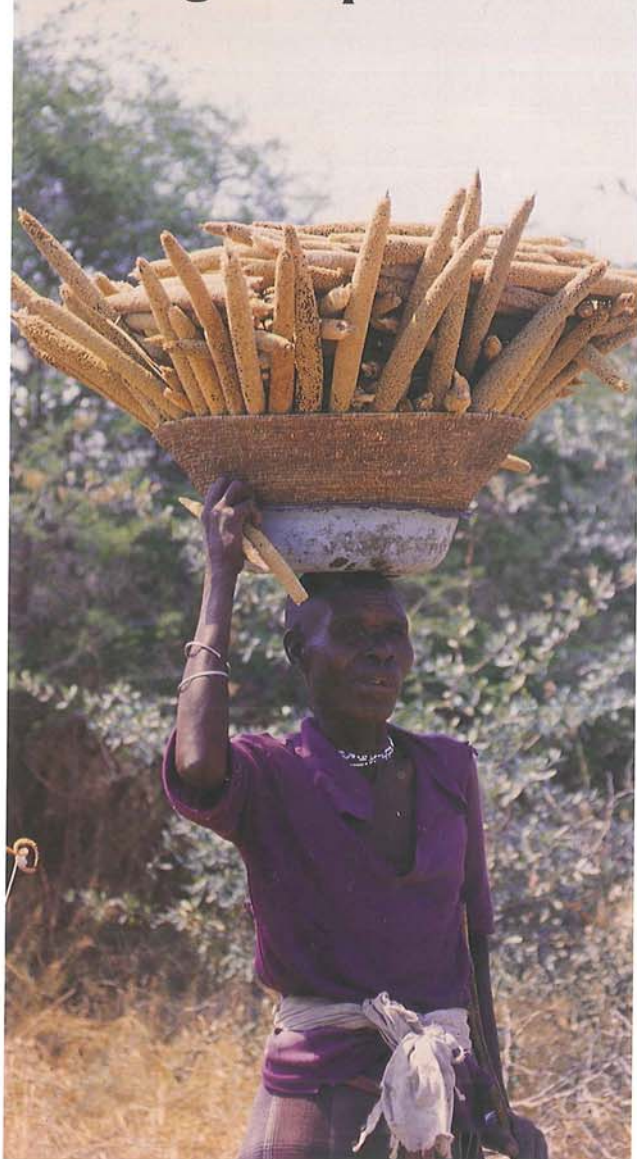


Chapter 6

Farming in Caprivi



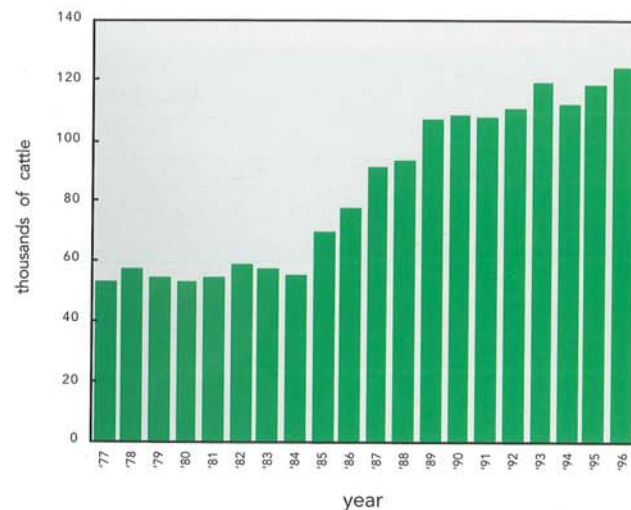
Of all economic and livelihood activities in Caprivi, agriculture is the most important. People spend more time farming than at any other economic activity. It provides the majority of people with most of their income, food and security. Farming activities have also had the greatest impact on the region's natural environment. Large areas have been cleared to plant crops, great numbers of cattle graze the region's natural pastures, and much of the area is burnt each year, apparently to stimulate the growth of new grazing.

Stock farming

Stock farming is dominated by cattle in Caprivi. Cattle are highly prized for their value as tangible resources providing benefits such as draught power, milk, meat and cash income, but especially for their social value in giving herd owners security, rights to land and status. Goats and poultry, by contrast, are valued only in terms of food and as a source of income. Control over cattle and goats is in the hands of men, while women control poultry. Cattle owners employ herd boys — because the majority of Caprivian children go to school, most child labour is obtained from Zambia and the Kavango Region.

The major constraints on cattle numbers are water, pasture or grazing availability and quality, and diseases. The total number of cattle in 1996 amounted to about 135 000 head — 10 500 cattle in the Mukwe area, 300 in the Caprivi strip and 124 000 in eastern Caprivi¹. Information on numbers of other stock are only available for the eastern Caprivi where, in 1996, there were about 6 600 goats, 21 500 chickens and just a handful of pigs and horses. Some 5 700 dogs and 1 900 cats were also counted!

Vaccination programmes which keep cattle healthy have been responsible for increasing cattle numbers in Caprivi recently. However, lung disease could have a devastating effect on Caprivi's cattle. Cattle in eastern Caprivi have not had any recent history of lung disease infection, so resistance levels are low. Widespread and significant mortality is probable if, or when, the disease is brought into the region, and radical control measures may be necessary. Several hundred thousand cattle were killed in north-western Botswana in 1996 in an effort to control an outbreak of lung disease. Cattle carrying the disease occur just north of the border in Zambia, and Caprivi cattle could easily be infected from that source.



Cattle numbers (1977–1996)

Cattle numbers have increased dramatically over the past 20 years, and have more than doubled during the last 11 years¹. There are probably two main reasons for this increase. The first is that the occurrence of many diseases has dropped in recent years². Perhaps the most important of these is the bacterial disease *Pasteurellosis*. Vaccines against the disease were introduced in the mid-1980s and cattle deaths dropped dramatically. The vaccination programme was stopped in 1992. The second reason is that the lower river levels and reduced flooding in recent years have led to increasing access to grazing pastures on the eastern floodplains, around Lake Liambezi and in the Linyanti Swamps. With increased pastures, cattle are probably in better condition, resulting in higher calving rates and lower death rates.

These changes in cattle numbers have had several major impacts in Caprivi:

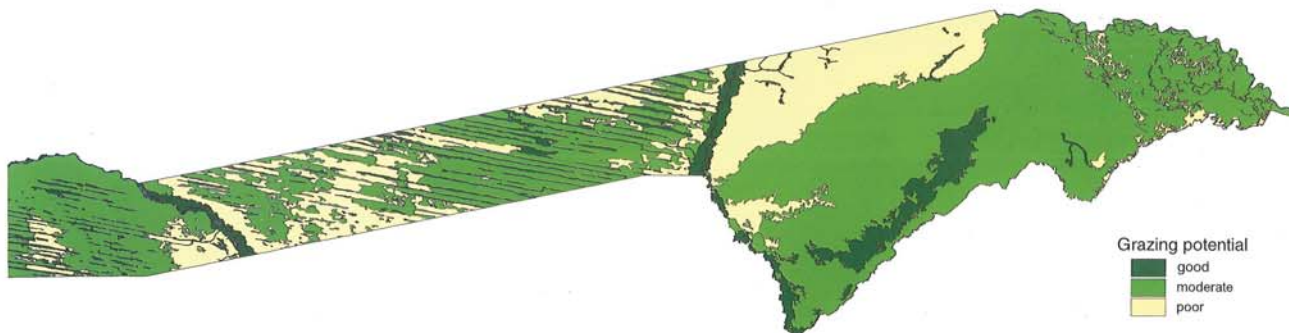
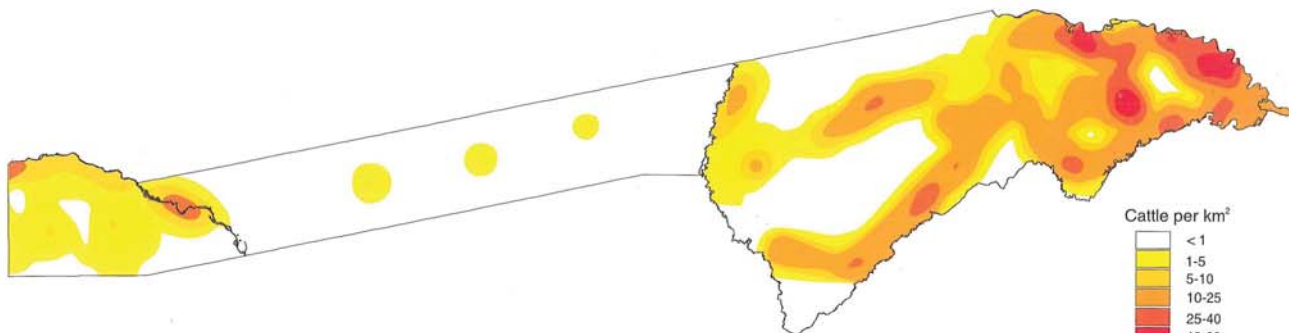
- grazing pressures on natural grasslands have doubled over the past 11 years
- the wealth and consumption levels of cattle owners have increased substantially
- the number of cattle owners has increased
- draught power with which to prepare fields for cultivation has increased, enabling farmers to clear and cultivate more land

Densities of cattle, pasture quality and grazing pressure

About half of all cattle in Caprivi are concentrated in the eastern floodplains. This map is based on cattle numbers counted at all crushpens and the assumption that all cattle are distributed within a range of ten kilometres from each crushpen². Other areas with high densities are along the Linyanti and Chobe swamps, along the Golden Highway (road between Katima Mulilo and Kongola), and along the Kwando and Okavango rivers. The crushpen counts were largely obtained during winter in 1996, but counts in 1995 provide very similar density patterns. In winter, cattle are more concentrated near permanent water, either along rivers or near water provided from wells and boreholes. After good summer rains have fallen they are often moved further afield into areas where temporary pans have filled with water. However, these movements are not over great distances and the overall density patterns in summer are similar to those shown here.



