



OKACOM

The Permanent Okavango River Basin Water Commission

**Transboundary Diagnostic Analysis of the Botswana
Portion of the Okavango River Basin
Output 5: Assess Existing Social Services and
Projected Growth through National and Regional
Development Plans**

Cornelis Vanderpost
Harry Oppenheimer Okavango Research Centre

July 2009

*Environmental protection and sustainable management
of the Okavango River Basin*

EPSMO

TRANSBOUNDARY DIAGNOSTIC ANALYSIS OF THE BOTSWANA PORTION OF THE OKAVANGO RIVER BASIN.

*Output 5: Assess Existing Social Services and Projected Growth through National and
Regional Development Plans.*



Final Report

**ASSESSMENT OF EXISTING SOCIAL SERVICES AND PROJECTED
GROWTH IN THE CONTEXT OF THE TRANSBOUNDARY DIAGNOSTIC
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PORTION OF THE OKAVANGO RIVER BASIN.

Consultant:

Dr. Cornelis Vanderpost,
Harry Oppenheimer Okavango Research Centre,
University of Botswana.

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EXECUTIVE SUMMARY: Major Trans-boundary issues arising from this report.

The Trans-boundary Diagnostic Assessment (TDA) component of the EPSMO project aims to identify the principal threats to the water resources of the Okavango basin. This component of the TDA aims to assess social services in the Botswana portion of the basin and the role they play in trans-boundary water resources conservation and utilisation. Many social services have environmental implications. For example, the provision of a centralized water supply or waste removal facility may prevent otherwise uncontrolled and potentially environmentally damaging practices. To have such services delivered efficiently thus helps to minimize local human environmental impacts. Moreover, by having one's own environmental affairs 'in order', Botswana may improve its bargaining position relative to its neighbours. Botswana therefore needs to aim to have its own environmental affairs 'in order'.

Rapid population growth in past decades and continued high current growth in Ngamiland (now 2% per year) remains of concern because of the implications for increasing demands for water abstraction and the challenges it poses to the universal provision of social services and their quality improvement. More attention therefore needs to be given in Ngamiland to programmes aimed at reducing the population growth rate. In view of the young age structure, more efforts are also required to combat youth employment. The young age structure (39% of the population under 15 years of age) and declining household size add to the challenges, especially in terms of employment provision for the youth and rapidly increasing demands for social services. These issues, in turn, have implications for upstream and local conservation of shared water resources.

The concentration of people in larger settlements, with currently 40% of the district population in Maun alone and an additional 28% in other large villages, leads to accelerated local demand for services while increasing the potential for environmental impacts as 70% of the population of Ngamiland lives within 10 kilometers of a river channel. A simultaneous increase in the number of small settlements (507 in 2001) provides a major challenge to service provision and has the potential to generate more widespread environmental impacts. Therefore, the proliferation of un gazetted settlements needs to be addressed either by 'closing down' those in sensitive ecological areas such as elephant migration routes or, preferably, by recognising them and providing them with appropriate services. Most human environmental impacts (as measured by the human footprint) are concentrated along the western and southern Okavango wetland margins. This is where innovative solutions are needed.

Universal education of good quality is important to achieve the goal of a well-informed nation able to understand international trans-boundary river issues. In Ngamiland, major expansion has occurred in the provision of government education facilities, but further improvements are possible. Issues of concern remain the high rate of illiteracy, the shortage of government primary school classrooms, the lack of qualified teachers for government secondary schools, the existence of only one public senior secondary school in the region and the very limited tertiary and higher education options. These problems are recognized and attended to in the context of District Development plans, demonstrating that the government is serious about addressing them.

Water related health problems can turn into trans-boundary issues. This is frequently the case with the spread of cholera, for example. Existing medical facilities should thus be equipped to deal with water related disease outbreaks even when these are of a trans-boundary nature. Major expansion has occurred in Ngamiland in the provision of government health facilities, but

further progress is possible to improve trans-boundary health issues. The current issues of concern about health facilities in the region include the limited availability of hospital services (at Maun and Gumare only) and problems of access for people in remote areas, the limited services and staff available at clinics and health posts and problems with drug availability. These problems are recognized and attended to in the context of District Development plans, demonstrating that the government is serious about addressing health issues.

The provision of drinking water is an essential service for all people. The abstraction of water from the Okavango Delta, which is a protected Ramsar site, requires environmentally sound practices and appropriate waste management aimed at avoiding contamination and pollution. The current issues of concern about water and waste management in Ngamiland include the increasing demands for water abstraction and the need to do this in environmentally acceptable ways, the unregulated water abstraction and waste disposal at ungazetted settlements, conflicts between water abstraction for people, livestock and wildlife and problems with the enforcement of waste management regulations. Most of these issues are mentioned in the Delta Management Plan and may therefore receive attention within the next few years.

Transport, communication and information dissemination are important in providing inhabitants with the possibility to establish contacts with neighbouring countries and to distribute relevant information about developments in the river basin, including those in other countries. Social welfare services and services provided by community-based organizations may be important because they influence people's environmental behaviour and attitudes. Over past decades major improvements have been achieved by the government and the private sector, but issues of concern remain the lack of good roads, ferry connections and public transport east of the Okavango river and in western Ngamiland, the incomplete telephone coverage and limited number of telephone connections, the poor postal services and limited tv and radio(FM) reception and internet connectivity. Also there are limited police services and law enforcement in remote areas and limited access to government support programmes and shops and banking facilities outside major settlements. The government is aware of the problems and various programmes are ongoing or planned to make improvements.

Availability of government support services such as old-age pensions are important because of their potential to influence people's environmental behaviour and thus local conservation. Community based organizations also play a potentially important role not only in re-directing benefits from natural resource exploitation to local communities but also in the improvement of nature conservation practices. More government support is therefore recommended.

Provision of accessible social services of good quality, especially in education and health, are important for promoting people's understanding about trans-boundary river issues and problems and may contribute toward sustainable solutions. A good communication infrastructure can support this. Government initiated Development Plans at national and regional level are important platforms for raising awareness about shortcomings and for generating activities to address these. In the Botswana portion of the Okavango river basin, the Okavango Delta Management Plan provides a comprehensive framework for both conservation efforts and development plans in the region that will ensure its long-term conservation and that will provide benefits for the present and future well being of the people. It requires full implementation.

TDA Botswana Social Services and Project Growth

Assessment of Existing Social Services and Projected Growth in the context of the
Transboundary Diagnostic Analysis of the Botswana portion of the Okavango river Basin.

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Assessment of Existing Social Services and Projected Growth in the context of the Transboundary Diagnostic Analysis of the Botswana portion of the Okavango river Basin.

INTRODUCTION

Background

The Permanent Okavango River Basin Water Commission (OKACOM) acts as technical advisor to the governments of the three basin states on matters relating to the conservation, development and utilisation of the resources of common interest. OKACOM initiated the EPSMO project to support efforts at integrated management of the basin. The Trans-boundary Diagnostic Assessment (TDA) component of that project aims to identify the principal threats to the water resources of the Okavango basin. This component of the TDA aims to assess social services in the Botswana portion of the basin and the role they play in trans-boundary water resources conservation and utilisation.

A variety of social services is, directly or indirectly, of relevance with respect to trans-boundary issues in the Okavango river basin. Communication and information dissemination, for example, are important in providing inhabitants with relevant information about developments in the river basin, including those in other countries. Lack of or wrong information may lead to mistrust and misunderstandings, such as for example when people in Maun blamed reduced river flow on dam-building in Angola while no such activity was happening. Information dissemination needs to be supported by education, which is equally important. An educated and well-informed nation as envisaged under Botswana's vision 2016 is better able to comprehend issues and problems that arise out of the sharing of an important regional water resource.

Another important service of relevance is health, especially where this relates to cross-border water-related health issues. Problems with bilharzia, malaria, cholera, sleeping sickness can be better tackled when local health facilities are in good shape and good cooperation exists between neighbouring countries. International cross-border traffic is also an important factor in the spreading of HIV/AIDS which tends to follow transport routes.

Many social services have environmental implications. For example, the provision of a centralized water supply or waste removal facility may prevent people from 'doing their own thing', using possibly uncontrolled and potentially environmentally damaging methods. To have such services delivered efficiently thus helps to minimize local human environmental impacts. Moreover, by having one's own environmental affairs 'in order', Botswana may improve its bargaining position relative to neighbours in the Okavango river-basin.

The level of social services, in terms of availability and quality depends on a number of variables, including the number of facilities relative to the growing population, the geographic spacing of the facilities, the quality of facilities and equipment and the number and level of competency of the staff. In the following paragraphs we discuss some of the relevant issues for the area covered by the Okavango Ramsar site or the Ngamiland district in which it is situated (whichever is more applicable). Firstly the relevant demographic details of Ngamilands population will be addressed. Next the characteristics of educational and health services will be discussed. Further, some information will be provided on communication services and general

government services. The remainder of this introduction contains one paragraph on the 1997 TDA report and another on major issues of trans-boundary concern arising from this report.

The 1997 TDA report

The 1997 TDA report entitled 'The Human Environment' (Cassidy 1997) is a comprehensive document describing social and economic services and conditions in the Botswana section of the Okavango river Basin and remains an important background document for future river basin planning. Major changes in the region since 1997 that are relevant in the context of the current report include:

- continued rapid population growth
- major advances in government infrastructure in education and health
- major advances in transport and communication infrastructure (roads, telecommunications) and government services in general
- major developments in the private sector, particularly in the tourism, hospitality and wholesale/retail industries.

It also needs to be mentioned that since 1997 a new population census in 2001 and a demographic survey in 2006 have provided updated population information, while new government plans did become operational during the intervening period, particularly National Development Plan 9 and the Ngamiland District development Plan 6. Most importantly, the Okavango Delta Management Plan was formulated and has now entered its implementation phase. For the first time in history, therefore, both conservation efforts and development plans are guided by the comprehensive framework set out in the Okavango Delta Management Plan, which has as its overall goal:

"to integrate resource management for the Okavango Delta that will ensure its long-term conservation and that will provide benefits for the present and future well being of the people, through sustainable use of its natural resources" (Dept. of Environmental Affairs 2008).

This is an exciting national development. The next step to which this report aims to contribute is to achieve similar objectives for the entire Okavango Basin in cooperation with Angola and Namibia.

