SAND AND WATER

CHAPTER
SIX

RESOURCES

Natural wealth

Kavango looks the way it does because it was moulded by various geological and historical events, many of which were described in Chapters 2 and 3. The region's plants and animals were likewise shaped by evolutionary processes of long ago, but the way in which these organisms live today is also a more direct consequence of three fundamental inputs: energy from the sun, water provided by rain, the river or from underground, and the soils in supplying a medium in which plants can grow and draw nutrients and water. These three ingredients – alone and in combination – determine the nature and abundance of living organisms in the region.

Solar energy is obviously abundantly available in providing energy for plant growth and heat to warm the air and ground. By contrast, water is a severe problem, especially for anything that lives any distance from the river. Rainfall is highly seasonal and unpredictable (see Chapter 4), and the growth of crops and natural vegetation is often limited by a shortage of rainwater. Underground water is beyond the reach of most roots, and it is only through the recent use of boreholes and pumps that groundwater can be used for people and livestock, as described below in this chapter. Soils, too, are a severe problem because they are so infertile and hold little water in most areas.

This chapter begins with accounts of underground water and soils as two of the fundamental inputs on which life in Kavango depends. Then follows information on the region's natural vegetation and the major impact that repeated bush fires have on the structure and composition of woodlands. A variety of aspects concerning animal life in Kavango are described with a special focus on the abundance and distribution of larger mammals. A final section considers the region's conservation areas and the use that tourism makes of these natural parks.

THE SUPPLY OF WATER

People and livestock in Kavango get their water from two sources: the river and from boreholes that pump water from under the ground. Various aspects concerning the flow of water in the Okavango River are described in Chapter 5, but what is important here in the context of water supply is that only a small fraction of the water is used. The total amount of river water now used in Kavango each year is about 22 million cubic metres (Mm^3), of which approximately 74% supplies agricultural irrigation schemes, 15% is used by rural people for their livestock and domestic needs, and 11% is for urban use in Rundu.[1] The 22 Mm^3 amounts to about less than $^1/_4$ of a percent of the total average volume of water that enters Botswana at Mohembo, and even during years and months with low flows, the amounts removed from the river in Kavango are relatively small. However, several new and large irrigation schemes are being developed and planned (see page 99) and, once implemented, these would raise the total amount of water extracted from the river to about 136 Mm^3 per year, or about 1.4% of all water that leaves Namibia at Mohembo. This proportion still appears small but the effects of removing these amounts of water on the health of the river, especially the Okavango Delta in Botswana, have not been assessed. A good deal of irrigation water would be pumped at the start of the growing season in early summer when the volume of water in the river is at its lowest. Moreover, the proportion of water extracted during the driest months in years when flows are unusually low could be substantial. No regulations or quotas control the use of river water in Angola, Namibia or Botswana.

The supply of water is one thing, but having access to uncontaminated water is also important for reasons of avoiding diseases caused by bacteria and other parasites in dirty water (see page 85). Water sources are commonly divided into those that are unsafe (potentially contaminated water from the river or hand-dug wells) and those that are safe (underground or borehole and treated river water). In 2000, approximately 52% of all households used so-called 'safe' sources, a slight improvement from 46% in 1991. The great majority of homes that use unsafe water are in rural areas. Thus in 2000, only 40% of the rural population had access to safe water compared to 82% of people in Rundu.[2]

Most underground water is provided through boreholes drilled and supplied with pumps by the Department of Water Affairs, although a few wealthier farmers have also installed their own boreholes and pumps. Borehole pumps generally draw water using diesel, wind or electrical (often solar powered) energy, whereas water in hand-dug wells is usually winched to the surface by hand. The main effect of having access to groundwater has been to enable people to settle in inland areas where they would otherwise have been unable to live (see page 114). However, underground water has also been of value in places close to the river, especially where it is used to provide safe water to bulk water supply schemes for schools, hospitals and the public at such places as Nkurenkuru, Kahenge, Tondoro, Rupara, Bunya, Mupini, Kayengona, Shambyu and Nyangana.

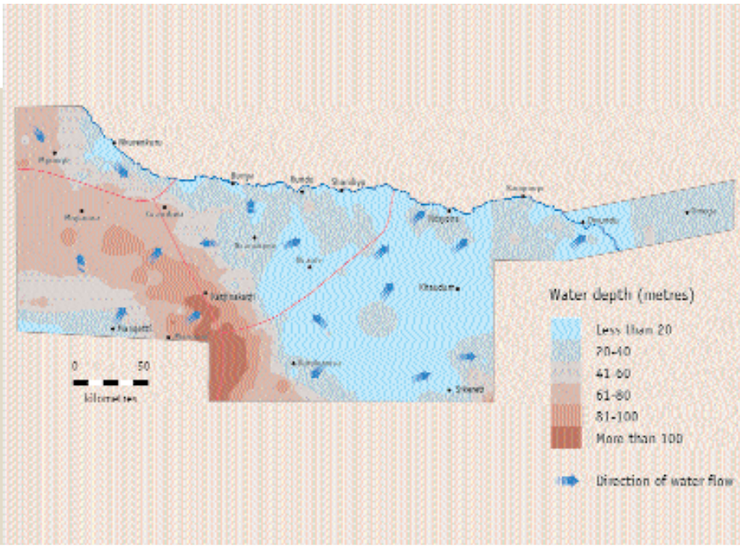


FIGURE 26-
Underground water is usually found at much shallower depths in eastern than western Kavango. The scale to the map shows the average depth at which borehole water is pumped from below the surface. The red lines indicate the approximate boundaries of four zones in which underground water flows in different directions, as shown by the arrows.[3]

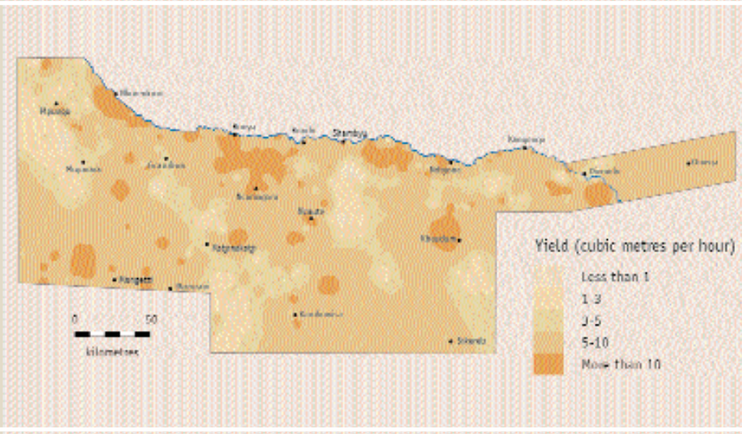


FIGURE 27-
Most boreholes provide moderate supplies of water sufficient for the small villages. The map shows average yields from boreholes measured in cubic metres of water pumped to the surface per hour.[4]