(PT)

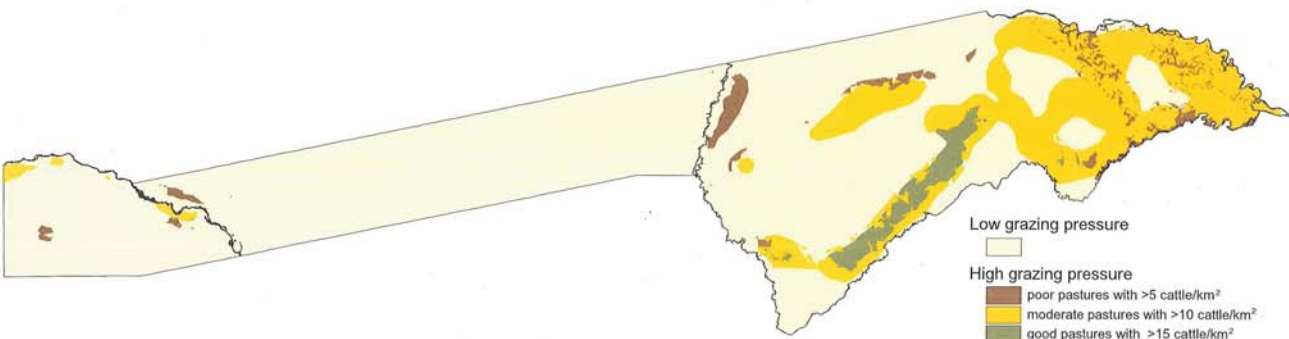


What consequences do cattle have on the plant life in Caprivi? An index of grazing potential for different vegetation units was derived, with each unit being rated as low, moderate or good grazing potential. This was based on an overall assessment of the palatability of grasses and their abundance. Carrying capacities for these indices were not determined directly, and are known to vary according to rainfall and local conditions. However, results from studies in the Caprivi during a period that had seen much more rain than has fallen in recent years and from a variety of similar habitats⁴ suggest suitable stocking rates of roughly 15 cattle/km² on good pastures, 10 cattle/km² on pastures with moderate potential and five or less cattle per square kilometre on poor pastures.



(CW)

Comparing stocking rates with grazing potential provides an idea of where natural pastures are under greatest pressure, and shows that much of the eastern Caprivi is probably over-stocked with cattle. One further concern is that localized patches of highly nutritious grasses along drainage lines on the eastern floodplains must be under extreme pressure, since most of the floodplain area consists of leached sands where grasses have little nutritional value.



Crop farming

Three crops predominate in the Caprivi: *mahangu* (pearl millet) being planted in 47% of fields, sorghum in 27%, and maize in 26% of fields surveyed during 1994/95⁵. Maize is planted more often in the eastern, moister areas while *mahangu* and sorghum are preferred in drier areas. Other, minor crops include various vegetables, especially pumpkins, beans and groundnuts.

Cultivation practices are often characterized as "low input – low output", with farmers tending to invest little in their fields and harvesting low yields. Most fields are planted using seed collected in previous years, rather than "improved" seeds or cultivars which should produce better yields. Very few fields are fertilized with commercial fertilizers, manure or compost, and few fields are irrigated^{5,6}. Although inputs into fields are seen as "low", considerable amounts of time are invested in the fields, varying between 150 and 400 hours of labour per field. The majority of fields (81%) are prepared using draught power, usually cattle, to pull ploughs, while 12% are prepared by hand (usually by women) and 5% are prepared using tractors. Weeding is done mainly by women. The availability of labour and draught power at the times that it is required can be a limiting factor⁶.

Not only are yields low, they are also highly variable. From year to year yields vary between 70 and 445 kg/ha of *mahangu* and sorghum, and between 30 and 700 kg/ha of maize. Much of the variation in yield is due

to the variation in rainfall, with yields being lowest in the driest years. However, even in years with high total rainfall, yields can be poor if the rain is badly spaced. Other factors affecting yields include outbreaks of pests such as locusts and other insects and birds.

Of all the activities, the clearing of land for cultivation has perhaps the greatest and most visible impact on the environment in Caprivi. New fields are cleared when existing fields are considered to be no longer as fertile as they should be, and when householders have enough resources to increase the area they can farm. This is especially true when a farmer gains access to more oxen and labour for preparing and weeding fields. The total amount of land farmed by each household varies considerably, from less than one hectare to about ten hectares. The average subsistence farmer in the Caprivi probably farms about four hectares. However, the growing number of commercial farmers (page 29) clear and farm much bigger areas.

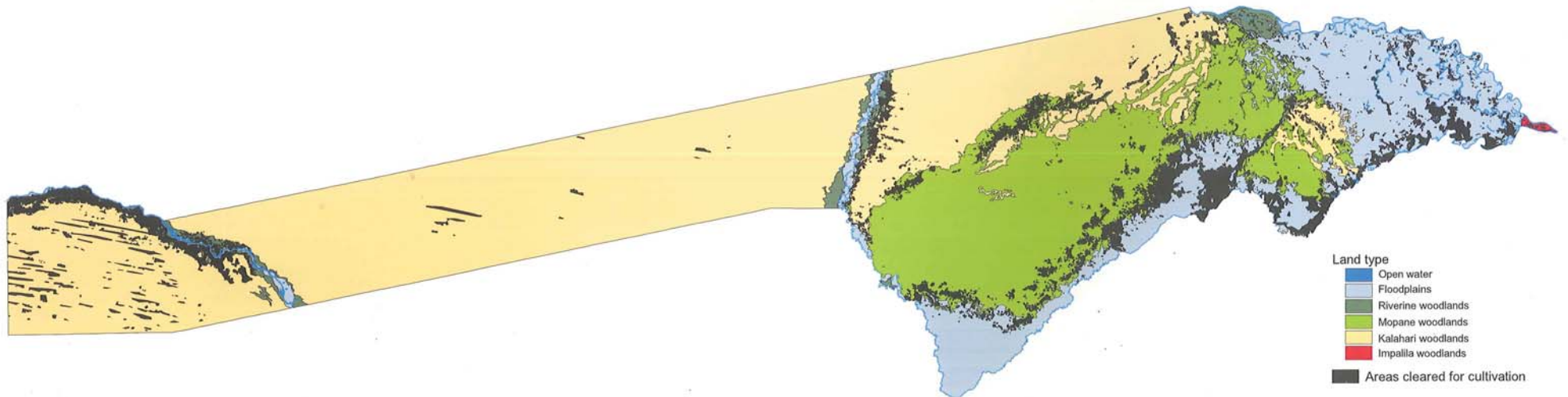
There are three categories of land cleared for cultivation: active fields, fallow fields, and abandoned fields. Fallow fields are those that are left to "rest" for one or more years before being planted again. Abandoned fields are those that farmers consider to be no longer productive. Of all the fields maintained by farmers during 1994/95, about 70% were active and 30% were fallow^{5,7}. No one has yet measured the area of abandoned fields, but almost all of this land is badly degraded; plants growing there consist largely of pioneer shrubs and weeds.



Storing the season's harvest

Land type	Area (km ²)	Area cleared (km ²)	% cleared
Open water	166	9	5
Floodplains	3 762	673	18
Riverine woodlands	511	212	41
Mopane woodlands	4 613	437	9
Kalahari woodlands	10 939	384	4
Impalila woodlands	18	4	22
Total	20 009	1 719	9

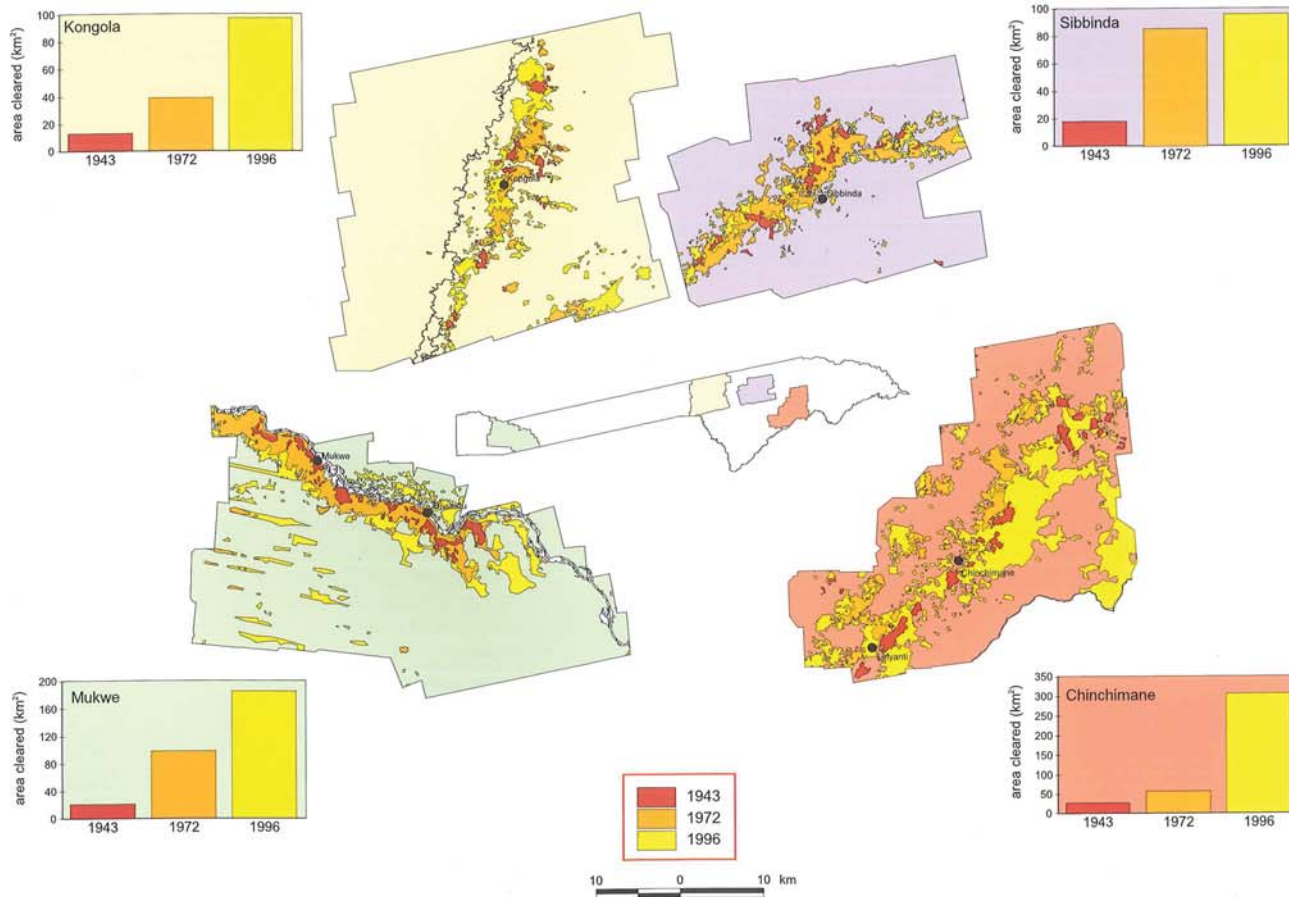
Areas of different land types cleared for cultivation, 1996