1. DEMOGRAPHIC SITUATION NGAMILAND

1.1 Population growth

The Botswana Demographic Survey of 2006 estimates the natural rate of increase for the population of the country at 1.9% per year (CSO 2009). This is a slightly above the 2001 figure due to a higher crude birth rate (29.7 per thousand) and a lower crude death rate (11.2 per thousand). The 2006 population of Ngamiland was estimated at 138,654 compared to 124,712 in 2001, an increase with 13,942 people or 11.2% over this five-year period. This is considerably more than the increase of the national population over the same period, which was only 5.5% and implies that Ngamiland's population growth remains fairly high.

Over past decades, the Ngamiland population has indeed increased rapidly (Table 1) and this growth has to some extent hindered the maintenance or improvement of the general level of social service provision in the region. This is understandable because between 1971 and 2006, the population of Ngamiland more than doubled from 68,000 to 138,654, requiring therefore minimally a doubling of various social services such as for example health facilities. Such rapid physical expansion of facilities almost invariably leaves little room for quality improvement. Table 1 shows the population increase for the relevant census periods.

Table 1: Population growth Ngamiland, 1971 – 2006.

<i>Intercensal period</i>	<i>% Growth</i>	<i>Added population</i>	<i>New Population Total</i>
1971-1981	26.3 %	14,000	68,000
1981-1991	38.9 %	27,000	95,000
1991-2001	31.9 %	30,000	125,000
<i>2001-2006</i>	<i>11.2 %</i>	<i>13,942</i>	<i>138,654</i>

Source: CSO 2003, 2009.

1.2 Migration

The recorded migration rate for both Ngamiland south and north was negative, i.e. more people left the district than entered (CSO 2009). The high population growth is thus mostly the result of high fertility and not in-migration. However, informal information indicates that unofficial in-migration occurs from Namibia (especially San people) and from Angola (HamBukushu people). This may have cross-border security and health/disease implications.

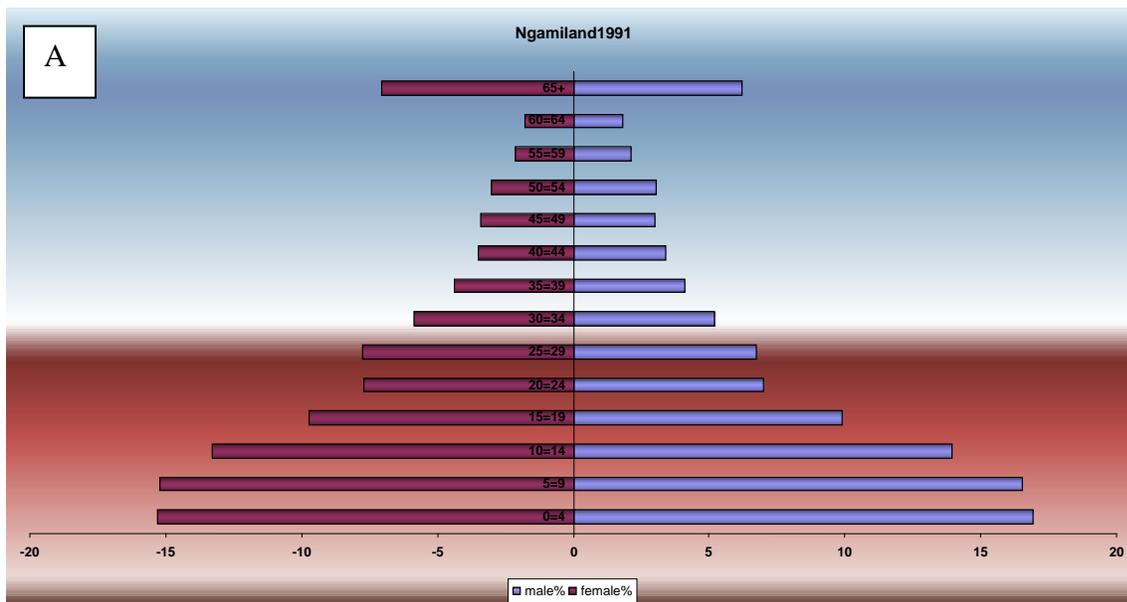
In the past, migration was more significant (Tlou 1985) and has over time resulted in a tribally and linguistically mixed society (Bock and Johnson 2002). Different San groups are living in the area, with the BaQanikhwe group to the north of the Delta, the BaGumahii scattered throughout and the BuGakhwe mainly in the Khwai area. Then there are the WaYeii and HaMbukushu settled respectively along the south-eastern edge of the Delta and (mostly) north of Sepopa.

The Tawana, the politically dominant group, settled during the early 1800s and at the beginning of the 20th century, the OvaHerero immigrated to Ngamiland from Namibia in response to German land expropriation. They settled mostly to the south-west of the Delta.

Several tribal groups, particularly the San and HaMbukushu are related to similar tribal/language groups in Namibia and Angola (for some personal histories of San people see: Vanderpost 2003). This, potentially, allows for opportunities for cross-border cultural and language interactions and cooperation on issues of river-basin knowledge sharing, possibly facilitated by NGOs working with these groups. This issue may need further exploration.

1.3 Age structure

As a consequence of high fertility, the population currently has a very young age structure (Figure 1B) with a large proportion (39%) of the population under 15 years of age (CSO 2003). The effects of a young age structure and a high population growth are experienced in the socio-economic sphere as it becomes progressively more expensive for the government to provide social services such as education and health. Other effects are felt in the labour market. Currently, the population of school-leavers looking for employment is growing at about 5% per year due to the previously high birth rate (CSO 2003).



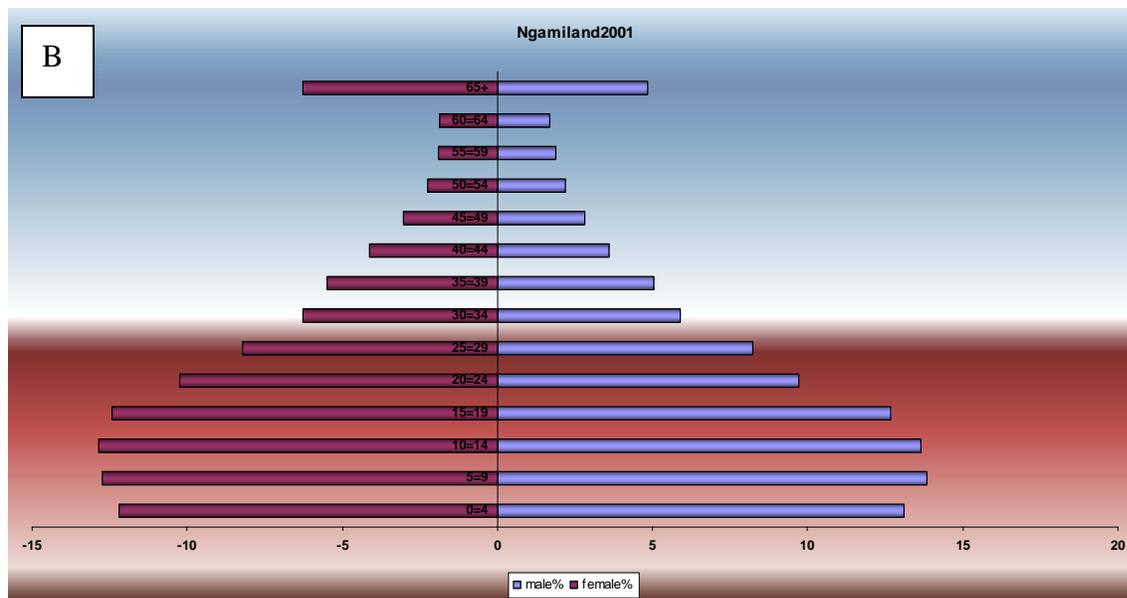


Figure 1: Population age structure Ngamiland, 1991 (A, top) and 2001 (B, bottom), showing large size of young age groups

Population growth also plays a role in decreased access levels to land for housing, cultivation and grazing. In fact, together with land-use designation changes, population growth has been responsible for a five-fold reduction in the per-person availability of communal land for subsistence farming (Table 2), resulting in increased environmental pressure on the remaining land (Vanderpost 2006).

Comparison of the age structure in 1991 (Figure 1A) and in 2001 (Figure 1B) shows that the age groups between 15 and 30 years have increased substantially due to the previously high birth rate, while the youngest age group (0-4 years) shows a relatively decline in 2001 as a result of the decreasing birth rate.

Table 2: Communal land per person Ngamiland, 1964 – 2006.

<i>Year</i>	<i>Population Ngamiland</i>	<i>Communal Land Available per person (km²)</i>
1964	42,500	2.6
1981	68,000	1.5
2001	124,700	0.6
2006	138,500	0.4

Source: CSO 2003, 2009, Vanderpost, 2006.

The population growth rate was highest in the 1981-91 period and has since gradually declined. However, the current rate of just over 2% per year is still high as it implies a doubling of the population in 35 years. This is difficult to manage in terms of social service provision over the long term. The reason for the slowly declining growth rate is two-fold. On the one hand, fertility levels are slowly declining throughout the country. On the other hand, mortality levels, which had increased substantially nationwide as the HIV/AIDS pandemic took hold, have now leveled

off and are slowly declining, partly due to the increased use and effectiveness of ARV treatment (CSO 2009).

It is expected that fertility in Ngamiland will continue to decline slowly in line with trends elsewhere in the country. Mortality is also expected to decline slowly as the HIV/AIDS pandemic is brought under control. The combination of declining fertility and mortality implies, however, that overall population growth will remain relatively high in the near future at about 2% per year or just below that, providing a continued challenge to the provision of government social services such as education and health.

1.4 Projected population to 2011

It is important to recognize the high population growth of the recent past and the expected future high growth rate when considering the provision of social services. Although the expectation is that the growth rate for Ngamiland will slowly decline from just over 2% to somewhat below 2% per year, it would be prudent to assume an average growth rate for the period up to 2011, which is the year of the next population census, of 2% throughout. On that assumption, the Ngamiland population is expected to increase with approximately 3,000 persons per year as shown in Table 3 and will reach 156,148 by the end of 2011.

Table 3: Projected population Ngamiland, 2006 – 2011 at 2% growth per year.

