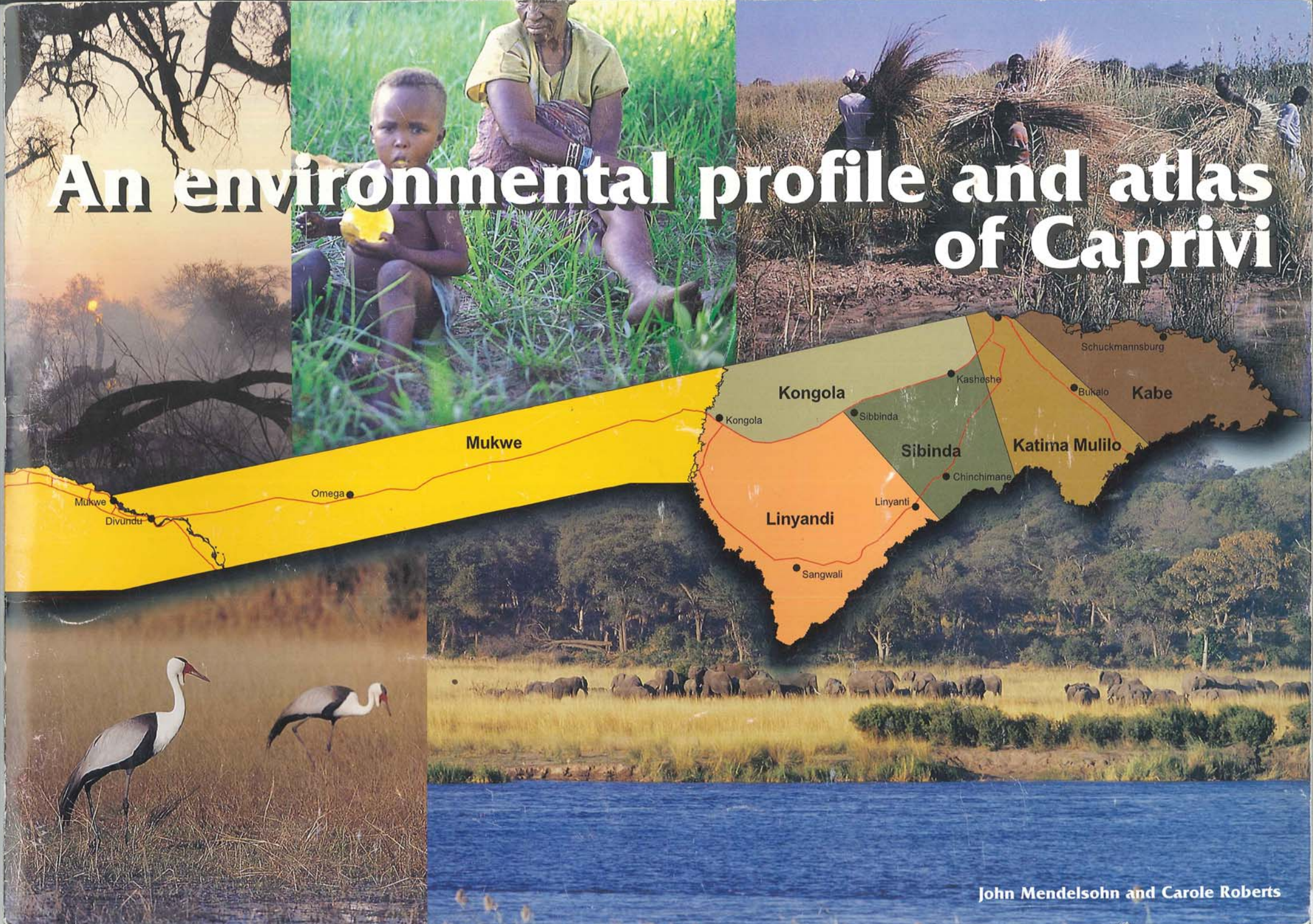


An environmental profile and atlas of Caprivi



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Directorate of Environmental Affairs
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Windhoek
Namibia

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Satellite images of Caprivi taken in June and July 1994. The images were recorded from a Landsat satellite circling some 700 km above the earth. Colours and patterns on the images reflect different types of vegetation and the effects of bush fires.