Distribution of areas cleared for crop cultivation by 1996 ▲

As seen on aerial photographs⁸, the areas shown on this map had obviously been cleared for fields. They were most visible in woodland vegetation types where the original trees had been removed leaving distinct scars. In floodplain areas, old fields were not as clear and many areas that have been used for cultivation were no longer visible, and were not mapped. This is therefore a minimum estimate of the area that has been used for crop farming.

The majority of cultivation takes place along rivers and in areas occasionally flooded when these rivers reach high levels. Away from the rivers, most cultivation is in the mopane woodlands, especially along the margins, and down the dune valleys in the Kalahari sands area.



Areas cleared for crops in 1943, 1972 and 1996 in the Mukwe area, and around Kongola, Sibbinda and Chinchimane

The minimum total of 171 900 ha, or 1 719 km², cleared by 1996 amounts to about 9% of the total surface of Caprivi. To see how this figure has changed over the years, areas cleared for cultivation were also mapped off aerial photographs taken in 1943 and 1972. Cleared land was compared in these areas with those mapped in 1996.

Four areas were selected to represent different landscapes. In the Mukwe area, scattered fields in 1943 had been expanded to a continuous band of cleared land along the west bank of the Okavango River by 1972. After 1972, most newly cleared land was away from the river, especially along dune valleys, as well as along the east bank. In the Kongola area, the few scattered clearings in 1943 expanded uniformly along the east bank of the Kwando River, while the large area of fields near Sachona only started being cleared after 1943. There was a substantial increase in the area cleared around Sibbinda from 1943 to 1972, but relatively few areas were cleared after that. The Chinchimane area has, by contrast, seen a dramatic increase in cultivated areas since 1972, and this was largely due to the drying of Lake Liambezi (page 38) and the surrounding floodplains. In 1972, the lake was large and all fields were then on much higher ground away from flooded ground. In 1943, however, the area was dry with many of the fields placed closer to what would later become the lake.

Although patterns of increased clearing of land differ to some degree in the four areas, the total area cleared has increased at an average rate of 4.1% each year since 1943. If the large expansion of farms in the Chinchimane area is excluded, the rate drops to 3.8%. Both rates are similar to the population growth rate of about 4% over these last few decades (Chapter 4).

Soil quality	Total area (km ²)	Area cleared (km ²)	% cleared
Poor	14 021	581	4
Moderate	2 851	355	12
Best	3 137	783	25
Total	20 009	1 719	9

Areas of different quality soils cleared for cultivation, 1996

Not surprisingly, most cultivated fields are on soils that are of relatively high quality, especially loam, sandy loam and clay-loam soils. About 25% of the area rated as having the best soils in the region had been cleared by 1996. The scale at which soils were mapped and rated for the suitability for cultivation did not allow for recognition of much of the very fine variation in the distribution of soil quality. For example, very small fields are often located above termite mounds which are rich in nutrients, but may cover an area of perhaps 10x10 m². In the eastern floodplains, many fields are along the edges of old drainage channels and meanders, and are therefore thin and long. There are thus many small areas with good soils in large geographic units which are generally rated as having poor quality soils, and many patches unsuited to cultivation in areas with soils which are generally of higher quality.

Commercial farming

Farming in the Caprivi is characterized as being subsistence in nature, giving the general idea that all farmers cultivate small field areas and have small herds of cattle. However, there is also a growing commercial sector. Farm products are sold in a number of ways, ranging from local bartering and sales within villages to the sale of cattle, maize and sorghum to buying agencies in Katima Mulilo, Rundu and Windhoek. For example, about 2 500 tonnes of maize was sold in the 1995/96 season to the mill in Katima Mulilo, about 360 tonnes of sorghum was sold in 1996 to a company in Windhoek, and MeatCo have been buying between 4 500 and 5 500 head of cattle per year in Katima Mulilo over the past few years. Total maize sales to the mill amount to about 20% of the total yield per year, while only about 2–3% of the total number of cattle are sold to MeatCo. Local sales of cattle in so-called “bush markets” amount to about another 2% of the total cattle herd per year.

One of the main reasons for the growing number of large, commercial farming units is the fact that many people are employed by government as teachers, extension officers, nurses, policemen, etc. Salaries paid by these jobs are substantial, especially if living costs are relatively small in the absence of major housing costs, local taxes, and water and electricity charges. Such employees often save money which can be invested in cattle, seed, fencing, labour, farming equipment and other assets. Perhaps about 20% of all households have a household member earning such a salary⁶, but no information is available on what proportion or number of people use these assets to become commercial, large-scale farmers. What is likely, however, is that the number of commercial farmers will grow, as will demands on land to serve their needs. Indeed, many people have recently been asking government to clear large areas to create new farms for them.

Chapter 7

Wild animal resources



Wild animal resources are of substantial value to Caprivi for several reasons. First, they provide people with food. The fishing industry is a good example of this, but many people also hunt for food. Second, tourism in the region depends largely on the diversity and abundance of animals. Visitors are attracted by the prospects of seeing game and birds. Tourists to Caprivi are estimated to contribute some \$31 million to Namibia's economy¹. Third, many species occurring in Caprivi have great conservation value because they are found nowhere else in Namibia. Some of these species need both national and international conservation efforts because they are uncommon elsewhere in Africa. Finally, wild animals are an integral part of the natural environment and Caprivi's heritage. They contribute to the health of that environment in many ways. For example, many people now believe that, in addition to lower rainfalls and subsequent river flows, the recent clogging of river channels in the Linyanti and Kwando river systems is due to declining numbers of hippo. These animals help to keep river channels open which otherwise become overgrown with reeds and other aquatic vegetation. The reduced supply of water to villages along the Linyanti and reduced fishing grounds in that area might well be due to the lower numbers of hippos further upstream.

More is known about large mammals, birds and fish in Caprivi than other animals, and this account therefore focuses on these animals. However, patterns and processes important to other animals will be similar to those shown for mammals, birds and fish. For almost all groups of animals, Caprivi has a substantially higher diversity of species than other regions in Namibia.

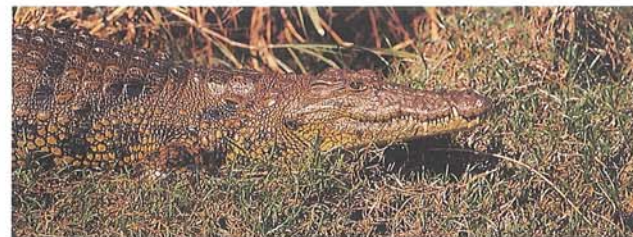
Large mammals

Over the past 17 years a number of aerial counts have provided good information on the distribution and numbers of large mammals. These studies have shown that most large mammals are confined to nature reserves and the areas immediately around them, as well as areas near the Okavango and Kwando rivers. This comes out clearly on the maps showing their distributions.

There have been substantial changes in the numbers of large mammals over the past 15 years. The most dramatic has been that of the lechwe population which dropped from over 11 000 in the early 1980s to just a few hundred in 1995. This species used to occur in large numbers on the eastern floodplains and in the Chobe Swamps, but has now essentially disappeared from these areas².

Black rhino is now extinct in Caprivi, and giraffe and wildebeest are no longer found in eastern Caprivi. Large numbers of several species (elephant, buffalo, eland, roan, sable and kudu) were counted in the state forest area during the 1980s, but these have all but disappeared. The same is true for the eastern floodplains where several species have essentially gone: sable, kudu, reedbuck and waterbuck, in addition to lechwe. However, total numbers of elephants in Caprivi have increased substantially, and perhaps those of buffalo. These increases have been most marked in conserved areas, because areas elsewhere are now less suitable for these large animals.

