THE DYNAMICS OF THE LAND USE SYSTEMS IN NGAMILAND: CHANGING LIVELIHOOD OPTIONS AND STRATEGIES

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Abstract

This paper describes the traditional land use systems in and around the Okavango Delta in terms of their spatial coverage, job and income generation potential. It outlines which natural and socio-economic factors determine the selection of certain resource use choices. Special emphasis is given to crop production and to the livestock sector and their role in the multi-strand rural economy. The dynamics of the land use pattern in response to the constant fluctuations of the natural conditions and livelihood strategies and options that people in Ngamiland have adopted enable them to cope with this unstable environment. Finally, the paper explores the influence of government programs and policies on the livelihood choices of people and stresses the role of increasing formal employment opportunities, in particular in the fast growing tourism sector, as drivers of change.

INTRODUCTION

The general objective of this research paper is to improve the understanding of the existing land use systems and the range of livelihood options of local resource users in the Okavango Delta. To understand the dynamics of the resource use pattern, and the factors which are the drivers of change is a prerequisite for planners and decision makers to be able to come up with zoning recommendations, design management plans and determine levels of use and introduce effective control mechanisms to ensure sustainability and protection of the natural resources.

The majority of people in Ngamiland maintain a diversified income generation system as a means of reducing risks in an unstable environment. The main economic activities in the district are rainfed and flood recession cultivation, livestock management, fishing, hunting, gathering of veld products, small scale commercial enterprises like the production and sale of crafts and local food and beverages, wage labour in the tourism industry, and formal employment in the government and in the private sector. "The importance of the individual economic activities varies from household to household; from community to community; from season to season and from year to year in response to variations in rainfall and flooding, access to resources, labour and capital, and cultural and other factors influencing preferences" (IUCN, 1992: 2-10)[2].

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SPATIAL COVERAGE OF DIFFERENT LAND USE ACTIVITIES

The distribution of the particular types of land use in Ngamiland depends largely on natural factors like the distribution of water, soil and range land quality (Langdale-Brown & Spooner, 1963), and the presence of vector-borne diseases (tsetse flies), but is also strongly related to the traditional preferences of different ethnic groups for particular economic activities (Bendsen & Gelmroth, 1983). Furthermore, government policies and the zoning and land use planning decisions made by district and tribal authorities have influenced the spatial coverage of different land use activities.

Distribution of dryland and floodplain cultivation

According to a land use assessment carried out by the HOORC in cooperation with the University of Sachsen Anhalt (Meyer et al, 2002) using the most recent remote sensing material the total area cleared for cultivation in Ngamiland amounts to 48,900 ha. Out of this, 75 % are dryland fields and 25% of the lands are located in temporarily inundated floodplains (in Setswana *molapo*, plural *melapo*). According to the reports of the Agricultural Statistics Unit (1968-2002), out of the total arable area only about 10,000 ha are cultivated on the average per cropping season.

Along the Okavango Panhandle and in the Etsha area, where the HaMbukushu are the dominant ethnic group, dryland farming is the main land use activity. *Molapo* cultivation is found in the floodplains at the western and south eastern fringes of the Delta, mainly in Tubu and in the Shorobe-Matlapaneng area (Map 2). The main dryland cultivation areas in Ngamiland are located around Etsha and on both sides of the Okavango Panhandle.

Livestock distribution in and around the Okavango Delta

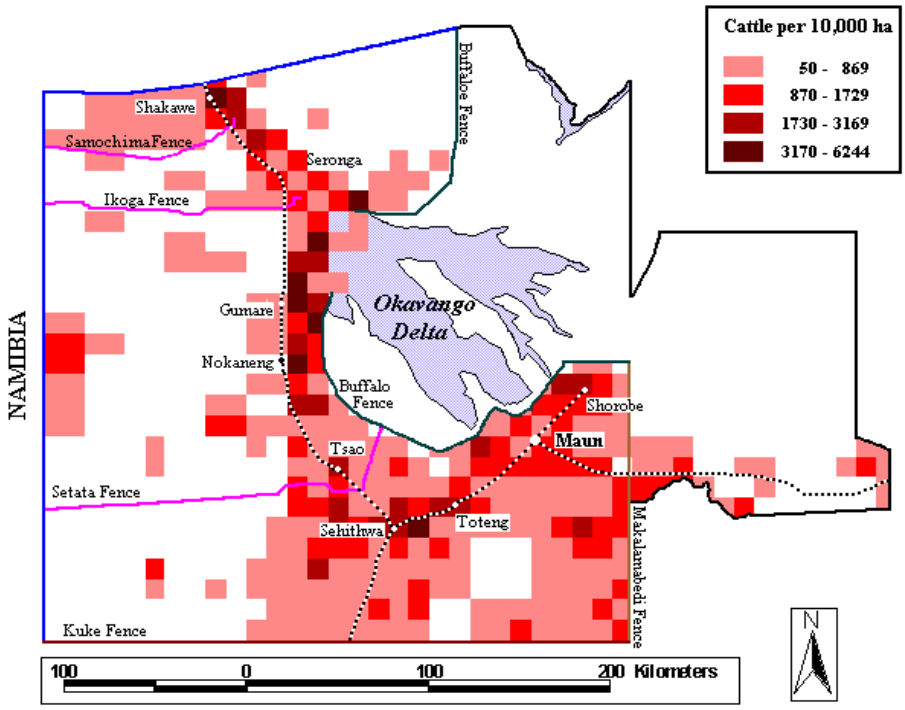
63% of the tribal land in Ngamiland district has been zoned for communal use (Ngamiland District Council, 1997). According to customary law, all tribesmen have open access to grazing and to natural surface water for stock watering in communal areas to meet their subsistence needs.

Map 1 clearly illustrates that the distribution of livestock in Ngamiland is directly related to the availability of water. In most of the communal areas livestock is mainly concentrated along the permanent open water sources at the fringes of the Okavango Delta or is watered from shallow wells in old river channels, inter-dune valleys, floodplains or in the old bed of Lake Ngami (HOORC & Ecosurv, 2000: A 55). People who own only small numbers of livestock keep their animals during the dry season at the edges of the *melapo*, close to the villages. As soon the rainy season starts, water collects in natural pans, hence cattle are driven away from the

overgrazed floodplains to the dryland pastures. Livestock owners who have bigger herds often maintain a separate cattlepost. Those farmers who can afford to develop artificial water points can apply for individual water rights to the Water Apportionment Board and for the allocation of a water-point site to the Tribal Land Boards. For the establishment of wells in areas with a shallow ground water table (floodplains, river or lake beds) no permission is needed. Particularly in the sandveld to the west and south of the Okavango Delta, where palatable groundwater is scarce, drilling for water is a risky enterprise. According to the "Water Point Survey Ngamiland" 45% of all the waterpoints developed in the district are either dry or cannot be used due to their high salinity (Bendsen, 1984). The borehole technology is very expensive and accessible only to wealthier farmers (White, 1993). Through the development of watering points in the sandveld, better off livestock farmers have been able to gain the *de facto* rights to new grazing areas. To distribute livestock watering points evenly and avoid over-utilization of the rangeland, the Tawana Land Board (TLB) has adopted the national allocation practice, that boreholes must be spaced at an eight-kilometre distance.

Map 1: Cattle Distribution in Ngamiland

pre CBPP in 1995



Adapted from: DWNP, 1995

The main livestock rearing areas in Ngamiland are Maun/Shorobe, Toteng/Sehithwa/Tsau, Nokaneng/Gumare, Shakawe, and Seronga. The areas from Nokaneng southwards up to Lake Ngami and eastward to Toteng are primarily used as grazing land only intermixed with small arable fields. There, the Herero, who are mainly pastoralists, are the dominant ethnic group. The BaTawana are also foremost livestock

farmers, but simultaneously practice dryland farming around the Toteng and the Maun area. The HaMbukushu, who reside in northern Ngamiland, place arable agriculture first in importance among their subsistence activities (Gibson et al., 1981: 217). However, they are increasingly accumulating livestock. The Tribal Grazing Land Policy (TGLP) ranches in the Hainaveld, in the dryland south of Maun, have been developed in the last 25 years as a commercial livestock zone. The area fenced for ranch development is presently being extended to Toteng and Sehithwa under the "Fenced Ranching Component" of the National Policy on Agricultural Development.

