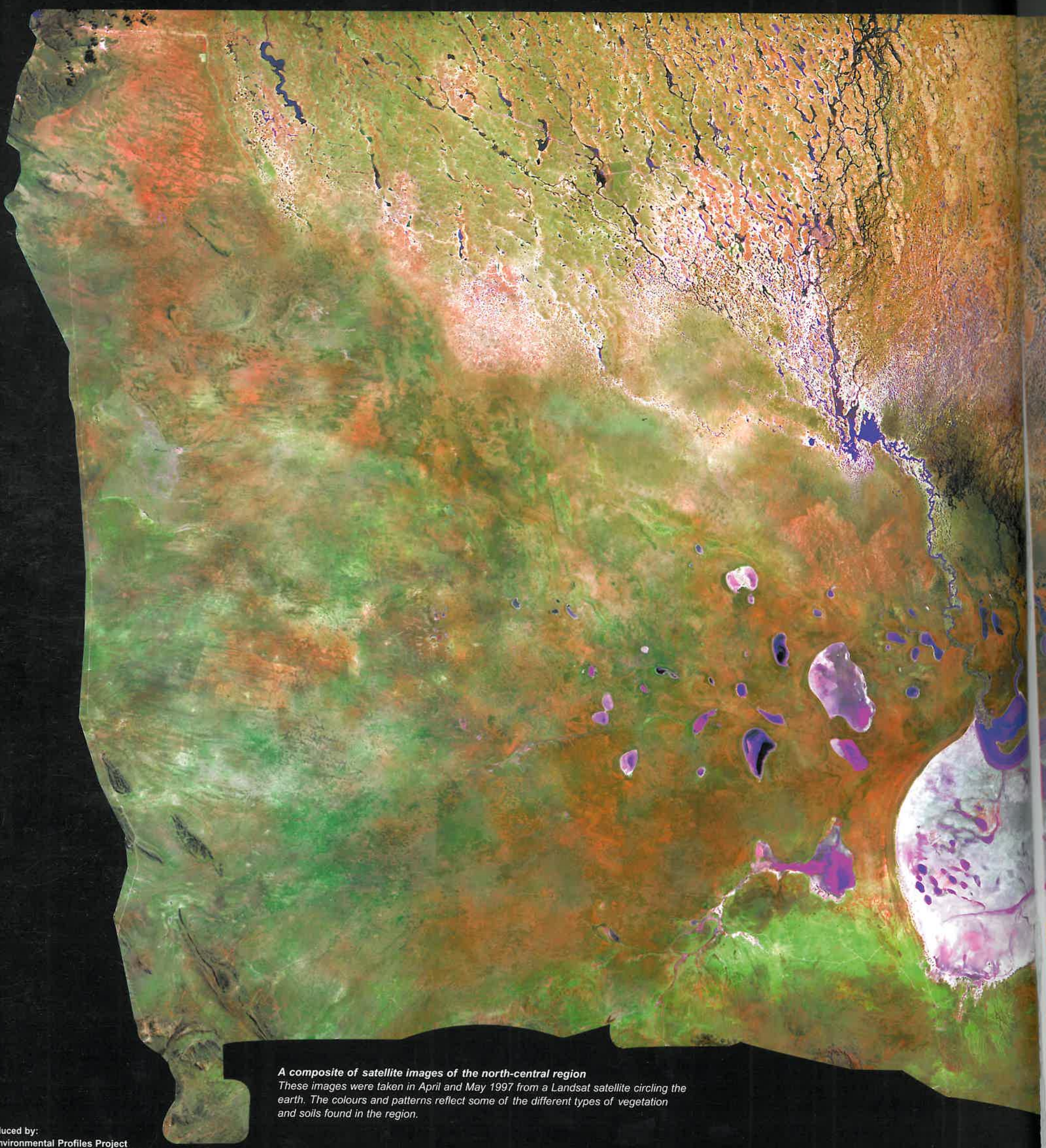
A profile of north-central Namibia

John Mendelsohn, Selma el Obeid and Carole Roberts



A composite of satellite images of the north-central region
These images were taken in April and May 1997 from a Landsat satellite circling the earth. The colours and patterns reflect some of the different types of vegetation and soils found in the region.