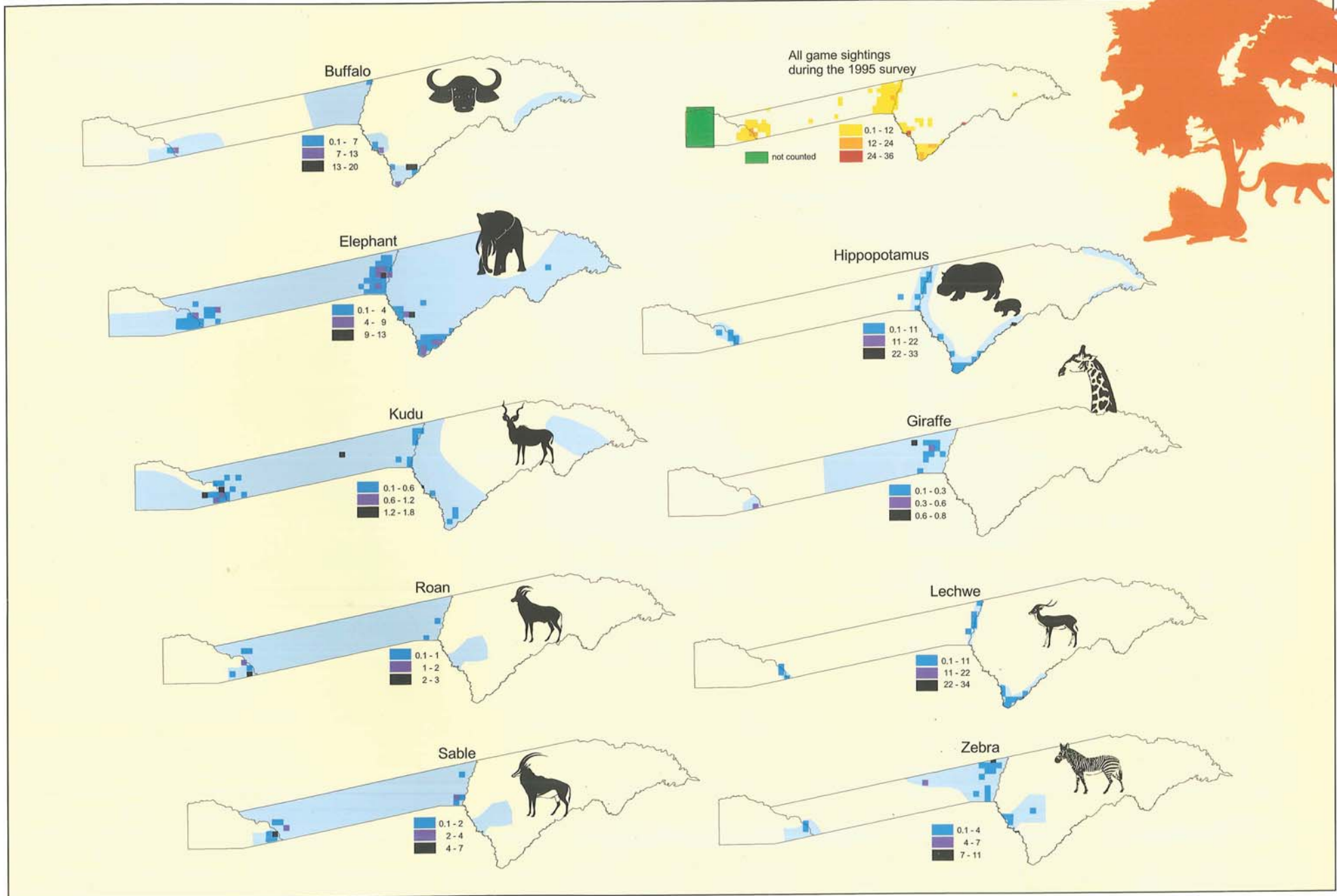
There appear to be two major factors which account for most of the changes in numbers of large mammals. First, increasing human populations and increased exploitation have led to a reduction in their numbers and ranges. The second is that lower rainfall and river levels have led to changes in their habitats. Surface water in small pans and depressions is less available than during wetter periods, and suitable grazing may be less abundant. In addition, the extensive areas of waterlogged floodplains no longer exist and are now used to a greater extent by people. For species such as lechwe, that prefer these flooded habitats, changes in numbers are largely due to these recent climatic changes. But for species such as giraffe and wildebeest in the eastern Caprivi, exploitation through poaching has probably led to their numbers being reduced.

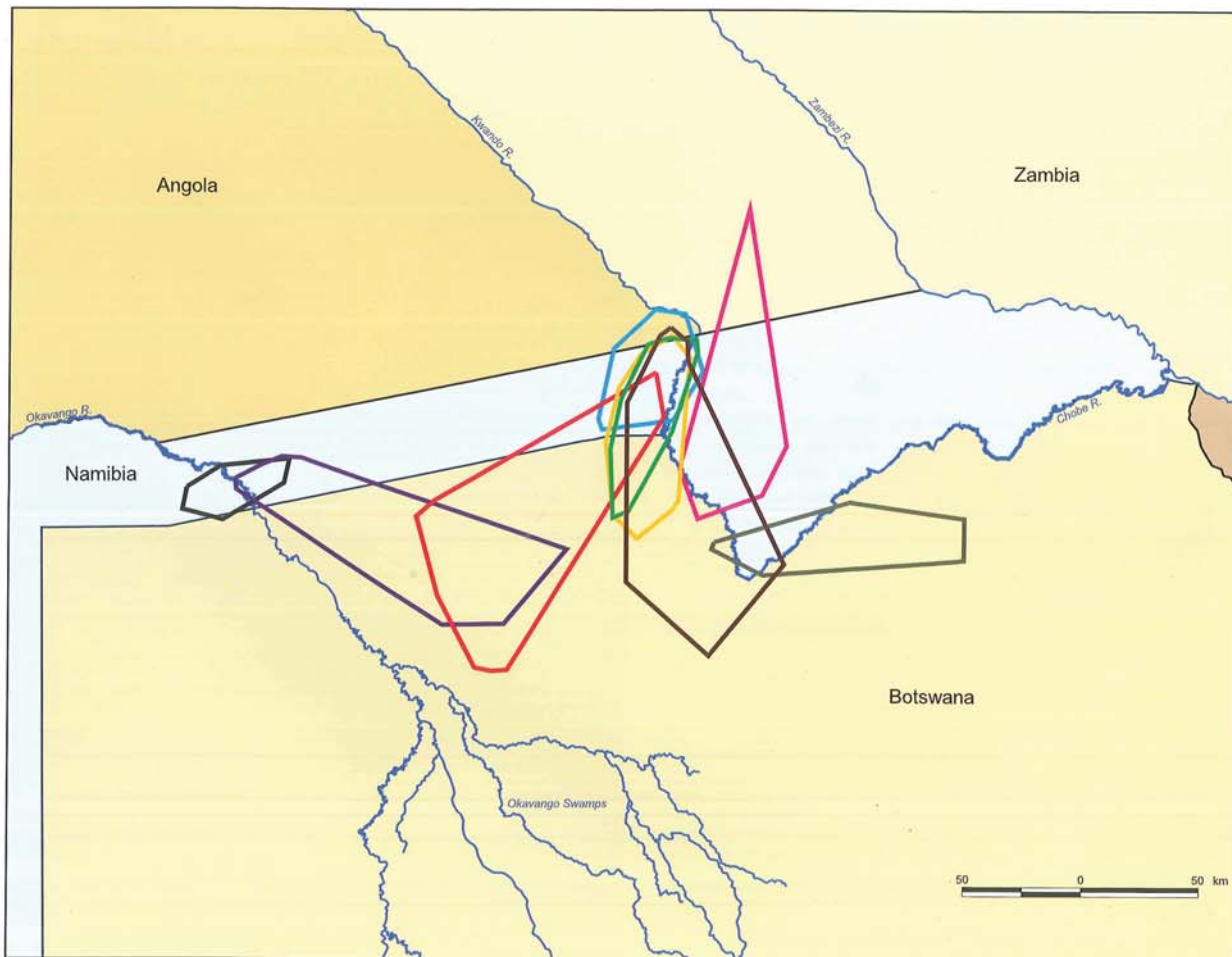


(CW)

Estimated densities of large mammals (each square is 5x5 km) and the broader zones in which these species range () ▶

While estimates of mammal densities are based on just one year's counts, information from other years provides results showing similar patterns of abundance and distribution. Densities were calculated from an aerial census in late August and early September 1995 before the summer rains had started². During these dry winter months most animals concentrate near the rivers where they have access to water.





◀ Conflicts between people and large mammals

Most conflicts between animals and farmers result from damage caused to crops and stock. In a study along the Kwando River, 80–100 cases of elephant damage to crops were reported each year between 1991 and 1995. About 70–80 head of cattle were also taken each year, mainly by lions and hyaenas³.

This map compares the distribution of people with that of large mammals recorded in the 1995 aerial census. It is clear from this that most mammals avoid areas where there are lots of people, and so most people in the Caprivi do not suffer these kinds of damage.