<i>Year</i>	<i>Population</i>	<i>2% Increase</i>	<i>Projected Population after 1 Yr</i>
2006	138654	2773	141427
2007	141427	2829	144256
2008	144256	2885	147141
2009	147141	2943	150084
2010	150084	3002	153086
2011	153086	3062	156148

1.5 Changing household size

Against this demographic background, some specifics of social services in Ngamiland are discussed in later sections of this report. But it is important to note that demographic variables other than population growth also affect the requirements for service provision. The age structure was mentioned above in connection with the need for employment for the rapidly growing number of young school leavers. Another variable of relevance is the changing average household size. In line with developments elsewhere, the average household size in Ngamiland has been decreasing, which –among other things- tends to push up per person water consumption. For example in Maun the average household size decreased from 5.5 in 1991 to

4.4 in 2001 (CSO 2003). Liu (et al. 2003) have shown that smaller households consume more resources per person because of their lower efficiency of resource use per capita compared to larger households where goods and services are shared by more people. More water may for example be used per person in smaller households for house cleaning as there is a larger per person floor space in smaller households. Per person water consumption is also likely to increase as more households are provided with access to communal or individual standpipes, continuing the trend evident for the 1991-2001 period as shown in Table 4.

In 2001, 23% of households had access to piped water (in house or yard) against 15% in 1991 with an additional 54% (1991: 37%) of households with access to communal standpipes. This trend has since continued with more village water supply schemes coming on line. Thus, demand for water is growing on account not only of population growth but also in relation to increasing per capita water use that is related to improved access of households to piped water and generally declining household size.

Table 4: Household access to water sources, Ngamiland 1991 and 2001.

<i>Type of Water Supply</i>	<i>% Households 2001</i>	<i>% Households 1991</i>
Piped water in house or yard	23	15
Communal pipe	54	37
River	9	17
Borehole	7	8
Other	7	23
Total	100	100

Source: CSO, 2003.

Current domestic water demand in Ngamiland is thus increasing on account of population growth and rising per capita water use, which is related to decreasing household size and improved access to drinking water. The total quantity of water currently abstracted in the Delta is about 3.84 million cubic meters (MCM) per annum, which represent 0.04% of mean annual inflow. This is predicted to rise by 188% to 11.04 MCM per annum or 0.1% of mean annual inflow by 2020-25 (Dept. of Environmental Affairs, 2008). This is generally not regarded as a problematic quantity. However, it needs to be realised that additional abstraction takes place for people living in un-gazetted settlements, for livestock watering and for irrigation.

1.6 Population distribution

The way in which people are distributed in the region is relevant to the manner in which access to water is negotiated, but also has an effect on conservation of water resources. Before the introduction of boreholes, human habitation in the Okavango region was limited to places near surface water, although there were restrictions imposed by the presence of disease vectors

such as tsetse fly and mosquitoes. Although dispersal of rural settlement has recently been facilitated through the expansion of borehole construction to tap groundwater resources and by the tsetse fly eradication campaigns of the early 2000s, the majority (about 70%) of the population of Ngamiland still lives within 10 kilometers of a river channel (Vanderpost 2004). Figure 2 displays the population distribution pattern.

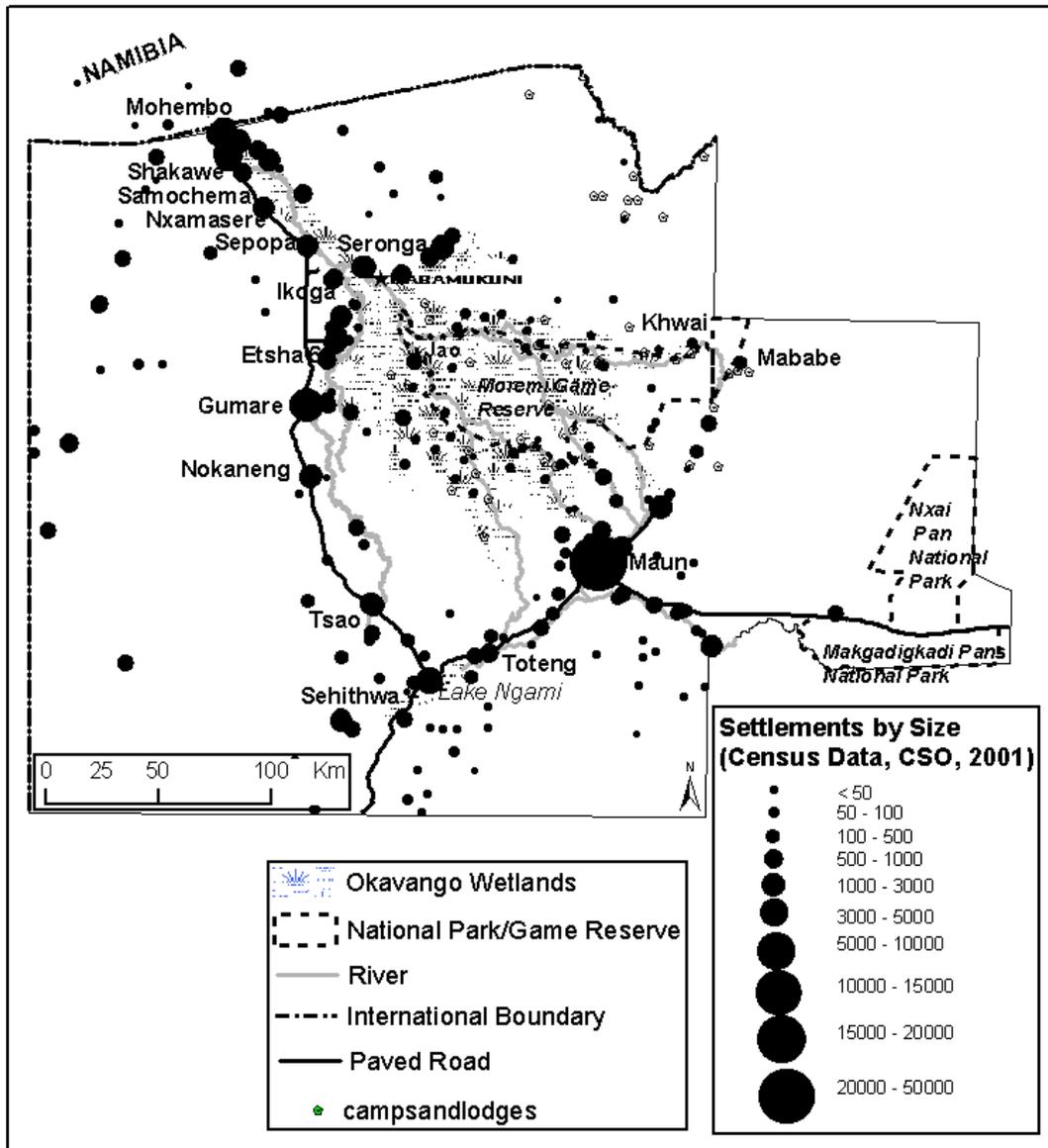


Figure 2: Distribution of settlements by size, Ngamiland, 2001.

Over recent decades, the major trends in population distribution relate, firstly, to rural sprawl, i.e. an increasing number of small settlements in areas formerly sparsely inhabited, and, secondly, to urban concentration. The latter has been mostly centred on Maun, the regional capital, which has grown from a small village with less than 10,000 people (18% of the district population) in 1971 to a town that had about 50,000 inhabitants (40% of the district population) in 2001. The continuation of this trend will result in Maun housing up to 50% of the regional population by 2011. This concentration has both potential disadvantages in terms of increased environmental

pressure along river banks in Maun and advantages such as a potential for centralised and efficient waste management.

This population concentration trend is also reflected at the level of major villages. In 1991, 14% of Ngamiland's population was residing in recognised villages other than Maun. In 2001 this was 28% (CSO 2003). This concentration of people has facilitated the provision of social services for the government and is therefore recommended under the Ngamiland District settlement strategy (MLH 2003). Nevertheless, there has also been an increase in small rural settlements between 1991 and 2001, some of them unofficial or unrecognized. In 2001, there were 507 'other' settlements (mostly cattle-posts and small farm hamlets with less than 500 inhabitants), while there were only 433 such settlements in 1991 (Vanderpost 2004). To provide inhabitants of these hamlets with basic social services remains a major challenge (Swatuk and Kgomotso 2007), especially because the needs of larger settlements with more people may have higher priority and are more easily provided for.

1.7 Human environmental impacts

A growing population with a changing distribution, coupled with major regional economic development and infrastructure improvements –if not adequately managed- inevitably results in increased environmental impacts in and around the Okavango region. The overall human impacts on the environment can be monitored by mapping the 'human footprint'. Using methodology similar to that used for the global 'human footprint' project -a world-scale attempt to produce a world map of human influence on the land surface (Sanderson et al. 2002)- the human footprint was reformulated more precisely for the Okavango Ramsar site by Vanderpost (2007), applying locally available data.

Measurement of the human footprint involves the allocation of scores to land areas on the basis of population density, land transformation characteristics, human accessibility and power infrastructure (Sanderson et al. 2002). This was adapted to local conditions for example by including cattle-grazing (mostly on communal lands) and borehole construction as additional elements of land transformation (Vanderpost 2007). GIS buffering and overlay techniques were used to allocate scores to land units and create a compounded scores map for the region. Scores for individual land units vary between 0 and 46. The resulting footprint map is reproduced in Figure 3.

The map shows a 'light' human footprint for the Moremi game reserve and its buffer zone of wildlife management areas because few people live there permanently, although there are many activities, including tourism, hunting and fishing that potentially impact on natural waters. A substantial population is resident just outside the Moremi buffer zone with the human footprint particularly strong along the western and southern margins of the Okavango wetlands (Vanderpost 2007). This is where innovative solutions are needed in the context of the Okavango Delta Management Plan.