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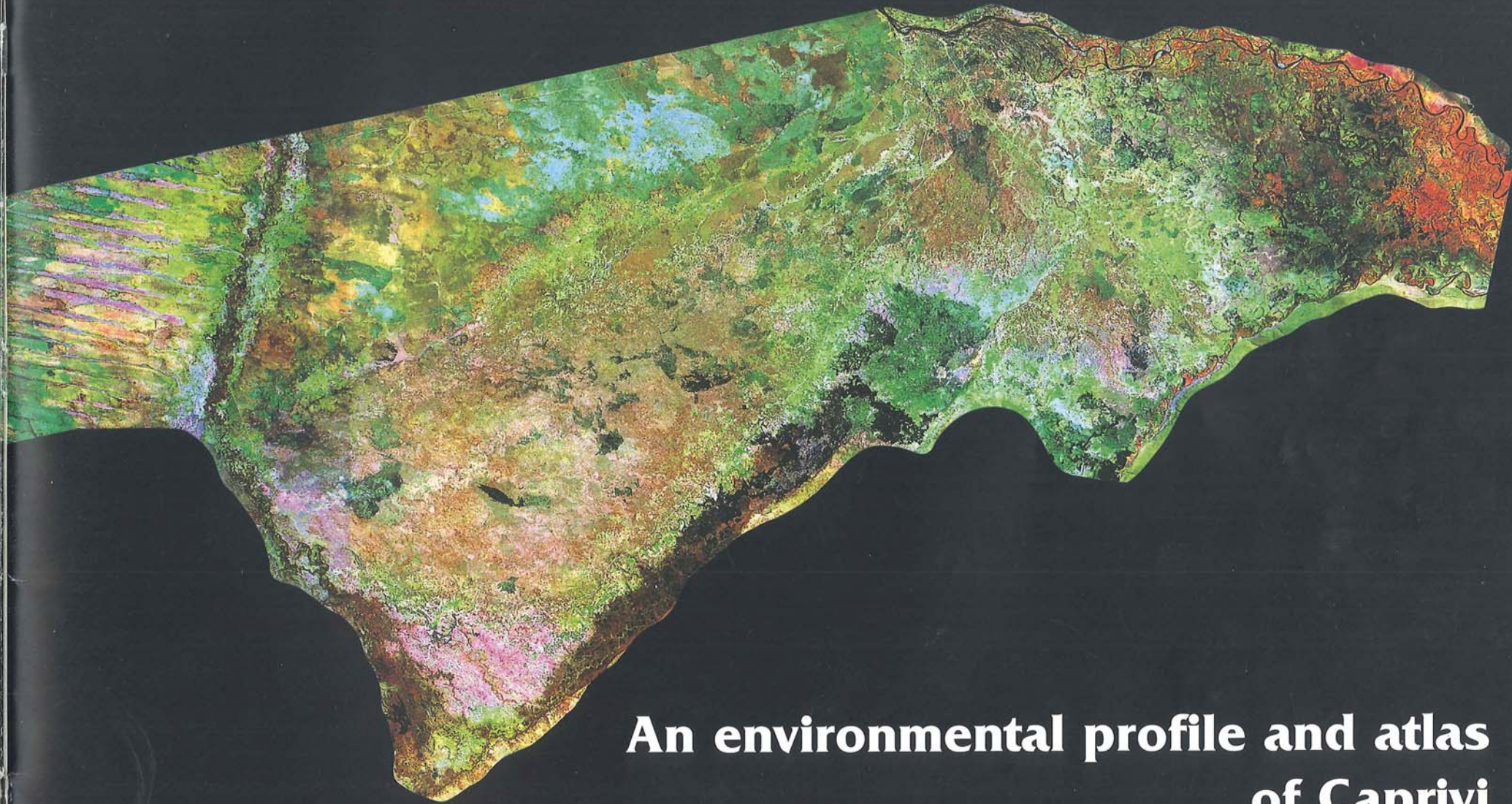
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An environmental profile and atlas of Caprivi

John Mendelsohn and Carole Roberts

with vegetation descriptions
by Christopher Hines

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List of abbreviations and symbols

°	degrees	MAWRD	Ministry of Agriculture, Water and Rural Development
'	minutes	mm	millimetre(s)
"	seconds	NDC	Namibian Development Corporation
°C	degrees Celsius	NOAA	National Oceanic and Atmospheric Administration (USA)
AIDS	Acquired Immune Deficiency Syndrome	NOLIDEP	Northern Livestock Development Programme south
CSO	Central Statistics Organization	SARCCUS	Southern African Regional Commission for the Conservation and Utilization of Soils
DWA	Department of Water Affairs	SD	Standard deviation
E	east	SIAPAC	Social Impact Assessment and Policy Analysis Corporation (Pty) Ltd.
GIS	Geographic Information System	sp.	species (singular)
GPS	Global Positioning System	SPOT	Systeme Probatoire d'Observation de la Terre
ha	hectare(s)	spp.	species (plural)
HDI	Human Development Index	SSD	Social Sciences Division (University of Namibia)
HIV	Human Immunodeficiency Virus	TDS	Total Dissolved Solids
ITC	International Institute for Aerospace Survey and Earth Sciences (ITC)	TM	Thematic Mapper
kg	kilogram(s)	UNDP	United Nations Development Programme
km	kilometre(s)	WWF	World Wildlife Fund
km ²	square kilometre(s) (1 km ² = 100 ha)		
LIFE	Living in a Finite Environment, programme of WWF in Namibia		
m	metre(s)		
m ³	cubic metre(s)		
m ³ /s	cubic metre(s) per second		

Chapter 1

Introduction



(PT)

About 100 years ago there were probably about six thousand people living in the area we now call Caprivi. People lived off the land, farming, hunting, fishing, and using wood to build their homes and cook their food. The quality of their lives depended on having ready access to good natural resources, and demands for food, water and fuel could easily be met by what the natural environment could supply. With 6 000 people in an area about 20 000 km² in size, each person had access to more than three square kilometres of land, on average, and all the resources that were available on that piece of land.

Now, 100 years later, people still largely depend on what the land has to offer. However, Caprivi now has a population about 18 times higher than it was then. Very simply, each person lives off 18 times less land than he or she would have 100 years ago. And the number of people keeps growing! In a perfect dream we would have hoped for the land to keep growing, but the amount of land and what it offers has not been maintained – instead, it has shrunk. Repeated and frequent bush fires have burnt away woodlands; land has been cleared, farmed and abandoned to become fields of thickets and weeds; game has been killed and driven away; and fish numbers have dwindled.

