wild meat, when there was an abundant number of animals.

The drying of the river has been attributed to the low rainfall in Cincinimani. Farmers stated that the worst years were 1950/52, 1952/53, 1933/34, and 1993/94 for poor rainfall. The response to these changes has included the following:

- dependency on fish from the swamps to provide sustenance;
- collection of tubers from lilies growing in the swamps for sustenance;
- in the past the Chief had the power to allocate game when required, this power was been removed by the former Government (this has not changed with Independence).

6.6.8 Wildlife Issues

Kabbe

Wildlife are still located in the vicinity of Kabbe, but the presence of game are not as profound as they were in the past. Traditional laws protect hippos, elephants, rhino, giraffe, eland and cheetah. Lion and hyena can be hunted if they have become a pest, however, a farmer would require permission from the Chief.

Elephant are common during the wet season, when they move through Kabbe towards the river. Farmers have not experienced any real problems with elephants.

Lisikili

Wildlife species such as game are found in the woodland, however, there numbers are low due to disturbance in the locality. Today, there are less restrictions against poaching in Lisikili.

Cincinimani

As stated in Landscape and Land Use Changes, there were many types of wildlife in the area, however, many have been dispersed. The Traditional Laws protected many species under the control of the Chief. Common animals in the area included giraffe, elephant, hippo, rhino, lions and buffalo and eland. Today, buffalo and some
elephants are seen, while most of the others are a rarity.

The Headman stated that the traditional control mechanisms were more effective than the Government control, as local people have more respect for their local leaders.
CONCLUSIONS

Caprivi’s subhumid climate dictates that its vegetation is characterised by forest savanna, woodland and floodplain zones near the 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.

The system of grazing is simple transhumance from dry season grazing through to wet season grazing, however, there are significant areas of overlap. All the sites have perennial rivers, which communities are dependent upon during the dry season, while they use pans during most of the wet season. These rivers include the Kasai, Zambezi and Linyanti. Dry season grazing is located on floodplains at all the sites, however, the floodplain at Cincinimani has been dry since the 1980s when Lake Liambezi dried. Meanwhile wet season grazing is located in mainly woodland pasture and open grassland near mulapos channels.

The carrying capacity (CC) estimates by the former Government in 1966 for Eastern Caprivi were 6 ha/LSU. The CCs were high at several sites, while all sites appeared to have relatively good grazing after a good rainy season this year. The CCs at Kabbe ranged from 5 to 9 ha/LSU, at Lisikili it was between 13 and 14 ha/LSU with signs of heavy grazing at some of its sites, while at Cincinimani it ranged from 3 to 14 ha/LSU. There was no consistence between wet and dry season areas, which could be better or worse than each other at different sites. The palatable grass species indicated by farmers in the region included Aristida effusa, Brachiaria sp., Digitaria sp., Themeda triandra, Cynodon dactylon, Pennisetum glaucocladium and Panicum sp., while the reed Phragmites australis is palatable when it is dry. Palatable tree and shrubs included Terminalia sericea, Acacia albida, T. stuhlmani, A. nigrescens, Dichrostachys cineria, and Lonchocarpus cappasa. Most of the shrubs/trees are not available as browse near most floodplain areas, as the habitat is devoid of most woody species.

Livestock are significant in all the communities as a form of cash generation and insurance against poor harvests. In addition, livestock are used for their draught power and as a source of food.

Management of livestock follows the transhumance system for grazing from dry to wet season areas. However, at most dry season sites there is overgrazing due to overstocking by either the inhabitants of the communities or stock from neighbouring communities. Currently, some farmers are trying to halt the immigration of livestock into their areas. However, the limitation of water forces everyone to converge on the same grazing zones. None of the livestock in these communities are fed supplementary fodder, other than crop storks used by livestock in situ after the harvests.
The main diseases for livestock in the communities include blackquarter, heart water, pasteurellosis, and eye infections. Meanwhile, many disease like rabies, foot and mouth, lung disease, pneumonia, as well as tsetse fly are less of a problem in most communities. Pests in the past included hyena, crocodile, wild dogs, leopard and lion. Presently, the only significant pest is the crocodile by the rivers and swamps, as well as occasional hyena attacks. Drug supplies for communities are available from the DVS and the Caprivi Pharmacy in Katima Mulilo. Farmers are willing to buy drugs but they inhibited by the cost, their availability for those far from Katima Mulilo, administration skills to apply drugs and a shortage of sites for drug storage.

Management of land is focused 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.

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 ploughingof grazing, while outsiders are compelled to ask for permission from the Headmen.

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 a permit is 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.

Significant development opportunities focus on livestock and water developments. Water points at inaccessible or difficult wet season grazing areas were cited as a way to remove grazing pressure from the dry season areas. Meanwhile animal husbandry techniques eg veterinary skills, with appropriate equipment and facilities eg crush pens, where noted as very important for livestock development.
The most severe changes to the landscape occur at the dry season areas, where overgrazing has occurred. In some places this causes soil erosion from both wind and water agents. Overgrazing has been directly influenced by rise in the population of people. This disturbance has greatly reduced the number and diversity of wildlife in the area. Today, tolerant species like elephant, buffalo, hippos and crocodile still prevail.

The response to these changes during poor rainfall years in each community have been primarily dependent reactions on wild products. These products include fish, lily tubers, and wild game - when they were more common in these domains.
6.8. WATER RESOURCES OF THE CAPRIVI

6.8.1 Geology of the Caprivi

The area under study in the Eastern Caprivi lies within the east/central margin of the Kalahari deposits and is composed of characteristic sands, clays, gravels, calcretes and silcretes of Tertiary age. The origins of the deposits are aeolian but have been re-worked and deposited by fluvial activity. This reworking resulted in sporadic and intercalated clay lenses. The deposits are usually fine to very fine white, red brown or yellow partially consolidated silty sand. Coarser sands have been found near Bukalo but gravels are rare. Clay lenses are green to grey. Within these sediments lime and silica form the occasional lenses of silcrete and calcrete. The depth of the Kalahari deposits varies from 60 metres northeast around Katima thickening southwest to almost 500 metres.

The northeast-southwest alignment of the Linyanti River and the parallel alignment of pans through the centre of the region suggest major structural dislocation. These faults have been active during and subsequent to the deposition of the Kalahari sediments as is indicated by surface flow patterns on flat terrain that normally encourages a meandering flow (Figure 6.8a).

It is likely that the Kalahari is underlain by sedimentary and volcanic rocks. Boreholes in the shallower deposits around Katima have penetrated sandstone, shale and highly weathered basalt of the Karoo. Exposures of Karoo basalt occur along the Zambezi (KFW Report 1994 and Interconsult 1991).

6.8.2 Climate of the Caprivi

The Caprivi Region has a sub-tropical climate and records the highest rainfall in Namibia with 500 to 700mm/a (see Figure 3.8a). The maximum recorded is 1473mm/a and the minimum is 262mm/a. The rainy season is between the months of October and April, with the highest rainfall between the months of December to March. Since 1988 the yearly average has dropped below 500mm. The highest recorded temperature is 39.4°C and the lowest 10°C. The humidity varies between 20 and 80% and the annual open surface evaporations in the order of 1740mm (Burmeister Van Niekerk 1993, Interconsult 1991).