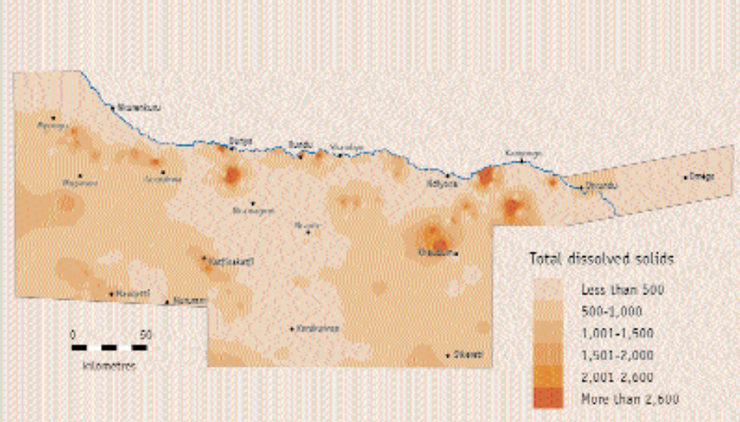


FIGURE 28-
Underground water in the region is usually of good quality, as shown by the values of total dissolved solids (TDS) in milligrams per litre. The purest water has low TDS values, and humans can drink water with values of less than 2,000. Water with values above 2,600 should be avoided, while even live-stock should not drink water having TDS values above 5,000.[5]

Most underground water lies in bodies of water – known as aquifers – in the Kalahari sediments (see page 24). The water is trapped under pressure in tiny spaces between the grains of sand and other sediments. The aquifers lie at various depths (FIGURE 26), those in the eastern half of the region being at the shallowest levels of 10 to 30 metres below the surface. Water in western Kavango is usually found below 60 metres, and water in some places has only been found at depths of as much as 350 metres. The main effect of these different depths is that deeper water is much more expensive to find and pump. Other than aquifers in the Kalahari sediments, the only other underground water bodies are in Damara Sequence rocks of the Nosib Group in the area of Andara and Popa Falls (see page 24).

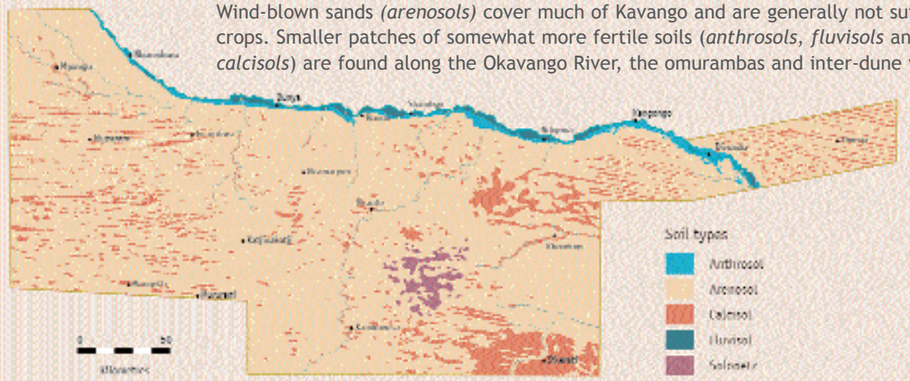
The shallow aquifers along the river often consist of shallow bodies of water trapped in old channels of the Okavango River. Most of the water seeping into those ancient deep channels probably flows in from the south. Indeed, these movements of underground water from the south mean that the Okavango River gains water from shallow aquifers, rather than the river water recharging aquifers. Flows of underground water into the river valley occur in three of four separate zones of movement of underground water (FIGURE 26). The first is in the north-west where water permeates south-eastwards from Angola. A second zone is in the centre of Kavango, and here water flows radiate out from the vicinity of Ncamagoro. Flows also spread out in a third zone in the south-east, while water flows north into Kavango from the Grootfontein area in the fourth zone.

Shallow aquifers in the east are recharged much more rapidly by good falls of local rain than the deeper aquifers into which water seeps over much longer periods. Water is also relatively easy to find in the eastern shallower aquifers, and yields of 5–10 cubic metres per hour can generally be obtained (FIGURE 27). These are adequate to supply the household and livestock needs of small villages. There is, however, a good deal of variation in yields, even between boreholes close to each other. Most differences are due to three factors: (a) differences in the permeability of the sediments in which the water is trapped, (b) the thickness of the aquifer (and the depth to which the borehole penetrates the aquifer), and (c) the diameter of the borehole well.

The majority of boreholes in Kavango provide pure, good quality water with values of total dissolved solids (TDS) of less than 1,000 milligrams per litre (FIGURE 28). Water unsuited for use has been found in only a few areas, in many of which the water was probably contaminated by animal waste, especially where cattle troughs or kraals were close to wells drawing water from shallow aquifers. Precautions should be taken to guard against additional contamination of the region's underground water resources as the number of people and livestock grow.

Water is often transported over substantial distances, and people in Kavango use many methods of carrying water to their homes.

FIGURE 29
Wind-blown sands *(arenosols)* cover much of Kavango and are generally not suited to crops. Smaller patches of somewhat more fertile soils (*anthrosols, fluvisols* and *calcisols*) are found along the Okavango River, the omurambas and inter-dune valleys.[6]



Soils in the bottoms of omuramba valleys are more clayey (and thus dark) than the pale coloured sands higher up and away from the valley. This is the Ndonga Omuramba.

SOILS

Soil is often taken for granted as the substance that soaks up rainwater and in which grasses, trees and crops grow. Other than farmers, many people also fail to recognize how soils vary and how their qualities affect how much water is retained, the depth to which a plant's roots may extend, and what nutrients the soil contains for plant growth. The combination of these qualities dictates such important features as what plant species can grow and the structure of plant communities.

Different kinds of soil are generally characterized by the way in which water, air and mineral and organic components are arranged within the soil body. Soils in Kavango are completely dominated by sand (FIGURE 29), especially fine wind-blown sands deposited as a mantle across the region during much drier times long ago. The fine sands, loosely called Kalahari sands, are more correctly termed *arenosols*, and they usually extend to a depth of at least one metre. Other than sand, which generally makes up more than 70% of the body of the soil, less than 10% of the soil consists of clay and silt. The sandy texture allows water to drain away rapidly, leaving very little moisture at depths to which most plant roots can reach. The porous sand also holds very few nutrients, and the loose structure of sand means that there is little run-off and water erosion.

There are two types of soils along the river. The first and closest to the river are *fluvisols*, which are sediments deposited during floods. Most of these soils are therefore on the floodplains (see Figure 22, page 51) where periodic flooding means that most areas of *fluvisols* cannot be used for crops. The sediments usually consist of a mix of silt, clay and fine sands. The soils are not infertile but also not very productive. On higher ground within the river valley are so-called *anthrosols*, which are soils that have been modified by repeated ploughing and crop growth. The body of soil originally consisted mainly of two layers: a top layer of *arenosols* overlying deeper deposits of *fluvisol* sediments. The *fluvisols* were probably deposited during a much wetter period while the wind-blown *arenosols* were placed there during a later arid phase. The two layers have been mixed by repeated ploughing in many areas because it is on these soils that most crops are grown in the region. The *anthrosols* are, however, generally low in nutrients.