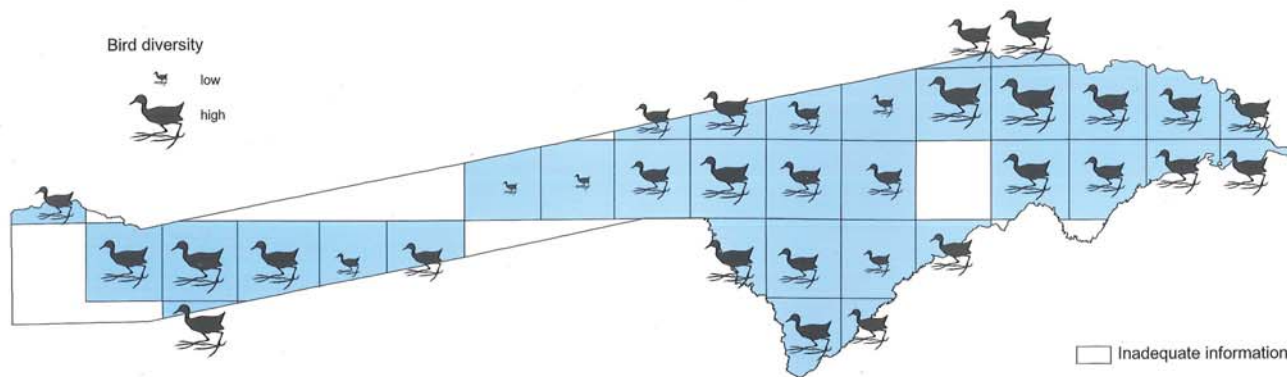
This map also shows those areas where there are high densities of both large mammals and people, and consequently where the great majority of conflicts are likely to happen. Such areas are confined to zones along the east bank of the Kwando River, north of Mamili National Park and just north of Mahango Game Reserve. The limited extent of these “conflict” areas suggests that much could be done to manage problems by placing a few Ministry of Environment and Tourism staff in appropriate places. In addition, there is an area along the Chobe River where large mammals move out of the Chobe National Park in Botswana on to the eastern floodplains. This usually happens at night, so these animals are not seen during aerial surveys. Damage in other areas may also occur in the rainy season when some animals move away from the rivers.



Elephants come into conflict with humans more than any other animal in Caprivi (PT)

◀ Movements of nine elephants

The total population of elephants in Caprivi is estimated to be between 5 000 and 6 000 animals⁴. A study which tracked nine individual animals (eight of which were females moving in family herds), each carrying a satellite transmitter, have shown that they are largely confined to areas near the large rivers in the dry, winter months. During the summer rainy season, however, they move away from the rivers. Many move south into northern Botswana, but some also move north into Angola and Zambia and into the central area of the Caprivi strip. Some of these tracked elephants covered areas up to 5 500 km² during their regular annual movements. It is important to realise that elephants and many other species are dependent not only on protected nature reserves but also on much larger areas that surround these reserves. Caprivi's elephants are, indeed, part of a much larger population of about 120 000–130 000 elephants that occupy a broad zone across northern Botswana, western Zimbabwe, and southern Zambia and Angola.⁵



Bird diversity in Caprivi ▲

Each square represents a quarter-degree square (15' of latitude x 15' of longitude). The size of the bird in each square is directly related to the diversity of birds recorded there⁷.



Wattled cranes – an endangered species in Africa (PT)



Kudu are widespread in the woodlands (CW)

Birds

Information on the distributions of birds in Caprivi shows that the greatest number of species are to be found along the major river systems, especially in the Mahango, Mudumu and Mamili protected areas, and in the area around Katima Mulilo. Mahango Game Reserve actually has the highest diversity of birds recorded anywhere in Namibia⁸. Vegetation along the big rivers is much more diverse than elsewhere and the diversity of birds follows the same pattern. Water birds are also restricted to rivers and flooded areas. Of 110 species of birds in Namibia that are rare, endangered or need to be monitored, 73 have been recorded in Caprivi⁹. While some of these are common in countries further north and east, others are generally rare, and the Caprivi is the only area in Namibia which can offer them some protection.



Fish have both household and commercial value (CW)

Fish

Fish are clearly an important resource in Caprivi, providing food and income for many people, as well as recreational angling¹⁰. The rivers are home to a diverse fish fauna: 79 species having been recorded in the Okavango River system and 82 species in the Zambezi¹¹. Forty-three species of fish were recorded in Lake Liambezi in the early eighties (see page 38). Different species of fish use the rivers in different ways. Some remain as residents, others migrate up and down the rivers, while others move laterally between the river channels and seasonally inundated floodplains.

Perhaps the most prominent feature of fish in Caprivi is the dynamic nature of their populations, their habitats and the resulting exploitation. Much of what is now known about Caprivi's fish is based on information collected during the 1970s and early 1980s when river levels were higher and flooded areas were much bigger than now. At peak levels, as much as about 3 265 km² of flooded area might be available, while the rivers and open water channels amounted to only about 166 km² in mid-1994, or 5.5% of the area that can be flooded (Chapter 8).

While lower river levels have reduced the extent of fish habitat dramatically, a more important change concerns the relative scarcity of flooded areas for species that require such habitats in which to breed. These species live as adults in open water but lay their eggs among plants growing in shallow water. The absence of regular flooding has probably had a major impact on breeding rates and consequently the populations of those fish. In addition, flooded areas have been damaged in many areas by increasing numbers of cattle trampling and grazing grasses and other vegetation growing in the water. Finally, erosion and increased deposits of silt along the banks of rivers cause the rivers to flow along more defined channels, thus reducing the chances of flooding.

In its day, Lake Liambezi was estimated to yield some 600–800 tonnes of fish per year¹². A fishing co-operative existed in Caprivi and fish were then exported to Zambia, Botswana and Zimbabwe. That all stopped in 1985 when the lake finally dried up. For the rest of the region, estimated annual yields amounted to about 700–900 tonnes from the Zambezi, Kwando and Chobe rivers, and perhaps about 150 tonnes from the section of Okavango River flowing through Caprivi. These estimates were also obtained during previous wetter periods. New information on current yields would be worth collecting.

Fishing is an important aspect of the local economy and food security for the region as a whole, but especially for those communities living near the major rivers and floodplains. There are substantial differences in fishing practices between those along the Okavango and those along the Zambezi, Chobe and Kwando rivers¹⁰. Along the Okavango, many households fish (about 35–55%), access to fishing grounds is not restricted, catches per day tend to be small, greater use is made of traditional fishing methods (such as fish traps), most of the catches are consumed at home, and a good deal of the fishing is done by women and children. By contrast, along rivers in the eastern Caprivi, relatively few households catch fish (about 15%), access to fishing grounds is often based on territorial rights, daily catches are larger, more use is made of nets and other modern gear, many of the fish are sold commercially, and fishing is largely the preserve of men.

Chapter 8

Rivers, wetlands and water supply



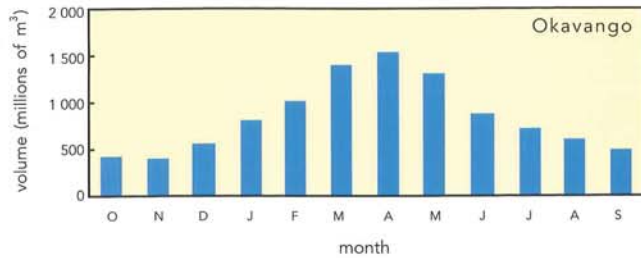
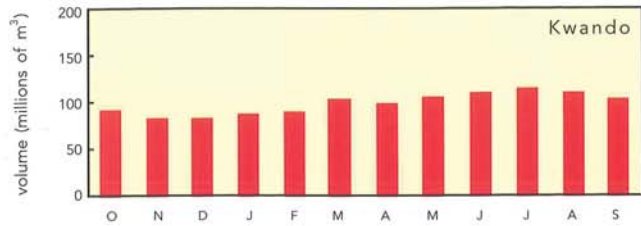
Caprivi's rivers

The abundance of water, perhaps more than anything else, sets the Caprivi apart from the rest of Namibia. Of only five permanently flowing rivers in Namibia, Caprivi has three — the Okavango, Kwando or Mashi, and Zambezi. Not only do these rivers hold water permanently, but they are also relatively large rivers. In years of high rainfall, their waters may flood over large areas, forming extensive marshes and the legendary Lake Liambezi. There are two other rivers in Caprivi that are often regarded as rivers in their own right — the Chobe and the Linyanti. However, both are really extensions to the Zambezi and Kwando rivers, respectively.

In fact, all these rivers can connect with one another if water levels are

high enough. The Zambezi and Kwando Rivers are often connected through the Linyanti and Chobe Rivers and Lake Liambezi. The Okavango River can also connect with the Kwando River when river levels are exceptionally high. This is through the Selinda Spillway, an outlet from the north-eastern corner of the Okavango Swamps which joins the Kwando at its southern limits and merges into the Linyanti. Water can potentially flow in either direction — from the Kwando into the Okavango Swamps, or from the swamps into the Kwando, up the Linyanti, through Lake Liambezi, into the Chobe and finally into the Zambezi. (See map on page 3.)





▲ Average monthly volumes carried by the Zambezi River past Katima Mulilo, the Kwando River past Kongola and the Okavango River past Mukwe¹

Seasonal changes in the levels and volumes of these rivers reflect seasonal changes in rainfall. However, the increased volumes of water in these rivers are only seen in Caprivi several months after the summer rains have fallen in the catchment areas. At Katima Mulilo and Mukwe, flows in the Zambezi and Okavango peak in March, April and May, having been lowest in October and November. The Kwando shows a much longer lag between the summer rains falling in Angola and highest flows passing Kongola in June, July and August. The fluctuations in the flow of the Kwando are small because it first drains through a large swamp system in Angola which holds and slows the flow of water into the river.

◀ Catchments of the Zambezi, Kwando, and Okavango and Cuito rivers in Zambia and Angola

The three major rivers have their origins or catchments in Angola and Zambia, up to 800 km from where they reach Caprivi. Just before the Okavango River enters Caprivi it is joined by the Cuito River which carries about the same volume of water as the Okavango. The total area of Angola and Zambia drained by these rivers is huge, amounting to about 750 000 km² — an area not much smaller in size than the whole of Namibia!