Many may argue that this description is too bleak. Large areas in Caprivi remain unsettled and unused by people, and some areas are still home to large numbers of game. All of this is true, and certainly Caprivi is no wasteland. But Caprivi can expect to have more people as time passes, and more people will need more land. Parts of Caprivi are also no longer available for subsistence farming, with competing uses for game parks, forest management, tourism and commercial farming. How can these competing interests be accommodated and how can we hope for Caprivians of the future to have access to the resources they need?

This publication does not pretend to answer all these questions, but it does present information and comment that people should consider if such questions are of any value at all. It attempts to bring together information on key issues and processes that affect the health of both the physical and social environment in the Caprivi. It has been written with a broad audience in mind, ranging from key leaders and politicians who need to make bold and wise decisions, to men and women who should know more about their region, to the youth who might face a sad future if these questions are not posed in this, the last decade of this century.

Much of the publication explores the relationship between the quality and distribution of natural resources and the spread of people who depend on these resources. Water is needed, both for domestic uses and livestock. The majority of homes obtain most of their income from subsistence farming, planting crops that need good soils and tending cattle that do best on healthy pastures. Most homes are constructed from

wood, so timber is required to build them, especially from those types of trees which provide more durable timber. Most homes have thatched roofs which require certain kinds of grasses and reeds. With almost all households using wood fuel for cooking, firewood is another critical resource. For communities living close to rivers, fish are an important source of food and may be sold to generate cash. Other natural resources of direct benefit to Caprivians are indigenous fruits and other foods, and materials for the crafting of utensils and items for sale.

In compiling this publication, we have sought to emphasize the most important issues and processes that drive and affect the environment in Caprivi. The choice of what to highlight has been ours, but was guided by two workshops — one in Katima Mulilo, the other in Windhoek. Participants highlighted issues, constraints and problems of an environmental nature that we have taken up in assembling the profile. The contents of the publication have also been influenced by current events and climatic patterns. Recent years have been relatively dry compared to rainfalls in the 1960s and 1970s, and the rivers now run low. New political structures and aspirations have been introduced, and the tensions of the past 25 years have faded. New ways of conserving the environment are being tried, new entrepreneurs are emerging, and old ways are being scrutinized.

This publication, a product of the Environmental Profiles Project of the Ministry of Environment and Tourism, is a step towards their goal of having information on important environmental issues and processes in Namibia accessible to everyone. Work done to compile the profile was largely funded by the Kingdom of the Netherlands as part of their ongoing commitment to enhancing environmental awareness throughout the world. This particular project has aimed to provide two products: this publication, and a range of information that was collected during the process. Our hope is that a variety of people will pick up this information, analyse it further, add to it, and generally use the information for whatever good purpose it may serve.

This is a publication intended for a wide readership. Within that frame, however, two groups of readers are perhaps more important than others: The first is Caprivi's new Regional Government, a body that needs to gain structure and stature to administer and lead Caprivi forward to a productive future. It is a modest hope that information presented here will aid the members of this body in their task. The second group consists of the many Caprivians who have been badgered by researchers and students collecting information. Too often one hears that nothing comes of these studies and no feedback is given. Again, it is our hope that information compiled here will provide some reward for sharing their knowledge so generously.



Aerial view of the Linyanti Swamps with Kalahari woodlands in Botswana in the background

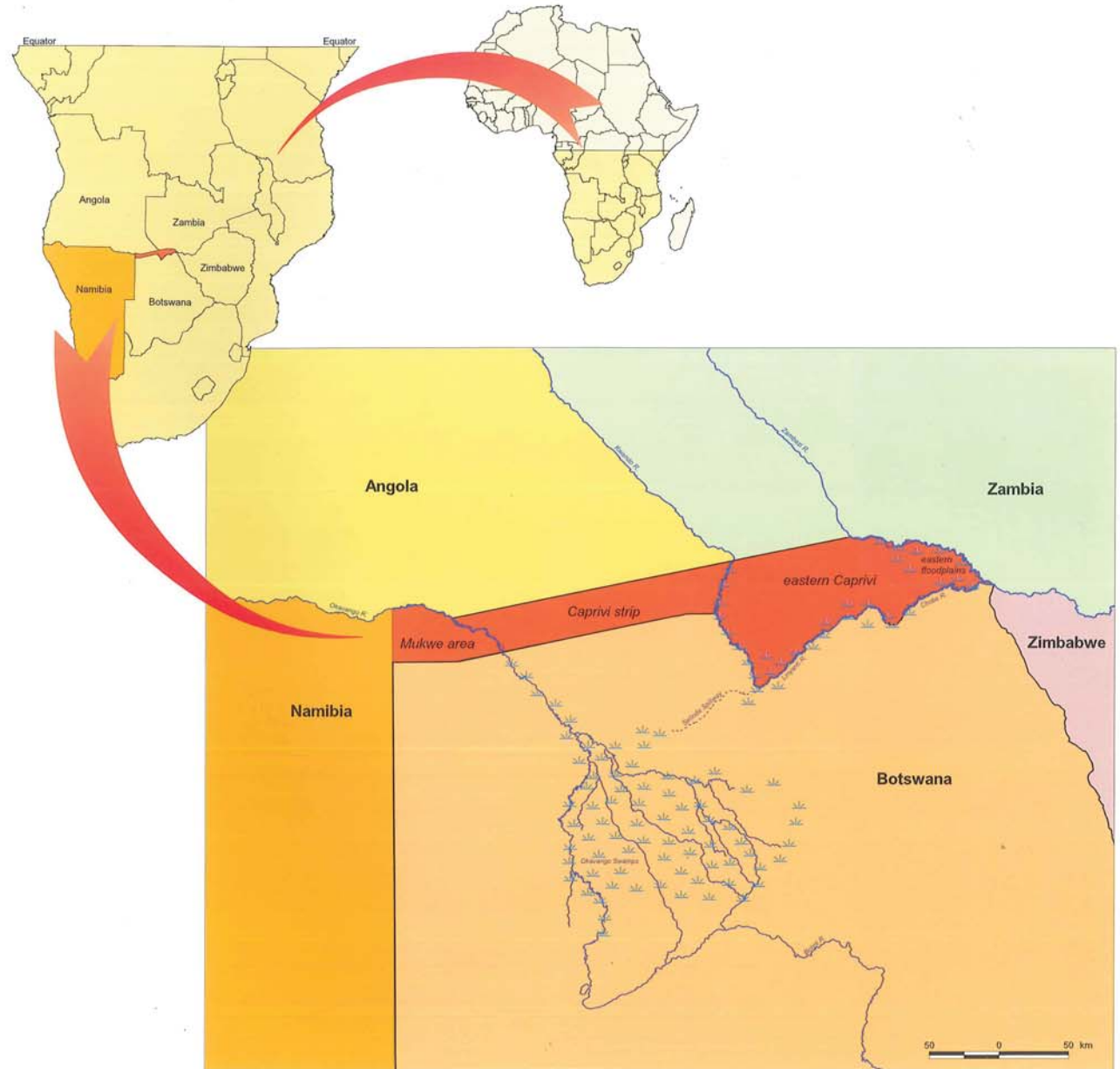
Information compiled by the Environmental Profiles Project