Most other crops are grown on *calcisols* in the omuramba and inter-dune valleys. A layer of calcium carbonate lying at some depth below the surface characterizes *calcisols*, which consist mostly of fine sand and smaller proportions of clay and silt. In some areas the calcium carbonate forms blocks of calcrete. The soils are potentially quite fertile but they generally contain little organic material and iron and zinc may not be available to plants as a result of the high concentrations of calcium.

A large area of *solonetz* soils occurs to the west of Khaudum. These are not suited to crop growth because they are characterized by concentrations of sodium salts at levels that are harmful to many plants. Much of the sodium accumulates in a layer of clay below the soil surface.

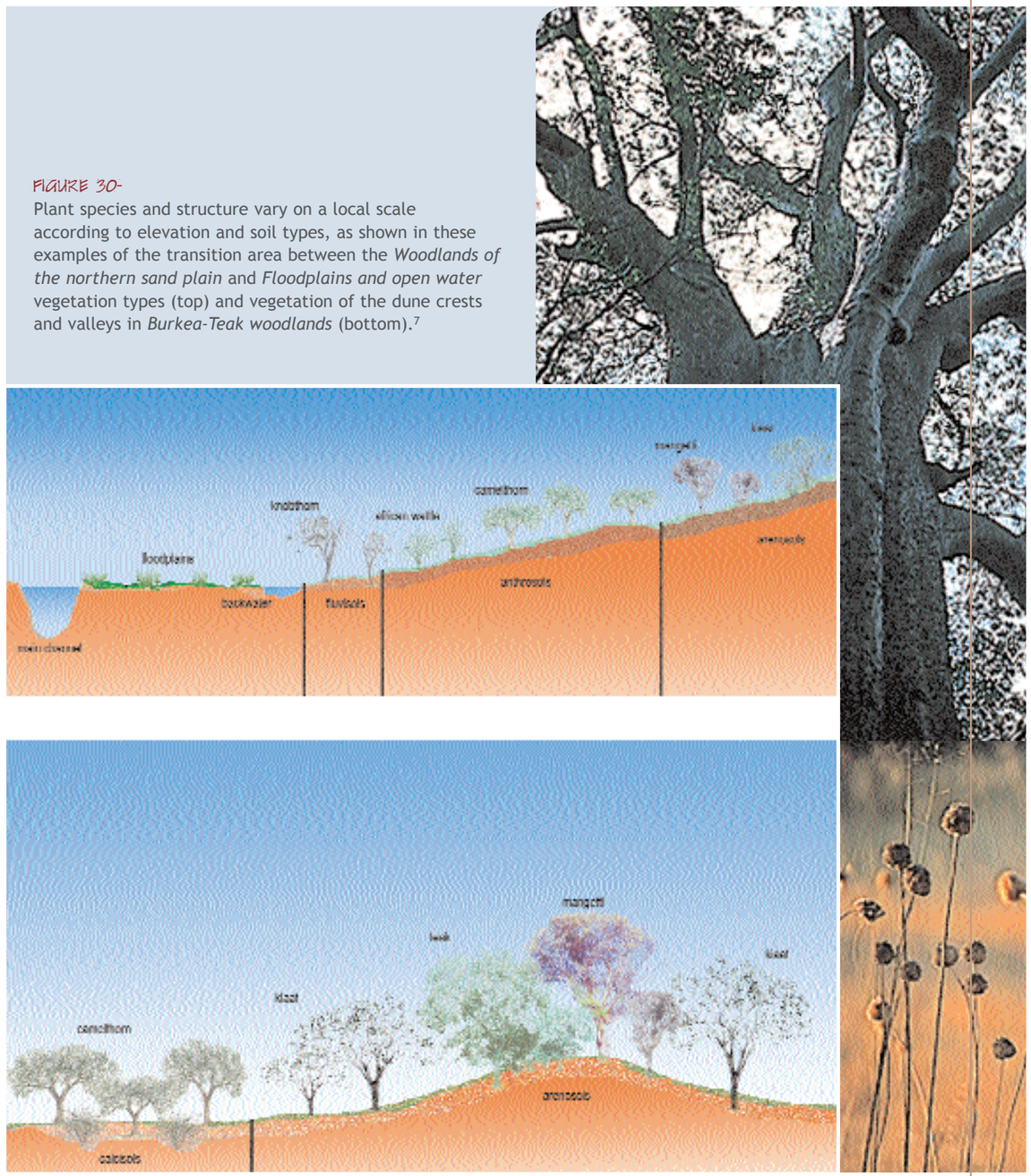
This account of the five major types of soils should make it clear that soils in Kavango are generally not fertile. Much of this is due to the predominance of sand and comparative scarcity of clays and silt. Water thus drains away rapidly and the percolating water also often carries away nutrients from within the soil. The poor fertility of the soils is also a reflection of the arid environment in which relatively little plant material is available to decompose into organic nutrients. Moreover, frequent fires burn away fresh plant material and humus that could decompose into the soil, and cause nitrogen and sulphur in the top soil layers to be released into the atmosphere. Experiments have shown that crop yields can be boosted substantially by the addition of nitrogen and phosphorous, but these need to be applied at specific times and in appropriate amounts to be effective. The fertilizers, particularly nitrogen, will only be effective in years with adequate rainfall, however, and poorer farmers will be reluctant to buy fertilizers if there is a sizeable risk of them not providing any benefit.

PLANT LIFE AND TYPES

Plants are important to Kavango for many reasons: in providing pastures for livestock, materials for building, weaving and wooden craft, fuel wood, fruits and nuts and traditional medicines. These are aspects of value to people, but plants are also the most important components of all natural habitats. There would be no animals without plants, and the greater the diversity of plants in an area, the higher the diversity of birds, mammals, insects or other groups. For example, wildlife in Mahango is abundant both for reasons of the protection that the reserve offers and for the fact that a diversity of plant life is present to offer animals food and shelter.

The topography or relief of the ground and soil types are the most important factors to determine the nature of plant communities, and the effect of these is

FIGURE 30-
Plant species and structure vary on a local scale according to elevation and soil types, as shown in these examples of the transition area between the *Woodlands of the northern sand plain* and *Floodplains and open water* vegetation types (top) and vegetation of the dune crests and valleys in *Burkea-Teak woodlands* (bottom).[7]



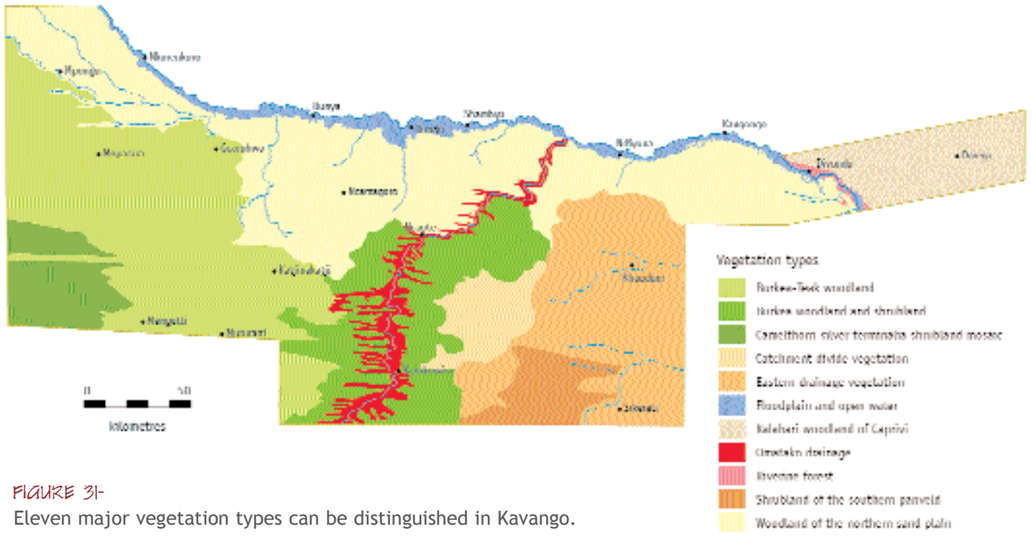


FIGURE 31-
Eleven major vegetation types can be distinguished in Kavango.