6.8.3 Relief and Drainage of the Caprivi

The relief can be divided into three distinct categories:

- the flood plains and terrace systems of the boundary rivers
- the interior sand plateau which includes in the west poorly defined drainage
channels know as Mulapos

the eastern flood plains of the Zambezi/Chobe confluence

The deposition of the fine sands, silts and clays described earlier was followed by a
drier period characterized by colluvial downslope movement of the sands. This resulted
in the covering of the silts and clays along various river boundaries. The levelled plain
and distribution of clayey bottomland depressions of the present day was formed
(Schneider 1988).

The average elevation of the Eastern Caprivi is 931 metres amsl. The eastern flood
plains that form part of the Zambezi and Chobe River systems are prone to seasonal
flooding. The central region is flat while the southern region has a gentle slope

The Eastern Caprivi is bracketed north and west by the Zambezi and the Kwando
Rivers whose headwaters are in Angola. The south boundary of Eastern Caprivi is
marked by the Chobe and Linyanti Rivers. The Zambezi departs Angola, entraining
numerous tributaries in Zambia before it enters Caprivi. At Katima Mulilo the Zambezi
changes from a north-south direction to an west-east direction. The Kwando demarcates
the southwest boundary of Angola and Zambia as it approaches the Caprivi. The
Kwando flows across the Caprivi, terminating in the Linyanti Swamp. From the
Swamps the Linyanti River drains into Liambezi Lake. Liambezi in turn is drained by
the Chobe River which joins the Zambezi at Impalela Island. Depending on the relative
elevation of the Linyanti and the Zambezi the Chobe River can flow in either direction

6.8.4 Surface Water Resources of the Caprivi

The flatness of the area combined with geological faults have created a network of
perennial and ephemeral stream channels, lakes, depressions, swamps and flood plains.
As mentioned the major sources of surface water flow are the Zambezi and the
Kwando/Linyanti/Chobe drainage system. The major lake in the region is Liambezi,
located in the southwest near the Botswana border. Irregular drainage and flooding
from the Zambezi brings fresh water into the flood plains of the east.

The surface water resources of the region are undergoing sharp fluctuation at the
present with flows in major rivers dropping and channels drying up. Studies in the
1970’s show that the Liambezi Lake received recharge from the following sources:

In March and April the Zambezi would overflow its banks south of Katima
Mulilo sending water through a series of depressions and pans into the Lake
from the North.
In April and May the Zambezi would also backwater through the Chobe and associated floodplains sending water into the Lake from the east.

In September and October seasonal floods from the Kwando would push through the Linyanti swamps into the Lake from the west.

The Lake was considered as perennial and served as a source of fish stock for local population. Since 1982 no floods have reached the Lake from any direction except in 1989 when a backwater from the Chobe carried a small amount of water into the Lake. No significant floods have occurred on the Kwando and the wetlands of the upper Linyanti are dry. The Zambezi used to seasonally flood the eastern floodplains but has only done so 3 times since 1982. These low flows coincide with historic low flows of the Okavango and near zero flows of the KUNENE over the same period of time. A general change in the regime of river flows is evidently occurring but the periodicity is difficult to establish due to lack of historical data. Historically Liambezi Lake was know to have been dry as recently as the 1940’s, suggesting a periodicity (Van Langenhove and Rukira 1995 and MAWRD Hydrology Division 1994).

Seasonal pans and ponds occur during the rainy season and serve as an important source of water for 2 to 3 months after the rainy season. Some ponds are connected by shallow ephemeral channels known as Mulapos. The Mulapos do not flow outside the rainy season and the ponds become stagnant and unfit for domestic use (MAWRD Hydrology Division 1994).

During construction of the Katima Mulilo-Kongola road in the late 1970’s a pipeline was built for construction purposes. The pipe was taken out of use in 1980 after the road was completed. In 1987 the pipe was recommissioned as a drought relief measure. The water is piped from the Zambezi via Katima Mulilo and Kongola (from the Kwando). The structure of the pipeline is poor due to its age and to the fact that its original purpose and subsequent construction was only temporary (Burmeister Van Niekerk 1993).

6.8.5 Groundwater Resources of the Caprivi

Groundwater occurs in the unconfined aquifer of the Kalahari sediments. Underlying sandstones of Karoo age are also potential aquifers but their depth is a prohibiting factor. The upper 70 metres of the Kalahari exhibits a dual aquifer system. The upper aquifer, approximately 50 metres thick, is predominantly sandy, of fluvial origin, unconfined and contains good quality groundwater. At its base is a 15 metre thick band of clayey material that acts as an aquiclude between the two aquifers. The aquifer below occurs at depths of 75 to 95 metres and provides good volume of water but of poorer quality (higher salinity). This may be a result of the clay zone inhibiting
groundwater flow within the lower layer.

The aquifers are recharged by the surrounding network of rivers and, to a lesser degree, precipitation. Water quality of near surface groundwater shows good quality water in the north and adjacent to rivers. Quality deteriorates southwards and in the interior indicating a longer residence time of groundwater in the interior.

The borehole yields in the Kalahari show consistent but relatively low yield, averaging no more than 5 m³/h. Clay horizons yield less. Due to the fine grade of sediments a careful borehole design is important to prevent sand flowing into the borehole. Another option is to regularly (every 12 to 18 months) clean the borehole (KFW Report 1994, MAWRD Hydrology Division 1994, Interconsult 1991).
6.9. BASELINE WATER RESOURCES

6.9.1 Introduction

The Caprivi was surveyed as per methodology. The sites surveyed exhibit a higher utilization of surface water resources with the use of local channels along the Zambezi near the flood plain and the earlier piped off-take from the old river channel south of Cincinnati. Shallow wells and shallow jetted wells are more common in these sites than in other regions surveyed in the country.

6.9.2 Water Resources at Each Community

Kabbe

Site 1

Kabbe (solar system)  S 17° 43.052’
School  E 24° 37.912’

The system was installed in 1992 and consists of banks of solar panels that power a monostream pump. The borehole is 72 metres deep with Rest Water Level at 4.5 metres (from adjacent well, record shows 6 metres). The water is pumped to a tower (15 metres elevation) to fill 2 tanks which gravity feed to the clinic and school. A tap is at the base of the tower surrounded by standing water that occurs from misuse or leakage.

Water quality analysis show the water to be Class B or Good Quality, being suitable for domestic and stock watering. Due to high salinity irrigation should be limited to plants with a high salt tolerance and with soils of good drainage capacity. The water is corrosive.

Site 2

Kabbe (hand dug well) coord as above
School

Beside the school is a hand dug well, concrete ringed and covered. It is no longer in use and waste has accumulated in the well. Rest Water Level is 4.5 metres.