The Environmental Profiles Project assembled several sets of data which are available from the Directorate of Environmental Affairs in the Ministry of Environment and Tourism. Those compiled by the project are freely available and those derived from other sources can be used with permission from the relevant organizations. The information is freely available in the spirit that human development is stimulated by the unrestricted flow of information.

Aerial photographs	prints of 1:20 000 photographs taken in 1996 and 1997 of the whole region; prints of certain areas taken in 1943, 1972, 1990, 1993 and 1995; and a list of other aerial photographs taken of Caprivi
Birds	records of species occurring in each quarter-degree square
Boreholes	co-ordinates, rest water levels, yields and total dissolved solids for several hundred boreholes
Climate	rainfall, temperature, humidity and evaporation data for weather stations in and around (Zambia and Botswana) Caprivi
Cultivation	areas cleared for cultivation in the whole of Caprivi in 1996, and of sample areas in 1943 and 1972 have been mapped; the data is available digitally
Fire	images showing active fires and fire scars derived from an interpretation of NOAA images taken in 1996
Infrastructure	positions of schools, health facilities, air strips, police posts, roads, telephone lines, power supplies and tourist facilities
Literature	lists and copies of publications relating to Caprivi
Mammals	point co-ordinates of game counted in the 1994 and 1995 aerial surveys
River levels and volumes	data on river flows at Katima Mulilo, Mukwe, Kongola, Victoria Falls, Ngoma and several other gauge stations
Satellite images	LandSat images of the whole region taken in 1994, and of the eastern floodplains taken in 1989
Settlements	co-ordinates of all settlements, the numbers of households and estimated numbers of people in 1996, and the numbers of households in sample areas in 1943 and 1972
Stock numbers	co-ordinates of crushpens and stock counts in 1995 and 1996
Vegetation units	mapped vegetation types, with associated information on species composition, soils and ratings for potential land uses

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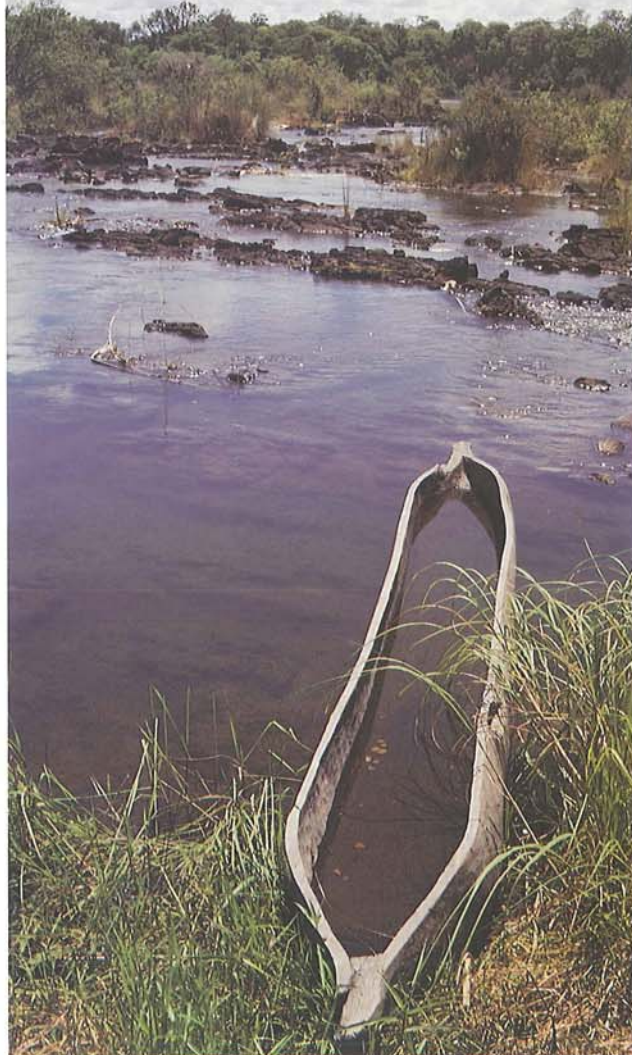


Caprivi's position in southern Africa

Projecting eastwards from Namibia, Caprivi lies in the centre of southern Africa. It is bounded by four other countries. Three perennial rivers cross Caprivi, making it a unique area in the otherwise arid Namibia.