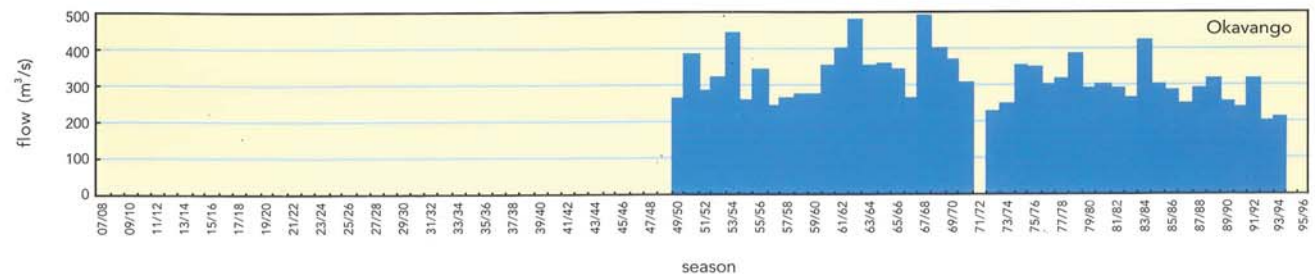
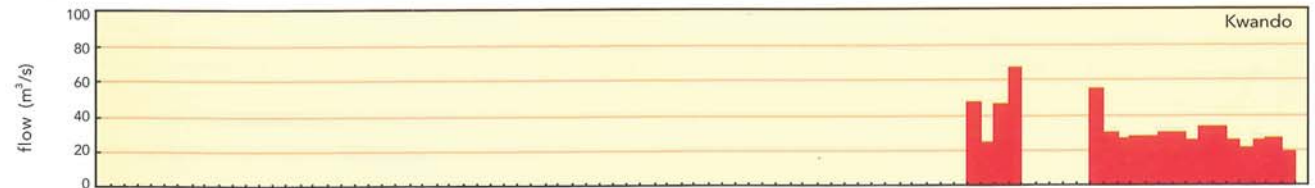
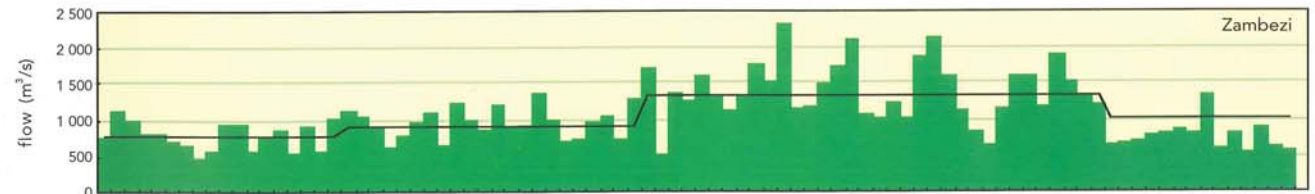
Oxbow lake on the Kwando River

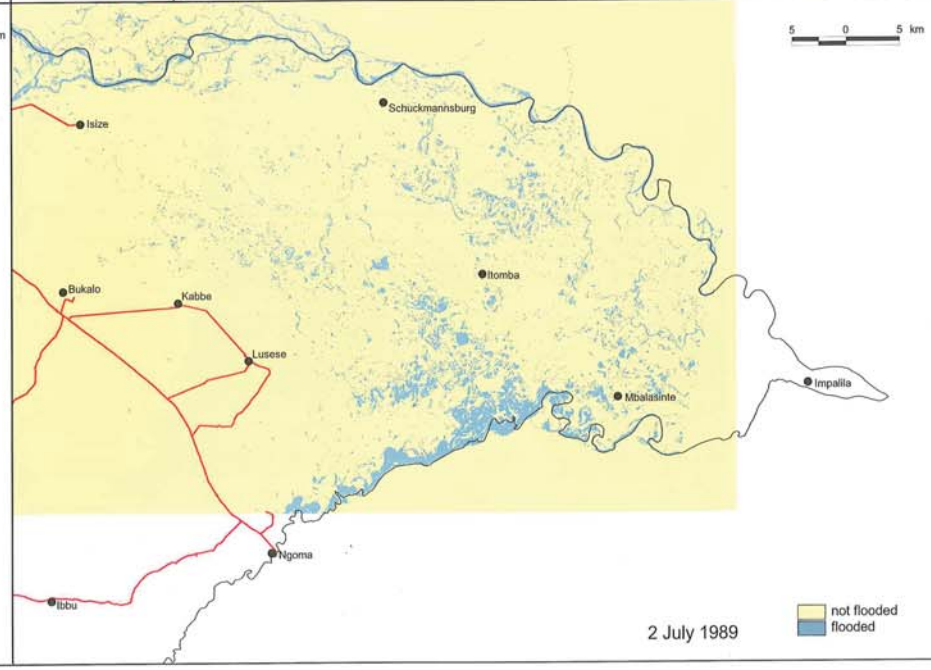
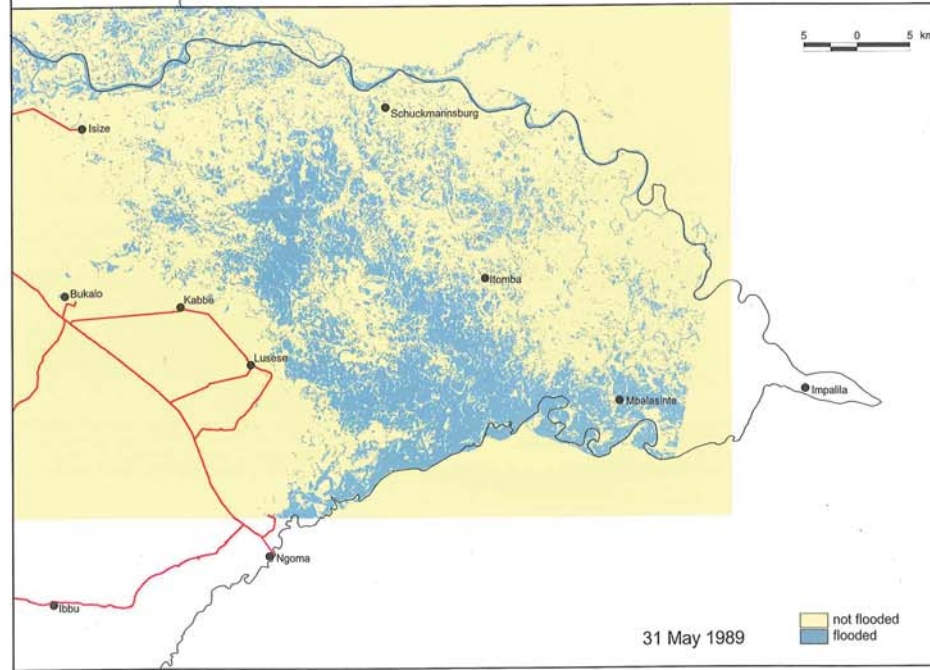
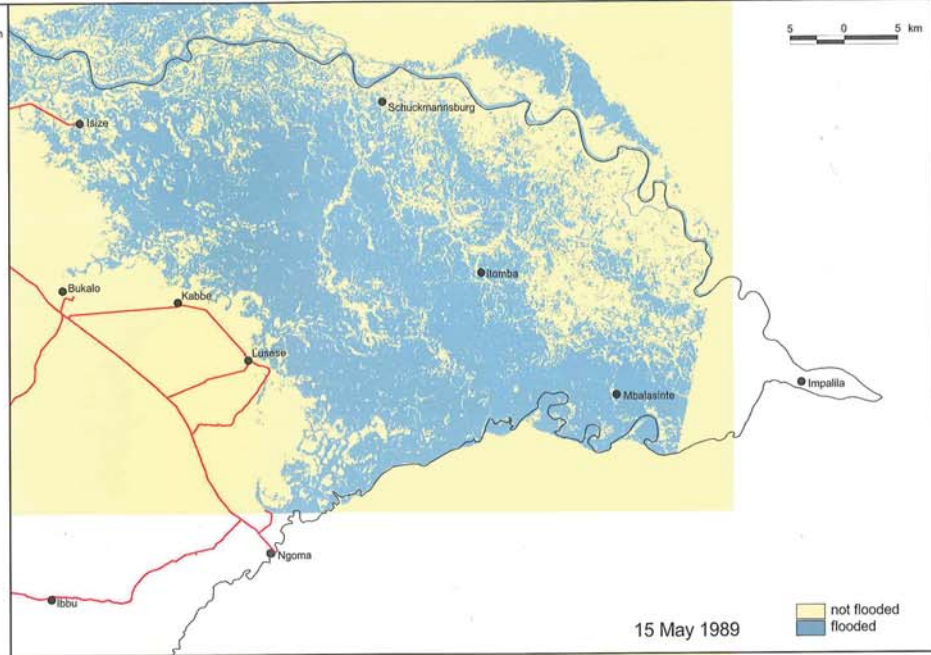
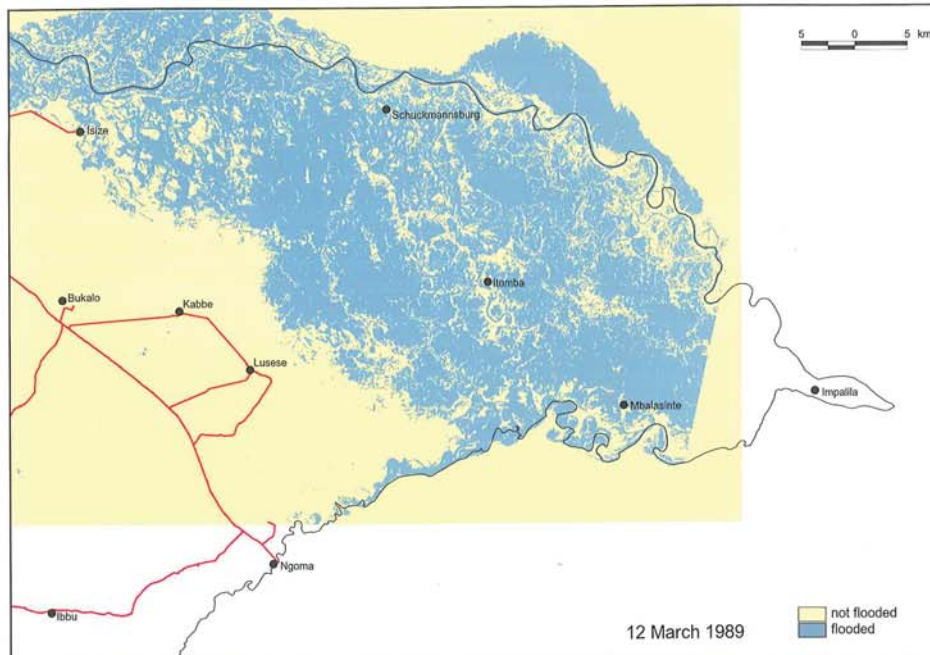