Water quality analysis show the water as Class B, the same as site 1 but with a slightly lower sodium content.
Site 3

Kabbe (handpump)  
Primary School  

S 17° 42.965’  
E 24° 38.119’

The borehole was installed in 1987 and initially equipped with a handle-action pump. It is now equipped with a rotating wheel design (similar to Flame Wheel or Volante) which the locals prefer.

Water analysis shows that the water is of Class A or Excellent Quality, suitable for domestic, stock or irrigation purposes. The water is corrosive towards steel.

Site 4

Sim pauko (handpump)  

S 17° 42.917’  
E 24° 38.642’

The borehole was installed in 1995 by the Indian Aid program WAPCOS. The borehole depth is 31 metres with a Rest Water Level of 5.7 metres. The yield is quite strong at 15m³/h. It is equipped with an India Mark III handpump.

Water quality analysis show the water to Class A or Excellent Quality, suitable for domestic, stock or irrigation purposes. Medium salinity limits irrigation to plants with moderate salt tolerance in soils with moderate leaching of salts occurring. The water is corrosive towards steel.

At 75 metres distance is a hand dug well of concrete ring structure that was also sampled for water quality. It has the same quality as the borehole but with lower salinity.

Site 5

Mudaniko  

S 17° 43.130’  
E 24° 39.123’

The borehole was installed in 1995 by the WAPCOS program. The borehole is 32 metres deep with a Rest Water Level of 4.7 metres. The yield is strong at 9m³/h. The borehole is equipped with an India Mark III handpump.

Water quality analysis shows that the water is Class C or Low Risk Quality. It is suitable for drinking water and unsuitable for stock. Due to medium salinity irrigation is limited to plants with moderate tolerance to salts and in soils providing moderate leaching of salts. The low pH contributes strongly to corrosion of metals. The water is corrosive towards steel.
At the same site a sample was taken from a hand dug well. The water quality is Class A or Excellent Quality for all uses but with less corrosivity.

Site 6

Lambeza (pond)  
S 17° 42.768’  
E 24° 37.483’  

The pond was opened up by caterpillar in the 1970’s by the Govt. It fills regularly from the flood waters of the Kasai that lies to the north.

Site 7

Lambeza (handpump)  
S 17° 42.811’  
E 24° 36.942’  

The borehole was installed by the WAPCOS program in 1995 to a depth of 31 metres. The Rest Water Level is 5.4 metres and the yield is high at 25m³/h. The borehole is equipped with an India Mark III handpump.

Water quality analysis shows that the water is of Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. The water is corrosive towards steel.

Site 8

Lambeza (hand dug well)  
S 17° 42.720’  
E 24° 37.420’  

The site is a hand dug well of concrete ring construction. It was put by the Govt in 1993. The Rest Water Level is 4.2 metres and the well is uncovered.

Water quality analysis shows that the water is Class A or Excellent Quality, suitable for domestic, stock or irrigation purposes. The water is corrosive towards steel.

Site 9

Kwalala (handpump)  
S 17° 40.365’  
E 24° 35.531’  

The borehole was installed by the Govt in the 1970’s (exact year uncertain). The borehole is equipped with a handpump (design?) that, according to the residents, is the original pump. Breakdowns are rare.

Water quality analysis shows that the water is Class A or Excellent Quality and suitable for domestic, stock and irrigations purposes. The water is corrosive towards steel.
Summary

The Rest Water Level varies between 4 to 6 metres, indicating a shallow water groundwater resource consistent through the area. Water with high salinity is encountered by Kabbe Clinic and in the deeper boreholes established by WAPCOS. This could illustrate the two types of aquifers discussed in section 6.8.5. This could be confirmed by a complete borehole log from the WAPCOS holes but they have yet to be provided.

Lisikili

Water resources include seasonal wells, local swamps and jetted boreholes of an average 18 metres depth.

Site 1

Chito/Nbizwe Swamp  
S 17° 33.148’  
E 24° 27.038’

This is an area name for an arm of the Zambezi that flows in from the east. It carries water year round but fluctuates in level with the seasons. This is in keeping with the seasonal flood performance of the Zambezi in this region. During the dry season these two areas may disassociate. The water is used for domestic, fishing and stock purposes. The residents experience problems with crocodiles and hippo.

Water quality analysis shows that the water is Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. The water is non-corrosive.

Site 2

Mponge (hand dug well)  
S 17° 32.229’  
E 24° 24.606’

The site is a concrete ringed well, uncovered. The well was constructed with a Drought Relief Food For Work Program in 1988. The well had been drained from active use so Rest Water Level was not possible. The well is not in use from May to November when the residents move from the site to the river. Stock are watered north at Kuzwe Swamp.

Water quality analysis shows that the water is Class A or Excellent Quality, suitable for domestic, stock or irrigation purposes. The water is corrosive.
Site 3

Cheza (handpump)  
S 17° 33.257'  
E 24° 23.489'

The borehole was established in 1973 by the Govt. The borehole is equipped with a handpump (design?) that gave good yield in the beginning. Since 1977 the water yield diminished to the point that it pumps two buckets of water only every 30 minutes. It supplies the local village only. If the pump fails they go into a nearby pan and dig temporary wells. Stock is moved north to Kuzwe Swamp. West of the village in the forest are a number of pits that hold water. They were dug in the past when the local road was being constructed.

Water quality analysis shows that the water is Class A or Excellent Quality water, suitable for domestic, stock and irrigation purposes. The water is corrosive towards steel.

Site 4

Mutoiwa (hand pump)  
S 17° 33.253'  
E 24° 24.602'

The borehole was established by the Govt in 1993. It is equipped with a Blair design handpump that has only one breakdown since 1993. During pump failure the residents will go to Chito Swamp for water. DWA has in the past supplemented the village (only 4 years old) with water tankers.

Water quality analysis shows that the water quality is Class A or Excellent Quality water, suitable for domestic, stock and irrigation purposes. The water is corrosive towards steel.

Site 5

Mukendwa (hand pump)  
S 17° 33.244'  
E 24° 25.242'

The borehole was established by the Govt in 1990. It is equipped with a Stewart and Lloyds design handpump. The borehole has a steady yield to also support 4 villages across the road as a water source.

Water quality analysis shows that the water is Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. The water is non-corrosive.
Site 6

Lisikili School (hand pump)  
S 17° 33.048’  
E 24° 26.689’

The borehole was established in 1995 by Govt. The borehole is equipped with a BushPump design hand pump. The yield is very low, with 10 minute waits necessary between 20 litre buckets.

Water quality analysis shows that the water is of Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. Salinity is medium at this site, limiting irrigation usage to plants of medium salt tolerance with soils providing moderate leaching of salts.

Summary

The water quality in Lisikili area is excellent. All of the sources are shallow and do not show signs of salinity except for the site at Lisikili school. Some of the pumps in this area are showing signs of very poor delivery. It is possible that this is a recharge problem and the boreholes may need to be cleaned of sand.

