

APPENDIX N

APPENDIX N

INITIAL ENVIRONMENTAL EVALUATION

SPECIALIST REPORT ON:  
LAND AND RESOURCE USE ALONG THE OKAVANGO  
RIVER SYSTEM IN NAMIBIA AND IN THE  
OKAVANGO DELTA IN BOTSWANA

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## 1. INTRODUCTION AND BACKGROUND INFORMATION

The Central Areas of Namibia are facing a water crisis. This may be aggravated by continuing drought in the area to the point where the economy of Namibia is seriously impacted. Additional water for the Central Areas of Namibia is sought from the Okavango River. The means of supplementing the water supply to the central areas is a proposed pipeline from the Okavango River to the Eastern National Water Carrier (ENWC).

An environmental impact assessment, including both ecological and social impact assessments, is required by Namibian environmental policy for such major development projects. Impacts may arise from two sources: the pipeline construction and attendant infrastructure, and the abstraction of water from the Okavango River.

The Study has been structured to take place in stages, the first being scoping and public consultation; second, an initial environmental evaluation (IEE) and dry season assessment; followed by a full wet season assessment. The result would be a comprehensive Environmental Impact Report.

The scoping stage began in September, 1996 in Namibia and continued in Botswana in November and December. Consultations with interested and affected parties will continue throughout the study process. The IEE process commenced in Namibia in late October and an assessment of the downstream impacts was carried out in Botswana in early December. This Report details the specialist studies on land use and natural resource use along the Okavango River in Namibia, and the Okavango Panhandle and Okavango Delta in Botswana.

In Namibia, the social survey has indicated that people use the land and other resources near the Okavango River throughout the year. However, this riverine area is also regarded as a hedge or "insurance policy" against drought effects. Thus, during periods of drought, use of the Okavango River increases and added pressure is put on the system. Any impacts that are anticipated to arise as a result of lowered water levels caused by water abstraction will add to the pressure on the system, particularly during the dry months of the year and during drought years.

Similarly, the social survey has shown that people use the land and other resources near the swamps and rivers of the Okavango Panhandle and Okavango Delta, but outside the tourism concession area, throughout the year. Again, river and wetland resources are currently under heavier pressure than normal owing to the fact that all cattle have been destroyed in

the area to the west and south of the Buffalo Fence in Botswana because of lung-disease. Only the areas in the Okavango Panhandle and outside the Buffalo Fence are officially open to use for farming, grazing, etc. Any impacts that are anticipated to arise from lowered water levels caused by water abstraction will add to current pressures on the Natural resources of the area. This will be particularly intense if it occurs before the restocking of cattle is completed.

The purpose of the survey was to gain a preliminary understanding, backed by the initial social survey work, of the land and other resource use in the riverine area in Namibia and the swamps in Botswana in order to design follow-on wet season intensive surveying activities and to provide an initial evaluation of the potential impacts of the project on resource use both in Namibia and Botswana.

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## 2. METHODS

In both Namibia and Botswana, five methods were used to identify natural resource use during this initial study phase:

- the social survey techniques (see the Social Assessment Report);
- informal discussions between the technical specialists and residents of the area;
- helicopter overflights and a boat trip to quantify certain resources and activities;
- land capabilities and soils studies (see the Geomorphology, Geology and Soils Report); and
- literature study

Specific methods used in the Namibian and Botswana sectors are described below.

### 2.1 Namibia

Informal discussions were held at several points along the Okavango River with residents who were fishing, tending their gardens, washing, bathing, holding meetings, or otherwise engaged. In addition, we met with three of the traditional leaders in the Kavango Region to discuss the study. These discussions centred around natural resource availability, and changes in availability, under conditions of low water levels, and heavy rates of natural resource use, as well as the timing and extent of natural resource use.

The helicopter overflights were conducted along the entire stretch of the Okavango River from Rundu to the Botswana border at Mohembo. However, due to other demands on the helicopter, different parts of the river were flown at different times of the day (the main flights were at 07:30 and 14:30). The data obtained from these aerial surveys indicate that certain activities are time-of-day dependent. It is likely that many of the activities are seasonally dependent as well. Hence, it will be necessary to survey the entire river in one continuous flight, perhaps at 3 different times of day in order to accurately compare activities in the 4 to 6 ecological zones identified by the aquatic team and used by the social team in their work.

The data in hand have been grouped into the geographic regions used by the social team. Despite the differences in the timing of flights, several interesting patterns have emerged. Since both the Angolan and Namibian side of the Okavango River were surveyed from the air, comparisons in terms of natural resource use can be made regardless of the time of the

flight. Gardens, of course, are stationary and not dependent on the time of flight so good comparisons can be made of these.

Some of the figures obtained are only estimates (numbers of cattle, numbers of fields, numbers of people bathing in a group) since we had limited time to cover the river for all activities. In further studies, flights could possibly be activity specific, where observers can concentrate on 1 to 4 activities rather than trying to count activities, fields, animals, patterns of land use, etc., on the same pass. Where available, figures from MAWARD and related organizations (NOLIDEP) are not broken down to the riverine area versus areas further from the river that would not likely be impacted by the project. The most reliable means of assessing fields and animals that are located in the riverine area is to use survey techniques.

Since approximate population figures are available for the various regions along the Okavango River, the different activities can be analyzed on a per capita basis.

## 2.2 Botswana

Informal discussions were held with residents at several points along the Okavango Panhandle on the east side of the Okavango River. In addition, we met with Botswana Government officials in Maun, including those in the lung disease control programme, the Ministry of Fisheries offices, Veterinary Services, and others. Many officials were already on holiday and we were unable to see any officials in the Departments of Agriculture or Tourism. We also held discussions with people from the village of Ditshipi, inside the Buffalo Fence (a village that exists primarily to cater for tourists coming into the region). The discussions with residents centred around natural resource availability, and changes in availability, under conditions of low water levels, rates of natural resource use and the timing and extent of such use. The meetings with Government officials were used primarily to gather information on the previous livestock situation, farming, and fishing. The discussions with people from Ditshipi focused on tourism in the area and the degree to which they are dependent on tourism for their livelihoods.

The helicopter overflights were conducted along most of the western (Thaoge) arm of the Okavango Delta from the Okavango Panhandle downstream. The Thaoge area is drying out and being subjected to subsistence dryland farming development. This overflight also extended outward along the Nqoga River, down the Mboroga River and westward across Chief's Island.



A second flight was taken from Maun, over the Thamalakane River, up the Gomoti River, across to and down the Santantadibe River, up the Boro River and then down to the west. This flight gave us a view of the seasonally flooded areas, both outside the Buffalo Fence and within the concession area, as well as a part of the Moremi Wildlife Reserve. The area outside the Buffalo Fence and west of the road that leads northeast out of Maun towards Shorobe, was reasonably heavily settled and supported a great deal of subsistence agriculture. Within the Buffalo Fence there were several abandoned villages, as well as a few villages like Ditshipi, that cater primarily for tourists. There were also, of course, several tourist camps and lodges above the Buffalo Fence.

### 3. RESULTS AND DISCUSSION

#### 3.1 Namibia

##### 3.1.1 Background

Figures calculated against the 1991 Namibian census (CSO, 1993) using the national growth rate of 3.1 % per annum and dis-aggregated for the region indicate approximately 33,000 people living in the area from Rundu to the Caprivi Region border in an area up to 10 kilometres from the Okavango River. The population in the Okavango Region increased 140 % in the period 1970-1991 and is set to double in 23 years (Tapscott, 1994). From discussions with community members and with the social survey team, it is clear that the riverine area has experienced significant in-migration during the recent drought - mainly from people moving toward the river from the interior and from some crossover (immigration) from Angola.