THE AGRICULTURAL LAND USE SYSTEMS IN NGAMILAND[3]

Arable farming

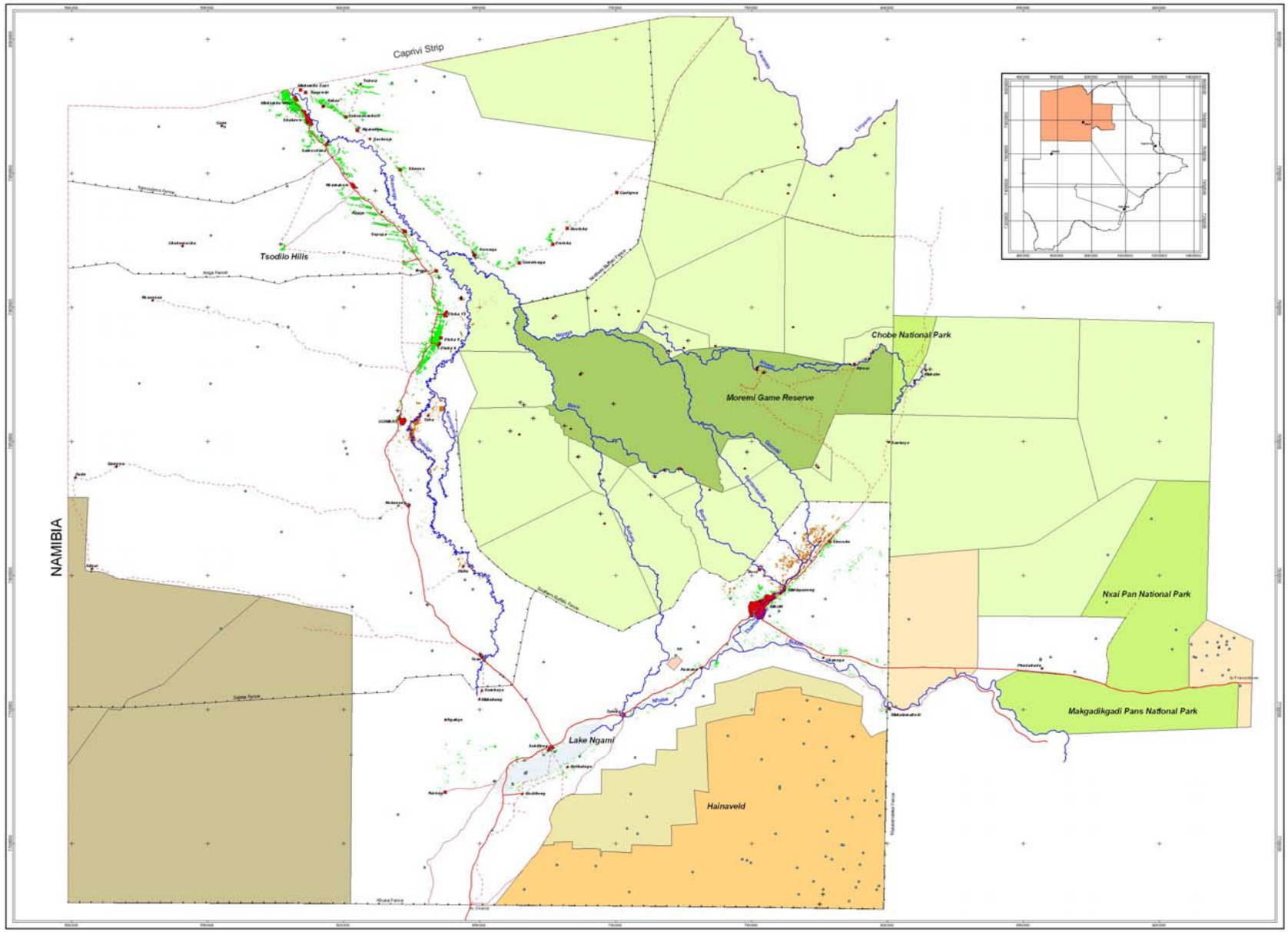
Despite the limited potential for crop production and the high risks this activity carries, the majority of households in Ngamiland are involved in crop production. During the last 30 years, 66% of the agricultural holdings in the district planted crops (Agricultural Statistics Unit, 1968 – 2002). After 1996, when all the cattle in the district had been culled due to the outbreak of Contagious Bovine Pleuro Pneumonia (CBPP or cattle lung disease), arable agriculture became one of the major alternative sources of livelihood for the population in Ngamiland (Fidzani et al, 1999). Despite the rapid population increase between 1968 and 2002, the cultivated area has remained almost static (Figure 1). Although the area farmed per household is in decline, arable agriculture remains an important source of livelihood for communities in Ngamiland (Scott Wilson, 2001: 31).

Most farmers cultivate small areas for subsistence purposes. At present only 10% of the farmers reach full subsistence level and live mainly from their own production (Ndozi, Nthibe & Bandeke, 1999: 36). According to the Agricultural Statistics (Agricultural Statistics Unit, 2002), not more than 10,668 ha were cultivated in Ngamiland in 1997. Looking at the long-term average 2.1 ha are ploughed annually per household (Agricultural Statistics Unit, 1968-2002).

[3] Some of the information on the agricultural system in Ngamiland is based on the experience and in-depth knowledge the author, H. Bendsen, gained during her long-term assignment as Land Use Officer for the Ministry of Agriculture and as consultant for the North-West District Council and the Tawana Land Board in the District during 1979-1989.

Map 2:

Land Use Map Ngamiland



Legend

- Villages > 1000 Inhabitants
- Main Village
- SUB- DISTRICT CAPITAL
- ***DISTRICT CAPITAL***
- Settlement
- Village
- Airstrip
- Tourist Lodge
- Tarred Road
- Main Track
- Gravel Road
- International Boundary
- Agricultural Drift Fence
- Veterinary Cordon Fence
- River
- Lake Nagami

Protected Areas/ WMA's

- Game Reserve
- National Park
- Wildlife Management Area (Cattle free)
- Wildlife Management Area (Multipurpose)

Cultivation Areas

- Dryland
- Molapo

Fenced Ranches

- BLDC Ranch
- BCU Ranch
- TGLP Ranch
- NPAD-Fencing Component Ranches
- Borehole (Livestock watering)

Land Use Map Ngamiland

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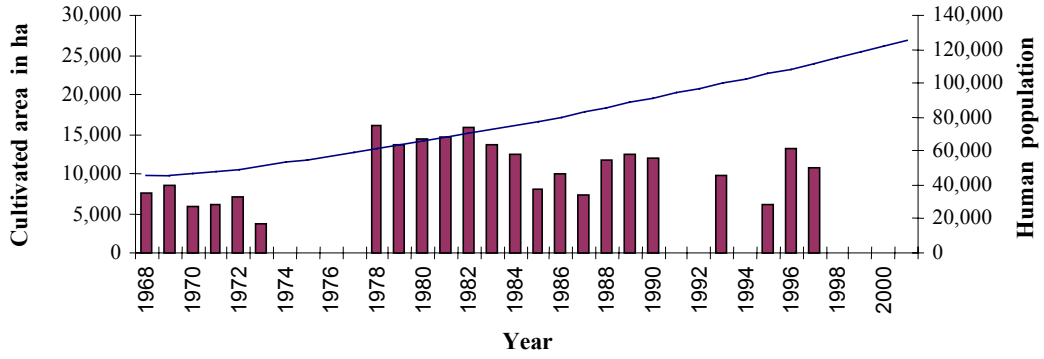
Projection: UTM Zone 34 South
Spheroid: Clarke 1880
Datum: Cape

22/10/2002, Maun / Botswana

Figure 1: Demographic changes in relation to area cultivated in Ngamiland



Source: Agricultural Statistics Unit, 1968-2002b (during the years with a data gap no statistic reports were produced)

An arable lands survey carried out by Ngamiland DLUPU (1979) maintains that larger areas used to be cultivated per household in the past. In 1978, 39% of the farmers ploughed up to 4 ha, 36% between 5-14 ha, and 18% cropped lands areas of 15-20 ha (Ngamiland DLUPU et al, 1979). The main cereal crops grown in Ngamiland are sorghum, maize, and millet (Table 1). Secondary crops like beans, pumpkins, and watermelons and occasionally sweet reed (sorghum bicolour) and peanuts are grown in varying quantities throughout the region (Afriyie, 1976: 183). The selection of millet as against sorghum can mainly be attributed to traditional preferences of particular ethnic groups.

Table 1: Distribution of cultivation areas between different crops in Ngamiland

	Average 1968 - 97	%
Maize	3,283 ha	31%
Sorghum	3,592 ha	33%
Millet	3,079 ha	29%
Pulses	552 ha	5%
Others	242 ha	2%
Total cultivated area	10,748 ha	100%

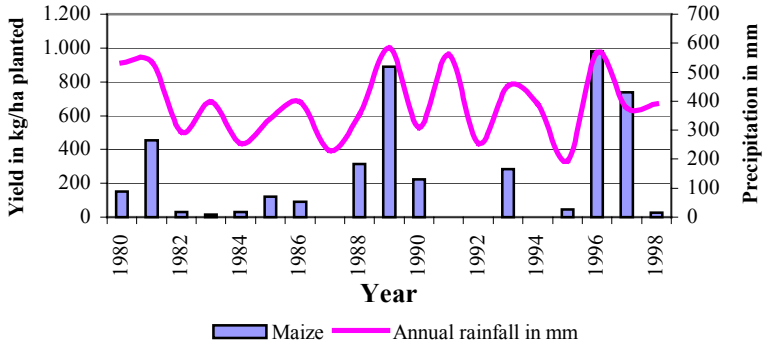
Source: Agricultural Statistics Unit, 1968-2002

The HaMbukushu predominantly grow millet in the dryland in Ngamiland West in Etsha and on both sides of the Okavango Panhandle. Most of the other ethnic groups like the BaYei and the BaTawana prefer maize and sorghum as their staple grain crops. Sorghum is also processed into a traditional alcoholic beverage called *Bojalwa jwa Setswana*. The BaYei who consider themselves "river people" grow maize in the floodplains at the fringes of the Okavango Delta while sorghum is planted in the higher, drier parts of a *molapo* field.