Cincimani

Site 1

Cincimani is supported by piped water scheme from two wellfields and a series of seasonal ponds. The original piped water system from Mukunu channel was established in 1982, but began to fail when the channel started drying up. This was heralded by increasingly poor water quality noticed in 1988 and drop in water levels starting in 1989. By the end of 1992 water was being supplied by road tankers. Six boreholes were drilled from 1992 to 1994 to set up a wellfield in the area of the channel and equipped with solar panels. The boreholes suffered the following problems:

- corrosion of mild steel borehole installations
- siltation of boreholes, gravel packs and screens
- encrustation of filters and gravel packs
- bad water quality (unacceptable smell, taste and black powder content)
- increasingly high sulphate, sodium and iron content.

All boreholes produced Class D or Higher Risk quality water. In 1994, as a temporary measure, the water from the wellfield was mixed with water tanker supply, bringing the...
quality up to Class B or Good Quality water. This proved to be a costly measure (N$1000/load) and temporary at best. In 1995 4 boreholes were drilled west of Cincimani away from the the now dry Mukunu channel. Two boreholes were equipped with solar panel systems from the wellfield system and the water pumped to Cincimani for mixing. They have a Class B or Good Quality classification but produce saline water (see Appendix 6). This may be a temporary measure as the water table has dropped almost 3 metres since 1995 (pers com).

Site 2

Northern Pans

Locininina Pan
S 17° 57.294'
E 24° 05.917'

Lupondo Pans
S 17° 56.892'
E 24° 04.729'

The pans are located in the forested area north of the Linyanti road. Locininina pan carries water for stock up to June. The Lupondo pans, which are larger and deeper carry water up to December with a good rainy season.

Water quality analyses show the water of both sites to be Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. Lucinina pan’s water has higher salinity (medium) which is likely a function of the final stages of a seasonal drying pan with higher concentrations of salts. Water in both pans is corrosive towards steel.

Site 3

Wasmona Pan
S 17° 59.319'
E 24° 07.547'

The pan is located south of Cincimani and carries water up to November/December in a good rainy season. It is used mainly for stock watering.

Water quality analysis shows the water to be Class A or Excellent Quality, suitable for domestic, stock and irrigation purposes. The water is corrosive towards steel.

Site 4

Kagama Pool
S 18° 00.126'
E 24.07.547'

The pool is set in the same channel that used to feed the piped system. This portion of
the channel dried up after the piped system access site. The pool is used for stock only.

**Water quality analysis** shows the water to be of Class D or High Risk Quality. It is unsuitable for domestic, stock or irrigation purposes. The low pH promotes corrosion of metals and has high TDS.

**Site 5**

**Mukuni Channel (hand dug well)**

S 17° 59.603’

E 24° 68.677’

The well is dug in **Mukuni Channel** adjacent to the original piped system intake. The channel is dry.

As with the Kagama Pool site the water quality is Class D or High Risk, being unsuitable for domestic, stock or irrigation purposes. The water is corrosive towards steel.

**Summary**

The wellfield at Cincimani should serve its needs for the near future in terms of domestic supply. As can be seen from the history of its water supply problems the option of drilling boreholes may not be a viable option. The ponds and pans in the area used for stock have good quality. The hand dug wells or pits in the old channel to the south produce very bad quality water.

**6.9.3 Water Management Issues**

**Kabbe**

**Water Management Practices**

A regional Water Point Committee was established in 1995 with the help of Department of Water Affairs extension program. The regional committee is managed by the Headman of Kabbe community with each village within this area forming a sub-committee. With the DWA extension work locals expect to be trained in maintenance techniques of the water point. The community has also been informed that they will have to pay for repairs. These two extension activities have not yet commenced. The community does clean and maintain their hand dug wells which were not closed during construction (some ring-lined are covered). The central committee has not yet begun to manage as they are waiting for some of the villages in the area to form sub-committees.

**Water Resource Sharing**

Water is shared equally among the villages if their is a problem with system
breakdowns. The Kabbe user area appears to be quite well defined, with no outside traffic of livestock moving through from other communities. From discussions this appears to be a result of permanent water points that have been established in other areas of the Caprivi since the 1970’s.

Water Issues and Problems

At the village sites with handpumps and the solar system water quantity does not appear to be a problem for domestic consumption but is not adequate for livestock needs. It should be noted that some of the concrete ring wells do not appear to have been sunk very much below the water table. For these sites it takes very little siltation to fill in a well and limit a village water supply. Consequently such wells require constant cleaning.

According to the community the hand pump systems do not deliver enough volume for stock watering. After the rainy season when the pans dry up in the forested grazing area (usually around May) the stock are moved north to the Kasai River (part of the Zambezi system) for grazing and a reliable water source. It was asked whether a piped system could be installed for Kabbe area (same as Bukalo). Other options were discussed such as deepening existing ponds that are fed by flood channels or the deepening of hand dug wells which have silted up.

Most of the interest was expressed on putting water points in the southern forested area (boreholes and/or dams) that serves as the wet season grazing area. This would allow cattle to be grazed in the new southern area rather than walking cattle north to the river.

A number of the hand dug wells (concrete) were not covered when they were established. The result is that they have been collecting windblown refuse, insects and donations from children during their lifespan. This diminishes water quality. The hand dug wells also silt up regularly and must be cleaned to ensure good water flow.

A recent problem has appeared at one of the water sources. Since 1995 cattle drinking at Kabbe Swamp have been getting sick, with some of them dying.

Lisikili

There is no Water Point Committee at Lisikili and there is no Rural Water extension work occurring at Lisikili. Water management practices are traditional and within the jurisdiction of the headman. All of the boreholes are equipped with handpumps. The users of the water points contribute a small amount of money to the Headman to help pay for repairs when necessary. Water is accessed on a first come first served basis.
Sharing of Water Resources

Within the community water is shared with the hand pump water points when breakdown of handpumps occurs. However the nearby river/swamp system is preferred by most people as an option. The borehole and handpump at the Lisikili school is also used by the village but is regarded as the property of the school. Outsiders wishing to use the Lisikili section of the River must ask the local Headman for permission to use. At nearby Mponge, where a concrete ring lined well has low yields, the residents use another swamp to the north rather than the river sources used by Lisikili.

Water Issues and Problems

Although the river-fed swamp system is the preferred source of water it has the following problems:

- the water is not clean and is a cause of diarrhoea among all ages
- there is an element of risk in collecting water at this source, crocodiles are present and children have drowned
- with shallow water at the edges and thickness of reed growth, the task of drawing water is awkward

The main request from the community is for water points to be established at villages to improve the domestic water supply situation.

Cincimani

There is no Water Point Committee in Cincimani and no Department of Water Affairs extension program yet in this area. There is a Village Development Committee that will work with water related issues such as hygiene. The community is serviced by a piped water scheme from a well field that is attended by a Department of Water Affairs Caretaker. Areas around water taps are fenced and children are discouraged from playing at these sites. Water is taken from the system from early morning until mid-morning as that is when the water is finished in the storage system. There is no payment in any form for water or repairs to systems. Residents are unaware of any program of payment for water resources. The Govt is perceived as the owner of the water resource. Water is taken as needed from the system.