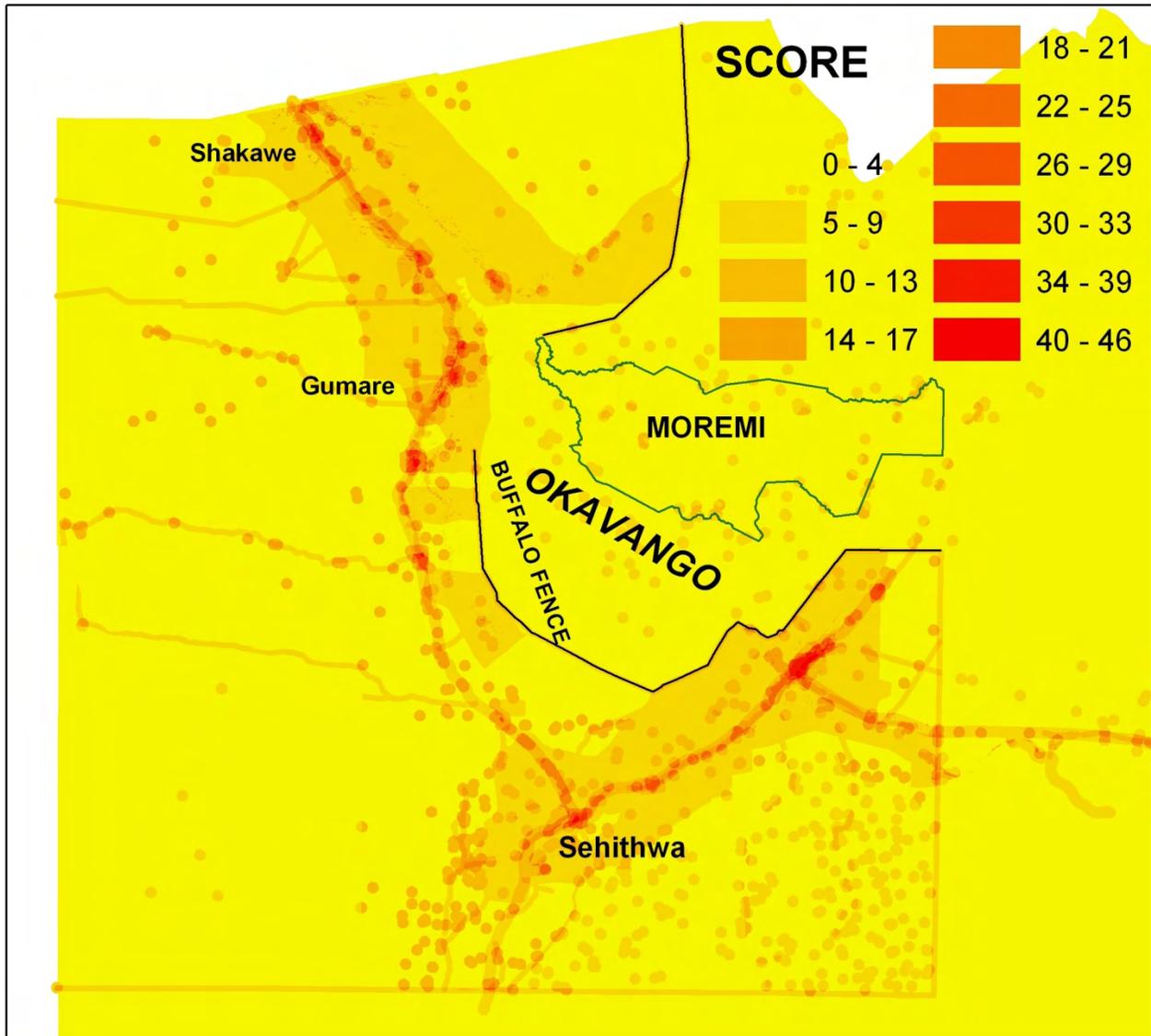


Figure 3: Human Footprint scores Ngamiland: measure for Human Environmental Impacts (from 0=minimal impacts to 46=highest impacts).

1.8 Demographic issues of concern

In summary, the current demographic issues of concern therefore are:

- 1.continued high population growth that challenges provision of social services and their quality improvement
- 2.continued young age structure and declining household size: these are challenges in terms of employment provision and increased demand for social services and domestic water provision
- 3.concentration of people in larger settlements where demand for services accelerates while increasing the potential for environmental impacts
- 4.simultaneous increase in small settlements which is a challenge to service provision and has potential for more widespread environmental impacts.
- 5.human environmental impacts (human footprint) concentrated along Okavango wetland margins.

These issues come with the following implications:

- 1.more attention needs to be given to high population growth and by implication issues of fertility, mortality and health;
- 2.more programmes for youth employment may be required;
- 3.population distribution issues may need re-examination from an environmental and water resource conservation perspective.

2. EDUCATION

Universal education of good quality is important to achieve the goal of a well-informed nation (as intended under Botswana's Vision-2016) able to understand international trans-boundary river issues. Ngamiland has long been the district in the country with lowest education levels. For Ngamiland as a whole, in 2001 only 60.5% of the population was literate (MLH 2003). Informal education programmes are, however, in place to improve the literacy situation. Several efforts are also ongoing to document indigenous (traditional) knowledge (Vanderpost 2003) and to apply it to natural resource management and conservation issues. The main formal education channels are through government provided infrastructure for primary, secondary and tertiary education.

2.1 Primary and secondary education

The quality of basic primary and secondary education is of prime importance to the general educational level in a country or region. Data on government primary school facilities in 2002 are given by the Ngamiland District development Plan 6 report (Ministry of Local Government (n.d)) and are summarized in Table 5 below, which compares them with 2009 data from the Maun regional education office.

In 2002 there was a shortage of 276 primary school classrooms (Ministry of Local Government (n.d)). This shortfall is a major issue of concern for the quality of education offered. Many schools currently work in double shifts. For children who have to attend school in the -usually hot- afternoon, learning conditions are definitely disadvantaged. Another noted problem was the prevalence of unqualified teachers, which affects the quality of education.

Table 5: Primary and Secondary Education details Ngamiland, 2002 and 2009.

	Schools		Pupils		Classrooms		Teachers		Pupils/Teacher	
	2002	2009	2002	2009	2002	2009	2002	2009	2002	2009
Primary	38	64	28175	37288	731	907	991	1090	28	34
Secondary, Junior	10	12	6998	9445	134	232	405	563	17	17
Secondary, Senior	1	1	1678	2224	42	60	95	137	18	16

Source: Ministry of Local Government (n.d), Maun regional education office, 2009.

Table 5 shows that there has been considerable expansion in secondary education over the 2002-2009 period. Junior secondary school enrolment increased with 35%, the number of classrooms with 73% (thereby improving the classroom/pupil ratio) and the number of teachers with 37% (thus maintaining the pupil/teacher ratio). These are very positive achievements. There is however only one public senior secondary school in the district and this limits the options for further study especially for children from remote areas.

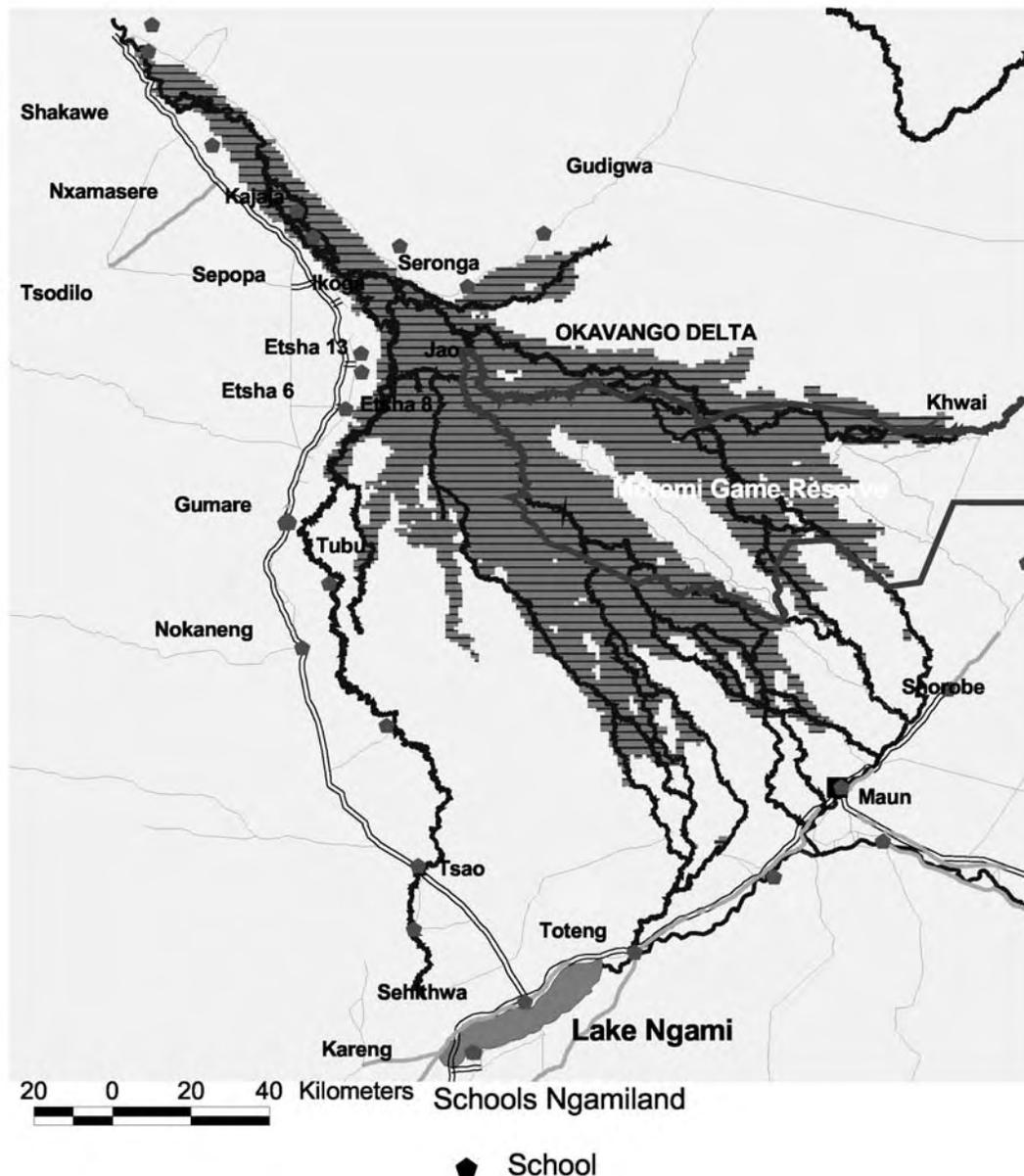


Figure 4: Distribution of schools in Ngamiland.