On average only 40% of the total area cultivated can be harvested at the end of the cropping season (Agricultural Statistics Unit, 1968 – 2002). In some years, the ratio between area harvested and planted is even less favourable. These figures clearly illustrate the uncertainties crop-farming bears. The high failure rate can be attributed to drought or erratic rainfall patterns (Figure 2), flooding (in flood-recession farmland) and crop losses or crop damage by livestock, wildlife, birds (particularly quelea), rodents, and pests. Even though millet is more likely to be damaged by birds, it is far more drought resistant. When comparing the likelihood of crop failure between different crops, it becomes apparent that maize and sorghum are more vulnerable to total crop losses than millet (analysis of Agricultural Statistics, 1968-2002).

In general, traditional arable farming is an extensive system with minimal input and occasionally fair, but more often low returns, depending largely on unpredictable environmental conditions during the cropping season, which are beyond the control of farmers. A minimal input approach in crop production is reflected in traditional cultivation practices (Riezebos et al, 1991: 38). As the natural conditions change drastically, yields vary considerably from year to year, from crop to crop and even between different arable zones in Ngamiland during the same cropping period. Due to the high rate of total crop failure yield figures are commonly based on the area harvested and not the area planted. According to calculations using the government's agricultural statistics, long-term yield averages for all the grain crops harvested amount to 142 kg/ha in Ngamiland (Agricultural Statistics Unit, 1968-2002). Long term average yields for maize are 162 kg/ha, for Sorghum 121 kg/ha, for millet 144 kg/ha and for pulses 28 kg/ha.

Figure 2: Maize yield variations in relation to precipitation rates



The strength of the traditional agricultural system is its flexibility and the spread of risk it allows. Farmers change to more drought resistant crops in periods of low flooding or persistent low rainfall. Others, who have the option, shift from flood recession cultivation to dryland farming or vice versa. If crop losses occur early during the cropping season, replanting is commonly practised. In years when crops fail there are other

sources of income such as livestock rearing, fishing, collection of veld products (like wild fruit, berries, mushrooms, traditional building materials etc.), production of traditional crafts, in former times also hunting, and these days increasingly formal employment in the tourism sector to fall back on (Rashem, 1988: 6).

Dryland farming

Dryland farming is the predominant farming system in Ngamiland practised by 85% of the farming households (Ngamiland DLUPU, 1979). Areas suitable for floodplain cultivation are limited. In the late seventies 35% of the farmers cultivated *molapo* land, while 20% had access to both dryland and *molapo* fields (Ngamiland DLUPU, 1979). The Agricultural Statistics Reports of the Central Statistics Office do not distinguish between the two farming practices.

As irrigation of cropland is not practised in traditional agriculture in Ngamiland, yields are directly related to the annual precipitation rates and the rainfall distribution pattern during the growth period.

Molapo cultivation

Floodplain cultivation is a traditional farming system commonly practised in and at the fringes of the Okavango Delta mainly by BaYei farmers. In March to April, the floods peak at Shakawe in northern Ngamiland and spread gradually throughout the Delta. In Maun the water level starts to rise usually three months later (June-August). Depending on the precipitation rate in the catchment area of the Okavango Delta, the Angolan highlands, the flood level can vary considerably from year to year. During the recession of the floods *melapo* land gradually dries up (as result of evapo-transpiration, infiltration into the groundwater and outflow) until it becomes available for cultivation.

Due to constant changes in the flood distribution pattern some *molapo* fields do not get flooded every year but benefit from the raising groundwater table or run-off from adjacent areas and are cultivated under rainfed conditions. As the magnitude and distribution of the floods vary considerably from year to year, farmers are forced to adapt their cultivation patterns accordingly. In 1974-78 for example, the floods never receded, so large parts of the Shorobe *molapo* area could not be cultivated (Staring et al., 1981:6), whereas in 1986-87 (Rosenow, 1990) and during the 1990s parts of the *melapo* were not flooded at all and could only be cultivated after the onset of the local rains. Yields in the fertile *molapo* areas are generally higher than in the dryland. Under rainfed conditions 500 kg/ha sorghum could be obtained whilst under optimal flooding conditions 1800 kg/ha - 2900 kg/ha sorghum have been recorded (Rosenow, 1990:55).

To protect their standing crop from the second flood caused by the precipitation over the Okavango Delta (setting in between November and January) and to benefit optimally from this additional source of

moisture, the *molapo* farmers traditionally construct small hand-built dams (bunds) out of grass sods. These structures are meant to control the rainwater distribution but do not obstruct the main flood. They subdivide the cultivated *melapo* in sections to avoid rainwater from collecting in the lowest places.

Commercial irrigation farming

Since the beginning of the nineteenth century the abundance of water in the Okavango Delta has always raised the hopes of people to develop large-scale arable projects. Early travellers (e.g. Stigand 1913) as well as development agencies (Langdale-Brown & Spooner, 1963; Siderius, 1970; Swedeplan, 1989, and SMEC, 1991) carried out comprehensive surveys and identified areas with some potential for irrigation farming. The Nokaneng Flats and the area around Lake Ngami were repeatedly recommended for agricultural development. However, many adverse factors, some of them associated with the constant alteration of the natural flow regime, temporary drying up of rivers, market constraints, and high costs for agricultural inputs, dampened the optimism of decision makers and investors. However, several attempts have been made to grow crops at a large commercial scale in Ngamiland. Except for two commercial irrigation schemes (125 ha and 12 ha in size), still in operation south of Shakawe, where there is abundant perennial water, all the commercial projects have failed and have been abandoned.

A few small fruit and vegetable gardens have been established at some of the schools in the district. Supported by the Financial Assistance Policy (FAP), a program no longer in existence, a few individuals have started to grow fresh vegetables and spices at a small scale. They market their products directly to the safari industry or to the retailers in Maun. Along the Boro River at the Kunyere fault the Department of Prisons has an irrigation scheme and is growing vegetables.

Livestock farming

Prior to the outbreak of the contagious bovine pleuro-pneumonia (CBPP) in 1995 and the eradication of the entire cattle population in Ngamiland carried out in 1996 by Government as a preventive measure, the cattle industry formed the backbone of the economy of the District (Scott Wilson, 2001). In 1991, 40% of all the people in the district with formal employment worked in the agricultural sector (CSO, 1991). Before the CBPP cull, 320,000 head of cattle were kept in Ngamiland, which accounted for 12% of the entire cattle population of the country (Scott Wilson, 2000). Sixteen years earlier, in 1979, cattle numbers had even been higher and had reached an absolute peak of 376,000 due to livestock sale restrictions imposed on Ngamiland after a Food and Mouth disease outbreak (Agricultural Statistics Unit, 1980).

Ownership of livestock has always been unequally distributed. Certain ethnic groups like the Batawana and the Herero have traditionally been more involved in the livestock sector (Campbell, 1976). Within these ethnic groups the bulk of the cattle are concentrated in the hands of a few wealthy farmers. According to the findings of Campbell (1976), of the Batawana-owned cattle 60% were under the control of only 4% of the Batawana farmers. A study carried out in the communal remote zone in Ngamiland west in 1992 (Smit & Kappe) confirms that cattle ownership is still significantly related to ethnic background. According to an analysis of all the Agricultural Statistics reports, over 35 years carried out by the author (Agricultural Statistics Unit, 1968 – 2002), on the average 67% of the farming households possessed cattle before 1996. Ownership has become more skewed since the CBPP epidemic in 1996. In 1999 only 29% of the farmers did own livestock (Ndozi, Nthibe & Bandeke, 1999).

Cattle play a multifunctional role in the rural economy. They are marketed commercially or if a particular need for cash arises. Cattle were and are still regarded as a status symbol and have a high cultural value (Murray-Hudson and Parry, 1997). Cattle are used to pay the bride price (*lobola*), are passed on to the next generation by inheritance and are slaughtered locally for particular occasions like weddings or funerals. Their milk is a major contributor to the subsistence economy. Oxen are mainly used and hired out by the farmers as draft power for ploughing. By-products, like the hides are sold to commercial tanners, while manure is applied even though to a minor extent as fertilizer in vegetable gardens and fields. Mixed with clay, it is also used as building material for the construction of traditional houses.

Since the CBPP cull, the economic significance of the livestock sector in Ngamiland has decreased (Scott Wilson, 2000). Two socio-economic impact studies reveal the drastic effect of CBPP on rural livelihoods in Ngamiland. Whereas in 1996 (during the cattle eradication exercise) cattle were ranked by 52% of the population as their main source of income, followed by arable farming (41%) and by smallstock (28%) (Fidzani *et al.,* 1999) the importance of cattle diminished drastically after the CBPP culling. The loss of cattle caused temporarily a major economic reorientation in Ngamiland. In 1997 people considered arable farming (37%), wage employment (17%), and government assistance (15%) more important as sources of livelihood than cattle. Cattle were seen at that time only by 7% as main source of subsistence (Fidzani et al., 1999). However cattle numbers are rapidly increasing.