Produced by:
Environmental Profiles Project
Directorate of Environmental Affairs
Ministry of Environment and Tourism
Private Bag 13306
Windhoek

Published by:
Gamsberg Macmillan Publishers
PO Box 22830
Windhoek
Namibia

Editing: Sandie Fitchat and John Pallett
Typesetting, reproduction and printing: NBD, Drukkery Street, Goodwood, Western Cape
Cover design: Opportuniti, Windhoek
Cover photographs: CH, DD, EPP, HD, HK, NAN, NASA and WdP

ISBN 99916-0-215-1

A profile of north-central Namibia

John Mendelsohn, Selma el Obeid and Carole Roberts

Contents

Acknowledgements

The production of this book would not have been possible without the interest and support of a number of people and organisations that generously shared their data and knowledge. In particular we would like to thank Arnold Bittner, Nad Brain, Chris Brown, Kathi Damon, Diane Davies, Wynand du Plessis, Chris Eyre, Chris Hines, Stuart Kean, Mbaye Kébé, Marc Lejars, Johan le Roux, Celia Mendelsohn, Roy Miller, John Pallett, Peter Tarr, Hans van der Veen and Alex Verlinden.

We are also extremely grateful to R. Alexander, A. Amunime, B. Auala, J. Auala, C. Auer, P. Barnard, J. Barnes, F. Becker, F.V. Bester, J. Bevan, F. Blanc, D. Bonis, L. Brecher, G. Brettschneider, O. Britz, E. Britz, G. Brulé, A. Burger, T. Burger, M. Coetzee, A. Corbett, J. Cox, C. Craig, C. Daffin, N. de Klerk, G. Denker, H. Denker, K. Dierkes, H. Drews, J.P. Engelbrecht, P. Erb, A. Erkkila, J. Eysselein, V. Fischer, K. Fleissner, M. Fowler, B. Fuller, O. Graefe, F.S.M. Hangula, R. Hanssen, M. Harris, M. Hipondoka, J. Hoffmann, Mr and Ms M.C. Hoffmann, P. Hutchinson, F. Iipinge, A. Jarvis, Ms L. Kafidi, Mr L. Kafidi, J. Kandombe, A. Karita, R. Kavandje, E. Kaveru, I. Khoeseb, H. Kisting, N. Kisting, B. Kruger, W. Lechner, E. Leopoldt, C. Lombard, A. Low, J. MacGregor, M. Mallet, P. Manetti, T. Marwick, V. Mauney, P. McKivergan, D. Mouton, T. Mufeti, E. Muradzikwa, P. Murtovaara, P. Namfua, B. Namwandi, C. Nel, J.S. Nepembe, P. Nghileendele, T. Nghitila, U. Noells, L. Olivier, M. Ottile, V. Pescher, J.P. Petorin, V. Petzel, A. Platt, M. Prins, Q. Rea, L. Reilly, P. Reiner, T. Robertson, V. Rope, C. Salinas, J. Saunders, W. Schalken, C. Schemmer, G. Schneider, P. Shaanika, I. Shailemo, M. Shambwila, D. Sheya, G. Shihepo, H. Shipena, W. Schroeter, A. Sieberhagen, J. Silvester, A. Simmonds, R. Simmons, P. Stander, V. Stuart-Williams, R. Swart, J. Sweet, V. Tjikuzu, S. Trigg, M. Truebody, R. Tschudin, G. Tshiguuo, J. van der Heide, H. van Wyk, W. Versveld, W. Volkmann, J. Ward, V. Ward and W. Werner.

Contributions by the following organisations are also acknowledged: Central Statistics Office, Etosha Ecological Institute, Gamsberg Macmillan, Lund Consulting Engineers, Ministry of Agriculture, Water and Rural Development, Ministry of Information and Broadcasting, church missions at Oniipa, Oshikuku and Okatana, Namibian Meteorological Services, NBD and National Archives of Namibia.

The Environmental Profiles Project of north-central Namibia was funded through the generous support of the Kingdom of the Netherlands as part of their commitment to enhancing environmental awareness throughout the world.

PHOTOGRAPH: WdP

Introduction

North-central Namibia is a fascinating place – a myriad of landscapes home to half the country's population engaged in a diversity of activities. The mixture of urban and rural, formal and informal activities is unique in Namibia. The people, victims of a protracted recent war, are also the beneficiaries of a long, rich history that produced a society of traders, entrepreneurs, political leaders and any number of other dynamic characters. All these people arose from a community of farmers and most of them continue using the land to grow crops and keep livestock.