Chapter 2

General description of Caprivi



Caprivi, one of the 13 regions of Namibia, forms the country's finger-like projection in the north-east which extends Namibia's borders into the centre of southern Africa (see map on page 3). The region lies about halfway between the equator and the southern tip of the continent and midway between the Atlantic and Indian oceans. Attached to the rest of Namibia only along a short border, Caprivi is bounded by four other countries: Botswana to the south, Angola and Zambia to the north and Zimbabwe to the east. The inclusion of this area into Namibia is the result of negotiations between Germany and other colonial governments at the end of the 19th Century. It was agreed at the Berlin Conference that it would be added to German South West Africa as an extension, allowing the German colony to gain access to the Zambezi River. It is to the chief German negotiator at this conference, Count von Caprivi, that the region owes its name.

In broad terms, the Caprivi stretches 450 kilometres from east to west and ranges between 32 and 100 kilometres in width from north to south. Our calculations indicate that it covers an area of about 20 000 km². The region is divided into three distinct areas by the Kwando and Okavango rivers (see map on page 3):

- eastern Caprivi, that area east of the Kwando River,
- Mukwe area, the triangle of land west of the Okavango River, and
- the Caprivi strip, the narrow strip of land between the two.

Like many other borders in Africa, Caprivi's boundaries either follow the midstream of rivers or run along straight lines¹. A number of disputes about the precise positions of these boundaries have arisen over the years. Most recently Botswana and Namibia have been at odds over the ownership of Kasikili, or Sudundu, Island in the Chobe River in the south-east, not far from its confluence with the Zambezi. The straight-line borders are delimited by cut-lines, many of which have become overgrown.

What is important about these borders is that they do not follow any distinct environmental or cultural boundaries. Environmentally, most of Caprivi is really part of a broader landscape of Kalahari woodlands, and plants and animals found in the Caprivi are to be found in adjoining areas of Angola, Zambia, Zimbabwe and Botswana. Many of the larger mammals in this semi-arid and dry sub-humid environment depend on being able to move freely around this broader landscape. They cannot be restricted to relatively small areas demarcated by borders cutting arbitrarily through their ranges and habitats.

Landscapes and land types

Topographically, Caprivi is particularly flat without a single feature recognizable as a hill. From the highest areas in the extreme west (about 1 100 m above sea level) elevations gradually drop to 930 m near Impalila Island in the east. There are slight local changes in elevation in the river valleys and between the vegetated dunes and dune valleys in the Mukwe area and Caprivi strip, but these are seldom more than 30 m.

The area is covered in thick deposits of Kalahari sands, with very little of the underlying geology exposed, except along certain sections of the river courses and on Impalila Island. The extensive Kalahari sands and the rivers with their associated floodplains, channels and deposits are the two major features which shape the landscape. The processes associated with these features have created six major land types:

- The Okavango, Kwando, Linyanti, Chobe and Zambezi rivers and their deeper channels make up areas of **open water**.
- The **floodplains** associated with the rivers are flat areas dominated by grasslands and old river channels. River waters flood over these areas when good rains cause river levels to rise.
- **Riverine woodlands** in the Okavango and Kwando river valleys and in the Maningimanzi area on the Zambezi River east of Katima Mulilo are characterized by a high diversity of tall trees.
- **Mopane woodlands** lie in an area of old river drainage lines which are being covered by wind-blown sand deposits.
- **Kalahari woodlands** cover the largest area, and are dominated by sand dunes and interdunes in the Mukwe area and Caprivi strip and extensive sandy plains in eastern Caprivi.
- **Impalila woodlands** covering the island make up a small but unique area from the rest of Caprivi. They are based on basalt rocks rather than wind-blown sands or river systems.

Land type	Area (km ²)	%
Open water	166	0.8
Floodplains	3 762	18.8
Riverine woodlands	511	2.6
Mopane woodlands	4 613	23.0
Kalahari woodlands	10 939	54.7
Impalila woodlands	18	0.1
TOTAL	20 009	100.0