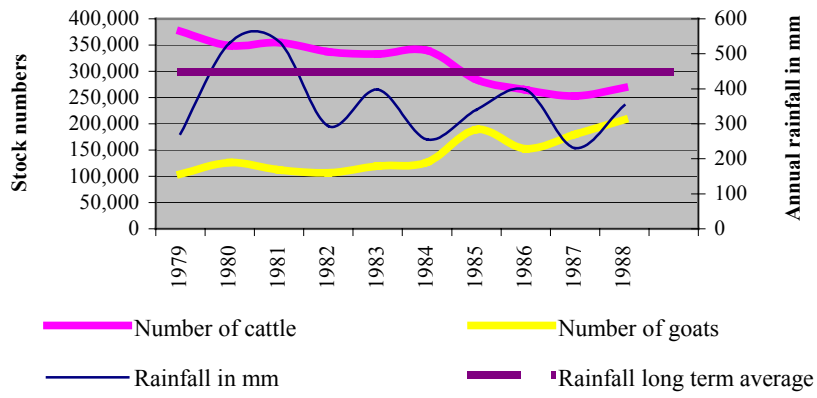
The role of smallstock

Smallstock (primarily goats) are the third component of the economy of rural households in Ngamiland (Fidzani *et al*, 1999). The total number of goats that graze mainly in the communal areas of

Ngamiland has tripled from 1968 to 1998. In 1998, as many as 185,711 goats and 24,525 sheep were kept in the district. They are usually kept close to the village and are kraaled at night in areas where the risk of preditation is high. In the last decades the keeping of smallstock has become slightly more popular by farmers in Ngamiland. While in 1980 50% of the households raise goats the number of farmers who invested in smallstock has gone up to 57% in 1998. Also amongst women headed or poorer households small stock rearing is an important source of livelihood (IUCN, 1992). In 1998 a family owned on the average a herd of 32 goats (Agricultural Statistics Unit, 2000).

Sheep are far less common in Ngamiland. Only 11% of the farmers raise sheep, on the average about 24 animals per household (Agricultural Statistics Unit, 2000). Most people in Ngamiland rely on smallstock and poultry for meat (Scott Wilson, 2001). The milk of goats and sheep is also used in many rural households. Smallstock has proved to be more drought resistant than cattle and still does reasonably well under poor grazing conditions (IUCN, 1992:6-32) (Figure 3). While during the long-lasting drought in the eighties 24% of the cattle in Ngamiland died, the number of goats increased by 21% in the same time span (Agricultural Statistics Unit 1980, 83, 86).

Figure 3: Effect of Rainfall on Cattle and Goat Numbers in Ngamiland



Source: derived from Agricultural Statistics Unit, 1979-1989

CHANGES AND TRENDS IN THE AGRICULTURAL SECTOR

Changes in arable agriculture

During the last 30 years the population of Ngamiland has increased rapidly (Table 2) whereas the area cultivated in Ngamiland has stagnated or even been slightly reduced (Figure 1). There are more factors hampering arable production than elements stimulating the sector that need to be analysed to explain this trend.

Table 2: Population Growth in Ngamiland between 1964 and 2001

	1964	1971		1981		1991		2001	
	Population	Population	Annual Growth Rate	Population	Annual Growth Rate	Population	Annual Growth Rate	Population	Annual Growth Rate
Country	514.378	574.094	1,6%	941.027	5,1%	1.326.796	3,5%	1.680.863	2,4%
Ngamiland	41.820	47.723	1,9%	68.063	3,6%	94.534	3,3%	124.712	2,8%
Maun	4.549	9.614	11,3%	14.925	4,5%	26.768	6,0%	43.776	5,0%

Source: Central Statistics Office 1964-2001

The effect of fluctuations in natural conditions

Arable farmers in Ngamiland have been repeatedly hit by disasters and short and long term fluctuations of the natural conditions for crop and livestock farming. Extremely high floods (in 1978/9), severe droughts (in 1964-65, 1982-88, and 1995), as well as gradual changes in the flood distribution pattern over the last century, have all negatively affected arable agriculture.

To be able to respond to these constant fluctuations in the environmental conditions, the land use systems in Ngamiland are both dynamic and resilient. An extreme example of the natural fluctuations, which occurred during the last century, is the drying up of the Thaoge River, formerly the main water tributary for the Tubu floodplains in western Ngamiland. Consequently some of the major *molapo* cultivation areas between Habu and Gumare had to be abandoned. Some of the farmers who used to rely on flood recession cultivation moved their lands to the northwest into the Karongana area. However, the total area cropped or suitable for floodplain cultivation in western Ngamiland has decreased considerably (Bendsen, 1983).

Outbreaks of vector-borne diseases killed or drastically decimated the cattle population. Consequently crop farmers were faced with draft power shortages and had to reduce their cultivation areas.

Historically, the reoccurring invasion of the Delta and its fringes by tsetse flies affected both domestic stock and humans and forced people to abandon some of their settlements and floodplain cultivation areas (especially during the peak of sleeping sickness outbreaks in 1942 - 1946 and 1971) (Okavango Community Consultants, 1995).

Comparing the agricultural statistics of the last decades, it becomes obvious that whenever the livestock sector has experienced severe losses, crop production was simultaneously affected. A serious

detrimental effect on arable production in Ngamiland was caused by the outbreak of CBPP in 1996 when the entire cattle population of Ngamiland district had to be culled. The government tried to alleviate the draft power shortage by assisting farmers with an Arable Lands Development Program (ALDEP) donkey subsidy scheme. Even though farmers made use of the program they were still faced with a severe lack of animal traction for ploughing (Ndozi, Nthibe & Bandeke, 1999). Many farmers fell back upon utilising the traditional hoe cultivation technique. One of the relief measures taken by government to overcome the detrimental effects of CBPP was the payment of farmers for ploughing, destumping, and weeding and the distribution of free seeds. The figures published in the Agricultural Statistics (1998), which indicate a drastic expansion of the cultivated area in Ngamiland (from 10,000 ha in 1997 to 27,000 ha in 1998) have to be treated with caution as they are contradictory to the records of the Regional Agricultural Office, which are based on actual measurements of the areas ploughed to effectuate the relief payments (2,073 ha ploughed in 1998). Both figures have been excluded from this report (figure 1). An evaluation of the socio-economic impacts of CBPP in Ngamiland indicates that before the outbreak of the disease, 25% of the population perceived arable farming as the most important source of income, while after the cattle culling this activity was ranked as main source of livelihood by 37% of those interviewed (Fidzani et al, 1999).

During the mid eighties a massive infestation of locusts and quelea birds damaged or destroyed the standing crop. In combination with the drought, it had a negative cumulative impact on crop production. In addition the increasing elephant population is constantly causing crop losses particularly in the remote villages in the south-eastern Panhandle. All these factors combined with the erratic unreliable rainfall make crop production a high-risk activity. Consequently, over the years farmers have not intensified their arable activities nor expanded their cultivation.

An analysis of land use changes in the Shorobe area comparing five series of aerial photographs over a 35-year period (Bendsen, 1987) indicates that certain prime *molapo* cultivation areas in and along the main riverbeds have been cultivated almost constantly over the last 30 years. As temporarily unused floodplain fields become heavily invaded by weeds, farmers attempt to cultivate lands with good to fair moisture conditions on a permanent basis. In the 1963, 1974, 1977 and 1978 cropping seasons the floods were so high that the water did not recede from the Shorobe floodplain cultivation area. This forced farmers to shift their arable activities temporarily to the dryland. As soon as the flood conditions allowed, farmers moved back to re-cultivate the more fertile soils of the *melapo* and largely abandoned the dryland fields despite the fact that some of them had been protected by wire fences to keep livestock and wild animals out (Bendsen, 1987).

When farmers decide upon the location of their arable lands, they tend to select areas with relatively superior soil fertility (e.g. floodplains, or inter-dune depressions). Declining soil fertility in the dryland is one of the reasons why farmers are discontinuing to use the previously cleared cultivation areas (Kirkels, 1992). Farmers often rotate the cropped section within their cleared arable plot but no clear pattern of fallow is detectable.

Employment alternatives to arable farming

Alternative employment opportunities have changed over time. While during the 1960s and 70s many men were working in the South African mines, today the tourism and service sector in Ngamiland is absorbing some of the male labour force. The low labour productivity and high risk in agriculture have forced traditional farmers in Ngamiland to search for more lucrative income generating options. Many young men migrate to larger villages and urban areas looking for employment opportunities (Rashem, 1988:27). Considering only formal employment options in Ngamiland, the agricultural sector has lost its dominant role after the CBPP cull. While in 1991 agriculture provided jobs for the largest share of the district labour force (40%) (CSO, 1999:78) only 14% of the formal employment was in the agricultural sector in 2001 (CSO, 2001). However, during the last ten years other sectors like construction (increase of 1%), wholesale and retail (increase of 4%), and in particular hotel and restaurants (increase of 7%) have provided employment alternatives. The district capital Maun has expanded into an administrative centre, housing many central and local government institutions. Hence, Maun has experienced disproportionate population growth during the last 40 years. While the district population has tripled, the population of Maun has multiplied almost 10 times (Table 2).