The riverine area is thus heavily utilised and there has been an increase in slash and burn agriculture. Evidence in the field showed that forested areas were being cleared south of the Trans-Caprivi highway, even at its furthest point from the river. Riverine woodlands and other vegetation which are key to the stabilisation of riverbanks, have been cleared and the cultivated lands along the river are characterised by eroded upslopes and the loss of topsoil (Seely *et al.*, 1994). Areas further to the south are said to be under-utilised (Yaron *et al.*, 1992).

The study area in Namibia receives approximately 550-600 mm of rainfall each year (Yaron *et al.*, 1992). In recent years the region has experienced severe drought, leading to decreased agricultural production and a shortage of food (the study by Yaron and his co-workers, carried out prior to the drought, showed that a shortage of food was the major problem identified by communities). People apparently rely heavily on "bush foods", particularly during periods of drought. In the region 88 % of surveyed households said they consumed "some bush foods" (Devereux *et al.*, 1994), and the social survey for this study found that several plants were utilised as food sources (see **Appendix Tables**).

Agricultural production is characterised by unadapted farming systems and declining productivity (Issacson, 1995). Agricultural production is comprised mostly of pearl millet (74 % of production), maize (13 %) and sorghum (7 %) (Yaron *et al.*, 1992). Yaron *et al.* (1992) also estimate that less than 16 % of household income is derived from agriculture in the region. The average land holding is 4 hectares. As mentioned, this may be

increasing as new lands are cleared. While yields from the new lands are significantly higher, their cultivation gives rise to a range of problems (such as lack of adequate draught animals to plough, and increased potential for erosion; Issacson, 1995).

Cattle are an important store of wealth for most households and a ready source of income in times of need. Some 65 % of households own at least some cattle and 43 % some goats. The average herd size is estimated to be between 20-25 cattle (Issacson, 1995), with poorer households having fewer (Yaron *et al.*, 1992). The total number of animals in the regions east of Rundu are: 22,500 cattle and 6,700 goats). The numbers for cattle are thought to be increasing by 5 % per annum (GTZ, 1991). In the river region, Yaron *et al.* (1992) state that the carrying capacity is 15 hectares per large stock unit (LSU), while the actual grazing pressure is 5 hectares/LSU. The area is heavily overgrazed, as was found to be the case in the field study and as can be seen in the LANDSAT satellite image of the area (Figure 1).

Aside from livestock, crops and "bush food", fish constitute a major source of food, with riverine communities averaging 3-5 kilogrammes of fish per week per household. Though fish were thought to have decreased as early as 1990, Van Der Waal (1990) did not find this to be true. Both the social team and the biophysical team found that people perceived a large decrease in fish populations in the past couple of years.

The major threats to the area, as identified in Yaron *et al.* (1992) were: deforestation from clearing of land and fuelwood use; soil degradation from slash and burn agriculture; and overgrazing in the riverine areas due to lack of water further inland. All of these problems were evident in the field and it is obvious from the land clearing that was witnessed that the problems are increasing in magnitude.

### 3.1.2 Discussions with residents

The main point of concern which emerged from discussions with residents was the perceived lack of fish in the Okavango River. Aside from the area west of Rundu, this view was expressed by nearly everyone we encountered. The problem was attributed to the low water levels, though a few individuals also mentioned that heavy fishing exploitation was responsible. Residents also said that if the water levels in the Okavango River were further lowered, more fish would die and a main staple in their diet would be eliminated. From our discussions it was obvious that fish form a very substantial part of the diet for most people, though they have had to switch to other food sources during the current drought.



People also commonly mentioned that many of the plants from the Okavango River (water lilies and reeds) were disappearing. Water lily tubers are a very common component of the diet, whilst reeds are used for thatching and mat-making, and are a source of income.

Most gardens were not in good condition, and those people living in backwater areas along the Okavango River floodplain (Figure 2) said that waters no longer reached a point near enough to their gardens to facilitate watering. Hand-dug wells in gardens in these backwater areas tended to be dry or held very little water. As a result, some people were moving their gardens ever closer to the main channel of the Okavango River. However, it was also mentioned that the backwater gardens were better (? more productive) than those nearer the Okavango River because they had to be fertilized less this is undoubtedly due to the soils (sandier and less organic matter) near the river. It is unclear at this point how important the gardens are in terms of their contribution to the nutrition of people in the area. No garden sales or barter sales were quantified.

As with the social survey findings, people living along the Okavango River mentioned that crocodiles and hippos had disappeared from their areas during the recent drought years. Indeed, from the aerial survey, very few crocodiles were seen upstream of the Mahango Game Reserve and hippos were seen only in the area downstream of Popa Falls to the Botswana border. People also mentioned that fewer water birds have been seen in recent years.

It was curious that regardless of how far residents were living from the centre pivot irrigation schemes or from the road, they blamed the current low water levels (aside from drought) most often on the irrigation schemes and the water used for road construction. People in nearly every area we visited complained bitterly about both of these practices.

People also mentioned that although they generally perceived no water quality differences they found it more difficult to find deep pools for washing clothes and drawing drinking water. In shallow areas such activities stir up silt which necessitates moving constantly in order to obtain clear water.

One of the major impacts of the recent drought has been an influx of people into the riverine area along the Okavango River. As mentioned in the social assessment results, the Okavango River acts as a major drought reserve area. When waterholes dry up and grazing is finished in the inland areas, people come to the river. In addition, immigration has also occurred from Angola. People said that the increase in population along the Okavango River has been extremely high in the past 2 to 3 years.



### 3.1.3 Aerial Survey

It is clear that people's activities are highly dependent on the time of day. Fishing in particular seems to be an afternoon activity, at least during this survey. Most other activities (washing clothes, bathing and swimming, collecting water, harvesting reeds, and others) seem to take place equally in the morning or afternoon, or to occur slightly more frequently in the afternoon, though seasonally this may change. Livestock are found at the river much more commonly during the afternoon. See **Resource Use Table 1** in the **Appendix** for details.

Fishing was more common in Region 1 (**Figure 3**), closest to Rundu (**Resource Use Table 1 - Appendix**). If Regions 3-4 had been flown in the afternoon their figures would likely have been higher than illustrated. However, it was our general observation that more people were fishing near Rundu. Indeed, west of Rundu fishing seemed very common and many fish were being sold in that area. Discussions with residents confirmed the aerial observations - fishing being seen to become progressively poorer as one proceeds eastward along the Okavango River from Rundu.

The number of people engaged in household activities, (washing clothes, bathing and swimming, collecting water, harvesting reeds, travelling in mokoros, and general activities such as walking or standing near the river), were again greater near Rundu (**Resource Use Table 1 - Appendix**). However, the time-of-day factor must be kept in mind here.

Gardens were more numerous near Rundu - decreasing in numbers, despite an apparent increase in population numbers, the further east one proceeds from Rundu (**Resource Use Table 1 - Appendix**). It was evident from the aerial survey that gardens occurred in groups, not were not necessarily based on population centres located near the Okavango River. Also, gardens in several areas were lying fallow (not in use). Given the recent severe drought, many of the fallow gardens may simply be gardens that have been abandoned due to lack of production. Further social survey work may serve to explain the differences in the apparent importance of gardens within the different regions along the Okavango River.