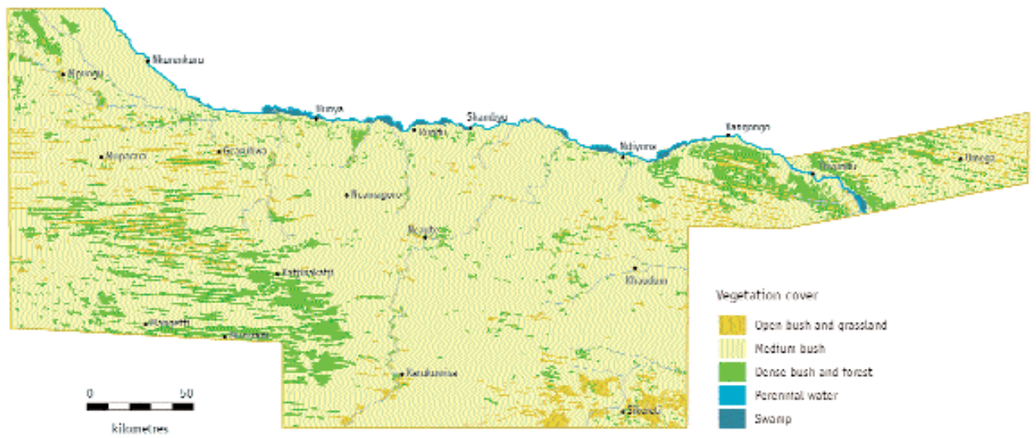


FIGURE 32-
Many parts of the region are covered in dense woodland, while other areas are more open grasslands or have been cleared of trees, as shown in this map of vegetation cover.

clear on both a broad and local scale. For example, the relative uniformity and predominance of broad-leafed, deciduous woodlands across the region is largely the result of widespread distribution of wind-blown sands (FIGURE 29). Examples of more local variation are provided by the diagrams in FIGURE 30, which show how small-scale changes in the composition and structure of plant communities relate to soil types and relief. These kinds of local and small-scale changes are found throughout the region and they are so prevalent that classifying plant communities into zones or types is often difficult. Indeed, much of the vegetation is often best characterized as mosaics of various small units.

While the vegetation types shown in FIGURE 31 are mosaics consisting of many species and communities of plants, there are three broad groupings. Firstly, much of the region consists of fairly tall woodland growing on deep Kalahari sands. This is true of the *Burkea-Teak woodlands*, *Burkea woodland* and *shrublands*, *Woodlands of the northern sand plain*, *Kalahari woodlands of Caprivi*, *Eastern drainage vegetation*, and *Catchment divide vegetation*. In many of these areas there are the remains of old dunes and the vegetation varies considerably between that on the sandy dunes and the more clayey soils in the inter-dune valleys. Thus, tall teak, false mopane *(msivi)*, burkea, kiaat *(mukwe)* and mangetti trees often dominate the deeper sands, while lower lying, more clayey soils are characterized by shrubby vegetation of silver terminalia, camelthorn, *Combretum hereroense*, *Acacia fleckii* and patches of grassland. Much of the *Catchment divide vegetation* grows on solonetz soils.

Much of inland Kavango looks like this savanna woodland dominated by Burkea africana.

Secondly, there are vegetation types associated with drainage systems: the *Floodplains and open water*, *Riverine forest*, and the *Omatako drainage*. Vegetation along many of the other dry omurambas is similar to that in the Omatako, the sides of the valleys being wooded with fairly tall burkea trees while the valley floors are often grasslands with scattered copses of shrubs. Much of the original vegetation in these drainage systems has been destroyed by the clearing of land for crops, especially along the Okavango River. The riverine forest flanking the river near Andara and Divundu is the only forest of its kind remaining along the Okavango, and every effort should be made to conserve the forest.

Thirdly, there are two vegetation types in which there are many pans: *Camelthorn-Silver terminalia shrubland mosaic and shrublands of the southern panveld*. The soils in these areas are often shallow and contain large quantities of calcrete.

In addition to changes in the types of vegetation in Kavango, there is also much variation in the amount of plant cover, especially of trees and shrubs (FIGURE 32). The fairly fine resolution provided in this map shows how old dunes are more wooded while the inter-dune valleys are more open. The same is true of plant cover along the dry drainage lines. Many of the patches of dense bush are teak woodlands, especially those in the Mururani-Katjinakatji area, west of Andara and in the Caprivi Strip.

PLANT GROWTH

FIGURE 33 provides a perspective on how plant growth and production varies from season to season. The 11 maps show an index of total plant growth each season between 1991-1992 and 2001-2002, and two features stand out very clearly in the maps. First, there is a high degree of variation in plant growth from season to season, a reflection of how annual rainfall varies so much. The season of 1994-1995 was by far the worst, and Rundu then received only 308 millimetres. Andara recorded 246 millimetres, the lowest total in 55 years of records for the station. Another bad season with low plant production occurred in 1992-1993. Most of the best seasons have been in recent years: 2001-2002 and the three between 1997-1998 and 1999-2000.

The second feature shown by the 11 maps is how much plant growth varies from place to place. Again, this reflects the patchiness of rainfall, some areas receiving good falls and others very little. But the variation in plant growth is also due to certain kinds of vegetation producing more new growth each season than other kinds. In most seasons, the swampy areas in Mahango Game Reserve show up as producing more growth for this reason. And, finally, the maps show how areas that have been cleared of natural vegetation now produce very little growth. This is best seen in the area around Rundu, where there is less plant growth each season than elsewhere.