The government has become the major employer in the district during the last ten years. In 1991 14% of the people with formal employment worked for the government. This rate has gone up to 29% in 2001 (CSO 1991 and 2002). As the education level in Ngamiland is still relatively low compared to other parts of the country (illiteracy rate in Ngamiland 43% as compared to 30% in Botswana in 1991) people from rural areas in the district have fewer chances to compete on the labour market. As formal employment becomes more readily available for men, arable agriculture is faced with a lack of male labour. Although women carry out most of the activities in crop farming, ploughing is considered to be a male domain. The fact that a growing number of households in the district are female headed (in 1980 27%; in 1996 38%, and in 1998 47%) (Agricultural Statistics Unit, 1980, 2000 and 2001) with limited access to male labour and to draft power for ploughing, contributes substantially to the stagnation of the arable sector. Traditionally, husbands, partners, or male relatives are socially obliged to provide ploughing services for the women (Dorloechter, 1989). Men engaged in

formal employment often try to take leave during the ploughing season in order to cultivate. As tourism (particularly hunting) is of seasonal nature, crop production is a convenient way to diversify and complement the family income. Most part time farmers only plough areas large enough to meet the subsistence needs of their families but do not expand the arable areas in order to produce marketable surpluses (Dorloechter, 1989). As other activities are of greater benefit farmers do not allocate more labour to develop arable farming (Rashem, 1988).

The increasing level and quality of public services have motivated many people to leave the lands and spend more time at permanent homes in larger villages. School attendance has expanded rapidly and children are only available to a limited extent to carry out farm activities. Only 40 years ago, the majority of the population in the district was illiterate and had never attended school. However in remote communities and in some ethnic groups (esp. HaMbukushu and San) people are more likely to keep their children out of school for farm labour (Cassidy, 2002 unpublished field survey). Survey results in Ngamiland West Communal Second Development Area (CSDA) indicate, "the youth has lost interest in agriculture" (Kirkels, 1992). Parents are not sending their children to school to become better farmers but with the aspiration to increase their chances to find formal employment (Rashem, 1988).

Government subsidy schemes

Government programs like the Arable Lands Development Program (ALDEP) Draft Power Subsidy Scheme and the Accelerated Rainfed Arable Program (ARAP) ploughing, planting, weeding, destumping, and fencing payments, introduced during the late seventies and enforced during the severe drought in the eighties, and used as relief measures after the CBPP outbreak, had a considerable impact on farmers initiative to expand their cultivation areas beyond the size they could or intended to actually cultivate during any given cropping season. In Ngamiland particularly, the ARAP ploughing subsidy was widely used by farmers (Ngamiland District Council, 1997:24). Especially around Maun, where tractor traction was available, large lands areas were cultivated using the ARAP ploughing assistance. The draft power subsidy was the component most readily used by farmers in the district followed by assistance for ploughs and fencing material (Ngamiland District Council, 1997:24). When ARAP was discontinued in 1991, a number of farmers who were merely attracted by the direct monetary benefits of the program (payment of P50/ha for ploughing etc.), no longer cultivated the entire area they initially cleared. According to observations by an Agricultural Demonstrator (written statement AD Sepopa in: Kirkels, 1992) a quarter of the farmers in his extension area failed to plough

after the discontinuation of ARAP. ALDEP funds were frozen in 2001. The program is presently under revision.

From 1996 to 1998 government assisted farmers in the CBPP affected area of Ngamiland with free seeds (32 kg of seed for 5 ha and 2 kg cow peas), payments for draft power (5 ha at P150/ha), row planting (5 ha at P60/ha.), and destumping. The relief program did not result in a production increase, as the rainfall was too low and sporadic (Regional Agricultural Office Ngamiland, 1998).

As Ngamiland has been repeatedly hit by natural disasters, farmers have become used to relying on government assistance. For example, after the cattle lung disease culling, 43% of the households in the district participated in Labour Intensive Public Works (LIPW) or received free food rations (69% of the households) (Ndozi, Nthibe, & Bandeke, 1999). In 1999, 14% of the households in the district were still dependent exclusively on government rations, as their source of food, 36% complemented their own production with government rations while 12% depended on a combination of government rations and wages from formal employment. This means that only 38% of households did not rely in some way on direct government support for their livelihoods. Only 8 % of the households made a living exclusively from formal employment and only 10% of the farmers lived from their own agricultural production (Ndozi, Nthibe, & Bandeke, 1999:36). Farmers apparently prefer low wage casual employment (e.g. Labour Intensive Public Works) to arable farming with its uncertain returns.

A new option for maintaining arable production and simultaneously working in the tourism sector has come up recently through the Community-Based Natural Resources Management joint venture agreements for community trusts administering a Controlled Hunting Area. Some communities receive free access to tractor traction for ploughing as an additional benefit from the safari operator, who is their joint venture partner. Farmers readily accept this assistance but might not necessarily be committed to engage more in farming in order to increase production. Conflicts may arise as this form of assistance by the joint venture partner is directed not to the whole community but to individuals.

Changes and trends in the livestock sector and underlying causes

Historically, the settlement and land use pattern in the area in and around the Okavango Delta was highly dynamic, being controlled by environmental factors such as the availability of potable water, changing flood levels, rainfall, tsetse fly distribution, and malaria occurrence (Murray-Hudson and Parry, 1997: 31). Development of permanent infrastructure and improved government services (like water supply, health and education facilities, roads) together with tsetse fly control measures have reduced the risks for humans and

livestock to minimal levels and allowed people to develop permanent settlements around the Okavango Delta (Murray-Hudson, Parry, 1997: 31). Government relief programs have helped farmers to overcome land use constraints and the severe impacts of natural disasters but at the same time the dependence of the rural population on government assistance and temporary wage employment has increased.

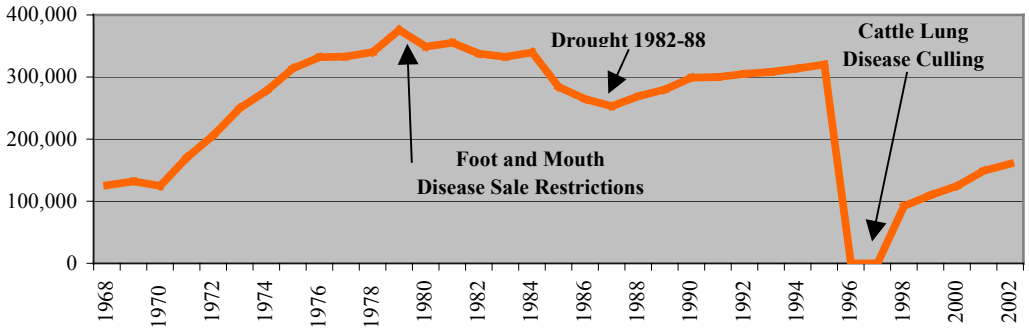
Climatic changes

Repeatedly livestock production in Ngamiland has been severely affected by drought. During extended periods of low rainfall, the carrying capacity of the rangeland drops drastically, resulting in higher cattle mortality. During the long-lasting drought in the eighties (1982-88), the cattle population in the district was decimated drastically (Figure 4). About 100,000 head of cattle (28% of the total livestock population) died from starvation. Large stock owners experienced cattle losses more as a temporary set back (Kirkels, 1992). Cattle of large farmers, who had more financial means to develop water points and maintain cattle posts away from the congested communal areas, had better chances to survive (Kirkels, 1992).

Livestock diseases

The livestock sector in Ngamiland has always been threatened by a number of trans-boundary diseases, like foot and mouth disease (FMD), contagious bovine pleuro-pneumonia (CBPP), and african animal trypanosomosis , locally referred to as "*Nagana*". Some of these diseases are by nature able to spread so explosively that they have the potential to devastate the livestock industry in Ngamiland and in the country at large, unless strict animal disease control measures are applied (Scott Wilson, 2001: 35).

Figure 4: Fluctuation in the Livestock Population in Ngamiland



Source: data derived from Agricultural Statistics Unit, 1968-2002

The outbreak of the epizootic rinderpest in 1896, that eliminated almost the entire livestock population in the district, has been the most dramatic historic event that has ever affected the livestock sector in Ngamiland. Only two Tawana families, who lived in the dryland far to the west of the Delta, could save their cattle and assist others with breeding stock to build up their herds again (Campbell, 1976:171).

One hundred years later, in February 1995, farmers in the district were hit by another devastating livestock disease, contagious bovine pleuro-pneumonia (CBPP) that was brought into the country from infested areas in Namibia by illegal cattle movements. The Department of Animal Health and Production tried in vain to control the disease by erecting three emergency CBPP cordon fences (the Samochima, Ikoga, and Setata Fences) to restrict livestock movement. However, when it became apparent that these measures were not effective, Ngamiland was declared an infested area. In March 1996 the entire cattle population in the district was culled to eradicate the disease (Scott Wilson, 2000).

After this cull, the government offered a range of compensation options to the affected farmers. While small farmers who had less than 10 head of cattle got 100% cash compensation, larger farmers had a choice of being given 100%, 70% or 30% cash and the rest in cattle. Most farmers opted for a high rate of cash compensation: 52% for 100% cash, 23% for 70% cash payment respectively (Fidzani et al, 1999). Only 4% of the cash compensation was immediately reinvested in cattle and by far the greatest amount (75%) was used for routine or major household expenditures. Only 5% of the compensation payment recipients tried to diversify their economy and invested in other income generating sectors like fisheries or small industries. According to Ndozi et al (1999) most of the people in Ngamiland became more dependent on government relief programs like food rations (55%) or Labour Intensive Public Works (24%) for livelihood.