The occurrence of livestock (only cattle are analyzed here as goat numbers were so few as to render comparisons meaningless) along the Okavango River varied according to region (**Resource Use Table 1 - Appendix**). Here it is clear that the time of day of the observations was a major factor. Nonetheless, for the sections flown at the same time (1 and 2 versus 3 and 4) it can be noted that cattle numbers seem to decrease from west to

east, despite an apparently opposite trend in population numbers. It may be noted that a general impression is that households become poorer further to the east - the area of least fishing activity, fewer gardens and fewer livestock observed. This may be due to the fact that those living nearer Rundu may have more employment opportunities available. The general observations have been summarized in **Figure 4**.

**Resource Use Table 2** compares the Namibian and Angolan sides of the Okavango River for: all fishing activities, numbers of gardens, people's activities, and numbers of cattle. Though time of day is a factor between regions, it was not a factor affecting a particular side of the Okavango River. The general trends show that the Angolan side has about the same levels of fishing (except near Rundu), more active gardens, greater or equal levels of activity (again, except near Rundu), and greater or equal numbers of cattle (again, except near Rundu). Unfortunately, population figures for the Angolan side are not available.

Aerial observations showed that permanent settlements were smaller and sparsely distributed; many long stretches of the Okavango River had no visible settlements on the Angolan bank. Hence, much of the natural resource use of the Angolan side of the Okavango River must be by Namibians, though people were very reluctant to admit to using Angolan territory when asked. Given the over-cropped and degraded state of many of the gardens on the Namibian side, it would make sense to move across the river to utilize the riverine and floodplain soils that have not been cropped continuously. A comparison of observations on activities conducted along the Namibian and Angolan banks of the Okavango River is shown in **Figure 5**.

We commonly saw cattle crossing over to Angola from Namibia. It is likely that Namibians rely heavily on the Angolan side for livestock grazing. The rangeland on the Angolan side of the Okavango River is in much better condition than that in Namibia, in almost every region down the river.

General observations, which have not been quantified at this stage, were that there were large sections of land along the Namibian side of the Okavango River (and to a much lesser extent on the Angolan side) that were very heavily degraded. In particular, some of the floodplain areas were nearly denuded of vegetation. Gardens in many of the backwater areas on the floodplains had been abandoned due to lack of flooding of those areas in the recent past - thereby increasing pressure on grazing of natural grasses as crop residues are no longer available to animals. Land is also being cleared on a large scale for several kilometres south of the Okavango River. This further limits grazing for subsistence farmers and increases deforestation. It is obvious that pressure on natural resources is increasing.



### 3.1.4 Social Survey

The rapid social survey found that several plants and animals were utilised (**Appendix Tables**). Most of the plants were used for their fruit and roots. Both medicinal and food uses were listed, with some of the medicinal plants being sold. The survey indicated that some of these plants were collected on the river banks and on the islands. However, many of the plants were quite widespread and would not likely be impacted by changes in water levels. However, further phases should particularly investigate those plants listed as being in the river, on the banks or on islands, though given the very small impact of withdrawal predicted by the hydrologists, it is unlikely that these plants will be impacted. It is, however, likely that these resources will slowly become depleted due to over-exploitation.

The survey found that very few animals were utilised, most for food and only some from the river itself. This is not surprising as the riverine area contained few animals (probably due to over-exploitation and disturbance). As with plants, the animals are likely to be impacted very little from the planned water abstraction, and more seriously impacted by over-exploitation.

## 3.2 Botswana

### 3.2.1 Background

According to the 1991 Botswana census (CSO, 1993), the population of Ngamiland District was approximately 96,700 (projected as 110,000 for 1997), with low population density relative to the rest of the country. Of this, 28 % live in Maun. Recent drought has led to an in-migration to the larger villages and population centres. The region's growth rate is estimated at 3.23 % (Scudder *et al.*, 1993).

Most households are engaged in smallholder agricultural production; most of these are engaged in dryland agriculture, and 15 % engaged in floodplain agriculture. Average field size is 2.2 hectares compared to the national average of 4.2 hectares (Ministry of Agriculture, 1995). On average only half of this land actually yields a harvest. Sorghum (31.7 %), maize (27.7%) and millet (32.3 %) are the primary crops. Though the northern area of the swamps receives 1,300 mm of rainfall per year, the southern area around Maun receives only 600 mm (Scudder *et al.*, 1993). There is increasing cultivation of former swamplands. While the soils in these areas may be rich, this increased cultivation, combined with livestock trampling, has resulted in serious wind erosion (Scudder *et al.*, 1993).

The area has a history of overgrazing, particularly during drought when livestock move toward the swamp (Scudder *et al.*, 1993). However, until the area is restocked with cattle (the herd was totally destroyed due to lung disease), further overgrazing will not be a problem, and there was no grazing, except by donkeys, at the time of this study. Areas of over-grazing along the western bank of the Okavango Panhandle and around the town of Maun can be seen on the LANDSAT satellite image (Figure 6).

Despite the importance of fishing to much of the population (2,000 - 4,000 people fish for home consumption and 750 people were classified in 1989/1990 as full-time fishermen), there are no reliable fish catch statistics (Scudder *et al.*, 1993).

Various plants and animals are exploited for food or sale. Reeds are an important source of income with yields estimated at P 10,000/hectare. Palms are used for basketry, an important source of income, and thatching grass is sold (Scudder *et al.*, 1993). Various fruits are utilised and two plants found throughout the swamps (tjita - bulrush) and tswii - waterlily) are common food items though, at the time of the IUCN report (Scudder *et al.*, 1993), these were thought to be on the decrease due to drought.

### 3.2.2 Discussions with Residents

We were fortunate to find a large group of people gathered in a meeting in Sekondomboro, on the east side of the upper Okavango Panhandle. We introduced ourselves and, were admitted to the meeting, along with our interpreter. The meeting was quickly transformed into a very hostile discussion of the proposed water abstraction project, as the people had heard of it from other sources, though they had few details. As we endeavoured to explain more about the proposals and about our role, the gathering became quite animated and hostility grew until two young men in the group, who spoke English quite fluently, came to our assistance and began to calm things somewhat. Once the group understood that we were assessing the local environment, and that we were interested in their uses of resources and their perceptions of potential impacts, people became quite helpful and the hostility disappeared. At that point, two hours or more into the meeting, we were able to gather useful resource-use information with the help of the two young men.

It became clear that people in the area were living through a period of severe stress. Their cattle had either died or were slaughtered due to the lung disease that had become an epidemic in the area. Given the culture of the region, this has caused both economic hardship and cultural distress, since the culture of the area is highly structured around livestock, and particularly cattle. The Botswana Government was providing some food and

financial assistance and had plans to re-stock cattle into the area. However, it was evident that the lung disease had a serious effect on the region as a whole.

People reported that fishing, which was a second major economic activity, was declining, though many people said that they still regularly ate fish. People all agreed that both water lilies (a food source) and reeds (a source of building material and a commodity commonly sold), had decreased since the previous year. People in the area, unlike those in Namibia, did not commonly have gardens near the river, nor did they engage in molapo farming. They did, however, have dryland farms, which had produced very poorly due to the prolonged drought. They had no boreholes or other water sources in the area, so they relied entirely on the river for all their water supplies.

As in Namibia, many people complained bitterly about irrigation along the Okavango River, though only one large scheme, downstream of this village (Sekondomboro) and near to Shakawe, was mentioned. People blamed irrigation, both in Botswana and Namibia, for the current low flows in the Okavango River. They stated that with continued extraction of water, the river would dry up and they would be without food or water.