Popa Falls on the Okavango River

Annual changes in the average flow of water carried by the Zambezi River past Victoria Falls, the Kwando past Kongola and the Okavango past Mukwe¹

Dramatic changes have occurred to the levels and volumes of water carried by the three rivers during this century. The longest and most complete set of information to illustrate these changes has been recorded for the Zambezi River at Victoria Falls since 1907. Even though there has been a good deal of variation from year to year, four quite different phases seem to have occurred over these 90 years². The first phase ran from the 1907/08 to the 1923/24 season when the average flow at Victoria Falls was 756 m³/s. The second lasted from the 1924/25 to the 1945/46 season when average flows increased to 941 m³/s. The third phase was the most dramatic this century when average flows of 1 392 m³/s were recorded, almost double that recorded in the first phase. This lasted from the 1946/47 to the 1980/81 season and it was then that Lake Liambezi filled with water and became such a prominent feature in Caprivi. The last period, from the 1981/82 season to the present, has seen average flows of about 750 m³/s, similar to those at the start of the century. Similar, but less dramatic, changes have occurred in the flow of the other rivers. In the case of the Kwando, river levels are now much lower than before and also hardly change from year to year. As a result, many of the channels in the river are now choked with reeds and other vegetation to such an extent that the flow of water up into the Linyanti is greatly reduced. The few years of data available from before the early 1980s suggest that the river sometimes carried very large volumes of water, and these substantial flows could have cleared the channels of blockages.





◀ The flood in 1989

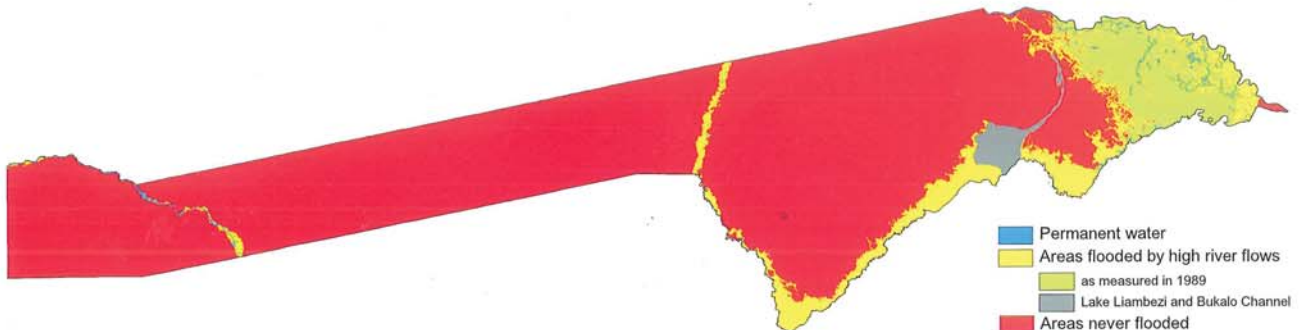
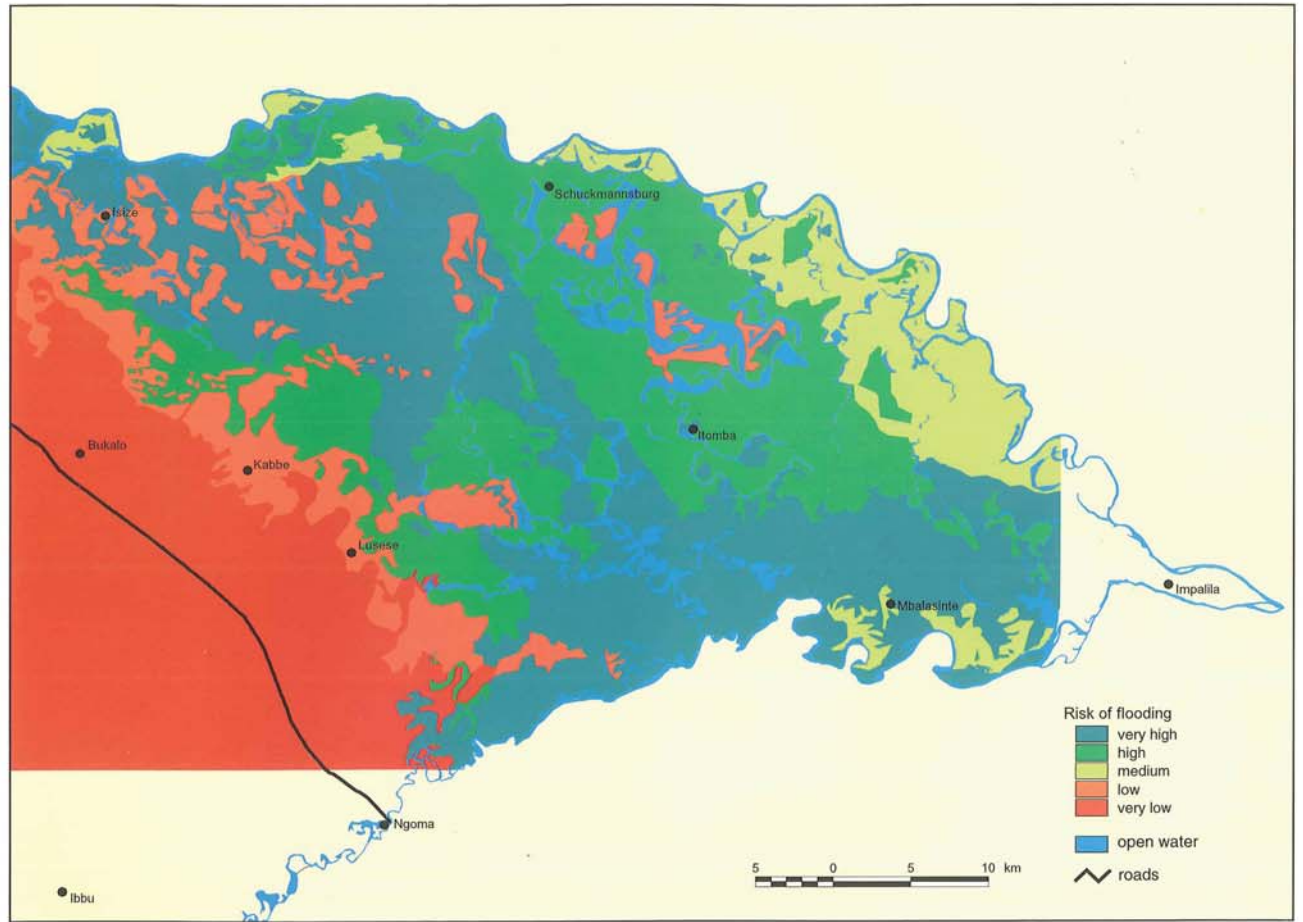
One exception to the generally dry conditions and low river levels over the past 16 years occurred in 1989 when the Zambezi pushed up to levels approaching those seen regularly between 1946/47 and 1980/81. The river was never high enough to start spilling into and down the Bukalo Channel towards Lake Liambezi, and its maximum level at Katima Mulilo in 1989 was still two metres lower than a high flood recorded in April 1969. Nevertheless, a large part of the eastern floodplain was flooded. These maps were drawn from an analysis of four photographs taken from a satellite at intervals between March and July³ and show how flooded areas expanded and then receded. (The photographs excluded the eastern section near Impalila Island.) The first areas to be flooded were those immediately south of the river as the waters broke over the banks, and the large Simalaha Flats in Zambia. This initial flooding had started before the first image was taken on 12 March 1989. From areas around the river, flood waters spread out over the floodplain in a fairly broad and shallow layer. They then drained southwards towards the Chobe River. In addition, water from the Zambezi flowed up the Chobe from Impalila Island and contributed to further flooding north of the Chobe. The largest, deepest and longest lasting flooded areas were therefore those north and north-west of the Chobe. Some water also pushed all the way back along the Chobe to form a small pool in Lake Liambezi. The pool lasted only a few months, however.

▶ The risk of flooding on the eastern floodplains

Studies of the 1989 images of the eastern floodplain³ also provide an assessment of which areas are most likely to be flooded. Those rated "very high" are likely to be flooded most frequently and extensively. Those rated "low" are likely to be flooded only rarely, perhaps only once every 50 years. Within these broad zones there is considerable local variation in relief, with old river channels, meanders and other low-lying areas being inundated with water much more than higher surrounding places. There has been an expansion of settlements and farming on the eastern floodplains in recent years, and some settlements will probably be threatened by high flood waters when levels of the Zambezi reach heights previously recorded. Taking all settlements in Caprivi, a total of about 3 640 households and 20 440 people would be affected if river and flood levels rose to the extent that they were in previous decades⁴. Lives would not be in danger, but current farming practices and food supplies would be threatened.