Restocking started in 1997. Since then, cattle numbers have rapidly increased at an annual rate of about 25,000 head (DAHP, 2002). By April 2002 the cattle population had reached half of the pre-CBPP level, amounting to 160,360 head as compared to 320,000 in 1995 (Scott Wilson, 2001). However, cattle ownership has become even more unevenly distributed. During the first three years of restocking, less than half of the farmers who had cattle before 1996 had managed to build up new herds (Ndozi, Nthibe & Bandeke, 1999).

As the income derived from the international meat trade is very important to Botswana, foot and mouth disease (FMD) has always been seen as a major threat to this sector of the rural economy. Three FMD outbreaks (1934, 1944 and 1977) (CSO, 1972: Scott Wilson, 2001) have been recorded in Ngamiland. This indicates that the strict control measures put in place since the seventies by the Department of Animal Health and Production have been successful in preventing the outbreak and the spreading of the disease.

Bovine trypanosomiasis is a vector-borne disease transmitted to livestock (mainly cattle, goats, sheep and horses) by infected tsetse flies. Tsetse fly has always been a threat to domestic stock in Ngamiland. Before the outbreak of the rinderpest in 1896 tsetse fly infestation extended to the fringes of the Okavango Delta that were inhabited by people (e.g., Thaoge River, Lake Ngami, the west banks of the Thamalakane River, the

Mogolelo and the Khwai River and the Mababe Depression) (Scott Wilson, 2001). After the rinderpest had eliminated or decimated nearly the whole host population, (cattle and some of the susceptible wildlife species), the Delta was almost tsetse free. From 1900 until 1920, before the re-infestation of the Delta by tsetse flies, cattle posts were established along the Khwai River in the east, in the Nxaraga Valley to the south and along the Boro river. However, as some tsetse flies had survived in small pockets in the inner Delta and the Kwando-Linyanti area, the fly belt in the Okavango Delta gradually spread again from 12,500 km² in the 1920s to 19,000 km² in 1942 and eventually to 30,000 km² in 1962 (Scott Wilson, 2001).

Livestock farmers reacted traditionally by moving their stock from the infested areas. In the 1920s, cattle were driven out of places like Chief's Island and Khwai River to tsetse free pastures at the edges of the Okavango Delta. In 1938 the situation got worse and people and their livestock had to be evacuated from the Kwando/ Linyanti areas. In 1942 the fly-belt reached major villages like Nokaneng, Tsao and Shorobe and advanced towards Lake Ngami, posing a threat to human lives and the growing cattle population. In 1942/43 223 people died of sleeping sickness and 1500 cattle were lost to Nagana in the Shorobe area (Bendsen and Motsholapheko, 2000). The first government measures to control the situation by bush clearing and game destruction (1930-57) were not very successful. In 1945 the Tsetse Control Unit was established. Despite the control measures, which consisted of ground spaying (1958-71), the tsetse front advanced further to villages like Maun, and Sepopa in 1962 (Scott Wilson, 2001). During 1966-76 72 people died of sleeping sickness (Bendsen, Motsholapheko, 2000). A comparison of time series of air photos and maps indicate, that several settlements located on islands in the northern Delta had to be abandoned. Between 1971-1991, aerial spraying operations successfully reduced the tsetse fly population but did not achieve complete eradication (Bendsen, Motsholapheko, 2000). For eight years (1992-2000) the Department of Tsetse Control (TFC) tried in vain to control the tsetse population by odour baited traps. When, in 1999, the tsetse reinfested an area of 8,250 km² and subsequently in 2001 a *Nagana* outbreak killed 450 cattle in the north west of the district, an integrated eradication program consisting of blanket aerial spraying, the use of traps, and the distribution of sterile male flies was initiated. The aerial spraying component was successfully terminated in September 2002. According to statements of the DAHP no surviving flies have been found so far. Therefore it has been considered to abandon the very costly component of releasing sterile males.

Government policies and programs

Since independence in 1966 a number of government policies, strategies and programs have guided the development process in the country and influenced the livelihood choices of people in Ngamiland. The first development initiatives after independence were mainly focused on reducing the risks of livestock production in an uncertain environment (Hitchcock, 1982) by providing animal health, disease control, and livestock marketing services.

The Tribal Grazing Land Policy The Tribal Grazing Land Policy (TGLP), launched in 1975, brought about major changes in land tenure of parts of the tribal land. TGLP was based on the assumption that better range management, grazing control, and increased livestock productivity could be achieved best by giving individuals and groups exclusive rights to portions of the tribal rangeland (Tsimako, 1991). It was assumed that removing large herds to commercial ranches would reduce overgrazing in communal areas. Ranch development should be based on infrastructure improvements like fencing, establishing boreholes, and water reticulation.

The Hainaveld, located in the south-eastern part of the district, was zoned for commercial ranch development under the TGLP program (zone 5). In the 1970s, 72 ranches were demarcated in the 'Commercial First Development Area'. In 1986, the commercial area was expanded by 17 ranches and, in 1990, by 31 additional ranches. The size of the individual ranches varies from 4,050 ha to 7,600 ha. Out of the 120 ranches that were demarcated, 68 are allocated to individuals, 42 to ranching syndicates, 1 to an Agricultural Management Association, 5 were reserved for communal group ranching and 4 have been de-zoned and are used as communal service centres (Tsimako, 1991).

Disease control measures Since independence the livestock sector has received a lot of attention and financial support. Most of the production costs, like veterinary services and disease control measures, are subsidized by the government (Murray-Hudson, Parry, 1997). The livestock and range sector claim the major proportion of the budget of the Ministry of Agriculture (IUCN, 1992). High standards of disease control and animal health measures have been maintained to facilitate the access of beef to the high value EU market from most parts of Botswana.

Botswana strictly enforces EU required disease control regulations. Currently the country is divided into three disease control zones, a foot and mouth disease (FMD) free zone, a surveillance zone, and a vaccination zone. Ngamiland is situated in the latter and has a buffer function. The Kuke fence (built in 1958) and the Makalamabedi cordon fence (built in 1968) control animal movement from Ngamiland to adjacent

districts (Scott Wilson, 2000). Before cattle can be brought out of Ngamiland for marketing, they have to be quarantined.

Since the erection of the buffalo fence in 1982, which separates cattle from wildlife (particularly from buffalo which are known to be carriers of FMD without being affected by the disease themselves), the likelihood of domestic stock getting in contact with wildlife has been minimized. On top of that, cattle in Ngamiland are vaccinated bi-annually against FMD. A risk assessment carried out in 2000 (Scott Wilson) indicates that the erection of cordon fences and quarantine regulations in combination with vaccinations and surveillance programs have considerably reduced the risk of a foot and mouth outbreak. Under the given control measures the likelihood of a FMD outbreak in Ngamiland is estimated to be once every 50 years.

The erection of the buffalo fence followed by the declaration of the Delta (planning zone 8) as a cattle free zone (van der Heiden, 1991) deprived local farmers of their traditional right to utilise the Delta as a fall-back grazing area. However, the local communities respected the fence and even during the drought in the 1980s no attempts were made to forcefully bring livestock into the Delta. Initially, communities who had remained with some cattle inside the fence, (such as Jedibe, Ditshipi, Daonara, Sankuyo, Khwai, and Mababe) were urged to move their cattle out. If they failed to do so, they were not allowed to market their stock. After the CBPP cull, stock regulations have been strictly enforced and no cattle are presently found in the Okavango Wildlife Management Areas.

Tsetse fly control program Tsetse control has had a long history in Ngamiland. Since 1930 various methods have been used to control the spreading of the tsetse belt the inhabited areas. The Department of Animal Health and Production is very optimistic that after two years of aerial blanket spraying followed by the introduction of sterile male flies the ultimate aim of tsetse eradication will be achieved.

Traditional farmers have always seen tsetse as a risk to human health, a threat to livestock production and an impediment to rural development. They fully support the government decision to take effective measures to eradicate tsetse permanently (Bendsen, 2001). A socio-economic impact study of the 2001 tsetse eradication program revealed that farmers do not intend to move cattle back into the Delta after the successful eradication of the fly as the floodplain grazing areas are associated with health and security risks (predators, liver fluke) for domestic stock. Most farmers would prefer to make use of the good, presently under utilized pastureland away from the Delta but are not able to absorb the cost for water point development without government assistance. Communities who have directly benefited from the Community Based Natural Resource Management program

(CBNRM) especially recognize the value of wildlife utilization and tourism in the Okavango Delta and see these activities as true alternatives to livestock rearing (Bendsen, 2001).

Map 3:

District planning and zoning Since independence, development planning has been guided by a series of National and District Development Plans. The planning process was centralised and mainly sector-oriented, and was carried out by the various line ministries. With the launching of the Tribal Grazing Land Policy (TGLP) in 1975, regional and detailed integrated land use planning has been delegated to the districts.