It was interesting to note that while we use "river" in this report, the local people continually told us that "there is no river", "the river has died", and/or "we only have swamps here, no river any longer". People mentioned the Botswana Government scheme that was to take water out of the Okavango Delta, saying that the plan had been defeated because Botswana knew the swamps would die. They were, therefore, obviously upset to hear that Namibia wished to take some water from the system.

The meeting lasted over 3 hours and subsequently we only spoke with individuals in the area, who confirmed the feelings of the meeting.

It is clear that the economic base of the area has been thoroughly disrupted by the combination of lung disease, the prolonged drought and low water levels in the Okavango system. People's economic survival base has been reduced and they perceive further stress on the system unless rains return and river levels rise. Given that re-stocking of cattle is likely to take more than a year, and probably 2 or more years, the effects on the local and regional economy and on the psychological state of the people are likely to become more severe with time.

In the village of Ditshipi we spoke briefly to residents about tourism in the area and the effects of the drought and prolonged low water levels. Obviously, since they were within the concession area, they did not have livestock other than donkeys (used for ploughing

their fields). Despite having some fields, the village relied almost exclusively on the tourist trade since their fields were under constant pressure from wildlife. People here acted as guides both on land and in mokoros on the water. The general consensus was that the drought had placed stress on the land and animals and that the economy of the village had been negatively impacted, though tourists were still visiting the area in fairly substantial numbers. Here, again, there was strong opposition to any water extraction upstream.

The villagers in Ditshipi who were most directly involved in tourism generally seemed to know the area well, had a good knowledge of animals, including birds, and appeared to have a sound resource conservation ethic.

At the Government offices in Maun, because of the time of year, we were unable to contact many of the officials that should have been tapped for information. However, we were able to see one official in the Fisheries Department who informed us that Lake Ngami had been dry since 1984, the Yambezi and Mopipi rivers had been dry since 1985, the Boteti River was dry since 1993/1994, and the Thamalakane River last flowed in the 1994/1995 season.

In the past, catfish, tilapia, bream, tiger fish, African pike and barbel were stocked in some of the rivers, but many of the areas are now dry. Since there are greater numbers of people moving into the area, there is more pressure on fish populations as there is no fishing limit for subsistence.

The Fisheries Department currently has no idea about fish populations within the system nor any very clear idea about overall offtakes or harvesting of fish populations. A stock assessment by NORAD is scheduled for early, 1997. The current price of fish on the commercial market in Maun was quoted as P5/kilogramme, having increased since the start of the dry period.

The Department of Fisheries official was very concerned about the current decrease in water within the Okavango system as a whole and he was not supportive of any developments that would further decrease water levels.

We meet with the Programme Coordinator for the CBPP (lung disease) Eradication Programme. He said that the programme had destroyed 298,000 cattle and would be slaughtering approximately 18,000 more. He could not say how many animals had died of the disease prior to the eradication programme though it may have been as much as another 100,000 head of cattle.

People had originally been offered 30 % compensation in cash and 70 % in cattle but this was later reversed to 70 % cash and 30 % cattle, though apparently some people had been offered other types of packages. About 70,000 to 80,000 head of cattle were to be restocked by the Botswana Government, with some owners re-stocking their own herds. It is estimated that it will take 1 to 2 years to restock the area with cattle. As a measure to encourage crop farming, some 2,200 donkeys had been brought into the area, according to the Programme Coordinator, although there were already a huge number of donkeys present in the area.

Despite the slaughter of cattle, meat prices in the area had largely remained the same, as meat was imported from other areas of Botswana. It was not clear whether this meat price was subsidized.

It was clear that the massive slaughter of stock was a serious blow to the economy of the immediate area as well as Botswana as a whole (given compensation and re-stocking costs). It was emphasized that the area had little crop-farming and was almost entirely reliant on livestock.

One of the potential benefits from the de-stocking might be that the rangelands may recover somewhat from the heavy grazing pressure that has occurred in the past. However, this is less likely to occur if the drought continues.

### 3.2.3 Aerial Survey

Due to limited helicopter time available, much less area of the Okavango Panhandle and Okavango Delta was covered than would have been optimal. However, given the restricted use of the land within the concession area, using the same approach as was carried out in Namibia would not have been appropriate (except, perhaps, in the Okavango Panhandle). Land use for agriculture has been concentrated in the area east of the now dry lower Thaoge River channel where people are settling on the old floodplain and engaging in dryland agriculture there.

The same holds true for the area northeast of Maun, which was a seasonally flooded area. In that zone, people are moving their fields closer to the three rivers as floods have been confined to narrower areas due to drought. The soils in these floodplain areas are obviously more productive than areas further from water so people are pushing their fields as close as possible to the water sources in order to make as much use of the soils as possible.

It is evident that some of the areas in the floodplain that have not been turned into fields had been heavily utilized for grazing prior to the lung disease epidemic. In short, where waters have receded, veld degradation is occurring. Given the limited time, it was not possible to quantify the area of floodplain that has been converted to fields.

Little fishing was observed in the seasonally flooded area north of Maun, though fishing was observed at a few points along the Okavango Panhandle. Other activities such as laundry, drawing water, swimming, etc., were not commonly seen in either area. Indeed, in the Okavango Panhandle the Botswana Government was delivering water in barrels to villages as part of a drought relief programme. Given the lung disease epidemic and the attendant destruction of cattle herds, the increased movement of subsistence agriculture onto the floodplain, and the lack of flooding in traditionally flooded areas, the land use aspect is in a state of confusion and flux. The aerial survey, therefore, was used primarily to run mammal transects within the concession area and to view the extent of cultivated fields in the areas outside the Buffalo Fence.

#### 3.2.4 Social Survey

As with Namibia, the social team, in its rapid qualitative survey, found several plants and animals were utilised by residents for food, building, and medicinal purposes (**Appendix Tables**). Many of these were found along the river banks or in the river. Of particular importance was the waterlily (also identified by Scudder *et al.*, 1993 to be of major importance). The waterlily was thought to be decreasing in abundance in 1993 due to drought and it is likely, because of further drought, to have decreased since that time. Until the particular areas that will be impacted in the swamps due to water abstraction are identified, it is difficult to determine the extent of impact on these plants, though the order of magnitude is not likely to be severe.

The survey found few animals harvested - primarily for food. Fish were of obviously importance and they were thought to be in decline. Only a couple of other animals were named as being utilised - this may be due to the fact that hunting restrictions (because of the tourism concessions) are applied. Given the few animals utilised, any impacts on those species utilised will likely be minimal.

#### 4. LAND CAPABILITY

Land capability/formation and soils studies are being carried out using a combination of satellite imagery followed by ground-truthing (see the Geomorphology, Geology and Soils Report). Due to the problems experienced in obtaining the correct satellite imagery in a workable format, the analysis of the imagery has been delayed. When completed, this analysis will be useful in determining the extent of available resources in the broader zone along the Okavango River, Okavango Panhandle and Okavango Delta. Some ground-truthing of previously mapped soils and land classes in Botswana was carried out during this study.

A generalized soil map and a land classification map of the Okavango Panhandle and Okavango Delta areas was taken into the field. Ground-truthing was carried out in more than 15 of the soil types and 45 of the land types. In each segment, vegetation, general soils characteristics, and general land form and condition were recorded along with a GPS reading for each site. These data will be used to verify the land capability maps.