Six land types in Caprivi, the areas they cover and their relative sizes



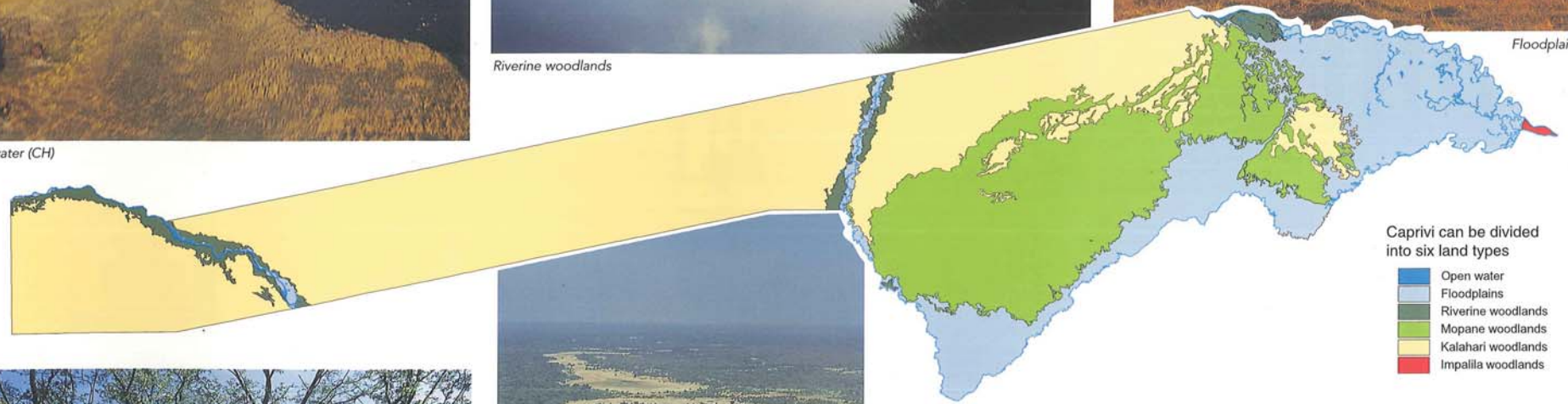
Open water (CH)



Riverine woodlands



Floodplains (CW)



Caprivi can be divided into six land types

- Open water
- Floodplains
- Riverine woodlands
- Mopane woodlands
- Kalahari woodlands
- Impalila woodlands



Mopane woodlands



Kalahari woodlands

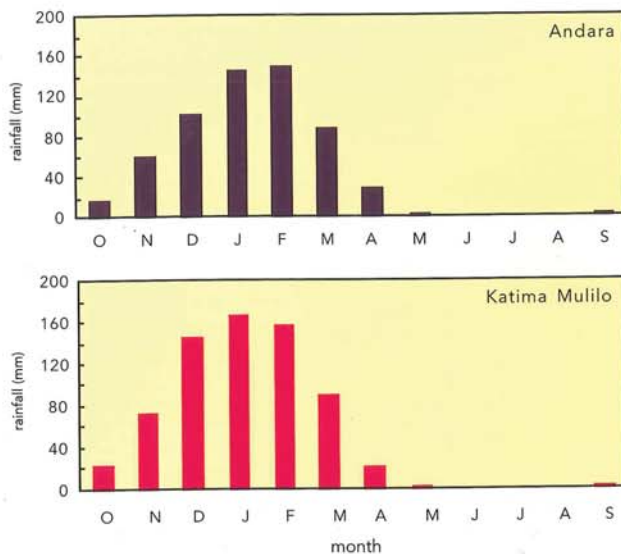


Exposed basalt forms the Mambova Falls on the Zambezi (foreground) and the basis of the Impalila woodlands

Climate

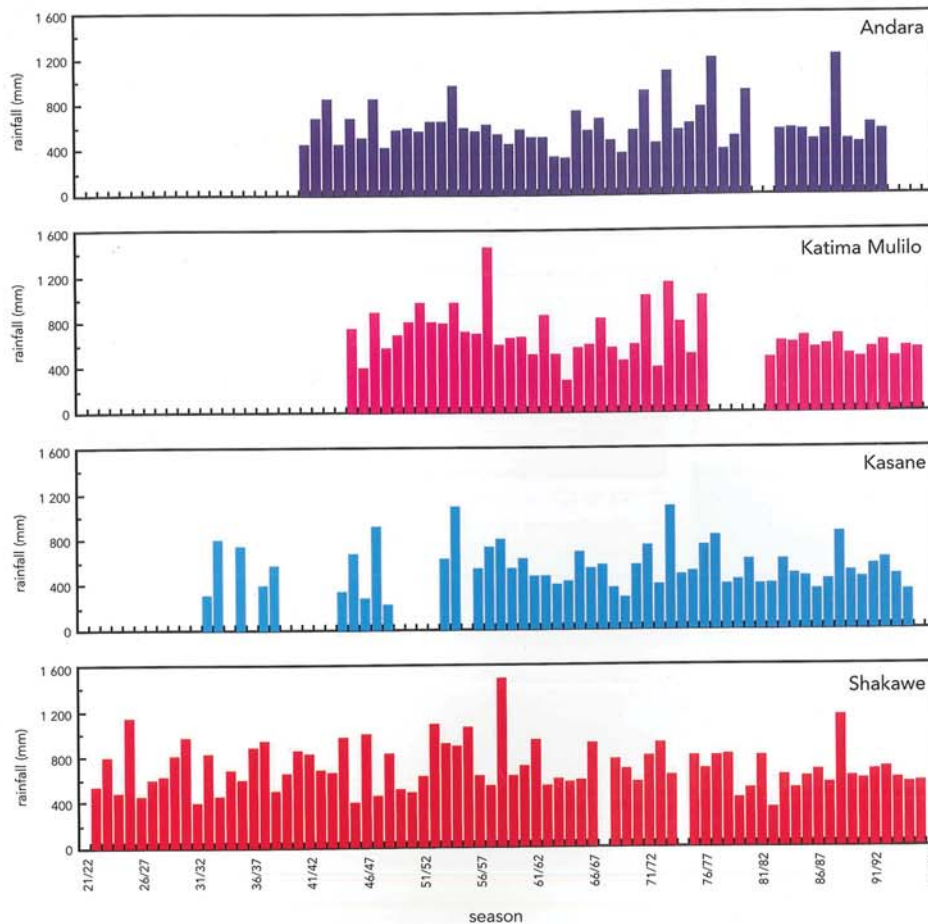
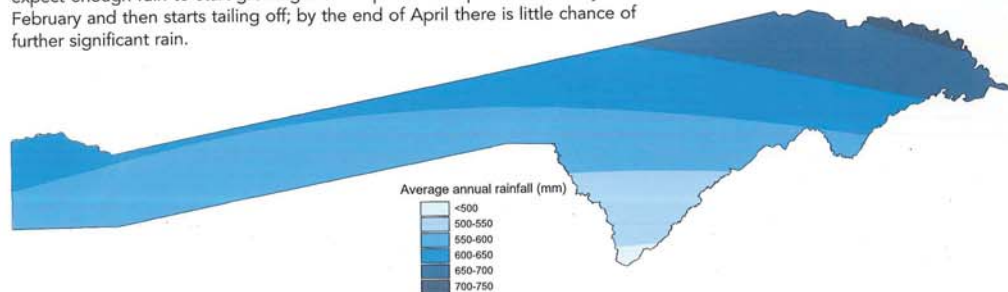
In a country often characterized as hot and dry, Caprivi is distinctly more tropical than any of the other regions. It enjoys a higher rainfall, less evaporation and a warmer winter than the rest of Namibia, providing a home to many tropical plants that are unable to survive elsewhere in Namibia.