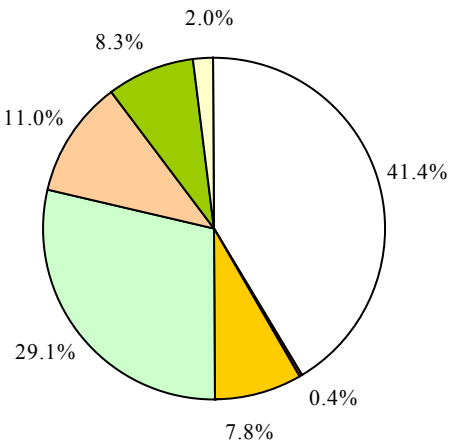
Under TGLP, Ngamiland was zoned into communal, commercial, and reserved areas (map 4, figure 5). For planning purposes these broad categories were sub-divided into eight planning zones and ranked according to their development priority in First, Second and Third Development Areas. The Hainaveld (zone 5) was earmarked for commercial ranch development, while the densely populated fringes of the Okavango Delta were subdivided into four communal development areas (Zones 1-4). The last of the five communal development areas (zone 6) is the remote area in the extreme west of Ngamiland. Due to its rich wildlife potential, the Delta

proper (zone 8 and part of zone 6) has been zoned as a Wildlife Management Area (WMA). Zones 1-6 and zone 8 are on tribal land and are administered by the Tawana Land Board, while zone 7 is Statelands and falls directly under the jurisdiction of the Ministry of Local Government (van der Heiden, 1991). Gazetting of land use categories has had direct implications on the land use options of traditional farmers in Ngamiland, as large parts of the district were no longer or only under certain conditions available for livestock grazing.

Under the Wildlife Conservation and National Parks Act (1992) zone 8, which encompasses almost the entire Okavango Delta, (24% of the tribal land or 25,505 km²), was declared a Wildlife Management Area (WMA). This means that the primary form of land use is consumptive (hunting) and non-consumptive (photographic) wildlife utilisation (WC&NP Act, 1992). According to the veterinary disease control regulations, the entire Delta is a cattle free zone. Particularly since in 1996, when all cattle were eliminated from the district, stock regulations could be effectively enforced so that presently no cattle are kept within the buffalo fence. One of the CHAs, (NG28), the Moremi Game Reserve, has been a protected area on Tribal Land since 1963. After having been extended twice, it presently includes an area of 4,881 km² (5% of the tribal land).

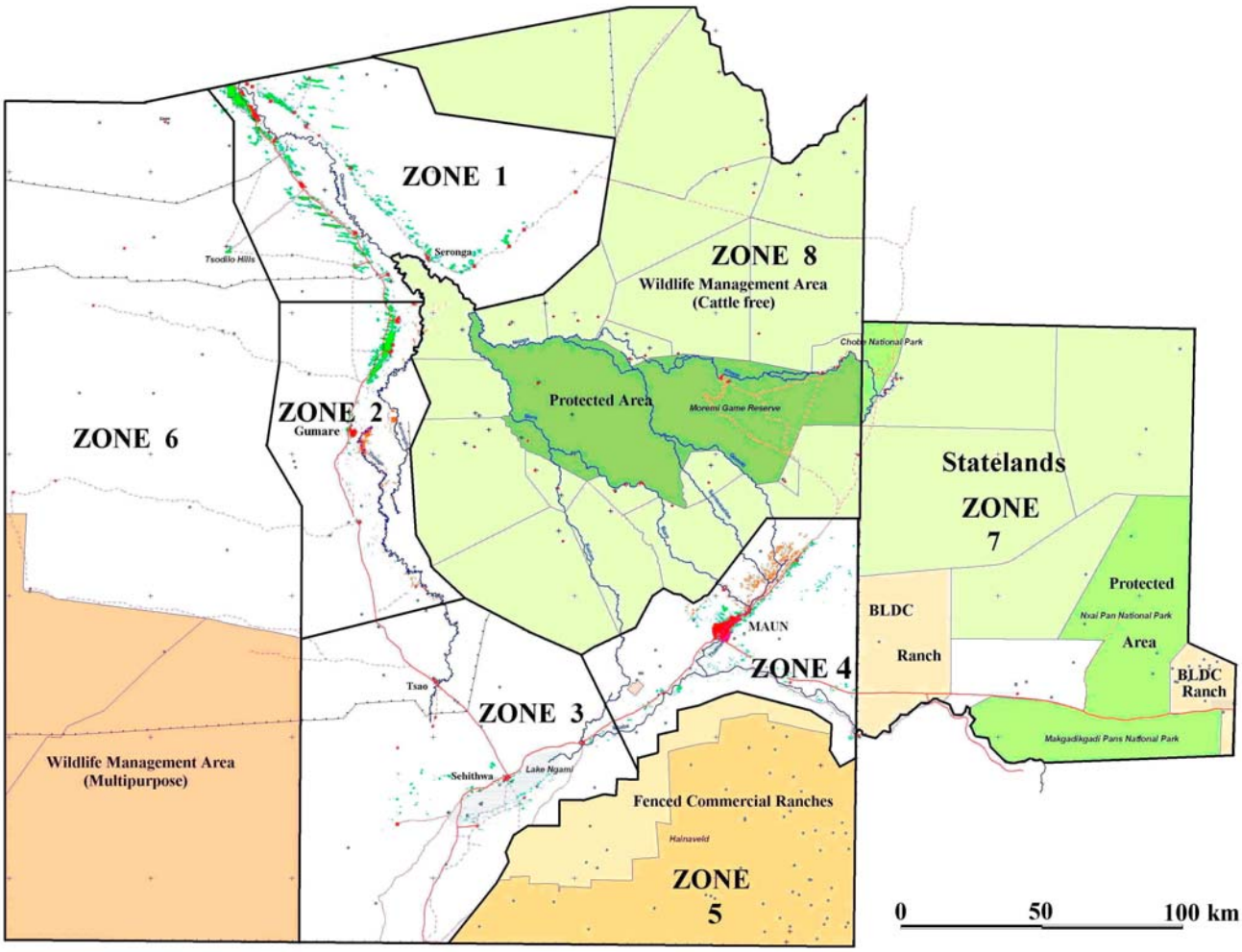
Apart from the Delta, two CHAs in the south-west of Ngamiland (NG4 and NG5) were declared WMAs. In these, livestock rearing is only permitted in as far as it is compatible with wildlife utilisation. Another 8% of the district (or 6,950 km²) has been demarcated under the Tribal Land Grazing Policy for commercial livestock rearing. In total, 37% of the Ngamiland tribal territory cannot be used any longer for communal grazing.

Figure 5 *Designated Land Use Zones in Ngamiland*



	Communal Grazing Area	46,175 km2
	Arable Areas	489 km2
	Fenced Commercial Ranches	8,734 km2
	Wildlife Management Area (Cattle free)	32,445 km2
	Wildlife Management Area (Multipurpose)	12,333 km2
	Protected Areas	9,227 km2
	BLDC Ranches	2,247 km2
	Total Ngamiland District	**111,650** km2

Map 4. *District Planning Zone*s



Source: Meyer et al, 2002

SUMMARY AND CONCLUSIONS

The overall economic significance of traditional agriculture in Ngamiland has declined during the last 40 years. One of the main drivers of change in the agricultural sector is the increasing availability of alternative, more reliable sources of income mainly in the tourism sector or in related support services for this fast growing industry (like transport and travel agencies, air charter companies, garages, hotels, and catering services, retailing of food and beverages, camp construction and maintenance, etc.). The percentage of people formally employed in the agricultural sector has drastically gone down in the last ten years. Seeking employment many people have moved from the rural areas into the booming district capital Maun. Government has become the major employer in the district (29% of the labour force in 2001). However, due to the low education standards in Ngamiland (an illiteracy rate of 43% in 1991) and the government employment policy, most government employees are not recruited from the rural areas of the district.

Despite of the fact that the percentage of the population involved in the agricultural sector is decreasing (Agricultural Statistics Unit 1968-2002 and CSO 1972, 1981, 1991, 2002), subsistence agriculture is still a very important livelihood activity as it absorbs all those, who do not have a chance to compete in the labour market. During the last decade, an increasing number of people have become dependant on Government relief programmes and handouts.

The livestock sector is rapidly recovering from the CBPP set-back. However, cattle ownership has become more unevenly distributed and the gap between rich and poor is expanding. Many of the bigger livestock owners have other sources of formal employment and see ranching more as an investment or as a secondary activity.

A factor, which has contributed to the long-term changes in the arable sector, is the alteration in the flood distribution pattern, which has forced farmers in Ngamiland west to give up their fertile flood plain cultivation areas.

Most other natural factors, like droughts and diseases, have always had adverse impacts on the traditional land use system in Ngamiland. As fluctuations are endemic to the Okavango Delta environment, the rural population has adopted a diversified, multi-activity, low input land use system as the appropriate livelihood strategy to cope with these risks.

Despite government incentives the arable sector is not likely to play a significant role in the economy of the district in future. An aspiration survey by Rashem (1988) found that people give higher priority to formal and casual employment as well as to cattle ranching rather than to arable farming.