## 5. IMPACTS

### 5.1 Namibia

Clearly, the potential impacts from the proposed water abstraction scheme will depend on the amount of water abstracted and the floodplain topography and sensitivity (recent calculations are that the planned abstraction will effect the water level in the river by a matter of a approximately a centimetre and in the backwaters by varying smaller amounts). The recent low water levels in the Okavango River have particularly affected the backwater areas on the floodplains. These are areas that have, in the past, provided local people with their main source of natural resources, from good garden soils, to edible and medicinal wild plants, and good seasonal grazing.

In addition, these floodplain areas are important breeding sites for fish, amphibians and reptiles after initial inundation of the floodplains. Since fish are of primary importance as both a food and income source, any negative impact on the fish populations would be very serious for the local population.

If some backwater areas are not inundated, this will seriously impact the grazing resource by reducing production in these areas and by eliminating crop residues from the livestock diet. Crop residues are an important dry season food source for livestock in many economies. Given the projected small areal effects from the planned emergency offtakes, only very small areas of backwater grazing and crop production will be affected.

Should gardens need to be moved nearer to the Okavango River, four problems will be encountered: 1) lack of available space; 2) poorer soil conditions; 3) the need to fertilize and the attendant risk of pollution from runoff into the river, 4) potential flooding in following season. Again, the necessity to move gardens as a result of the proposed water abstraction is regarded as minimal.

It is clear that lower water levels in the main river channel affect fishing success, the availability of reeds for home use and sale, and the availability of various aquatic food and medicinal use plants. The area is already heavily impacted by over-exploitation, particularly during the recent drought years. It is likely that drought and continued heavy use will have much greater impact on these resources than the planned emergency level water abstraction.

The people of this region are very poor (see the social survey); thus any negative impacts on their natural resources will have a devastating effect on their household economics and perhaps their ability to survive.



The potential extent of areas that may be affected by water abstraction was calculated long after the initial fieldwork (though the exact areas of the effect are still unknown and must be mapped in the follow-on work). In the follow-on wet season work it is essential to assess the probable loss of natural resources in those areas, as well as the attendant effects on the livelihood of the local populace. It would be unreasonable and dangerous merely to assume that small water offtakes, simply because they are small, would not have significant impacts.

## 5.2 Botswana

The potential impacts from the proposed water abstraction scheme would depend on the precise amount of water that is abstracted, the timing and duration of such abstraction, and the floodplain topography and sensitivity. Though the total areal extent of impact has been estimated, the specific locations of the impact are not yet mapped. Once this is done, the wet season work can assess the impacts on those particular areas. Clearly, the recent low water levels in the Okavango River have affected communities both in the Okavango Panhandle zone and, in particular, those in the seasonally flooded areas outside the veterinary cordon fence (the Buffalo Fence). These are areas that have, in the past, provided the local populace with good fishing, good seasonal grazing, and many other natural resources such as wild plants for food and medicine (see **Resource Use Botswana Plants and Animals Tables, Appendix**). In addition, some of these areas and their backwaters may be important breeding areas for fish, amphibians and reptiles. Since fish are of primary importance as both a food and income source, any negative impact on the fish populations would have very serious implications for the communities who rely on this resource.

If seasonally flooded areas are not inundated to the same extent as in the past, this will seriously impact the grazing resource by reducing production in these areas. In addition, fishing in these specific areas will be all but eliminated (as now appears to be happening), and medicinal and other plants requiring floodwaters could become scarce. Floodplain areas could be expected to be converted to fields; these may become flooded if a series of good rainfall years occurs. Conversion of floodplain areas to fields carries with it the attendant danger of increased erosion as well as soil nutrient depletion over the long-term. Current estimates based on the emergency scheme abstraction rates show approximately 7 km<sup>2</sup> of land would no longer be inundated due to abstraction. However, this would be an "edge-effect" around the shoreline and, due to topography, would vary across the Okavango Delta. It is unlikely that any one area would be seriously impacted. However, once areas can be mapped, the specific impact centres can be assessed in detail.

It is clear from the effects of the recent drought that lower water levels in the main channels of rivers in the Okavango Panhandle and parts of the Okavango Delta affect fishing success, the availability of reeds for home use and sale, and the availability of various aquatic foods and medicinal use plants (see **Resource Use Botswana Plants and Animals Tables, Appendix**). Again, once areas of impact are mapped, the potential significance of impacts at these particular sites can be assessed in detail. From the low total area to be effected it is unlikely that any one area would be seriously impacted.

The people of this region are now under severe stress from prolonged drought (which has affected cropping, grazing and fishing) and the recent elimination of their cattle herds due to lung disease. Thus any negative impacts on their natural resources due to water abstraction would have a further negative effect on their household economies and perhaps their ability to survive should key areas be seriously impacted. Again, given the small area of projected impact, serious adverse effects are not anticipated.

It is absolutely essential to quantify the potential extent of areas that may be affected by the proposed water abstraction scheme and to then assess the probable loss of natural resources and changes in land use patterns in those areas, as well as the attendant effects on the livelihood of the local population. Once again, it would be unreasonable and dangerous merely to assume that small water offtakes, simply because they are small, would not have significant impacts.

## 6. CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Namibia

Given the findings of the hydrology report which shows that water level changes along the Okavango River in Namibia and Angola would be very small, it is unlikely that any serious impacts would occur, or, if they did, they would be restricted to small areas.

It is essential to better quantify natural resource use by people along the Okavango River, including the use of water. First, it is critical that the particular areas that would be affected be mapped (this requires considerable survey work). The quantification of resource use in these areas could then be done in the wet season using additional aerial surveys coupled with social survey work on the ground. Alternative sources for various natural resources should be investigated. A critical point of investigation should be the extent to which backwater resources may be lost if water levels continue at a low level or are lowered even further. Additional information on the use of natural resources on the Angolan bank should be obtained.

If any areas are identified that would be seriously impacted (unlikely at the rates of emergency abstraction), it would be necessary to quantify the change in diet necessitated by the lack of fish, the reduced number of riparian food plants, etc., in order to assess the potential impacts of low water levels on people's incomes and health.

The quantities of garden produce, fish, reeds and other traded commodities should be estimated in any impacted areas in order to assess the potential impacts of low water levels.

### 6.2 Botswana

The situation with Botswana is similar. Once the particular areas that would be affected are mapped, the significance of the potential impacts in these areas can be assessed. In which case, more information would be needed to quantify the changes in land use, particularly the conversion of floodplain areas to dryland fields for subsistence agriculture. A history of water recession from areas previously flooded, and the impacts of that recession, would provide a good indicator of impacts that may result from continued low water levels or further lowering of water levels.

The potential for increased irrigation using water from the Okavango system must be investigated as many people believe that there are plans for medium- to large-scale projects

both in Namibia and Botswana, as well as possible moves to initiate irrigation projects in Angola. This would add to the cumulative impacts on the entire Okavango system.

As with Namibia, the low total area of impact, and the very strong likelihood that this would be expressed as an "edge effect", indicates that it is unlikely that impacts would be serious or, if so, the area of serious impact would be small. Nonetheless, an assessment should be made of areas that, due to their very flat topography, may experience water recession of a few centimetres up to several meters from the existing shoreline as some of these areas may provide essential habitat for plants and animals.