2.2 Technical and Tertiary education

Facilities for technical and tertiary education are extremely limited in Ngamiland. Most young people have to travel to Gaborone for such training. The following training options exist locally:

1. Maun Technical college
2. Brigades development trusts: 3
3. Rehabilitative training centre
4. Botswana Wildlife Training institute
5. University of Botswana satellite campus (with limited part-time course offering)

So very limited options exist for higher education and most students have to leave the district for further studies.

2.3. Education: current issues of concern

In summary, the current issues of concern about education therefore are:

1. the high rate of illiteracy
2. lack of government primary school facilities, especially classrooms
3. lack of qualified teachers, especially for government secondary schools
4. the existence of only one public senior secondary school
5. limited tertiary and higher education options

However, these problems are recognized and attended to in the context of District Development plans. This demonstrates that the government is serious about addressing these issues. Currently, District Development Plan 7 is under formulation. Some delay has been caused by the world financial crisis and the need to reduce district budgets in Botswana. Nevertheless, the draft re-prioritised education activities for Ngamiland include the following for the period 2009-2013.

1. construction of 6 new primary schools at Eretsha, Kajaja, Tobera, Senonnori, Khwai & Gumare
2. Construction of 35 primary school libraries
3. construction of 3 new Senior Secondary Schools at Gumare, Sedie & Sehithwa
4. construction of College of education for primary school at Seronga
5. construction of 2 new Junior Secondary schools at Matshwane & Shorobe
6. construction of a Regional Vocational Training College at Sehithwa
7. construction of Technical Colleges at Sepopa & Tsau
8. construction of Non Formal Education Centers at Sehithwa, Etsha 6 & Shakawe

These plans, if implemented, will go a long way toward improving many of the shortcomings in educational facilities in the district. It may also be useful to explore further the usefulness of local traditional knowledge about the river basin and apply this to improve trans-boundary understanding between related groups in neighbouring countries. An additional suggestion might be the development of teaching modules at different levels and in different languages, including local languages, in order to address river-basin and conservation issues (see the 'Factsheets' of the Harry Oppenheimer Okavango Research Centre for examples (http://www.orc.ub.bw/publications.html#fact_sheet)).

3. HEALTH

3.1 Health facilities

Water related health problems can often turn into trans-boundary issues. This is frequently the case with the spread of cholera, for example. Existing medical facilities should thus be equipped to deal with water related disease outbreaks even when these are of a trans-boundary nature. Data on government health facilities are provided in the Ngamiland District development Plan 6 (Ministry of Local Government (n.d)). The Ngamiland district has three hospitals, the General Hospital in Maun, the Primary Hospital in Gumare and an additional private (small) hospital in Maun. Throughout the district there are now 21 clinics, most with maternity wards. Thirty-one Health Posts, mostly in relatively remote areas, complement the health facilities and serve smaller villages, while very small localities are served by Mobile Stops (104 in all). This provides for a good geographic coverage of basic health services. Figure 5 shows the geographical distribution of health facilities, but note that not all mobile stops are shown. While this portrays a fair distribution (Figure 5), it must be noted that some facilities are understaffed. In addition, problems with drug availability and attitudes towards patients among health personnel have featured prominently in national newspapers in recent months.

3.2 Health: current issues of concern

The current issues of concern about health facilities are:

- 1.limited availability of hospital services (at Maun and Gumare only) and problems of access for people in remote areas
- 2.limited services and staff available at clinics and health posts
- 3.general problems with qualified staff availability, even in Maun
4. problems with drug availability

As with education, these problems are recognized and attended to in the context of District Development plans, demonstrating that the government is serious about addressing health issues. Currently, District Development Plan 7 is under formulation. Some delay has been caused by the world financial crisis and the need to reduce district budgets in Botswana. Nevertheless, the draft re-prioritised health activities for Ngamiland include the following for the period 2009-2013.

- 1.construction of 5 new clinics
- 2.upgrading of 4 clinics/health posts
3. construction of staff housing and other facilities

These plans, if implemented, will go a long way toward improving many of the shortcomings in physical health facilities in the district, but may not necessarily directly address staff shortcomings.

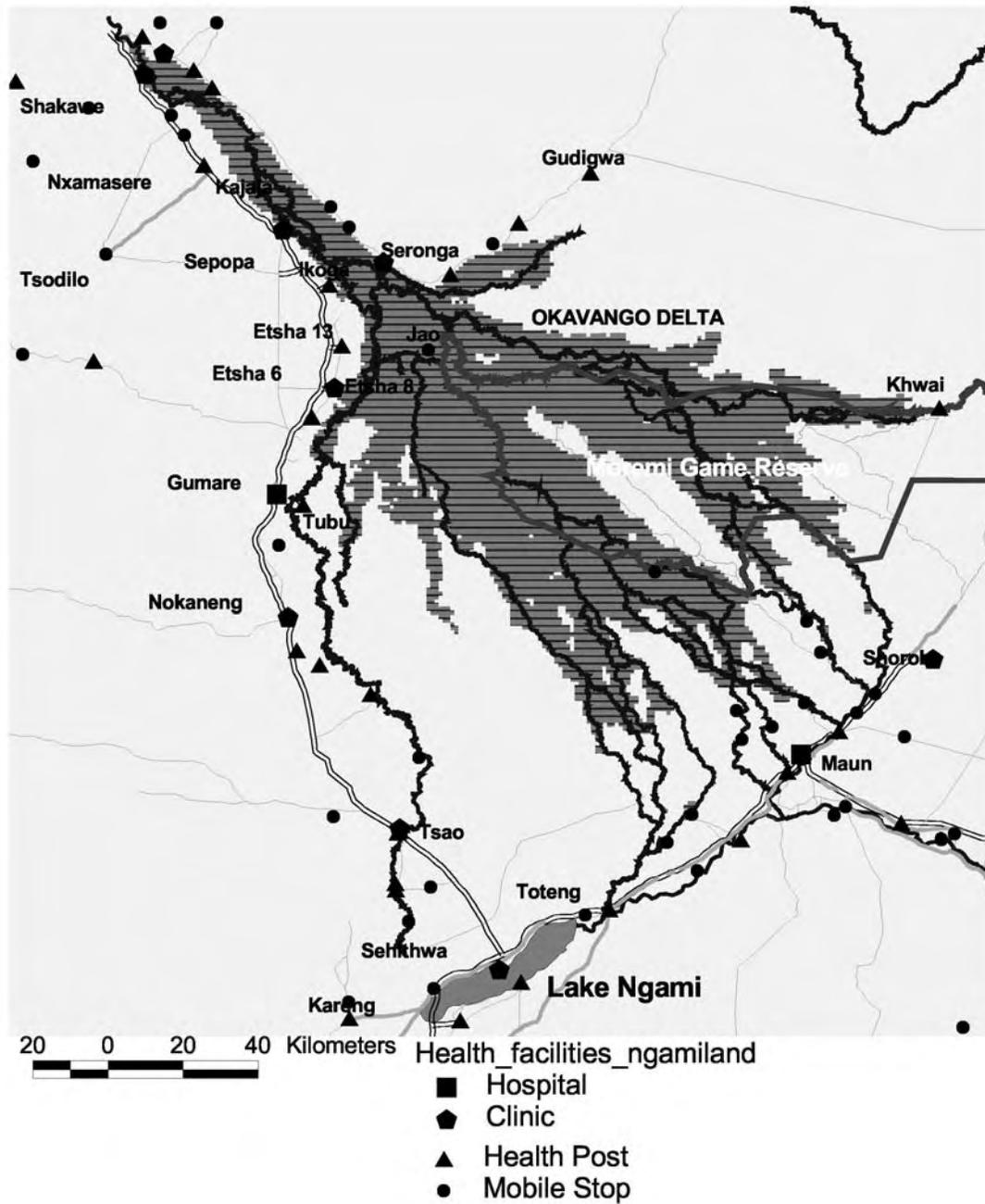


Figure 5: Health facilities Ngamiland, 2008. (NB not all mobile stops shown).

4. WATER PROVISION AND WASTE MANAGEMENT SERVICES

4.1 Water provision

The provision of drinking water is an essential service for all people. The abstraction of water from the Okavango Delta, which is a protected Ramsar site, requires environmentally sound practices and appropriate waste management aimed at avoiding contamination and pollution. For Botswana to request neighbouring countries to keep the Okavango waters clean and unpolluted, it is imperative that it keeps its own house in order by maintaining the strictest local standards.

All gazetted settlements in Ngamiland are entitled to a supply of drinking water by the District Council water unit. Villages along the Panhandle are supplied with treated surface water from treatment plants at Mohembo-east, Shakawe and Sepopa. In other areas, groundwater from individual boreholes or well-fields is the main source of household water. The total quantity of water currently abstracted in the Delta is about 3.84 million cubic meters (MCM) per annum which represent 0.04% of mean annual inflow. This is predicted to rise to 11.04 MCM per annum or 0.1% of mean annual inflow by 2020-25 (Dept. of Environmental Affairs 2008).

To sustain current per capita water availability, water abstraction levels need to increase at least in line with overall population growth in the region. Per person water consumption is, however, likely to increase as more households are provided with access to communal or individual standpipes (Table 4) and because of declining household size. This presents a considerable financial challenge to government. Programmes to save water and to make consumers pay for what they use have therefore been initiated and the provision of 'free' water from communal standpipes is coming to an end.

The other challenge is presented by unrecognized settlement. The thousands of people living in small, scattered, ungazetted settlements are responsible for their own water supply, usually sourced from privately owned boreholes, from rivers and hand-dug open wells or by hauling water from major villages or towns (Kgomotso & Swatuk, 2006). This situation potentially may give rise not only to health problems due to the consumption of untreated water, but also may result in environmental problems as a result of pollution caused by inappropriate water abstraction. In consultative traditional village community meetings (known as 'kgotla'), lack of a reticulated water supply was raised as one of the main problems people face (Bendsen, 2005). For example, in small settlements where there are no standpipes children are exposed to crocodiles when they fetch water from the river. Pollution of drinking water was in some cases blamed on elephants since drinking water sources were shared between people and wildlife.