While appearing at first sight to be flat and featureless, the region is dominated by two remarkable features: the Cuvelai delta and the Etosha Pan. Unlike other river systems, the sprawling Cuvelai network of drainage channels first spreads out across southern Angola and then, on crossing the Namibian border, converges through hundreds of meandering oshanas[1] into Etosha Pan. This huge pan, which seldom holds water, is the product of wind erosion and salt deposition over millions of years. Miles and miles of woodlands carpet the sands north-east of the pan, while tall makalani palms dot the grasslands to the north.

What is a profile?

A strong emphasis on environmental issues runs through this book, reflecting its primary purpose in presenting an environmental profile of the region. But it was clear that a title reflecting a wider outlook would be more appropriate, hence the heading: *A profile of north-central Namibia.* This broader title hopefully reflects the close relationship between what resources are on offer, what people do and how the natural environment responds. The book is intended to be a reference work from which we hope readers draw useful information. More importantly, there is the hope that the pages ahead tell a story, a narrative that paints a picture of where the region has come from, why it is the way it is, and perhaps where it is going.

The profile first describes what the region has to offer in the way of natural resources: its geology, climate, soils, vegetation and wildlife.[2] All these features reflect on what resources are available to people in an environment that is generally harsh and where natural resources are limited. Subsequent chapters focus on demands placed on these resources, showing how people have found ways of farming and developing a suite of livelihood activities that enable them to live and often flourish in the region. These aspects are explored in chapters that describe population dynamics, different kinds of land use and governance, and the roles of agriculture and livelihoods. The final chapter provides a perspective on the future, drawing on past and present processes, constraints and opportunities. A summary of the main points in each chapter is given on page 4.

A large emphasis is given to agriculture because farming, as such a widespread activity, has a massive impact on natural resources and productive farming depends on the availability of good natural resources. There is also a focus on relationships between farming and social and economic issues because there is such a mix between the cash economy and agriculture. This mix exists both between and within households, with some households relying on subsistence agriculture and others depending entirely on wages or business activities. Likewise, some people in a household are responsible for producing crops and tending livestock while others provide the home with incomes from wages or trading activities. These issues lead to the question of what happens when people move from a subsistence existence to a more modern, cash-based economy – a question that runs through several chapters.

This book is a product of the Environmental Profiles Project of the Ministry of Environment and Tourism, generously funded by the Kingdom of the Netherlands. The project aims to make information on important environmental issues and processes as widely available as possible. This profile was preceded by a similar study on Caprivi and each was designed to generate two products. The first product is a publication to be made widely available, and the second a collection of information assembled during the course of compiling the profiles. Much of that information, especially that of a geographical nature, is in the form of computer databases. Most of this information is summarised in the table below and is freely available for whatever purpose it may serve.