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**Resource Use Table 1: Summary of overflights in Namibia / Angola, both sides of the Okavango River by Region. Region boundaries correspond to those used in the Social Survey work. Numbers are expressed as counts per kilometre.**

Region	Distance (km)	Fishing				Total all Fishing	No. of Gardens	Other Activities Items						Total Other Activities	No. of Animals	Unused Makoros
		Bow & Arrow	Makoro	Basket	Net			Rod on Bank	Washing Clothes	Bathing & Swimming	Collect Water	Harvest Reeds	In Makoro			
1	54.25	0	2.45	4.52	5.83	0.40	63.51	10.91	12.67	1.83	0.20	2.41	44.97	284.29	11.05	
2	75.0	0.24	0.92	1.46	1.65	0.38	38.97	2.25	2.28	1.09	1.01	0.99	4.50	239.91	17.65	
3	48.25	0	0	0	0	0.05	30.76	1.05	0.25	0.53	0.46	0.39	3.89	9.93	4.41	
4&5	45.75	0	0	0	0	0	24.35	1.54	2.39	2.61	0.14	0.54	1.05	4.18	9.11	
End	17.0	0	0	0	0.29	0	9.55	1.69	0.86	2.25	0.90	0.04	0.78	2.84	6.07	

**Resource Use Table 2: Summary of people's activities per kilometre of Okavango River in Namibia and Angola, by Region. Region boundaries correspond to those used in the Social Survey work. Numbers are expressed as counts per kilometre.**

Region & Distance	Country	Fishing				Total all Fishing	No. of Gardens	Other Activities Items					Total Other Activities	No. of Animals	Unused Makoros	
		Bow & Arrow	Makoro	Basket	Net			Rod on Bank	Washing Clothes	Bathing & Swimming	Collect Water	Harvest Reeds				In Makoro
1 54.25 km	Nam	0	2.23	3.13	4.73	0.40	11.52	9.69	9.10	1.21	0.07	2.41	13.30	34.88	172.97	3.94
	Ang	0	0.22	1.39	1.10	0	51.99	1.22	3.55	0.61	0.13	0	2.13	7.64	141.38	7.12
2 75.0 km	Nam	0.24	0.11	0.59	0.69	0.11	16.01	2.02	2.17	0.69	0.31	0.99	3.35	9.33	41.66	15.31
	Ang	0	0.81	0.88	0.94	0.27	22.97	0.22	0.10	0.40	0.68	0	1.15	2.56	198.25	2.33
3 48.25 km	Nam	0	0	0	0	0.05	11.14	0.89	0.25	0.30	0.36	0.39	0.80	3.00	5.01	3.89
	Ang	0	0	0	0	0	19.63	0.17	0	0.23	0.11	0	3.09	3.60	4.91	0.52
4&5 45.75 km	Nam	0	0	0	0	0	11.45	1.11	0.57	0.73	0.14	0.54	0.75	3.83	2.85	3.57
	Ang	0	0	0	0	0	12.91	0.44	1.82	1.88	0	0	0.31	4.45	1.34	5.55
End 17.0 km	Nam	0	0	0	0.29	0	9.54	1.69	0.86	1.25	0.90	0.04	0.78	5.52	2.84	6.07
	Ang	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Resource Use Table 3: Namibia Data for resource use - plants.

Community	Location	Plant Used	Language	Part(s) Used	Purpose	Sales	Where Found	When Found		
Vhungu-Vhungu	River 1	ntija - tree	geiriku	fruit	food	yes	near the river	all year		
		shioo	geiriku	leaves, bark, flower	medicinal	no	near the river, on islands	all year		
		munyinda	geiriku	roots	medicinal	no	near the river, on islands	all year		
		njaki	geiriku	roots	food	yes	near the river	Jun-Sept		
		ndiyurengo	geiriku	roots	food	no	near the river	Feb-June		
Kehemu	River 1	sikafikali - tree	rukwangali	roots	medicinal	n.a.	river banks	all year		
		mulumivi	rukwangali	roots	medicinal	n.a.	near the river	all year		
		vamvara-vamvara - tree	rukwangali	roots	medicinal	n.a.	near the river	all year		
		mudingabu - tree	rukwangali	leaves	medicinal	n.a.	near the river	all year		
		ekengoro - tree	rukwangali	leaves	medicinal	n.a.	near the river	all year		
		nkomba - tree	rukwangali	roots	medicinal	n.a.	near the river	all year		
		karonda mambu - tree	rukwangali	roots	medicinal	n.a.	river banks	all year		
		sikangwe - tree	rukwangali	roots	medicinal	n.a.	near the river	all year		
		mukekete - tree	rukwangali	fruit	food	n.a.	near the river	all year		
		ugavi - tree	rukwangali	fruit and leaves	medicinal	n.a.	near the river	Apr-Aug		
		Katere	River 2	mashua	geiriku	roots	food	no	along river bank	Nov-March
				njaki	geiriku	roots	food	yes	near the river	Dec-Jan
				nibeti	geiriku	roots	food	yes	near the river	Nov-Feb
				namayara	geiriku	leaves	food	no	near the river	Oct-Jan
				livughu-vughu	geiriku	leaves	food	no	near the river	all year
shikuit-mulimbo	geiriku			leaves	food	no	near the river	all year		
nija - grass	geiriku			fruit	food	no	near the river	Oct-Jan		
ndagho - grass	geiriku			roots	food	no	near the river	June-Jan		
mughome - tree	geiriku			fruit	medicinal	no	various areas	all year		
matu - tree	geiriku			fruit	food	no	in the bush	June-Sept		
Shadikongoro	River 3	utunda - tree	thimbukushu	fruit	food	no	near the river	May-Sept		
		ghutha - tree	thimbukushu	leaves	medicinal	no	near the river	all year		
		shika - tree	thimbukushu	fruit	green manure	no	near the river	July-Oct		
		ghushi - tree	thimbukushu	roots and leaves	food	yes	near river, on islands	Nov-Apr		
		thimba - tree	thimbukushu	bark	medicinal	no	near river, on islands	all year		
		ghutu	thimbukushu	leaves	poison fish	no	near the river	all year		
		ghutu	thimbukushu	fruit	medicinal	no	in bush & near river	Oct-Mar		
		ghutu	thimbukushu	roots and leaves	food	yes	in bush & near river	Oct-Mar		
		ghutu	thimbukushu	fruit	food	yes	in bush & on islands	Nov-Mar		
		ghutu	thimbukushu	leaves	medicinal	no	in bush & on islands	all year		
Dagani	River 4, 5, 6	ghughumi	thimbukushu	fruit	beer	yes	near river, on islands	Nov-Mar		
		ghutha - tree	thimbukushu	roots and leaves	medicinal	no	near river, on islands	all year		
		ghushiko	thimbukushu	fruit	medicinal	no	near river, on islands	Nov-May		
		mukudikudi	thimbukushu	roots and leaves	food	yes	near river, on islands	Nov-May		
		ghuroro - tree	thimbukushu	fruit	medicinal	no	near river, on islands	all year		
		ghutu - tree	thimbukushu	fruit	food	no	near river, on islands	Sept-Nov		
		ghutu - tree	thimbukushu	leaves	medicinal	no	near river, on islands	all year		



Resource Use Table 4: Namibia Data for resource use - animals.