Sharing of Water Resources

There are no restrictions on who can take water from the local system but the neighbouring villages of Kanono, Shaile and Malundu are regular users. These villages are serviced by the same piped water system but due to a drop in pressure they are not receiving water.
Water Issues and Problems

The major concern of the community is the drying up of Mukuni channel from which the original water supply was piped from. This channel was also used in the past for stock watering but that is no longer possible. Due to the seasonal limitations of the local pans in it was now necessary to move the stock farther afield during the dry season. Past problems with salinity have built up a concern over water quality, although that seems to have been resolved for the present. A number of stock watering troughs have been made available the previous year for Cincimani but the Govt has yet to install them. Help from the project was requested on this issue. The major concern expressed was when the Project would implement some activity. Previous surveys had resulted in no action and the community was very sceptical about NOLIDEP.
In the eastern areas near the floodplain the quality of water is not a problem. Quantity is another issue that is tied to expanding population centres (some of the "villages" visited were only three years old) and the need for more grazing land. The supplying of water in the eastern regions can be done with shallow wells, either hand dug or jetted. A number of hand dug wells in Kabbe and Lisikili are not in use as they are not producing water. Some are also in disuse due to new boreholes drilled in the area. These wells are a good site for rehabilitation by deepening or jetting inside the structure. This should be considered as an option where identified need and unused wells occur. Expansion into new grazing areas will require water supply and for Kabbe and Lisikili the water table appears to be shallow enough to be accessed by shallow wells or jetted wells. It should not be necessary to go too deep.

Boreholes with large drilling operations are not necessary except for deep holes. In light of the discussion on saline waters in the deeper aquifer, this should not be a considered option.

Surface water resources can be expanded as has been done at Lambeza in the Kabbe community where channel flow has been taken advantage of. Such features are not necessarily the result of good rainfall but are more dependent on the flow of rivers in the region. It should be cautioned that recent changes in the flow regimes of channels in the region have altered surface water behaviour. Sites for establishing shallow dams in channels should be carefully researched in terms of historical flow and recent changes in flow dynamics. As can be seen by Cincimani, surface water resources are subject to extreme fluctuations which can reduce the effectiveness of surface abstraction from season to season. Pans such as those located north of Cincimani or the pits located in the forest west of Lisikili provide seasonal water based on rainfall. They can also be enhanced by deepening or widening.

Concern has been expressed that the opening up of water points in the potential grazing areas will also result in an influx of people into these forested areas. This may be followed by cutting and clearing of forest for settlement. This has been the case historically and the project may have to give some assurances that this issue is being addressed.
SOILS OF THE CAPRIVI REGION

Meester et al (1993) describe 3 physiographic regions representing characteristic types (Figure 6.11a).

The Mopaneveld which covers the southern, central and eastern parts of Eastern Caprivi. The soils are sandy, mainly solonetz and planosols and greyish sands with isolated patches of sandy loams.

The Kalahari Sandveld characterized by red sands and littoral sands. Also found are scattered patches of dark alluvial sands and loams in low-lying areas.

Floodplains holding extensive areas of alluvium enriched with organic matter with patches of dark alluvial sands and loams, solonetzic and planosolic soils with sandy A-horizons.

(Burmeister Van Nickerk 1993).
Representative soil samples were taken at each site of the major soil types as described by the residents of the area.

*Kabbe*

Site 1 (6023)

The soil is from the cropping area near Kabbe. It is a grey loamy sand with moderate water retention characteristics. The soil is slightly alkaline with high levels and a good balance of nutrients. The soil has good potential.

Site 2 (6025)

The soil is from the flood plain north of Kabbe. It is a grey sandy soil that has poor water retention characteristics. The soil is slightly acidic. Nutrient levels have a good balance, are below optimum but are not low. The soil has moderate potential.

Site 3 (6028)

The soil is from the common grazing area south of Kabbe. The soil is a white/grey sandy loam with moderate water retention characteristics. The pH is almost neutral and should not interfere with nutrient uptake. Nutrient levels are high and of a good balance. The soil has good potential.

**Summary**

The soils in this area all have good potential, having good nutrient levels and nutrient balance. The soil structure is good for moderate water retention.

*Lisikili*

Site 1 (6021)

The soil is a grey/white sandy soil from the grazing area that is slightly acidic. Soil nutrient levels are low but are in good balance. The soil has low to moderate potential.
Site 2 (6026)

The soil is from the cropping area in the flood plain area. It is a white sandy clay loam with good water retention characteristics. The soil is acidic and may interfere with nitrification of organic material will be retarded. Ca levels are high and may interfere with uptake of Mg. Nutrient levels are good to high and are in a good balance. The soil has moderate potential.

Site 3 (6027)

The soil is from the wet grazing area south of Lisikili. It is a grey sandy loam that has good water retention characteristics and is acidic. Nutrient levels are of optimum levels and are in good balance. The soil has good potential.

Summary

The optimal soils are in the flood plain area and in the wet season grazing area. Soils in all areas tend to be acidic, especially in the flood plain. The soils in the forested area to the south have a low to moderate potential.

Cincimani

Site 1 (6020)

The site is near the flood plain. It is a grey loamy sand that is slightly acidic and has good water retention characteristics. Nutrient levels are high except for K which is below optimum. The soil has moderate to good potential.

Site 2 (6022)

The soil is from the grazing area to the north west of Cincimani. The soil is a white sandy soil of slightly alkaline pH. All soil nutrients are in good balance and at optimum levels. The soils of this area have good potential.

Site 3 (6024)

The soil is from the old flood plain area. It is a grey sandy loam that has good water retention characteristics. The soil is slightly acidic but nutrient levels are high and in good balance. The Ca:Mg ratio is higher than optimum and Ca may interfere with uptake of Mg. The soil has good potential.

Summary

The soils in the area have good potential with floodplain soils tending towards to acidity. Floodplain soils also tend to higher levels of Ca.
6.13 SOIL CONCLUSIONS

No soils were encountered with low or poor potential. Grey and white soils in the flood plain vary in potential from poor to good where the soils occur with slight clay content (and better water retention) being superior. Flood plain soils tend to be acidic. Soils in the forested areas that have a sandy texture have lower potential. All of the soil regimes surveyed in Cincimani have good potential. With the relief in the region being flat to undulating, while slope erosion is not an issue.
SECTION 7

LEGISLATION AND POLICY
7.1 INTRODUCTION

7.1.1 Preamble

This Section addresses the legislation, policy and guidelines associated with water abstraction in Namibia. The legislation was adopted predominantly during the South African Administration, when Namibia was known as South West Africa (SWA). The legislation, policy and guidelines linked to natural resources and agricultural development are summarised in this Section.

Legislation, policy and guidelines discussed in this Section are only as good as their enforcement. In addition, there are legal statements in The Constitution of the Republic of Namibia with potential contradiction or misinterpretation relating individuals’ legal rights on Communal Land (pers. comm. Legal Assistance Centre). These statements are found in both Article 10 and Article 21 of the Constitution (see Section 7.2.3).