Even though Caprivi sees the highest rainfalls in Namibia, it is still plagued by rain that is highly variable from year to year and from one place to another, and experiences serious droughts from time to time. At these times the livelihoods of many farmers are placed in jeopardy.



▲ Average rainfall at Andara and Katima Mulilo for each month of the year

Almost all of Caprivi's rain falls during the summer months. Small falls may occur in October or even September, but it is only in November that farmers can expect enough rain to start growing their crops. Rainfall peaks in January and February and then starts tailing off; by the end of April there is little chance of further significant rain.



▲ Total rainfall measured each season at four places in, or close to, Caprivi

Only seasons with complete rainfall records are shown in the graphs. Seasons with no or incomplete records have been left blank — they should not be interpreted as seasons with no rain.

One place may have a bumper year while another may have below average rainfall in the same season. Similarly, rainfall can double from one season to the next, at the same place.

As in other regions of Namibia, rainfall has generally been lower in recent years, although lower totals have been recorded in previous years. The 1988/89 rain season was an exception. Shakawe, Kasane and Andara recorded very high rainfalls of close to or above 1000 mm, although Katima Mulilo missed these above normal rains. This illustrates the irregular and unpredictable way in which rain falls in Caprivi. For each of these places, the maximum amount of rain ever recorded in one season was about four times greater than the lowest amount of rain ever recorded.



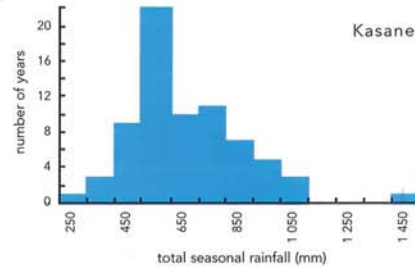
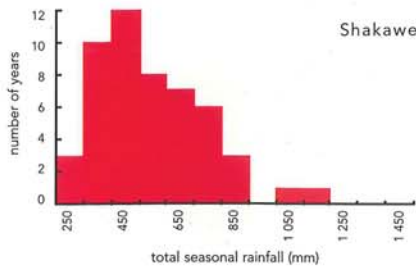
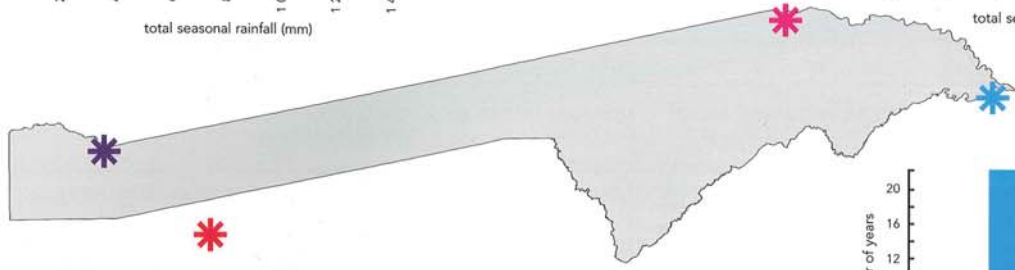
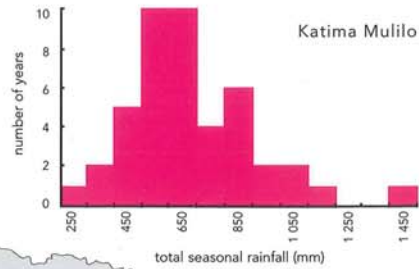
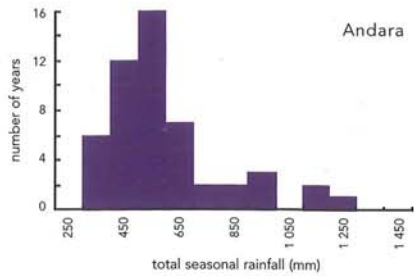
Rain falls mainly in the form of thunder showers (PT)

▲ Average rainfall and variation in rainfall

Despite highly variable rainfall figures, certain trends are apparent. An analysis of rainfall figures from a number of places in Namibia, Botswana and Zambia² shows that there is a general decline in rainfall from north to south and slightly so from east to west across Caprivi. In the north-east around Katima Mulilo, average total rainfall amounts to just under 700 mm and modal values are about 550 mm per year. In the southern-most parts of the region, averages are about 500 mm and modal totals are about 400 mm. In the west, around Mukwe, average rainfall is about 600 mm and modal rainfall is about 550 mm.