▶ Areas that may be flooded in years when river flows are high

It is possible to get an idea of what areas are sometimes flooded elsewhere in the region by looking at the distribution of grasslands that are characteristic of floodplains. This is because most trees do not grow in areas where their roots may be saturated. The total area which can be flooded covers about 3 265 km², which is about 16% of the total surface of the region. During dry periods the total area of water in rivers and open water channels may amount to only about 166 km², or about 5% of the total area that could be under water⁵.



Lake Liambezi

The explorer, Frederick Selous, saw Lake Liambezi filled in 1879, and this appears to be the only previous record of the lake before it filled again sometime during the 1950s. Because the lake is at a low elevation in eastern Caprivi, water could flow into it from several directions. The Zambezi, being highest in March and April would overflow its banks east of Katima Mulilo and water then flowed down the Bukalo Channel, past Muyako, and into the lake. Then, two or so months later, high waters in the Zambezi would have pushed up the Chobe through the Chobe Swamps until these waters, too, were added to the lake. Finally, water from the Kwando coming down the Linyanti would reach the lake in September and October. Flows into Lake Liambezi stopped in 1982, and the lake then gradually dried up. By 1985 it was completely dry, and the huge fishing industry that it supported collapsed. Today, the lake is a vast expanse of open grasslands and fields.

Kariba weed

The Kariba weed (*Salvinia molesta*), a floating aquatic fern, occurs in the eastern Caprivi as an invasive alien. It probably first established itself sometime before 1948, but even now new plants continue being washed down the Zambezi River into the region. The plant occurs naturally in Brazil and has become a major pest on many African rivers and lakes over the past few decades. It can grow very rapidly, forming dense mats of floating plants which may cover large areas, sometimes the entire water surface. More than 20% of the surface of Lake Liambezi was covered with Kariba weed in 1975⁶. The weed only grows on quiet waters, such as in swamps, lakes and river backwaters.

The *Salvinia* problem has now been reduced substantially, especially since 1981 when a tiny snout beetle (*Cyrtobagous salviniae*) was introduced to the Caprivi. This beetle controls *Salvinia* plants by feeding on them, and the level of Kariba weed infestation is now generally low. However, patches of the weeds covering small channels and ponds are still found, especially in the northern parts of the eastern floodplains and along the Kwando⁷. It seems very likely that both the weed and beetle are now permanent features of Caprivi's plant and animal life. Water levels have also been low since the early 1980s when the beetle was introduced and the weeds could become more of a problem if increased river levels and flooding led to an increase in the area of habitat favoured by the weed. The beetle may then not breed quickly enough to control a massive new growth. Fertilizers applied to fields can stimulate growth of the weed when they wash into the water and add more nutrients for the plants to use.



Lake Liambezi in 1982 (SB)



In 1996 large areas of the former lake were under cultivation



Mats of Kariba weed forming in a backwater near Katima Mulilo (CH)



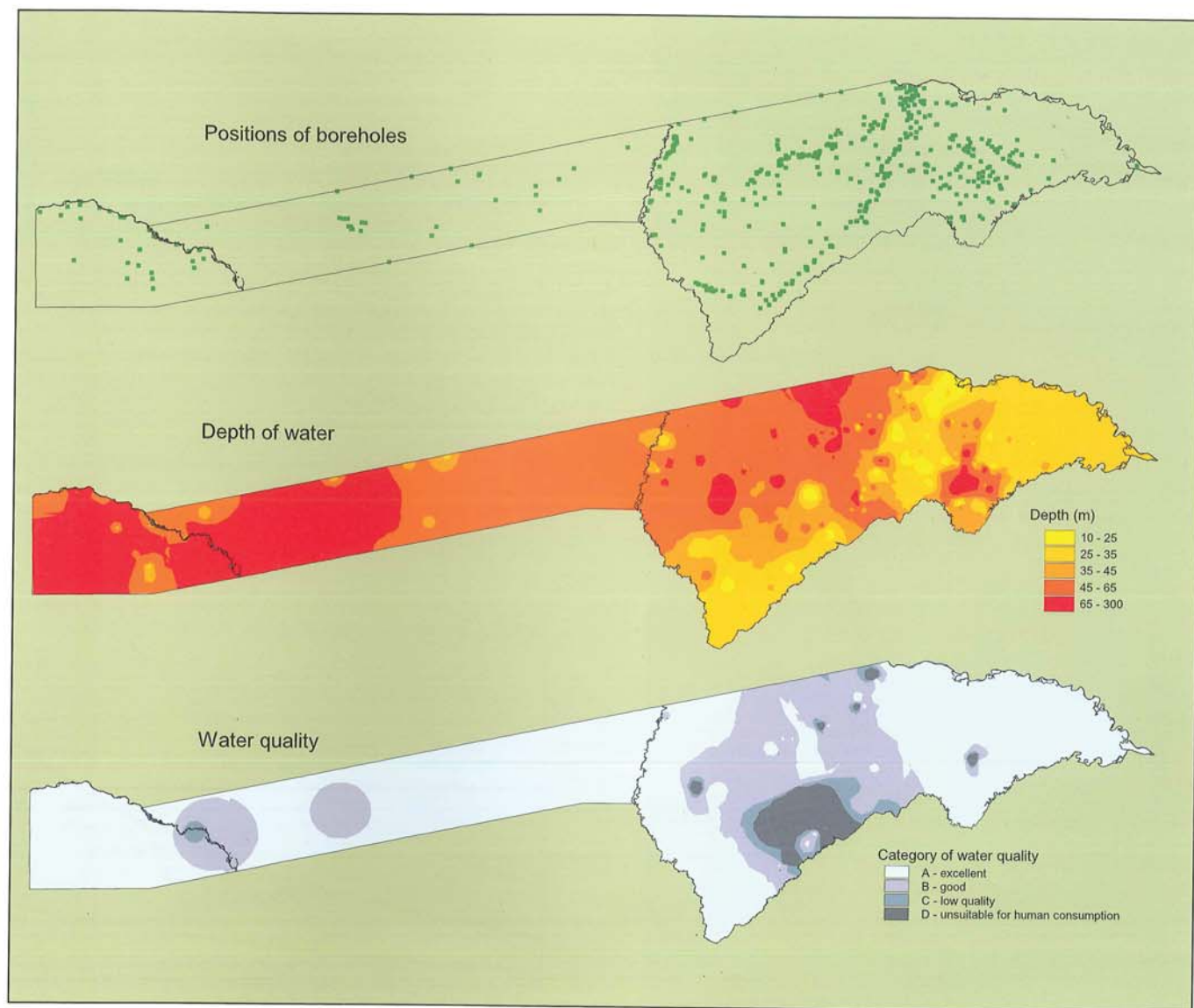
If the Kariba weed mat becomes well established, as it did here in areas of Lake Liambezi, secondary growths of reeds start to form (CH)

Water supply

People and cattle obtain water from several sources in Caprivi. In Katima Mulilo, almost all water is piped, either to communal or indoor taps. In rural areas, however, 32% of households obtain their water from rivers and other open, surface waters, 26% of households depend on wells, 24% on piped water, and 16% on boreholes⁹. While Caprivi has more rivers and open water than any other region in Namibia, people in the region perhaps have greater problems with the supply of water than anyone else. One survey of peoples' attitudes towards rural water supplies found lower levels of satisfaction in the Caprivi than in any other region⁹.

Several different kinds of problems are reported. Sources of water may be far from their homes, so women have to walk long distances and spend much time collecting domestic water. Access to water is also a problem for cattle, especially in the dry season when the only water available may be far from preferred grazing pastures. Farmers may have difficulty preparing fields before the summer rains because water sources for draught animals are far from fields that are to be ploughed. The volume of water available is often a problem, especially from boreholes that yield little water, that have silted up, or have been fitted with low-volume pumps, causing people and cattle to queue for water. Pans have dried up and underground water levels have dropped as a result of the poorer rains in recent years. Adding to the problem of reduced supplies is the fact that demands have risen a good deal over the same period. There has been a massive increase in numbers of cattle (Chapter 6) and, of course, numbers of people have also increased substantially. Finally, there are many problems associated with the quality of water. In some areas the groundwater is unpalatable, being salty and unfit for consumption, while in other areas people have to use dirty water from wells and backwaters. Water from these unhygienic sources contributes to the high incidence of diarrhoea, especially among children.

Over the years, many hundreds of boreholes have been drilled throughout the region, and many were fitted with pumps to deliver water. Most of these are close to settlements, but others have been drilled further away to gather information on how underground water varies from area to area. Unfortunately, a proper analysis of water supply in relation to demands by people and cattle cannot be carried out because there is no complete set of information available on which boreholes remain in productive use. A major pipeline runs along the road from Kongola to Katima Mulilo, carrying water pumped from both the Kwando and Zambezi rivers. While many people have depended on this pipeline, the water is not treated and the supply is inadequate to the extent that little water reaches the middle section of the line¹⁰. A new drilling programme is currently underway to supply communities in this area with underground water.



The positions of boreholes, depth of water below the surface of the ground and quality of the water¹¹

Underground water reserves generally are fairly abundant, so there is a good chance of finding water in most areas. Water reserves are also fairly close to the surface, between 10 and 40 metres below the ground in most areas, and closest to the surface in the eastern floodplains and in the southern areas of eastern Caprivi. The deepest reserves are in the West. The quality of water varies considerably, and some underground water is not palatable, especially in the area north of the Linyanti Swamps. This area now also suffers from the reduced flow of the Linyanti River, caused by lower river flows and blocked channels in the river. The pumping scheme at Chinchimane has been discontinued as a result. The trends shown here are general ones, and illustrate the overall likelihood of striking water at a particular depth and of finding water of a certain quality.