The present legal system has few Acts addressing environmental protection. Additionally, enforcement of existing legislation is inadequate, due to a shortage of inspectors and insufficient awareness of environmental legislation on the part of law enforcement and judicial officials. The institutional framework should be revised to included added supervisory, monitoring and enforcement measures concerning the environment and water resource protection, both of which are particularly important in an arid country.

7.1.2 Organisation of this Section

Section 7.2 Summaries of Legislation and Policy in this Report is organised as follows:

- Section 7.2.1 summarises legislation linked to natural resources;
- Section 7.2.2 summarises policy and guidelines linked to natural resources;
- Section 7.2.3 presents relevant articles of The Constitution of the Republic of Namibia associated with the environment and land use.
7.2  Summaries of Legislation and Policy

7.2.1  Legislation linked to Natural Resources and Agricultural Development

This section sets out the more relevant legislation which may be of importance for the development of Nolidep at each community.

*Fertilisers, Farm Seeds, Agricultural Remedies and Stock Remedies Act No. 36 of 1947*

This Act governs the registration, importation, sale and use of the items listed above.

*Animal Diseases and Parasites Act 13/1956*

This Act is important as it sets out the rules and establishment of the Veterinary Cordon Fence.

*Livestock Improvement Act No. 25 of 1977*

This act provides for the development and promotion of the livestock industry and regulates breeding.

Meat Industry Act No 12 of 1981

This Act controls the sale, import and export of meat and meat products by the Meat Board.

*Mountain Catchment Areas Act No. 63 of 1970*

The Act amended by Expropriation Act No. 63 of 1975; Mountain Catchment Areas Amendment Act No. 41 of 1976; and Mountain Catchment Areas Amendment Act No. 76 of 1981. It provides for the conservation, use, management and control of land situated in mountain catchment areas, which are declared areas under Section 2 of the Act to be a mountain catchment area by the appropriate Minister. The aim of the Act is to conserve the land lying within mountain catchments to minimise damage to the biotic and abiotic systems. This relates to land management, soil protection, and the protection of natural vegetation with the eradication of defined exotic species.
Foreign Investments Act No. 27 of 1990

This Act has a paragraph (e) referring to foreign investment activities. This states that a proposed enterprise must be supported by its impact on the environment and, where necessary, propose measures to deal with adverse environmental consequences.

Water Act No. 54 of 1956

This Act lays down the foundations for enforcement in the former South West Africa for subsequent legislation related to water resources. In addition, the Act establishes a Water Board and controls for subterranean and/or underground water.

Water Amendment Act No. 22 of 1985

This Act amends Water Act No. 54 of 1956 to regulate the impounding or storage of water for more than 20,000 m³ of private water, the use of a public stream, and the construction of water works involving the impoundment of more than 20,000 m³ of public water. The development of water works (dams) over 20,000 m³ requires a permit from the appropriate Minister under this Act. The Act extends the meaning of "subterranean water" to regulate its use.

Artesian Water Ordinance No. 35 of 1955

This Ordinance consolidates Water Act No. 54 of 1956 with regard to artesian water. However, there are no proclaimed "subterranean areas" or "artesian areas" in Kunene or other Communal Lands. Therefore, this Ordinance does not apply as yet to any of proposed boreholes in Kunene.

Forests Act No. 27 of 1968

This Act governs the demarcation, protection and management of forests. It provides for the prevention and combatting of forest fires, and it regulates trading in forest produce. This Act may be superposed in 1996 by a new Forstry Act.

Preservation of Trees and Forests Ordinance No. 37 of 1955

This ordinance outlines the protection of various tree/shrub species in Namibia.

Nature Conservation Ordinance No. 4 of 1975

This Ordinance protects various categories of wild animals especially protected game, huntable game, exotic game, huntable game birds, protected birds, problem animals and other wild animals, as well as specific fish and plant species. It sets forth the rules
which govern hunting, fishing, gathering of protected plants and provides for enforcement mechanisms.

*Agricultural Pest Ordinance No. 11 of 1972*

This Act covers the registration of nurseries and the control and destruction of certain plants, insects and animals. It also regulates the importation of plants, insects, honey, honey bees, and exotic animals.

*Locust Suppression Proclamation No. 34 of 1923*

This Act is self-explanatory relating to locust control measures.

*Soil Conservation Act No. 76 of 1969*

This Act is self-explanatory relating to the protection of soils.

Nature Conservation Amendment Bill

The emphasis of this Act focuses on the development of resource rights for communal farmers over wildlife. The Act establishes the concept of conservancies in communal lands and Wildlife Councils.

*Agricultural (Communal) Land Bill*

This Act is disputed at present, however, draft versions are available.

7.2.2 Policy Linked to Natural Resources and Agricultural Development

This section sets out the more relevant policies, which may be of importance for the development of Nolidep at each community.

*Guidelines for Environmental Assessments of Large Irrigation Projects of 1993*

The guidelines serve proposed developments of large irrigation projects. This has particular reference to those developments requiring a permit ie above 20,000 m$^3$ of water abstraction from groundwater control areas or State dam or perennial rivers. The aims of these procedures before development is to ensure sustainable development, with economically viable and environmentally aware planning.
Environmental Assessment Policy of 1994

The Environmental Assessment (EA) Policy is a response from the Government to its Constitution and Namibia’s Green Plan. This outlines procedures for effective EAs to inform decision makers, promote accountability, consider projects’ options and alternatives, encourage public participation, and apply cost/benefit analysis. Projects requiring EAs can be associated with many natural resources, however, those pertaining directly to borehole schemes in rural areas are classified as 'Small Scale (formal) Water Supply Schemes'.

A Digest of Water Supply and Sanitation Sector Policy of the Government of Namibia (WASP) of 1993

This policy document promotes awareness in part to the importance of water resources, the value of water as a commodity and the sustainable development of water resources. The objectives for water supply are to contribute to improved public health, reduce the burden of collecting water, promote community based development, support basic subsistence and promote economic development. This is supported by the objective within sanitation to protect water sources from pollution. Finally, WASP promotes household food security through the sustainable and economically viable development of irrigation schemes.

Water Policy: Payment for Water, 1996

The Govt of Namibia is attempting to create a sustainable rural water supply service through the devolution of responsibility for these services to the communities being served, and the recovery of service delivery costs from the user.

The policy formulation process to implement this concept included the input of delegates from the Ministries of Regional and Local Govt. and Housing and the Ministry of Agriculture, Water and Rural Development and representatives from the Department of Water Affairs including the Deputy Permanent Secretary of DWA and senior Departmental Staff. Regional representatives from DWA, Regional Governors and Executive Officers were also involved (see Appendix).

Preliminary Policy was formulated and presented to the Water Supply and Sanitation Coordination Committee (WASCO) for endorsement. The 11-point Policy statement was endorsed by WASCO with minor changes. In summary the water resource is regarded as an economic good for which the consumer shall pay for the supply and service thereof. Tariffs are to be set at levels to cover operation and maintenance for an initial 3 year period and then to be incrementally increased during the next 6 years. The goal is to achieve full cost recovery in nine years.
The service to be supplied is based on a minimum acceptable water supply to Namibian communities based on:

- a maximum walking distance of 2.5 km
- a minimum of 15 litres per person per day which may be regionally adjusted following studies to determine actual water needs
- a maximum of 30 minutes waiting time at the water collection point (see Appendix).