Another recurring issue is that water abstraction also takes place for the purpose of livestock watering, sometimes (illegally) using drinking water supplies intended for people. In 2001, 11,447 out of 30,673 households (37%) in Ngamiland owned cattle, while 13,328 households owned goats (43%) (CSO 2003). During village meetings many communities specifically raised concerns about access to water for livestock watering in areas away from the river (Bendsen, 2005). Subsequent to having been asked to move their livestock from the river to the drylands in order to prevent environmental damage and to minimise conflict with wildlife at the riverfront, communities raised concerns over lack of water in drylands. Rich farmers have constructed

boreholes, but most small farmers continue to rely on publicly accessible surface waters that are part of the Okavango wetlands in competition, sometimes, with local wildlife.

4.2 Waste management

Resource limitations and capacity constraints in the Ngamiland district make it difficult to adequately provide waste disposal services to all recognised villages in the Okavango region. In addition, there are unrecognised settlements which do not qualify for government services but are also generating waste, potentially with negative environmental implications. Although a district Waste Management Plan was completed in 2002, it did not necessarily address the unique and complex issues of waste management in the Delta wetlands. For example, with respect to the presence of a relatively large number of camps and lodges that cater for tourists visiting the Okavango Delta. In addition to obtaining a license, a lodge has to adopt environmentally friendly management, including proper handling of solid waste, which has to be taken out of the Delta, and safe discharge of liquid wastes. However, there are indications that the authorities responsible for issuing licenses and monitoring adherence to the agreed environmental practices suffer from lack of resources to carry out the required inspections. Several initiatives to improve the overall waste management situation are, however, planned for the coming years.

4.3 Water and waste: issues of concern

The current issues of concern about water and waste management are:

1. the increasing demands for water abstraction and the need to do this in environmentally acceptable ways;
2. unregulated water abstraction and waste disposal at ungazetted settlements
3. conflicts between water abstraction for people, livestock and wildlife
4. problems with the enforcement of waste management regulations, e.g. at tourist camps.

Most of these issues are mentioned in the Delta Management Plan and may therefore receive attention within the next few years (Department of Environmental Affairs 2008).

5. OTHER SERVICES

This section addresses some other pertinent services that have potential relevance to trans-boundary issues. These include transportation and communication, social welfare services, general economic services and community based organizations. Transport, communication and information dissemination are important in providing inhabitants with the possibility to establish contacts with neighbouring countries and to distribute relevant information about developments in the river basin, including those in other countries. Social welfare services and services provided by community based organizations may be important because they have a positive influence on people's environmental behaviour and attitudes.

5.1 Transportation

Transport, communication and information are crucial elements in the provision of education and health services and, in their own right, contribute to an informed population able to assess issues related to trans-boundary river basins. Existing services that are important for communication and information dissemination include networks of transportation, telecommunications, broadcasting and the internet.

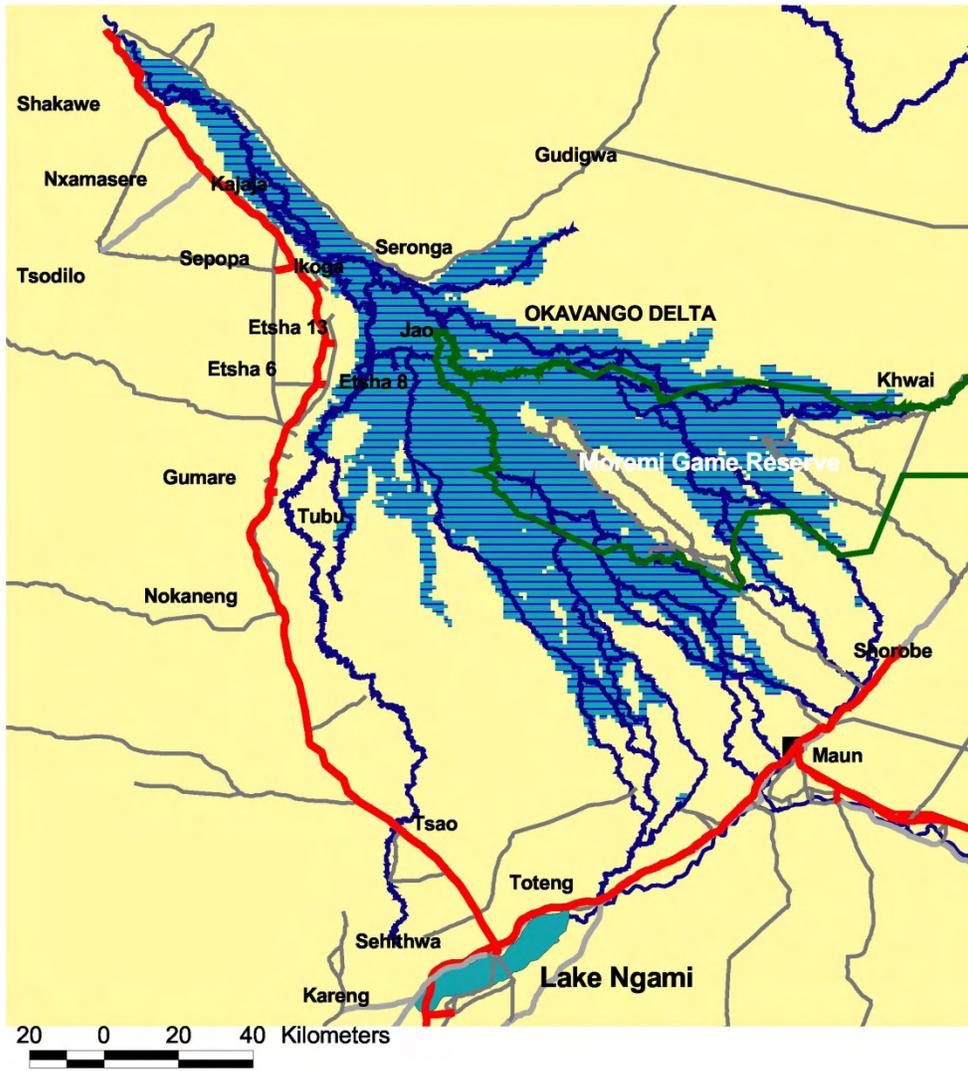


Figure 6: Main tarred roads in Okavango Delta region (red).

Transportation networks in Ngamiland have much improved in recent decades, especially with respect to tarred roads. Main tarred roads now service the entire district (Figure 6) with the exception of the Seronga area, western Ngamiland and the inner Delta. The people living in or near Seronga regularly complain about the difficulties of accessing important government services such as hospitals because these are mostly located in Gumare or Maun, due to lack of good roads and an unreliable ferry connection across the river at Mohembo. Lack of bus services on the eastern side of the Okavango compound the problem (MLH 2003). Otherwise, long distance public bus transport is quite well developed, providing connections to Francistown, Gaborone, Ghanzi, Serowe, etc.

While there are no railways in Ngamiland, good air transportation linkages exist. Maun has an international airport (currently being upgraded to an even higher standard) and there are an additional six government airstrips at Makalamabedi, Gumare, Tsodilo, Nokaneng, Tsau and Shakawe. 32 additional airstrips are operated by safari companies, mostly in the tourist areas of the Delta (MLH 2003).

5.2 Communication services

Postal services are generally poor and there is not a good geographic coverage with post-offices only located in Maun, Sehitwa, Gumare, Etsha6 and Shakawe and postal agencies in Seronga, Makalamabedi, Nokaneng, Sepopa and Gunutsoga.

Telecommunications, however, have undergone much improvement in recent years. Most villages now have telephone connections, with the notable exception of Shorobe. The mobile phone coverage extends from Maun all along the western margin of the Delta, but areas away from the tarred road and Shorobe are not covered. While mobile phone use has increased tremendously in recent years, fixed telephone connections in most villages are limited in number due to the high connection costs (see Table 6 below).

Table 6: Landline telephone connections Ngamiland, 2008.

Village	Nr of Telephone Connections, 2008
Chanoga	3
Etsha	48
Gumare	450
Komana	4
Makalamabedi	31
Maun	4680
Nokaneng	63
Sehitwa	70
Sepopa	51
Seronga	82
Shakawe	96
Toteng	14
Tsau	53

Source: Botswana Telecommunications Corporation Phonebook 2008

In remote areas, government offices and private companies such as safari camp operators often rely on two-way radio communications or satellite-phone connections for their communications. Internet connectivity in the district is slow and quite expensive and still restricted to areas served by, mostly low-capacity, telephone lines. However, Maun is now connected to the national fibre-optic cable network so improvements are expected. Television reception is possible in most areas only with an expensive satellite dish, while there are limitations also to the FM radio coverage in the district. In short, recent improvements have been impressive but more remains to be improved in tele-communications.

5.3 Social welfare services

The government of Botswana provides its citizens with a fair package of social welfare services. These include a modest old-age pension and allowances for orphans and destitutes. The government has also for a long time operated a 'drought relief' programme that provided casual employment to the unemployed. This programme has recently been reshaped into a permanent programme for labour intensive works. As pointed out by Kgathi (et al 2007) these welfare services are important income sources in rural areas and provide a safety net for local survival. Government social protection programmes, according to his study, which covered 5 villages representative for rural Ngamiland, are the second most important livelihood option for almost 10% of households.

In areas where these services are less easily accessed (for example because there is no social worker nearby), people are more likely to (over)exploit communal environmental resources than where those services are more easily accessed (Ngwenya, personal communication, April 2009). In that sense, the provision of these welfare services is highly environmentally relevant in the context of transboundary river-basin conservation efforts.

5.4 Community Trusts and NGO's

A fairly recent development has been the organization of community trusts in many villages. These typically deal with community development issues with an emphasis on community based natural resource management. The latter category exist in places such as Sankuyo, Seronga, Ikoga-Jao-Etsha's, Khwai and the Panhandle-villages. These trusts play a potentially important role not only in re-directing benefits from natural resource exploitation to local communities but also in the improvement of nature conservation. They are therefore important instruments that can help keep Botswana's portion of the Okavango river-basin in good environmental shape, thereby improving the region's bargaining position vis-à-vis neighbouring countries.