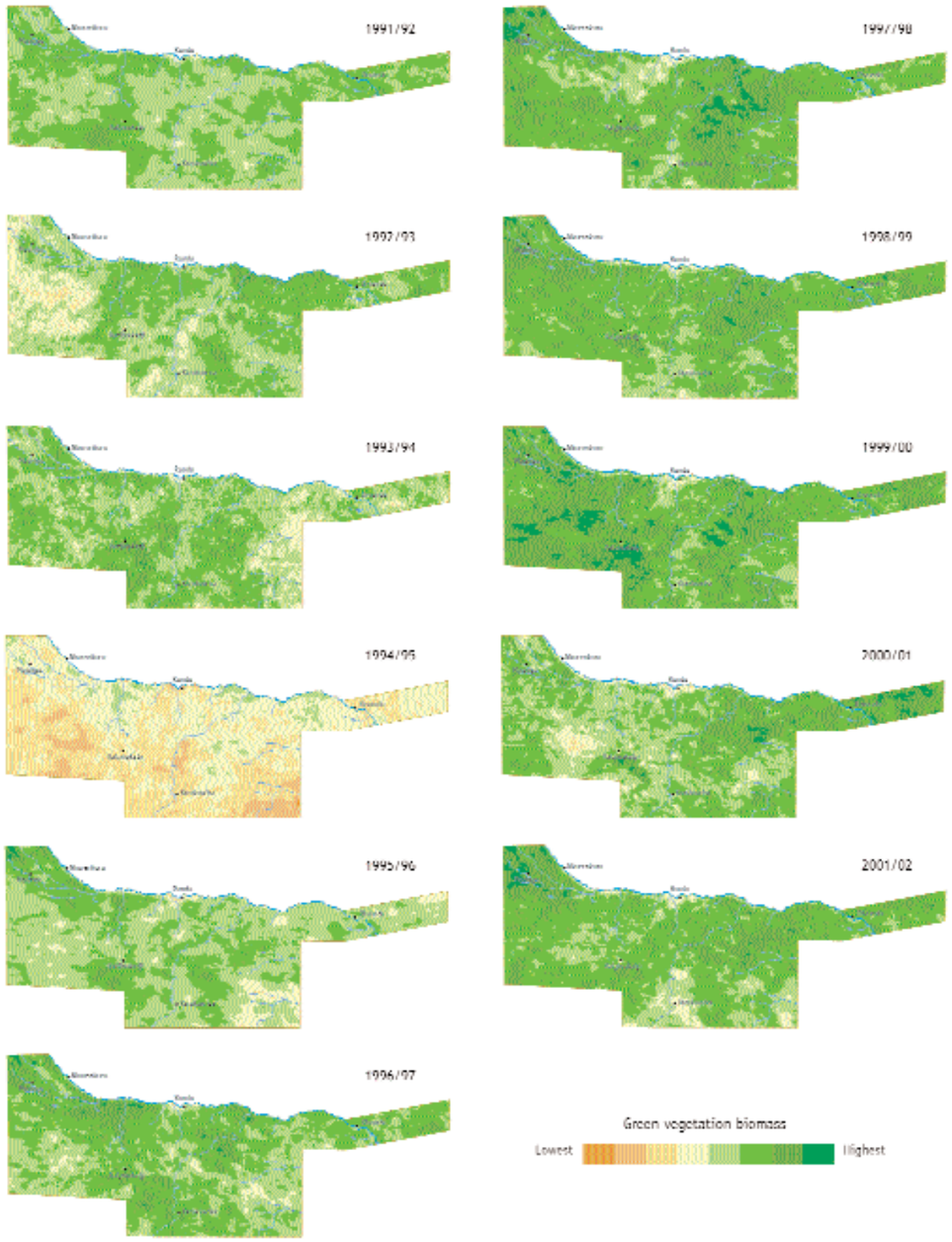
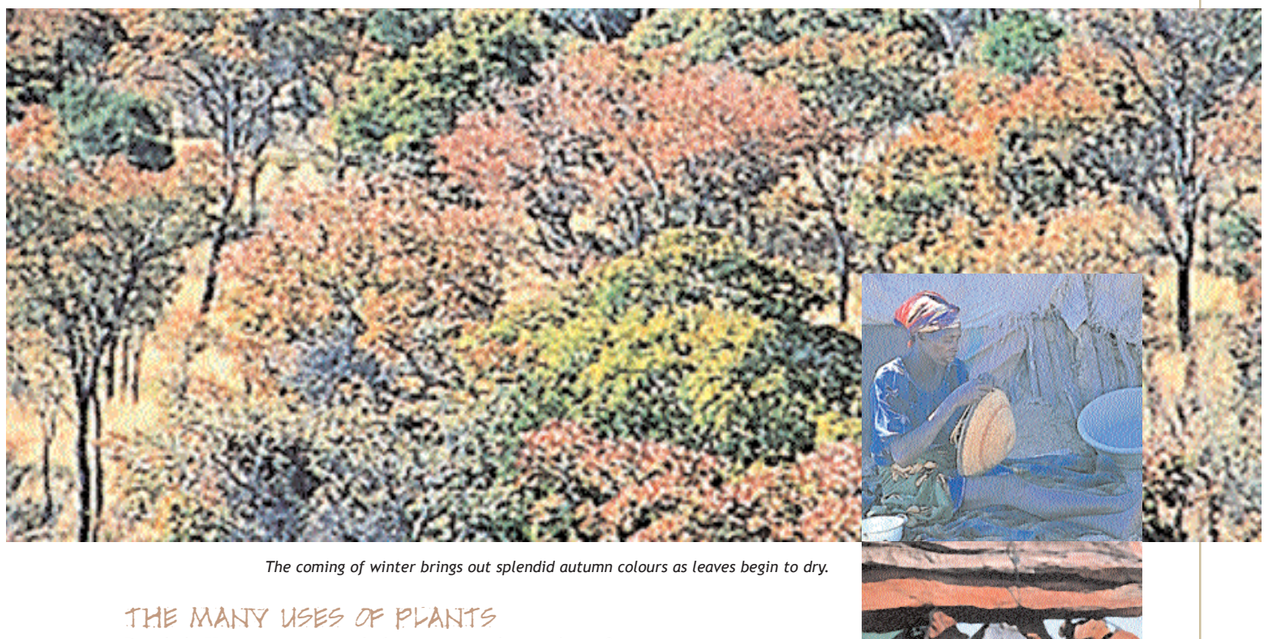


FIGURE 33-
Plant production varies from year to year and place to place, as shown over 11 seasons between 1991/1992 and 2001/2002. The colours are an index of the total volume of new plant growth during each season, which lasts from July of one year to June of the next.[8]



The coming of winter brings out splendid autumn colours as leaves begin to dry.

Baskets and firewood are just two of the many products derived directly or indirectly from the wealth of plant life in Kavango.

THE MANY USES OF PLANTS

People in Kavango use natural plant resources in a variety of ways. Many of the uses are essentially domestic in nature, the plant products being used at home and for the immediate benefit of members of the household. Other uses involve the sale of items to earn cash incomes, and many of the sold products are also exported from the region. Perhaps the most important use made of plant products is for wood. Most homes in Kavango are at least partially constructed using timber harvested from local trees such as kiaat, teak, burkea, camelthorn and silver terminalia. Wood was used as a fuel in approximately 90% of rural homes in 1991, and that proportion has probably not changed much since then. In fact, the use of wood fuel has probably increased as a result of the growing volumes of firewood now sold alongside the major roads, much of it being exported for use elsewhere. Sleds and dug-out boats are also made from pieces of wood or tree trunks. Other major uses of wood are for furniture and craft production. Large-scale commercial logging and harvesting of kiaat, false mopane and teak stopped in the early 1990s, but some furniture continues to be made from these trees. Until some 10 years ago, most wooden craft were small articles sold along the road between Rundu and Katjinakatji, but an increasing export trade both in small items and large statues has developed in recent years. Many of these items are sold in Windhoek and Okahandja. Large rough blocks of kiaat and false mopane wood are also exported for the use of carvers elsewhere. In theory, anyone cutting wood for the export of timber, craft production and sale of firewood should have a permit from the office of the Directorate of Forestry in Rundu.