Through a series of National and Regional Workshops with Regional Govt Staff, Regional Representatives, Community Representatives and NGOs the program will be structured and the concept disseminated through 1996. In April of 1997 the Strategy for Payment for Water will be implemented (see Appendix 7).

7.2.3 Relevant Articles from The Constitution of the Republic of Namibia Related to Environmental and Land Use Issues

This section sets out the more relevant articles from the Constitution, which may be of importance for the development of Nolidep at each community.

Chapter 3 Fundamental Human Rights and Freedoms: Article 10 Equality and Freedom from Discrimination

(1) All persons shall be equal before the law.

(2) No persons may be discriminated against on the grounds of sex, race, colour, ethnic origin, religion, creed or social or economic status.

Chapter 3 Fundamental Human Rights and Freedoms: Article 21 Fundamental Freedoms

(1) All persons shall have the right to:

(g) move freely throughout Namibia;

(h) reside and settle in any part of Namibia.

Chapter 7 The National Assembly Article 66 Customary and Common Law
(1) Both the customary and common law of Namibia in force on the date of Independence shall remain valid to the extent to which such customary or common law does not conflict with this Constitution or any other statutory law.

(2) Subject to the terms of this Constitution, any part of such common law or customary law may be repealed or modified by Act of Parliament, and the application thereof may be confined to particular parts of Namibia or to particular periods.

Chapter 10 the Ombudsman: Article 91 Functions

The functions of the Ombudsman shall be defined and prescribed by an Act of Parliament and shall include the following:

(c) the duty to investigate the complaints concerning the over-utilisation of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia.

Chapter 11 Principles of State Policy: Article 95 Promotion of the Welfare of People

The State shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at the following:

(1) maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilisation of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future; in particular, the Government shall provide measures against the dumping of foreign nuclear and toxic waste on Namibian territory.
Section 8

PROJECT CONCLUSIONS AND RECOMMENDATIONS
8.1 INTRODUCTION

8.1.1 Preamble

This section of the report discusses both project conclusions and recommendations. Project conclusions focus on the concept of Nolidep and its role in the northern regions. Conclusions are formed from experiences of the survey team in Namibia and during the survey exercises. Recommendations are based on the Nolidep approach, as it exists, where both fieldwork and logistical recommendations are suggested.

8.1.2 Organisation of the Section

This section of the report is organised as follows:

- Section 8.2 discusses project conclusions;
- Section 8.3 outlines recommendations.
8.2 PROJECT CONCLUSIONS

Project conclusions listed below were confirmed during the process of preliminary site surveys. These project conclusions relate directly or indirectly to each community.

The Nolidep programme could be liable for an Environmental Assessment (EA) forming the most significant component of site selection criteria. Namibia’s Environmental Assessment Policy was approved by Cabinet in August, 1994. Nolidep officials must consult the Ministry of Environment and Tourism to confirm the process for evaluation of projects, which determines the requirements for an EA in Namibia. Nolidep could be classified as a 'government policy, programme or project on the use of natural resources', as listed in the EA Policy’s guide for potential activities requiring an EA. The final decision of formal assessment is determined by likely significant impacts and costs associated by the proposed activity. Nolidep needs to have its status assessed before it proceeds, otherwise difficulties may arise if objections are raised by different Ministries and other bodies, during the later stages of the project.

The assistance of Nolidep to secure tenure (land rights) at each proposed site is quite profound. The present system is a combination of state tenancy combined with erratic customary rights. The Namibian Government has not resolved land tenure in Communal Areas, therefore, it would be premature for Nolidep to intervene before a legislated Communal Land Bill.

The potential fencing of boundaries at each site is not an essential requirement of the Nolidep programme. However, the brief does state that fencing would be considered if neighbouring livestock persist to utilise the grazing camps established on Nolidep ranches. If the last resort is fencing then the project should regard the position as a failure for Nolidep. The failure would be justified as semi-arid ranches in the northern regions require enormous flexibility with neighbouring villages, due to the spatial and temporal deviation of rainfall from year to year. This position is more pertinent moving across land westwards to former Kaokoland.

The target groups defined by Nolidep as food insecure and suitable for inclusion on the communal ranches could raise problematic issues. The system of livestock ownership and inheritance in Namibia differs from region to region. Both matrilineal and patrilineal computations of inheritance for livestock exist. Therefore, an individual/s within a family could move from food insecure to secure categories in a short period of time. Therefore, the project has to determine the isolation of an individual/s from economic prosperity.

Economic prosperity is also provided through informal social security systems. These systems are often family dependant, where a poor household may be supported by another member of the family. These informal social security systems appear to be healthier in areas where tribal associations are more homogenous. These households
may remain in the food insecure category, however, they may not be food insecure during times of need. Therefore, the selection of participants based on Nolidep's food insecure categorisation is not necessarily suitable for this project.

The exclusion by Nolidep of large livestock owners in the northern region is not recommended. The large herds affect and potentially degrade most of the region. In addition, these owners utilise in part MEATCO's marketing scheme for livestock, thereby a minor initiation of off-take is implemented. As Nolidep recognises that the Communal Land system may remain as freeholds or leaseholds available for communities rather than individuals; the project must equally note that wealthy farmers/individuals have the strongest position in this system.

If new/unused rangelands are opened in the pilot phase, will this process be replicable throughout the region? If 95% of the rural population are food insecure, then the task of Nolidep to consider new areas is limited by available land, particularly land in the already overcrowded former Ovamboland. Unused land is often unused for many factors as listed below:

- the reservation status of most communal farmers was determined by historical politics, rather than siting for the potential carrying capacities of land and livestock production - therefore unused land or most communal land has minimal commercial potential for the number of people living in these areas;
- groundwater salinity;
- groundwater contamination eg ferrous oxides;
- no available water sources;
- significant deviations in rainfall patterns affecting grazing;
- low recharge for deep groundwater, eg most of Kavango region;
- wet season camps reserved within the communal land system;
- other enterprises or potential uses eg woodland products, agroforestry, dryland or seasonal flood crop fields.

The factors listed above limit the availability of land to satisfy the relocation of people, or the availability of adjacent land for poor householders. Therefore, Nolidep has accepted that wealthy farmers will have to find commercial land to develop community tenure for the majority. Does Nolidep propose to move a wealthy communal farmer? These farmers are surely part of the community with customary tenure on their side, at present. Nolidep states that the new areas will ease pressure on existing community land. Why is this true, if those people who are food insecure have no or very few livestock?

Nolidep appears to understand that livestock owners on Communal Land are subsistence farmers, unlike commercial farms. Nolidep must acknowledge that subsistence does not entirely account for livestock on Communal Land, as significant numbers of animals originate from large investment stocks. These investments are often owned by
absentee communal tenants, who invest in cattle with finance from other businesses/income located throughout Namibia. This fact is pertinent in the North Central regions.