The proceedings of the Fourth National CBNRM Conference of November 2006 mention the 13 community trusts in the Okavango Delta region listed in Table 7. People in over 40 villages in different parts of the Okavango Delta region are involved with these organizations, many of which are supported by local or international NGOs. This demonstrates the wide geographic base for this type of organization and the great potential for influencing people's environmental behaviour and attitudes.

Although community based organizations face many 'teething' problems, they can potentially play a very important role in mitigating some of the consequences of recent developments. This includes for example the trend whereby economic assets tend to be concentrated in the hands of increasingly fewer people, especially in the cattle and tourism industries. This issue is a constant source of social tension in the region. Another problem emanates from the fact that although people retain traditional resource use rights, they loose actual access to areas that contain these resources (see again Table 2). Through community organisations and their partnerships with private partners some degree of compensation (income or jobs) can be achieved for these.

Table 7: Community Trusts Okavango region. Ngamiland, 2006.

<u>Name of Community Trust</u>	<u>Villages involved</u>
Bukhakwe Cultural Conservation Trust	Gudigwa, Seshora
Cgae Cgae Tlhabololo Trusts	XaiXai, Xaa, Qubi
Itekeng Community Trust	Mohembo, Kauxwi, Xakao, Tovera, Sekondomboro,
Khwai Development Trust	Khwai
Mababe Zokotsama Community Development Trust	Mababe
Okavango Community Trust	Gudigwa, Beetsha, Eretsha, Gunotsoga, Seronga
Okavango Jakotsha Community Trust	Jao, Ikoga, Etsha 1, Etsha 6, Etsha 13
Okavango Kopano Mokoro Community Trust	Xaxaba, Xuoxau, Duonara, Dibshiping, Boro, Xharaxao
Okavango Panhandle Community Trust	Mohembo, Shakawe, Samuchima, Xhauga, Nxamasere
Okavango Polers Trust	Seronga, Etsha 13, Gunotsoga, Mokgatsha
Sankuyo Tshwaragano Management Trust	Sankuyo
Teemacane Community Development Trust	Shakawe, Mohembo, Kaputura, Xakao, Tobere, Sekondomboro, Ngarange, Mogotho
<u>Tsodilo Community Development Trust</u>	<u>Tsodilo, Upanda, Xomkao</u>

Source: Fourth National CBNRM Conference of November 2006

5.5 Other general services

Most small settlements have two 'tribal' police officers attached to the village tribal authority. These tribal police officers are currently being integrated into the regular police force. In most small villages the chief is authorised to settle civil disputes. Police stations are found in most larger villages. Maun has a customary court, a magistrate's court and 2 prisons. This implies that law-enforcement is quite thinly spread across the Ngamiland district. This also affects the level of enforcement of environmental regulations.

Settlements with more than 500 people usually have a co-operative general dealer and a number of small shops and street-vendors. It is only in the main centres such as Maun, Gumare and Shakawe that specialised shops (clothing, furniture, etc.) are found. Access to banking facilities is another major concern of people not living in these major settlements as they need to travel long distances to cash their monthly salaries.

Certain essential services are provided by para-statal bodies that are closely linked to the government. This applies to electricity for which the Botswana Power Corporation is responsible. Most larger villages are now connected to the national power grid, although there are relatively few private connections due to the very high connection costs consumers have to pay. Remote areas in western Ngamiland, east of the Delta and within the Delta are not supplied with electricity. This is reflected in the fact that the use of firewood for cooking is high in these areas with up to 90% of households in the north and west of the district relying on firewood compared to about 50% of households in or near Maun (CSO 2003). This has local environmental implications, for example, in terms of potential deforestation.

5.6. Other services: issues of concern

Issues of concern related to the (other) services discussed above, include:

1. lack of good roads and public transport east of Okavango river and in western Ngamiland
2. poor ferry connection across Okavango river (but: bridge is planned)
3. incomplete telephone coverage of the district, including mobile phones
4. limited number of telephone connections in most villages due to high costs
5. poor coverage of postal services
6. limited tv and radio(FM) reception in parts of the district
7. limited internet connectivity (will improve once fibre-optic cable becomes operational)
8. limited police services and law enforcement in remote areas
9. limited access to government support programmes in remote areas
10. limited access to shops and banking facilities outside major settlements

Again, government is aware of the problems and various programmes are ongoing or planned to make improvements. This includes road construction, road upgrading, a bridge across the Okavango at Mohembo, connection of more villages to the telephone network, creating additional postal agencies and the building of tv and radio transmitters. At the time of writing it was not clear which specific projects were on the priority list for the new District Development Plan. The government, assisted by NGOs, is also supporting community based organizations that are important in influencing people's environmental behaviour and attitudes.

6. CONCLUSIONS

The Trans-boundary Diagnostic Assessment (TDA) component of the EPSMO project aims to identify the principal threats to the water resources of the Okavango basin. This component of the TDA aims to assess social services in the Botswana portion of the basin and the role they play in supporting trans-boundary water resources conservation and utilisation. Many social services have environmental implications. For example, the provision of a centralized water supply or waste removal facility may prevent otherwise uncontrolled and potentially environmentally damaging private practices. To have such services delivered efficiently thus helps to minimize local environmental threats to Okavango water resources.

In the Botswana portion of the Okavango river basin, the Okavango Delta Management Plan is intended to function as a comprehensive framework for both conservation efforts and development plans in the region that will ensure long-term conservation and that will provide benefits for the present and future well-being of the people. This is increasingly reflected in both district and national development plans, which is important because if Botswana wishes to request neighbouring countries to keep the Okavango waters clean and unpolluted, it is imperative that it keeps its own house in order by maintaining the strictest local environmental conservation standards.

From the perspective of the planned trans-boundary management and conservation of shared Okavango resources, the provision of relevant social services can play an important role by supporting local conservation efforts. Relevant in this respect are water-provision and waste removal but also government support services as these may reduce the need for rural people to overexploit environmental resources. The growth rate and the distribution of people are relevant variables in this regard. Other social services play a role by supporting cross-boundary understanding of shared water resources through communication and education and by promoting healthy living conditions as a buffer against trans-boundary disease. This is why good facilities and infrastructure for education, communication and health are important.

In Ngamiland, high population growth of the recent past and expected future high growth rate (now 2% per year) remain of concern because of the implications for increasing demands for water abstraction and the challenges it poses to the universal provision of social services and their quality improvement. The young age structure (39% of the population under 15 years of age) and declining household size add to the challenges, especially in terms of employment provision for the youth and rapidly increasing demands for social services. These issues, in turn, have implications for upstream and local conservation of shared water resources.

The concentration of people in larger settlements, with currently 40% of the district population in Maun alone and an additional 28% in other large villages, leads to accelerated local demand for services while increasing the potential for environmental impacts, especially because about 70% of the population of Ngamiland lives within 10 kilometers of a river channel. A simultaneous increase in the number of small settlements (507 in 2001) provides a major challenge to service provision and has the potential to generate more widespread environmental impacts. Most human environmental impacts (as measured by the human footprint) are concentrated along the western and southern Okavango wetland margins. This is where innovative solutions are needed.

Universal education of good quality is important to achieve the goal of a well-informed nation able to understand international trans-boundary river issues. In Ngamiland, major expansion has occurred in the provision of government education facilities, but further improvements are possible. Issues of concern remain the high rate of illiteracy, the shortage of government primary school classrooms, the lack of qualified teachers for government secondary schools, the existence of only one public senior secondary school in the region and the very limited tertiary and higher education options. These problems are recognized and attended to in the context of District Development plans, demonstrating that the government is serious about addressing them.

Water related health problems can turn into trans-boundary issues. Existing medical facilities should thus be equipped to deal with water related disease outbreaks even when these are of a trans-boundary nature. Major expansion has occurred in Ngamiland in the provision of government health facilities, but further progress is possible to improve trans-boundary health issues. The current issues of concern about health facilities in the region include the limited availability of hospital services (at Maun and Gumare only) and problems of access for people in remote areas, the limited services and staff available at clinics and health posts and problems with drug availability. These problems are recognized and attended to in the context of District Development plans, demonstrating that the government is serious about addressing health issues.

The provision of drinking water is an essential service for all people. The abstraction of water from the Okavango Delta, which is a protected Ramsar site, requires environmentally sound practices and appropriate waste management aimed at avoiding contamination and pollution. The current issues of concern about water and waste management in Ngamiland include the increasing demands for water abstraction and the need to do this in environmentally acceptable ways, the unregulated water abstraction and waste disposal at ungazetted settlements, conflicts between water abstraction for people, livestock and wildlife and problems with the enforcement of waste management regulations. Most of these issues are mentioned in the Delta Management Plan and should therefore receive attention within the next few years.

Transport, communication and information dissemination are important in providing inhabitants with the possibility to establish contacts with neighbouring countries and to distribute relevant information about developments in the river basin, including those in other countries. Social welfare services and services provided by community based organizations are important because they influence people's environmental behaviour and attitudes. Over past decades major improvements were achieved by the government and the private sector, but issues of concern remain the lack of good roads, ferry connections and public transport east of the Okavango river and western Ngamiland, the incomplete telephone coverage and the limited number of telephone connections, the poor postal services and limited tv and radio(FM) reception and internet connectivity. Also there are limited police services and law enforcement in remote areas and limited access to government support programmes and shops and banking facilities outside major settlements. The government is aware of these problems and various programmes are ongoing or planned to make improvements.

Availability of government support services such as old-age pensions are important because of their potential to positively influence people's environmental behaviour and thus local conservation. Community based organizations also play a potentially important role not only in re-directing benefits from natural resource exploitation to local communities but also in the improvement of nature conservation practices.

Provision of accessible social services of good quality, especially in education and health, are important for promoting people's understanding about trans-boundary river issues and may contribute toward sustainable solutions. A good communication infrastructure can support this. Government initiated Development Plans at national and regional level are important platforms for raising awareness about shortcomings and for activities to address these. In the Botswana portion of the Okavango river basin, the Okavango Delta Management Plan provides a comprehensive framework for both conservation efforts and development plans in the region that has the potential to ensure its long-term conservation while providing benefits for the present and future well being of the people.

However, many of the current socio-economic trends as described in this report, if continued unchanged, are not beneficial and sometimes potentially detrimental to the future prospects for environmental conservation of the ecological and water resources of the Okavango Delta. These trends include the continued rapid population growth, increasing water abstraction, proliferation of un-gazetted settlements and the increase in overall human impacts on the natural environment of the region. However, the effects of trends can be mitigated by projects already contained in existing and proposed national and district development plans and particularly in the Okavango Delta management plan. The catch is that such initiatives require adequate and timely implementation to effectively mitigate or overcome existing negative environmental trends.