Grass is used extensively, most notably for grazing Kavango's herd of about 150,000 cattle. Little information is available on the quality and availability of pastures in Kavango, but reasonable grazing is apparently widely available away from the comparatively small areas that are very heavily stocked (see page 102). *Kweek* or *Cynodon dactylon* lawns on the river's floodplains and along the omurambas are a particularly valuable grazing resource. Most rural houses are thatched with grass and many homes near the river have walls of platted reeds. A substantial export industry of thatching grass (mainly *Eragrostis pallens*) has developed in recent years, much of it going to commercial thatching companies in Windhoek, central northern Namibia and South Africa. In the few areas where palms grow in Kavango, their leaves are used to make baskets, both for domestic use and for sale in a growing export market.

People cause most of the hundreds of bush fires that ravage Kavango each year. Some fires are set deliberately while others run out of control, often when trees are burnt to clear new fields. Smaller trees can be cleared with an axe, but fires are best to kill tall camelthorns, as shown on the opposite page.

A large variety of trees and shrubs produce nuts and fruits that are consumed domestically. For example, a recent survey found that nuts and fruits from between 35 and 50 different species are eaten in any one area.[9] Most of these are taken only occasionally but others, especially mangetti, monkey oranges and *msivi* provide relatively large quantities of food. Mangetti nuts are also used on a large scale to brew an alcoholic drink, *kashipembe*, and as a source of oil. Studies are now exploring the potential for distilling *kashipembe* into a bottled liqueur and for producing oil for the cosmetics industry elsewhere in the world. The leaves of a number of wild spinach plants are regularly consumed, as are water lilies and various mushrooms. Many plants are also used for medicinal purposes, and the same recent study on plant uses found that the healing properties of between 20 and 40 different species were used in any area.

THE BURNING OF KAVANGO

Very large areas of Kavango burn year after year, especially so in eastern Kavango and the Caprivi Strip (FIGURE 34). This might be due to the higher rainfalls in the east producing more grass to burn than in the drier west. However, fires may also be better controlled in the west by the presence of more cattle farmers than in the east. The long lines of inter-dune valleys in the west (Figure 8, page 27) also restrict runaway fires to a greater extent than in the east where there are few natural barriers to stop fires from spreading.

The great majority of fires occur during the winter months and most are started by people. Some fires are set deliberately to stimulate the growth of new pastures, while others run-away accidentally when farmers burn small areas to clear land for cultivation or to remove vegetation from waterholes, for example. No quantitative studies have been done to assess the effects of fires in the region, but it is clear that frequent and widespread burning has several important impacts. First, large areas of grazing are lost, especially when fires rage over large areas. For example, between 21 and 50% of the region burnt each year from 1989 and 2001 (FIGURE 35). The average area burnt over those 13 years was 32%, and so farmers must battle to graze their animals if an average of about one-third of all pastures are lost to fire each year. Secondly, many young trees are killed and as a result very few young trees of valuable timber species are to be found in some areas. This is particularly true for teak and *msivi* trees. Thirdly, large and valuable timber trees (and other species) are either killed directly by fires or their trunks are gradually burnt away over several years until they die or fall over. Fourth, large areas become impenetrable thickets of shrubs, especially of silver terminalia and *Baphia massaiensis*. Fifth, soil fertility is reduced by the loss of nitrogen and sulphur to the atmosphere and the burning away of leaf litter and humus that would otherwise decompose into organic nutrients in the ground. Sixth, livestock, wildlife, homes and people may be burnt or killed by fierce fires. Finally, the extent and frequency of burning means that Kavango fires must add significant volumes of ash and carbon dioxide to the atmosphere. How significant those amounts are is unknown, but the contribution made by fires in Kavango to global pollution has to be acknowledged.

FIGURE 34-
Many areas of Kavango burn every year as shown by the number of times that different places burnt during the past 13 years (bottom). The three small maps show the extent of bush fires in three years: 1997, 2000 and 2001.[10]

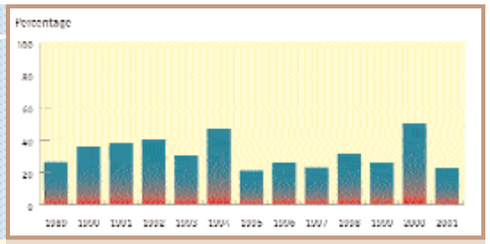


FIGURE 35-
Between one fifth and half of Kavango is burnt each year, as shown by these percentages of the region's total area that were burnt between 1989 and 2002.

With such large ears, kudus are well suited to life in woodlands where sound signals are often more valuable than visual ones.

WILDLIFE IN KAVANGO

Although large areas of uninhabited woodland cover Kavango, there are few large animals in many of those areas. Indeed, most large mammals occur in the region's game reserves, particularly in the Mahango Game Reserve and Khaudum Game Park, as shown in the table below and FIGURE 36.

Estimates of the numbers of large mammals in Kavango.[11]

Species	Mangetti Game Reserve	Khaudum Game Park	Mahango Game Reserve	Caprivi Game Park	Elsewhere in Kavango	Total population in Kavango
Lechwe			100			100
Reedbuck			150			150
Roan		100	50	20		170
Sable	25		130	20		175
Hippo			200			200
Oryx	20	150			50	220
Blue wildebeest	50	150	40	20	50	310
Giraffe	20	300	20	20	20	380
Eland	500					500
Buffalo			500	100		600
Kudu		200	150	100	500	950
Elephant	20	1,500	300	200	50	2,070

The species listed in the table to the left are of course not the only large mammals: there are reasonable numbers of tsessebe, impala and zebra in Mahango Game Park, and then also smaller animals such as duiker, situtunga, steenbuck and warthog in Mahango and elsewhere. Kavango is also home to six species of large predators (FIGURE 37), although they are so secretive that few people are lucky enough to see them. There are also very few of them, as estimates of their total populations in the region indicate: 20 brown hyaena, 30 cheetah, 40 spotted hyaena, 50 lion, 100 wild dog and 300 leopard.

Although there are many more elephants than any other large mammals, these giants come and go. For example, estimates at different times show that the population in Khaudum Game Park may vary between 800 and 2,200 elephants. Some of them move south into north-eastern Otjozondjupa while others travel east into Botswana. In fact, all the elephants in eastern Kavango form part of a much larger population of 120,000 or more animals that cover an area extending east to Caprivi and the Chobe and Hwange National Parks in Botswana and Zimbabwe, respectively. On the other hand, the small number of elephants in the Mangetti area may move west to link up with the large population of Etosha elephants.