Community	Location	Animal Used	Language	Part(s) Used	Purpose	Sales	Where Found	When Found
Vhangu-Vhangu	River 1	None listed	-	-	-	-	-	-
Kehemu	River 1	sinkarankara	rukwangali	urine	medicinal	n.a.	no information on the river	no information all year
		sikambo - bird	rukwangali	feathers	dress	n.a.	no information on the river	no information all year
		ngwe	rukwangali	claws	magic	n.a.	no information on the river	no information all year
		elephant	-	oil	medicinal	n.a.	no information on the river	no information all year
		mbago	rukwangali	skin / hide	magic	n.a.	no information on the river	no information all year
Katere	River 2	mvu	gciriku	meat	food	yes	in the river	all year
		mbuli	gciriku	meat	food	no	in the river	all year
		ntushi	gciriku	meat	food	no	in the river	September
		ntendi	gciriku	meat	food	no	in the river	Nov-March
		mbamba	gciriku	meat	food	no	in the bush	all year
		ndimba	gciriku	meat	food	no	in the forest	all year
Shadikongoro	River 3	None listed	-	-	-	-	-	
Bagani	River 4, 5 & 6	None listed	-	-	-	-	-	

n.a. = not asked

Note: people in some locations were reluctant to answer questions because hunting is prohibited.

**Resource Use Table 5: Botswana Data for resource use - plants.**

Community	Location	Plant Used	Part(s) Used	Purpose	Sales	Where Found	When Found
Matlapaneng	South	tswii - water lily	fruit and roots	food	yes	along river bank	all year
		lotlhaka - reeds	stem	building	yes	along river bank	all year
		tsitla	stem	thatching	yes	along river bank	all year
		mophiti	fruit and roots	medicinal	n.a.	within 500 m of river	Nov-March
		mogaga	root	medicinal	n.a.	within 500 m of river	all year
letsoo la khudu	fruit and roots	medicinal	n.a.	within 500 m of river	all year		
motimodiso	fruit and stem	medicinal	n.a.	within 500 m of river	Nov-March		
Beetsa	East	mongoma	root	medicinal	n.a.	near the river	Nov-March
		mogorogwane	fruit	food	n.a.	near the river	Nov-March
		mogwane	root	medicinal	n.a.	near the river	all year
		nxotamatemo *	fruit	food	n.a.	near the river	Nov-March
			roots and leaves	medicinal	n.a.	near the river	all year
Seronga	East	lotlhaka - reeds	roots, leaves, stem	medicinal	n.a.	in the river	May-Aug
	koma	stem	stem	building	yes	within 500 m of river	May-Aug
	botang - grass	roots	roots	food	yes	along river bank	Dec-Feb
	tswii - water lily	stem	stem	mats	yes	along river bank	Dec-Feb
	tsitla	fruit and roots	fruit and roots	thatching	yes	along river bank	all year
		stem	stem	food	yes	along river bank	all year
		roots	roots	thatching	yes	along river bank	Mar-June
			roots	food	yes	along river bank	Mar-June
Gumare	West	lebiba	roots and stem	medicinal	n.a.	near the river	Mar-June
		motshebi	fruit and roots	medicinal	n.a.	near the river	all year
		mophiti	roots	medicinal	n.a.	in the river	all year
		moupotu	fruit	food	n.a.	near the river	Nov-Apr
		moretologa wa kgomo	leaves and stem	medicinal	n.a.	near the river	all year
			fruit	food	n.a.	100 m from river	Nov-Apr
			roots	medicinal	n.a.	100 m from river	all year
			roots and stem	medicinal	n.a.	in the river	Nov-Apr
			fruit and roots	food	yes	along river bank	all year
			stem	building	yes	along river bank	Aug-Dec
	stem	thatching	yes	along river bank	Aug-Dec		
	roots	food	yes	along river bank	all year		
	stem	mats	yes	along river bank	all year		
	roots	food	yes	along river bank	all year		

note: n.a. = not asked; \* = name in Thimbukushu (all other names in Setswana).

Resource Use Table 6: Botswana Data for resource use - animals.

Community	Location	Animal Used	Part(s) Used	Purpose	Sales	Where Found	When Found
Matlapaneng	South	thlapi - fish khudu - tortoise pihudi - ducks uopane kubu - hippo	meat	food	yes	everywhere in river	all year
			meat	food	no	everywhere in river	all year
			meat	food	yes	on the river	all year
			feathers	pillows	yes	on the river	all year
			meat	food	no	in the river	all year
			meat	food	yes	in the river	all year
Beetsa	East	mokgweba - bird kgori - bird	meat	food	n.a.	near the river	all year
			bone	medicinal	n.a.	near the river	all year
			meat	food	n.a.	near the river	all year
			feathers & veins	medicinal	n.a.	near the river	all year
Seronga	East	sitatunga thlapi - fish letswee	meat	food	yes	in/near the river	all year
			meat	food	yes	everywhere in river	all year
			meat	food	no	in/near the river	all year
			skin - hide	mats	yes	in/near the river	all year
			stem	mats	yes	along river bank	all year
Gumare	West	sitatunga thlapi - fish letswee kubu - hippo	meat	food	yes	in/near the river	all year
			meat	food	yes	everywhere in river	all year
			meat	food	yes	in/near the river	all year
			skin - hide	mats	yes	in/near the river	all year
			meat	food	yes	in the river	all year
skin - hide	belts	yes	in the river	all year			

n.a. = not asked.

## COMMENTS ON THE SOCIAL IEE RESOURCE USE QUESTIONNAIRES

### NAMIBIA

Note: TD = traditional doctor  
R = residents

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*Question:* How are rules set among traditional doctors governing the use of plant resources? Are these rules effective, or are there problems?

**Area: River 1**

TD: No one should cut the trees which are being used by the traditional doctors.

R: There are rules. It is prohibited to cut or to burn the trees and this rule is effective. The problem is that it is very difficult to know who burned the tree or the bush.

**Area: River 2**

R: There are no rules.

**Area: River 3**

R: It is prohibited to cut or burn trees. The rules are effective but it is difficult to know who burned the tree. Some people burn the bush, then the fire burns some trees near it.

**Area: River 4,5,6**

R: Rules are very effective. Even if you want to have land, all other trees can be cut off but trees like ghughumi and other important trees can't be cut off even if it is in your field. But it is difficult to know who is burning and cutting trees.

*Comment:* While it appears that there are rules regarding trees in particular, it is also clear from observations that a lot of land is being cleared in the area between the river and the TransCaprivi Highway. It appears that burning and cutting are not as well controlled, and this comes across in the responses.

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*Question:* Of the plants available in the dry season of a drought year, such as this year, which are often in short supply? What are the causes of these shortfalls? What are the effects of these shortfalls?

**Area: River 1**

TD: Medicine for women is in short supply.

R: Mostly all the trees are in short supply. The cause is the shortfall of rain, and it affects the community, they are starving and there is no more fruit to eat.

**Area: River 2**

R: Maguni is in short supply.

**Area: River 3**

R: All trees are in short supply. The cause is the rain. It affects the community.

**Area: River 4,5,6**

R: Most of them are in short supply. The cause is this dry (no rain). Some people don't want to go in the field (bush) because they know that fruit is now in short supply and it is affecting them.

*Comment:* Again, trees (fruit) seem to figure prominently in this question. The extent to which people rely on fruit as part of the diet should be examined further in the full EIA. The distribution of these fruit trees should be investigated the tables associated with this study appear to show that distribution is heavily centred near the river.

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*Question:* Consider changes in access to such important plants over the past years. Are any of the plants in shorter supply now than in the past?

**Area: River 1**

TD: Yes, because some plants can't live without water.