7.RECOMMENDATIONS

Botswana should aim to have its own environmental affairs 'in order' to improve its bargaining position relative to its neighbours with respect to shared Okavango resources conservation, for example by the provision of centralized water supply and waste removal facilities for Ngamiland as this may prevent otherwise uncontrolled and potentially environmentally damaging practices.

More attention needs to be given in Ngamiland to programmes aimed at reducing the population growth rate because of the implications for increasing demands for water abstraction and the challenges it poses to the universal provision of social services and their quality improvement. In view of the young age structure, more efforts are also required to combat youth employment.

Because of their potential to generate more widespread environmental impacts, the proliferation of ungazetted settlements needs to be addressed either by 'closing down' those located in sensitive ecological areas such as elephant migration routes or, preferably, by recognising them and providing them with appropriate services.

In Ngamiland, more widely distributed facilities and improvement of quality are needed for primary and secondary education to achieve the goal of a well-informed nation able to understand international trans-boundary river issues. More facilities for tertiary education are also needed. An additional suggestion is the development of teaching modules at different levels in order to address shared river-basin and conservation issues in the curriculum.

It may be useful to explore further the usefulness of local traditional knowledge about the river basin and apply this to improve trans-boundary natural resource management and conservation of shared water resources and to promote understanding between related groups in neighbouring countries such as the San and HaMbukushu in Ngamiland who are related to similar tribal/language groups in Namibia and Angola.

While the geographic distribution of health facilities is quite good in Ngamiland, more work is required to improve the quality of health service delivery in remote areas and to improve access to specialized services for people living in remote areas.

The general infrastructure (roads, telephone, etc) in remote parts of Ngamiland needs further improvements to allow inhabitants to participate in sharing the benefits of the shared Okavango river resources. Similarly, access to government support services such as old-age pensions needs improvement because of their potential to influence people's environmental behaviour and thus local conservation. Community based organisations can also play that role and are therefore deserving of (more) government support.

In the Botswana portion of the Okavango river basin, the Okavango Delta Management Plan needs to function as a comprehensive framework for both conservation efforts and development plans in the region that will ensure long-term conservation and that will provide benefits for the present and future well-being of the people. Adequate and timely implementation through operational district and national development plans is essential toward the mitigation of environmentally detrimental socio-economic trends. This is important because if Botswana wishes to request neighbouring countries to keep the Okavango waters clean and unpolluted, it is imperative that it keeps its own house in order by maintaining the strictest local standards.

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The Okavango River Basin Transboundary Diagnostic Analysis Technical Reports

In 1994, the three riparian countries of the Okavango River Basin – Angola, Botswana and Namibia – agreed to plan for collaborative management of the natural resources of the Okavango, forming the Permanent Okavango River Basin Water Commission (OKACOM). In 2003, with funding from the Global Environment Facility, OKACOM launched the Environmental Protection and Sustainable Management of the Okavango River Basin (EPSMO) Project to coordinate development and to anticipate and address threats to the river and the associated communities and environment. Implemented by the United Nations Development Program and executed by the United Nations Food and Agriculture Organization, the project produced the Transboundary

Diagnostic Analysis to establish a base of available scientific evidence to guide future decision making. The study, created from inputs from multi-disciplinary teams in each country, with specialists in hydrology, hydraulics, channel form, water quality, vegetation, aquatic invertebrates, fish, birds, river-dependent terrestrial wildlife, resource economics and socio-cultural issues, was coordinated and managed by a group of specialists from the southern African region in 2008 and 2009.

The following specialist technical reports were produced as part of this process and form substantive background content for the Okavango River Basin Transboundary Diagnostic Analysis.

<i>Final Study Reports</i>	<i>Reports integrating findings from all country and background reports, and covering the entire basin.</i>		
		<i>Aylward, B.</i>	<i>Economic Valuation of Basin Resources: Final Report to EPSMO Project of the UN Food & Agriculture Organization as an Input to the Okavango River Basin Transboundary Diagnostic Analysis</i>
		<i>Barnes, J. et al.</i>	<i>Okavango River Basin Transboundary Diagnostic Analysis: Socio-Economic Assessment Final Report</i>
		<i>King, J.M. and Brown, C.A.</i>	<i>Okavango River Basin Environmental Flow Assessment Project Initiation Report (Report No: 01/2009)</i>
		<i>King, J.M. and Brown, C.A.</i>	<i>Okavango River Basin Environmental Flow Assessment EFA Process Report (Report No: 02/2009)</i>
		<i>King, J.M. and Brown, C.A.</i>	<i>Okavango River Basin Environmental Flow Assessment Guidelines for Data Collection, Analysis and Scenario Creation (Report No: 03/2009)</i>
		<i>Bethune, S. Mazvimavi, D. and Quintino, M.</i>	<i>Okavango River Basin Environmental Flow Assessment Delineation Report (Report No: 04/2009)</i>
		<i>Beuster, H.</i>	<i>Okavango River Basin Environmental Flow Assessment Hydrology Report: Data And Models (Report No: 05/2009)</i>
		<i>Beuster, H.</i>	<i>Okavango River Basin Environmental Flow Assessment Scenario Report : Hydrology (Report No: 06/2009)</i>
		<i>Jones, M.J.</i>	<i>The Groundwater Hydrology of The Okavango Basin (FAO Internal Report, April 2010)</i>
		<i>King, J.M. and Brown, C.A.</i>	<i>Okavango River Basin Environmental Flow Assessment Scenario Report: Ecological and Social Predictions (Volume 1 of 4) (Report No. 07/2009)</i>
		<i>King, J.M. and Brown, C.A.</i>	<i>Okavango River Basin Environmental Flow Assessment Scenario Report: Ecological and Social Predictions (Volume 2 of 4: Indicator results) (Report No. 07/2009)</i>
		<i>King, J.M. and Brown, C.A.</i>	<i>Okavango River Basin Environmental Flow Assessment Scenario Report: Ecological and Social Predictions: Climate Change Scenarios (Volume 3 of 4) (Report No. 07/2009)</i>
		<i>King, J., Brown, C.A., Joubert, A.R. and Barnes, J.</i>	<i>Okavango River Basin Environmental Flow Assessment Scenario Report: Biophysical Predictions (Volume 4 of 4: Climate Change Indicator Results) (Report No: 07/2009)</i>
		<i>King, J., Brown, C.A. and Barnes, J.</i>	<i>Okavango River Basin Environmental Flow Assessment Project Final Report (Report No: 08/2009)</i>
		<i>Malzbender, D.</i>	<i>Environmental Protection And Sustainable Management Of The Okavango River Basin (EPSMO): Governance Review</i>
		<i>Vanderpost, C. and Dhliwayo, M.</i>	<i>Database and GIS design for an expanded Okavango Basin Information System (OBIS)</i>
		<i>Veríssimo, Luis</i>	<i>GIS Database for the Environment Protection and Sustainable</i>

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			<i>Management of the Okavango River Basin Project</i>
		<i>Wolski, P.</i>	<i>Assessment of hydrological effects of climate change in the Okavango Basin</i>
Country Reports Biophysical Series	Angola	<i>Andrade e Sousa, Helder André de</i>	<i>Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango: Módulo do Caudal Ambiental: Relatório do Especialista: País: Angola: Disciplina: Sedimentologia & Geomorfologia</i>
		<i>Gomes, Amândio</i>	<i>Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango: Módulo do Caudal Ambiental: Relatório do Especialista: País: Angola: Disciplina: Vegetação</i>
		<i>Gomes, Amândio</i>	<i>Análise Técnica, Biofísica e Socio-Económica do Lado Angolano da Bacia Hidrográfica do Rio Cubango: Relatório Final: Vegetação da Parte Angolana da Bacia Hidrográfica Do Rio Cubango</i>
		<i>Livramento, Filomena</i>	<i>Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango: Módulo do Caudal Ambiental: Relatório do Especialista: País: Angola: Disciplina: Macroinvertebrados</i>
		<i>Miguel, Gabriel Luís</i>	<i>Análise Técnica, Biofísica E Sócio-Económica do Lado Angolano da Bacia Hidrográfica do Rio Cubango: Subsídio Para o Conhecimento Hidrogeológico Relatório de Hidrogeologia</i>
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		<i>Morais, Miguel</i>	<i>Análise Técnica, Biofísica e Sócio-Económica do Lado Angolano da Bacia Hidrográfica do Rio Cubango: Relatório Final: Peixes e Pesca Fluvial da Bacia do Okavango em Angola</i>
		<i>Pereira, Maria João</i>	<i>Qualidade da Água, no Lado Angolano da Bacia Hidrográfica do Rio Cubango</i>
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	Botswana	<i>Bonyongo, M.C.</i>	<i>Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Botswana: Discipline: Wildlife</i>
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		Ngwenya, B.N.	Final Report: A Socio-Economic Profile of River Resources and HIV and AIDS in the Okavango Basin: Botswana
		Vanderpost, C.	Assessment of Existing Social Services and Projected Growth in the Context of the Transboundary Diagnostic Analysis of the Botswana Portion of the Okavango River Basin
	Namibia	Barnes, J and Wamunyima, D	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Namibia: Discipline: Socio-economics
		Collin Christian & Associates CC	Technical Report on Hydro-electric Power Development in the Namibian Section of the Okavango River Basin
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		Ortmann, Cynthia L.	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module : Specialist Report Country: Namibia: discipline: Water Quality
		Nashipili, Ndinomwaameni	Okavango River Basin Technical Diagnostic Analysis: Specialist Report: Country: Namibia: Discipline: Water Supply and Sanitation
		Paxton, C.	Transboundary Diagnostic Analysis: Specialist Report: Discipline: Water Quality Requirements For Human Health in the Okavango River Basin: Country: Namibia

*Environmental protection and sustainable management
of the Okavango River Basin*

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Cuito Cuanavale, Angola



OKACOM

Tel +267 680 0023 Fax +267 680 0024 Email okasec@okacom.org www.okacom.org
PO Box 35, Airport Industrial, Maun, Botswana