Several conclusions or inferences can be drawn from the large numbers listed in the table to the left. First, the

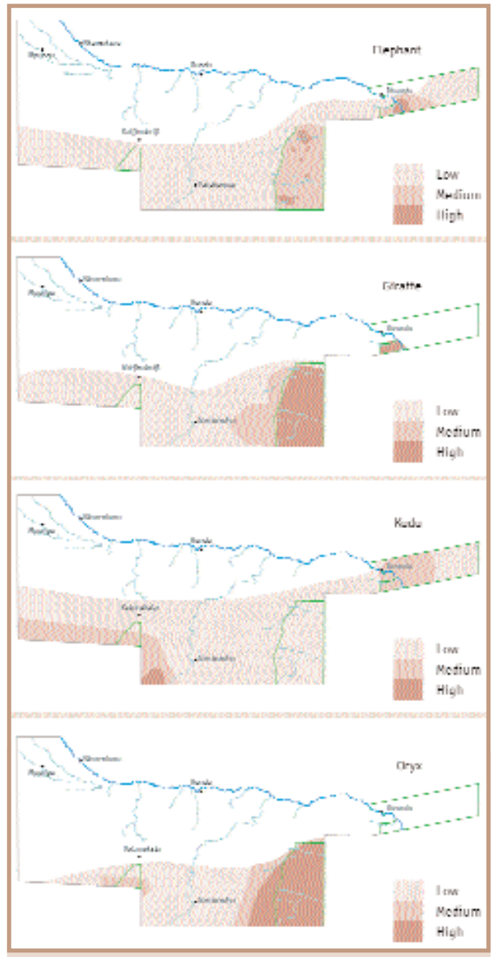


FIGURE 36-
Most large animals occur in Mahango Game Reserve and Khaudum Game Park, as shown by the relative densities of elephant, giraffe, kudu and oryx.

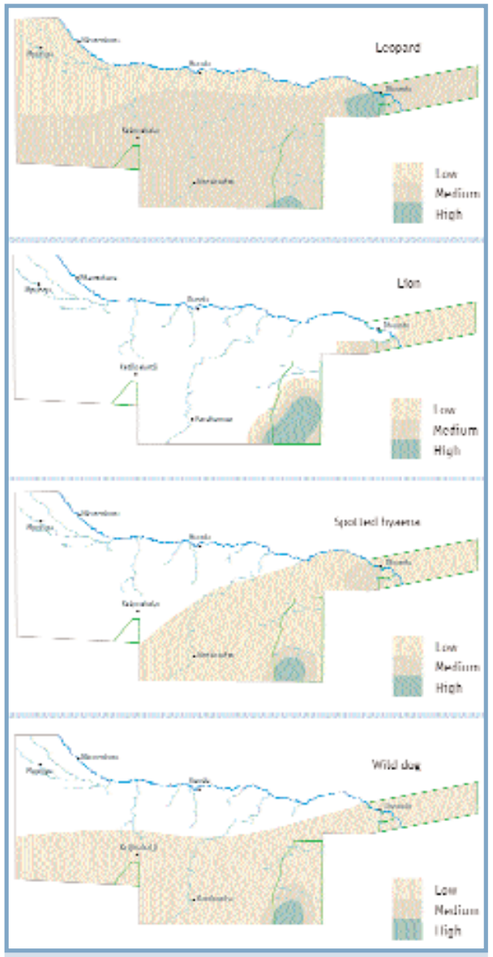


FIGURE 37-
Like other large mammals, most carnivores occur in the eastern parts of Kavango. The maps show the relative densities of leopard, lion, spotted hyaena and wild dog.[12]

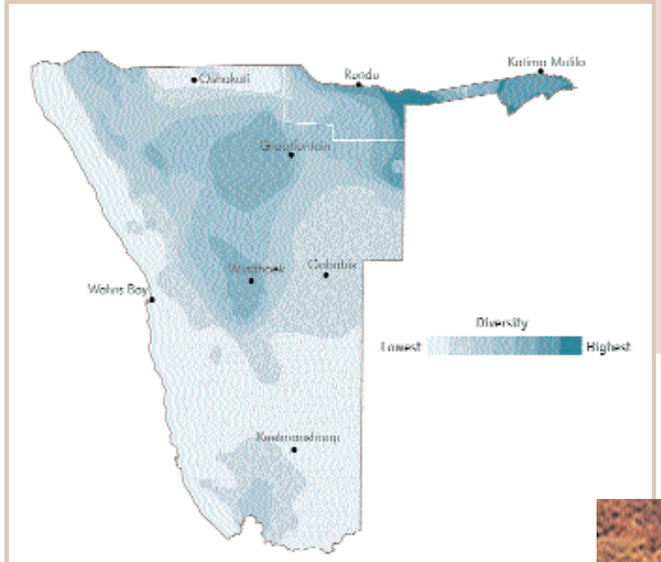


FIGURE 38-
Kavango is home to a more diverse community of plants and animals than most other areas in Namibia. Much of the diversity in Kavango is linked to the variety of habitats along and near the Okavango River. This overall measure of diversity is based on the numbers of species of plants, birds, reptiles, mammals, frogs, termites and scorpions found in different areas of the country.[13]

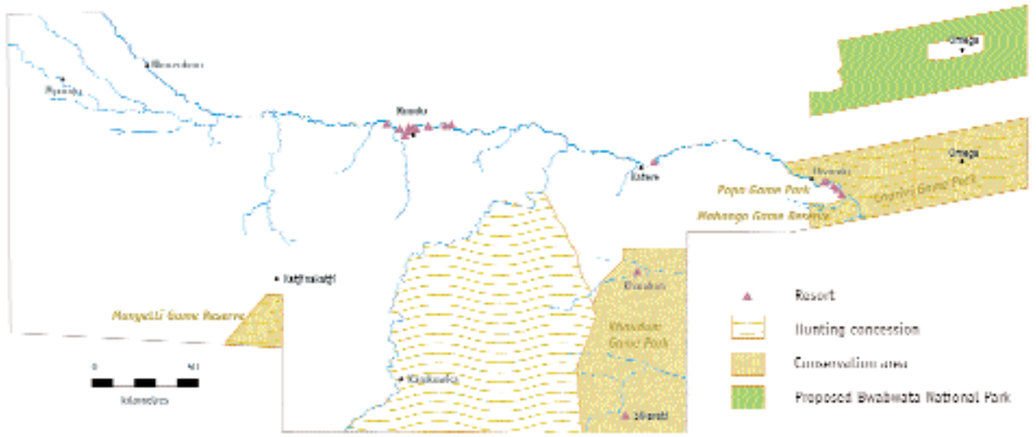


FIGURE 39-
Conservation areas cover about 15% of Kavango, but facilities for tourists are not available in most of these areas. Five areas are allocated as hunting concessions. The proposed Bwabwata National Park will consist of Mahango Game Reserve and much of the existing Caprivi Game Park.