Does Nolidep propose to have legally binding bylaws to replace the customary laws? Customary law has weakened and in part been responsible for the abuse of Communal Land by wealthy farmers. Therefore, would the bylaws and forms of leadership proposed by Nolidep change the concept of land use on all Communal Land? In addition, would bylaws be consistent at each Nolidep ranch and be enforceable on outsiders?

Nolidep advocates that the communal subsistence should be replaced by communal semi-commercialisation to reduce food insecurity amongst the inhabitants of the region. How does Nolidep justify the economic significance of semi-commercial livestock sales over the development of resources used for subsistence? Has Nolidep considered the value of intangible benefits and their role in the subsistence culture. What level of income is required to make a household food secure?

Security for households may be determined by the fortitude of individualism against communal use. How does Nolidep justify communal semi-commercialisation as opposed to semi-commercialisation for individuals or a household? Who can justify Nolidep’s compromise of semi-commercialisation with communal management? Where has the Nolidep concept succeeded elsewhere in Africa?

At the semi-commercialisation level, there is a contradiction between the targeting of the food insecure and the fact that most livestock are owned by the relatively rich. If Nolidep wants to benefit the food insecure, then the focus should be on subsistence rather than semi-commercial levels.
8.3 RECOMMENDATIONS

The recommendations are based on the findings and experiences of the survey team. These recommendations for Nolidep in the northern regions may influence its direction or approach.

- Rainfall in the region should be monitored to provide an early warning system in the region for farmers. Rainfall gauges could be placed at the homes of Extension staff or responsible members of Water Point Committees. These gauges should be measured at least once each week to provide an on-going seasonal assessment of rainfall. In addition, seasonal rainfall gauges could be used at the end of the wet season (May/June) at sites where regular measurement is not possible. These sites may include Oxfam’s target villages and Control Areas.

- The annual carrying capacities of land at each community must be assessed before any development concepts are discussed between the village, Extension staff and Nolidep. Assessment of grazing should preferably occur at the end of the wet season (May/June) to evaluate regeneration of vegetation and assist the identification of grasses. The preliminary survey’s carrying capacities are only indicators, as the wet season had not been completed at the time of the survey.

- The number of animals and their weight, at each target village, must be ascertained with assistance from the Directorate of Veterinary Service. This assessment will provide a figure for LSUs in each village. These figures are important as they will indicate if livestock numbers are exceeding or not, the potential of grazing in the village.

- The needs for water points must take into account the carrying capacity of land and the LSUs. In addition, any development or rehabilitation must address the logistical management problems and issues for grazing, ie the location of the water points. Often, there is insufficient water, while the management of the pumping of water is inadequate for the daily needs of livestock. The management issues must be discussed by all parties.

- Water points or supplies providing sufficient water for livestock based on current grazing conditions must not be increased, if this could lead to degradation of the area without adequate management and land rights. Water points should be spaced at least 5km apart for grazing management in this region. However, most communal farmers dependent on open access land have minimal rights over grazing, therefore, management may not be possible with suitable water supplies.

- The daily water requirements for people and the livestock of the village must be
assessed. This assessment must include the current pump rate of a borehole and pumping hours required each day.

- Perennial and ephemeral water point data should be logged and their locations mapped for each target village. This procedure will assist development objectives or decisions.

- Further assessment of the importance of browse in each village needs to be executed. As the grazing assessments indicated, this fodder is a significant form of maintenance for cattle as well as goats in each village.

- The extent of private fencing and the number of communal farmers practising this form of illegal grazing management needs to be assessed at all Oxfam’s target villages. This exercise will determine the approximate area of land with open-access and its potential for those who are reliant on this land.

- Nolidep must assess demands which may affect resource use and/or the status of the environment. Water provision may encourage the development of herds and fenced areas by wealthier farmers, and thereby reduce land and grazing availability for those reliant on open access areas.

- Nolidep must maintain its monitoring of target villages, as well as the provision of encouragement and training for Extension staff to monitor village resources.

- Normalised Difference Vegetation Index (NDVI) ratio’s trend analysis should be completed for all villages where there are proposals for agricultural development. This procedure provides a significant baseline for the monitoring of change for vegetation cover. Contact the Meteorological Office in Windhoek for further advice.

- Nolidep needs to define and understand its beneficiaries and their interests in communal areas. However, it may be difficult to focus on those marginalised within the communal areas, due to erratic customary laws and inadequate State legislation. Nolidep may need to address the draft version of the Communal Land Bill with assistance from spokespeople for ALL communal farmers in the northern regions. Nolidep may need to lobby with local people and other Namibian organisations to state the case for those who are marginalised and/or susceptible to poverty in the northern regions.

- Training of Government Extension staff and local representatives from each community should form part of Nolidep’s extension programme. Training associated with environmental issues should be directed at people associated with all land and water issues. Presently, the level of understanding by Extension staff appears to be limited, although there is potential for improvement. These training components need to address the principle of integrated development of
resources required by the local population, ie livestock farming in most villages. Meanwhile, training should always have a sustainable approach to resource utilisation.

- Many of the sites being considered for water resource expansion (for purposes of developing new grazing areas) are often areas where water is marginalized in terms of quantity or quality to some degree. This holds true for such extremes as the Kunene and the Caprivi Regions. In the Kunene, sites such as Omakange will yield bad quality water in its eastern boundary while the west of the community yields good quality and quantity water and should do so for the foreseeable future. In the Caprivi where floodplains meet the banks of one of the largest rivers on the continent and in an area where precipitation certainly exceeds Kunene, whole stream and channel systems have disappeared in the short span of 3 to 4 years as has happened at Cincimani. On the surface these regions appear to be classic stone-cracked desert and well forested plains. The reality is the opposite and this underscores the necessity of getting the correct information and enough of it to make a decision on managing the water resources of a region. For any surface water enterprise rain gauging is necessary to understanding catchment recharge. All historical information must be considered. When expanding groundwater resources, up to date information on Rest Water Levels and (if possible) current yields of boreholes in the area of investigation should be obtained. Water quality should also be tested as there is no purpose to establish an expensive system that cannot be used by humans, stock or for irrigation. Finally the needs of a community should be looked at critically and the systems that are intact (this includes user habits and practices) should be assessed to see if the water to the individual can be increased with a properly maintained delivery system, minimization of water wastage and the use of waste water.

- A number of water points do not have adequate facilities for domestic and household use. Many people must obtain water from a stock trough, from dam facilities or from open hand dug wells. The scope to accomplish safer water supplies to communities is wide and need not involve heavy expenxe. Two principles should be observed:

  the domestic water point must be closed to the environment and accessible only by people. The water point should not be accessible to large or small stock. A protected hand pump is ideal.

  facilities should have good drainage to minimize standing water.

- Many sites can give safer water supply with components such as cement, water lines, and basic fencing material. Rehabilitation is a good community activity, especially when it is accompanied by simple education about safe water
practices. If the project is going to consider expanding water resources in any form it should responsibly consider a degree of community education and awareness of safe water use.
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