R: All the plants are now in shorter supply than in the past. None have disappeared. There is no change in distance to plants as they are all near the river.

**Area: River 2**

R: Yes, even trees are not found

**Area: River 3**

R: All these plants are now in shorter supply than in the past. They are still at the same distance from the village. None have disappeared.

**Area: River 4,5,6**

R: All the plants are now in shorter supply, but the distance to them is still the same. All the important plants are still there; haven't disappeared.

*Comments:* This is similar to the response to the last question. We believe that people are thinking primarily about trees here some grass or forb species may well have disappeared from certain areas but people seem to attach less importance to them. This should be probed in the wet season work, especially as it relates to grazing. The economic effect of the short supply should be investigated.

Most people said that poorer households rely on plants more than richer households particularly certain trees that provide food and medicine.

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*Question:* How are rules set among traditional doctors governing the use of animal resources? Are these rules effective or are there problems?

**Area: River 1**

TD: Only rules are from the government. These say not to kill animals because they are very important.

R: No response.

**Area: River 2**

R: Rules say you can't kill animals even if they are damaging the beans.

**Area: River 3**

R: No response.

**Area: River 4,5,6**

R: No response.

*Comment:* Clearly, people were aware of rules governing hunting, hence the lack of response on all of the animal-related questions. People use some of the animals (see tables), but they are reluctant to discuss the killing of animals. Because of this, it may not be possible to get accurate figures on the use of animals in the area.

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*Question:* Of the animals available in the dry season of a drought year, such as this year, which are often in short supply? What are the causes of these shortfalls? What are the effects of these shortfalls?

**Area: River 1**

TD: All animals were available.

R: No response.

**Area: River 2**

R: No shortfalls.

**Areas 3,4,5,6**

R: No responses.

*Comment:* Again, an obvious reluctance to discuss animal-related issues. Animal population differences between the communal and commercial areas along the pipeline seem to indicate that there are still fairly large numbers of some large mammal species in both areas, though far more on the commercial areas than the communal. The difference may be due to hunting pressures, land use practices or a combination of both.

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The traditional healer was asked two additional questions:

*Question:* The Okavango River/Okavango Delta is at an all time low. Please describe how this flow has affected you and your work.

**Area: River 1**

Some of the trees are dry because of the low flow and the need for water.

*Question:* Are there parts of the river in your area that people fear to go to because of witchcraft? If yes, what are these areas and why are people afraid to go there.

**Area: River 1**

None.

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**BOTSWANA**

*Question:* How are rules set among traditional doctors governing the use of plant resources? Are these rules effective, or are there problems?

**Area: East**

TD: There are no rules. The forefathers used no rules so why should there be rules.

R: There are some rules set by tribal authorities

**Area: South**

TD: There are no rules because people don't cheat.

R: There are no rules.

**Area: West**

TD: There are no rules, why should there be. There is no need for rules because healers understand their work.

R: There are no rules.

*Comment:* It is interesting that in Botswana there appear to be no rules governing use of plant resources, unlike Namibia where trees, in particular, are protected. The patterns of resource use are, from observation, different in Botswana so rules may not be necessary. This may mean, however, that degradation might be less controllable in Botswana.

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*Question:* Of the plants available in the dry season of a drought year, such as this year, which are often in short supply? What are the causes of these shortfalls? What are the effects of these shortfalls?

**Area: East**

TD: There are some plant shortages because of shortage of water. We face some difficulties in the work and hence we have to gather a lot of plants in the rainy season to cover the dry season shortage.

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R: All of these plants have gone down because of a shortage of water.

**Area: South**

TD: All plants are available throughout the year and the supply is the same. These plants do not grow into the water and therefore they are not directly affected by the water. However, water offtake will lead to loss of the underground water which may have direct effect on the plants.

R: All plants are affected because during the dry season the water runs dry and this results in plants dying for they grow along the riverbank.

**Area: West**

TD: Plants are affected because of shortage of water and rain. This has affected the work because some of these plants are nowhere to be found.

R: The plants depend on the river. If it is dry but the river is there, there are no shortfalls.

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*Question:* Consider changes in access to such important plants over the past years. Are any of the plants in shorter supply now than in the past?

**Area: East**

TD: The supply has gone down. Some have disappeared. These were mainly used by the forefathers.

R: No plants have disappeared.

**Area: South**

TD: There are no plants that have disappeared.

R: Reeds have disappeared.

**Area: West**

TD: Motemodiso and moretologa wa kgomo have disappeared. We have to walk long distances to get some of these plants, like lebita.

R: Lotlhaka is in short supply. No plants have disappeared.

*Comment:* Most people did not notice local extinctions. It is not surprising that the healers tended to give more specific answers, since they depend more on plants for their living. The economic value of plants must particularly address the issue of traditional doctor's incomes.

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*Question:* How are rules set among traditional doctors governing the use of animal resources? Are these rules effective or are there problems?

**Area: East**

TD: Yes, these are set by government. You have to get a license when you want to hunt sitatunga and letswee.

R: Yes, there are rules set by government.

**Area: South**

TD: No response.

R: There are rules. You can kill hippopotamus if it destroys your field. You take a permit when you kill bucks.

**Area: West**

TD: No response.

R: There are rules set by government. They sometimes raffle and the winner gets to hunt sitatunga, letswee and hippopotamus. We are free to hunt fish anytime.

*Comment:* Rules regarding hunting seem to be widely known. The lack of response on animal questions by the traditional healers in two of the three areas is interesting. It may be because they are more likely to use animal resources and do not wish to discuss the topic.

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**Question:** Of the animals available in the dry season of a drought year, such as this year, which are often in short supply? What are the causes of these shortfalls? What are the effects of these shortfalls?

**Area: East**

**TD:** Fish are often in short supply because of a shortage of water. People are starving because they use fish as a source of food and income.

**R:** No response.

**Area: South**

**TD:** No response.

**R:** They are all reduced because they rely more on water.

**Area: West**

**TD:** No response.

**R:** They all depend on the river. As long as the water is available there is no problem.

**Comments:** The fact that fish were only mentioned by one respondent could be due to the phrasing of the question. "Animal" may not be viewed by some people as including fish. In *ad hoc* interviews regarding fish, all residents were very concerned that fish had decreased because of low water (though overfishing may also be a cause).

In all cases where people responded, they said that poorer households were more reliant on animals than people in other economic classes. Fish were mentioned here in particular.

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The traditional healers were asked two additional questions:

**Question:** The river/delta is at an all time low. Please describe how this flow has affected you and your work.

**Area: East**

The low flow of the water has affected me because many of the plants depend on the river and therefore some of these plants are no longer there.

**Area: South**

This has affected the work because many of these plants are hardly found and some of these have disappeared, like moretologa wa kgomo. I relied very much on those plants.

**Area: West**

No response.

**Comment:** Again, it would be important in follow-on work to more closely establish the location of important plants, to put scientific names to them, and to calculate the economic value to the residents of such plants and then determine the potential amount of loss, if any, from project-related impacts.

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**Question:** Are there parts of the river in your area that people fear to go to because of witchcraft? If yes, what are these areas and why are people afraid to go there. -

**Area: East**

No. Because everybody is a witch, people cannot be afraid of witchcraft because they are the ones that do that.

**Area: South**

No such places.



Area: West

No response.

*Comment:* The extent of resource use, particular for plants in or very near the river and backwaters and for animals in or near the river should be further quantified and the economics of such use should be studied to determine what effects any impacts may have on the economics of various economic classes of residents throughout the area.