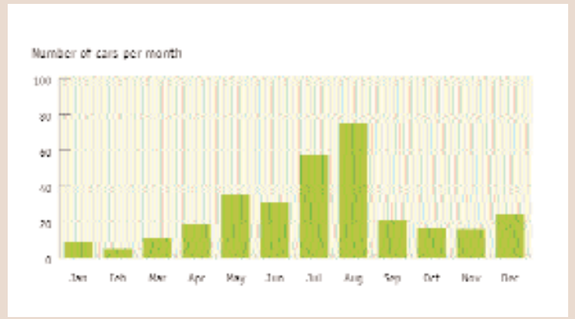
One of Kavango's comparative advantages is its ability to offer tourists camping sites in a spectacular environment.

numbers tell us that the reserves offer protection to significant populations of these species. Secondly, habitats in these areas are likely to be of reasonable quality if so many animals are present (although riverine forests in Mahango Game Reserve have been badly damaged by the large herds of elephants there). Thirdly, it is these kinds of animals that are attractive to tourists, and their relative abundance provides good cause for the reserves to draw visitors. Finally, an abundance of large mammals serves as an indicator that many other smaller species are likely to be present in the same areas. In this respect, Kavango has a much higher diversity of animals and plants than other areas in Namibia (FIGURE 38). Along with an area near Ngoma in Caprivi, more birds (419 species) have been recorded in Mahango Game Reserve than anywhere else in Namibia.

CONSERVATION AND TOURISM

Approximately 15% or 7,508 square kilometres of Kavango's surface area is allocated to conservation in five reserves: Khaudum Game Park (3,841 square kilometres), Caprivi Game Park (3,002), Mangetti Game Reserve (420), Mahango Game Reserve (245) and the minute Popa Game Park (0,25 square kilometres). Proposals are now being made to adjust the boundaries of the Caprivi Game Park so as to cut

FIGURE 40-
Very few visitors go to Khaudum, as shown here by the average number of visitors' cars recorded at Khaudum camp over the past four years. The graph also shows that the majority of visits are between May and August.



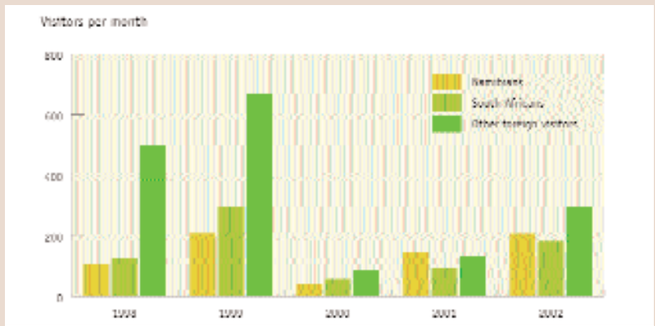


FIGURE 41-
Numbers of tourists crashed following the unrest that broke out at the end of 1999 and early in 2000. The graph shows the average number of visitors to Popa Game Park each month between 1998 and 2002.

out several areas used for farming and the settlement of Omega. These proposals would also provide for the establishment of the new Bwabwata National Park that would incorporate the Mahango Game Reserve (FIGURE 39).

Each park is managed by resident staff of the Ministry of Environment and Tourism while accommodation at Popa Game Park and Khaudum and Sikereti camps is run by a parastatal, Namibia Wildlife Resorts. However, both organizations have suffered from the loss of experienced staff and difficulties in recruiting competent new people. This has led to a variety of problems in the parks. In the unlikely event that there will be a drastic improvement, there is a strong argument for handing the management of the parks and resorts to private enterprise. Contracts to manage the parks could make it a condition that each area be run according to existing management plans stipulating, for example, aspects of maintenance, law and order, and the provision of water holes. The involvement of private enterprise could also do much to expand the provision of tourism facilities in the region and especially in the parks (see below).

There are five hunting concessions in Kavango, although one to the east of Omega extends further eastwards into part of Caprivi. The concessions are defined areas in which specific numbers of large mammals can be hunted under the supervision of a professional hunter. People who hunt the animals pay the hunter an agreed price. Each concession is awarded for a different price. The total value of the five concessions in 2002 amounted to N$2,840,000, which was paid into a trust fund to support the development of parks and community-based natural resource management projects. The concessions are normally awarded for a three-year period. During the most recent period, the concessions in Kavango allowed for the hunting each year of the following: 41 elephants, 10 leopards, six lions, hyaena, steenbok and duiker, four buffalo and roan antelope, five sable

Elephants, crested francolins (opposite), lilacbreasted rollers (above) and bullfrogs (right top) are just four of the thousands of species that give Kavango such a rich diversity of animal life.

antelope and eland, and two each of kudu, crocodile, lechwe, reedbuck, impala, wildebeest and oryx.

For such a large region there are remarkably few facilities to accommodate tourists (FIGURE 39). Most hotels, lodges and camp grounds are clustered in and around Rundu, where the majority of visitors are business people, government officials and people in transit through the region. There is also a group of five resorts south of Divundu. The small number of resorts for tourists is even more remarkable given that such large areas are allocated for conservation. There are, indeed, only three resorts in these conservation areas. Curiously, the most popular and biggest resort is actually in an area (Popa Game Park) that is much too small to serve any real purpose for conservation. The only other two resorts are the rudimentary facilities at Khaudum and Sikereti. Numbers of visitors to these two resorts are amazingly low, ranging between an average of five and 75 cars per month at the Khaudum camp (FIGURE 40).

The spate of unrest that broke out in Kavango at the end of 1999 and early in 2000 had a devastating effect on tourism to the region. Tourists simply abandoned the whole of north-eastern Namibia, and many resorts and hotels had to close for a year and longer. The effect of this is most clearly shown by the number of visitors to Popa Game Park (FIGURE 41). In keeping with the growing tourism business to Namibia, the number of visitors had increased year by year, with the number of foreign visitors (from South Africa and elsewhere) to Popa increasing by 4,000 from 1998 to 1999. Then came the great slump in 2000, when numbers of foreign visitors dropped by almost 10,000 from the 1999 total. Although the number of visitors increased in 2001 and again in 2002, it seems certain that it will take several more years before the confidence and numbers of visitors return to what they were.

Key notes

- Less than 0.25% of the total volume of Okavango River water is extracted in Namibia.
- Access to underground water has enabled people to settle in many inland areas where they could not otherwise live.
- Most boreholes provide moderate supplies of water that is of good quality; water in western Kavango is usually much deeper than that in the east.
- The wind-blown sands that cover much of Kavango are generally not suited to crop cultivation.
- Natural vegetation is used for many important purposes: grazing, building materials, fuel wood, food such as fruits and nuts, building, craft production, and as medicines.
- Plant growth varies greatly from season to season, and from place to place as a result of variation in rainfall, changing types of vegetation and human influences.
- Between 21 and 50% of Kavango burnt each year between 1989 and 2001. The extensive and frequent burning causes many environmental problems.
- Most large species of wildlife occur in north-eastern Kavango, particularly in the Mahango Game Reserve and Khaudum Game Park.
- Kavango has a greater diversity of plants and animals than most other areas in Namibia.
- Approximately 15% of Kavango is allocated to conservation areas, but there is a need to improve management of these areas. In most areas there are no facilities to accommodate tourists.
- Hostilities in Kavango at the end of 1999 and early in 2000 had a devastating effect on tourism to the region.