In the long run, the relative significance of agriculture is likely to decline further. This will mainly affect the resource poor rural population including the increasing number of female-headed households. To tackle this issue is a challenge for development policy of the future.

ABBREVIATIONS AND ACRONYMS

AD	Agricultural Demonstrator
AE 10	Agricultural Extension Law 10,
ALDEP	Arable Lands Development Program
ARAP	Accelerated Rainfed Arable Program
BAMB	Botswana Agricultural Marketing Board
CBNRM	Community-Based Natural Resources Management
CBPP	Contagious Bovine Pleuro Pneumonia
CFDA	Communal First Development Area
CSDA	Communal Second Development Area
CSO	Central Statistics Office
DAHP	Department of Animal Health and Production
DAR	Department of Agricultural Research
DLUPU	District Land Use Planning Unit
FAO	Food and Agricultural Organisation
FAP	Financial Assistance Policy
IUCN	International Union for the Conservation of Nature and Natural Resources - The World Conservation Union
LIPW	Labour Intensive Public Works
MFDP	Ministry of Finance and Development Planning
MLGL	Ministry of Local Government and Lands, (old title)
MLHE	Ministry of Lands, Housing and Environment
MoA	Ministry of Agriculture
NPAD	National Policy Agricultural Development
NWDC	North West District Council
SMEC	Snowy Mountain Engineering Corporation
TFC	Tsetse Fly Control Unit
TGLP	Tribal Grazing Land Policy
TLB	Tawana Land Board
UNDP	United Nations Development Program

REFERENCES

Afriyie, E.K. (1976) 'Human Resources of the Okavango Area: Some Implications for Development Projects', in *Symposium on the Okavango Delta,* ed Botswana Society, National Museum, Gaborone, pp. 179-185

Agricultural Statistics Unit (1968-2002) *Botswana Agriculture Statistics* 1968 – 1998, Department of Agriculture, Gaborone

Agricultural Statistics Unit (1995) *1993 Botswana Agricultural Census Report*, Division of Agricultural Planning and Statistics MoA, Central Statistics Office MFDP, Gaborone

Bendsen, H. (1984) *Water Point Survey Ngamiland,* Tawana Land Board, Maun

Bendsen, H., Gelmroth, H. (1983) *Land Use Planning Ngamiland CFDA*, MLGL, TLB, NWDC, Maun

Bendsen, H. (1987) *Land Use Trends and Problems in the Shorobe Area*, MoA, Division of Land Utilisation, Maun Bendsen, H., Motsholapheko, M. (2000) *Minutes of the Workshop on the Integrated Campaign to Eradicate Tsetse and Trypanosomosis from Ngamiland*, Maun

Bendsen, H. (2001) *Socio-economic Impacts of the Integrated Testes Eradication Campaign* in: Environmental Monitoring of Tsetse Aerial Spraying*,* HOORC/UB, Maun

Bendsen, H. & Motsholapheka, M. (2001) *The importance of different economic activities for the livelihood of people in the communities in northern Ngamiland*, unpublished

Campbell, A. C. (1976) *Traditional Utilisation of the Okavango Delta*. Pp 163 – 174 in: Symposium on the Okavango Delta and its Future Utilisation. The Botswana Society, Gaborone

Central Statistics Office (CSO) (1972, 1981, 1991, 2002) *Report on the Population Census 1964, 1971*, 1981, 1991, and 2001 Government Printer, Gaborone

Central Statistics Office (CSO) (1999) *Statistical Bulletin,* Vol.24, No. 2, Department of Printing and Publishing Services, Gaborone

Department of Animal Health and Production (DHP) (2002) *Cattle Crush Figures for Ngamiland 2000 – 2002*, unpublished

Department of Wildlife and National Parks (DWNP) (1995) *Aerial Census of Wildlife and some Domestic Animals in Botswana,* Gaborone

Dorloechter, S. (1989) *Women's Role in Agriculture*, Molapo Development Project, Special Report No. SE-2, MoA - Dept. Agricultural Field Services and German Agency for Technical Co-operation, Maun, Botswana

Fidzani, B., Mlenga, W. S., Atlhopheng, M. & Shatera, M. M. (1999) *Socio-Economic Effects of CBPP in Ngamiland,* Division of Agricultural Planning and Statistics, MoA

Gibson, G.D., Larson T.J. & McGurk, C.R. (1981) *The Kavango Peoples*, Studien zur Kulturkunde, Bd. 56, Franz Steiner Verlag, Wiesbaden, ISBN 3-515-03343-2

Hitchcock, R.K. (1982) *Botswana's First Livestock Development Project and its Future Implications.* National Institute of Research Gaborone. University College of Botswana.

IUCN (1992) *The IUCN Review of the Southern Okavango Integrated Water Development Project,* Final Report*,* Gaborone

Kirkels, M. (1992) *Change in Agriculture along the Okavango River in Botswana, in the particular under the influence of Government Policies*, Agrarian Change in Ngamiland CSDA (Western Part), Utrecht, the Netherlands

Langdale-Brown, I., Spooner, R.J. (1963) *Land Use Prospects of Northern Bechuanaland,* Directorate of Overseas Surveys, Tolworth, England

Meyer, T., Meyer, F., Lieder, M., Thoss, S. & Bendsen, H. (2002) *Land Use Map Ngamiland*, HOORC and University of Sachsen Anhalt

Murray-Hudson & M., Parry D. (1997) *Biophysical Environment (Botswana Sector),* Draft report, OKACOM Environmental Studies, Gaborone

Ndozi, C.T., Nthibe, H.B. & Bandeke, T.J. (1999) *Evaluation Study on the Socio-economic Impact of the CBPP Eradication and Government Relief Programs on the Communities of Ngamiland District and Okavango Sub-District*, Division of Planning, Statistics and Research, MLGLH, ISBN 99912-1-340-6

Ngamiland District Council 1997 *Ngamiland District Development Plan 5: 1997 – 2003*, DDC, MLGLH, ISBN 99912–1–255–8, Government Printer, Gaborone

Ngamiland DLUPU, Planning and Statistics Division, MoA & Institute of Development Planning (1979) *Planning for Agriculture in Ngamiland, The 1978/79 Arable Lands Survey and Pilot Project Proposal*, ALDEP Survey Report No. one, Vol. 1

Okavango Community Consultants, (1995) *Management Plans for Controlled Hunting Areas Allocated to Communities in Ngamiland WMA's,* MLGLH, Maun

Regional Agricultural Office (RAO) Ngamiland (1998) *Crop Situation as at the End of February 1998,* MoA, Department of Crop Production and Forestry, Maun

Rashem, K. (1988) *Economic Findings and Results Dryland and Molapo Farming Systems of Western Ngamiland*, Agricultural Development Ngamiland, Technical Report No.5, DAR, MoA, Gumare

Riezebos, H.Th. Ph.D., Kirkels, M.A.L.J., van Hoof P.J.M. M.Sc., Schledorn J.L.M., de Wit, M.J.M. (1991) *Ngamiland District CSDA Western Part, Socio-economic Baseline Survey and Land Suitability Analysis,* University of Utrecht*,* Faculty of Geographical Sciences, Utrecht

Rosenow, S. (1990) *Zugtiernutzung bei der Bodenbearbeitung im semiariden Afrika, Flutflächenlandwirtschaft im Nordwesten Botswanas*, Institut für Rurale Entwicklung, Georg-August-Universität, Göttingen

Scott Wilson Resource Consultants & The Environmental and Development Group (2000) *Environmental Assessment of Veterinary Fences in Ngamiland*, Summary , Report ,

Scott Wilson Resource Consultants & The Environmental and Development Group (2001) *Integrated Program for the Eradication of Tsetse and Trypanosomiasis from* Ngamiland, *Environmental Impact Assessment,*

Siderius, W. (1970) *Land Capability Classification*, Technical Note No. 11, UNDP/FAO Project

Smit & Kappe (1992) *Socio-Economic Baseline Survey of Ngamiland's Remote Zone*. Report to the Western Communal Remote Zone Working Group of the Ngamiland DLUPU and to MLGLH.

Snowy Mountain Engineering Corporation (SMEC)(1991) *Southern Okavango Integrated Water Development,* Final Report,

Staring, G., Roostee, R., Bendsen, H., Masikara, S & Mogaetsho, G. (1981) *Molapo Development and the Drought Relief Program*, Research on the Swamp and Dryland Soils of the Okavango Delta**,** BOT 72/019, FAO/UNDP

Stigand, A.G. (1913) *Notes on N'gamiland,* Transaction of the Royal Society of South Africa 3/3 1913

Swedeplan (1989) *Program for the Planning of Resource Utilisation in the Okavango Delta Region,* Volume 1 Natural Resource and Utilisation Inventory, MLGL, DTRP Gaborone

Tsimako, B. (1991) *The Tribal Grazing Land Policy (TGLP) Ranches Performance to Date*, MoA, division of Agricultural Planning and Statistics, Gaborone

The Ngami Times, Vol.4, No.139 (20 - 27.09.2002), Maun

van der Heiden L. J. (1991) *Land Use and Development Plan Kwando and Okavango Wildlife Management Areas.* First Draft.

White, R. (1993) *Livestock Development and Pastoral Production on Communal Rangeland in Botswana.* The Botswana Society.