Variation in rainfall

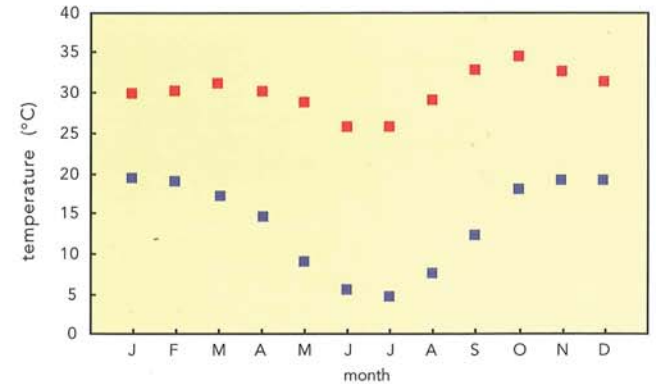
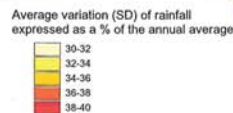
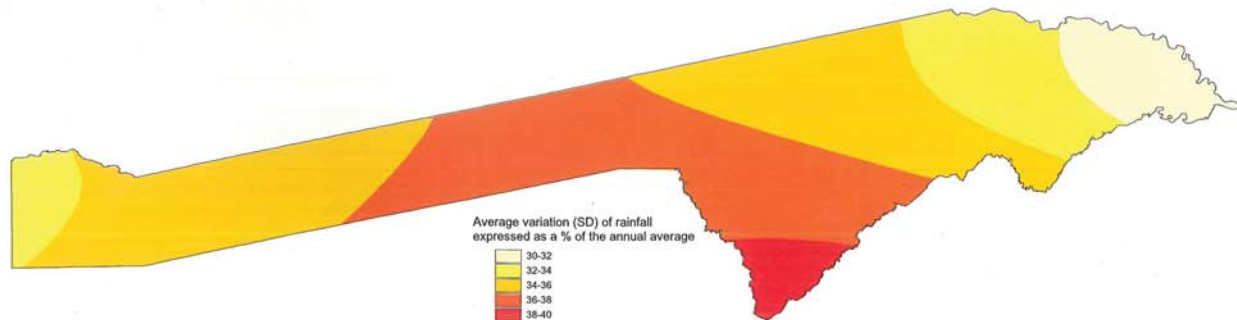
The degree of variation in rainfall from year to year also changes across Caprivi. As a proportion of the amount of rain that falls on average, rainfall is more variable in the southern-most parts of the region and most predictable in the eastern areas.



	Seasonal rainfall (mm)	
	mode	average
Andara	550	603
Kasane	550	666
Katima Mulilo	600	683
Shakawe	450	550

How often can Caprivi expect average or good rainfalls?

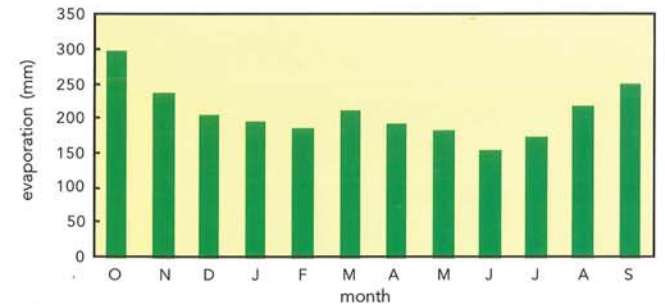
Due to the high variability in rainfall, average rainfall figures tend to give an exaggerated view of how much rain normally falls. For example, the average rainfall for Andara over the last half century has been 603 mm. However, this average is distorted by some very high falls during those years when over 1 000 mm fell in each of three seasons. Another way to express the amount of rainfall that a place "normally" receives is through modal values. Modes are perhaps the best measures of usual rainfall because they reflect the amounts of rain that fall most often. So, for Andara the modal value for total annual rainfall is 550 mm. Graphs for Andara and Katima Mulilo in Caprivi and for Kasane and Shakawe in Botswana show how total annual rainfalls are more often in the low end of the range of totals recorded.



▲ Average monthly minimum and maximum temperatures at Katima Mulilo

Summer days are often cloudy, becoming progressively so during the day as clouds build up between the morning and afternoon. The effect of these clouds is to keep temperatures fairly low, especially during the middle and late summer months. In fact the highest temperatures are felt in September, October and November when there is often little cloud cover. The sun's radiation is then high, and average daily maximums are between 32° C and 35° C.

Average daily minimum temperatures vary between about 20° C in summer and about 5° C in winter. Frost is unusual, but may occur in some years in low-lying river valleys, especially in the western parts of the region. Clear skies during the winter months result in fairly high average maximum temperatures, but they also allow daytime heat to escape during the night. The range of temperatures during winter is thus greater than in summer.



▲ Average monthly rates of evaporation at Katima Mulilo

The rate at which water evaporates into the atmosphere varies during the year, from the highest rates in September and October when it is hot and dry and clouds are sparse, to the lowest rates in the coldest mid-winter months. About 2 500 mm or 2.5 m of water evaporates in an average year, which is over four times the volume of water normally provided by rain. Evaporation rates are higher than usual in dry years when temperatures are high and cloud cover is sparse; plants and crops then suffer both from lower rainfalls and greater losses of water into the air.