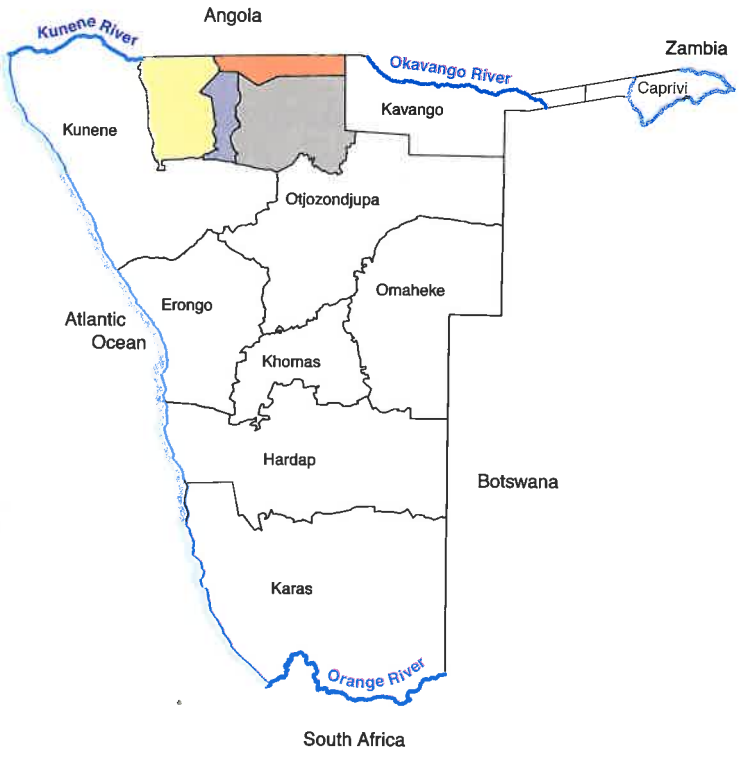
A brief historical context

Perspectives on current conditions in Owambo are often coloured by assumptions that the liberation war had massive effects on settlement patterns, economic activities, migration and demographic patterns, and environmental conditions. That the war had serious effects is undoubtedly true – after all, tens of thousands of people left Namibia and many lost their lives – but an objective account of its effects on the region's economy, demography and land uses remains unavailable. Likewise, a thorough analysis of the effects of the war on natural resources is apparently not available. However, some impacts are obvious, and have a bearing on the use of natural resources. The war clearly hindered the development of commercial farming and the expansion of settlements into unoccupied areas. Many of those that returned after the war came back as both heroes and role models, and SWAPO's victory meant that those people rose in status, acquired good jobs and can now return relatively large sums of money to the region. Development was slow during the war, but many development projects have focused their activities there since independence. The same is true for the provision of services.

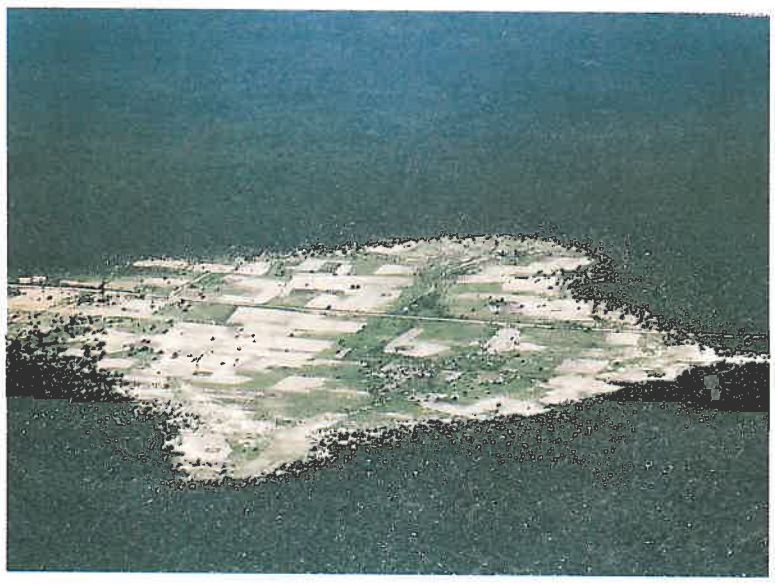
Claims that focus on the important effects of the war also ignore, to some degree, other historical features of the region and those of its people. The first of these is, of course, the communal and homeland economy imposed on the region by previous governments. Second is the fact that people in the region have had a long history of trade and entrepreneurship, an aspect explored in some detail in the chapter on household economies. That history goes back to the 19th century and long before. Trading arose because the economy had developed to such a degree that surplus commodities were available for sale. Thirdly, the region has had a history of periodic famines. While surplus products could be traded in some good years, those famines promoted traditions to store food and acquire capital investments (in the form of land and cattle) that could be drawn upon in the event of major food shortages. In essence, flexibility and mobility have been hallmarks for a long time, allowing people to integrate different strategies into their livelihoods.

* ***Data and other resources on the north-central region available from the Environmental Profiles Project, Directorate of Environmental Affairs, Windhoek (www.dea.met.gov.na)***

Subject	Description
DATA	
Administrative and political boundaries	Boundaries of the four political regions, the constituencies, magisterial districts and townlands (1999), and positions of the homes of 2000 headmen (1994)
Households	Positions of 85,000 rural households throughout the region (1996) and for selected areas (1943, 1964, 1970 and 1972)
Infrastructure	Positions and information (1999) on agricultural extension offices, education facilities, health facilities, magisterial offices, milling services, police stations, post offices, roads, seed distribution points, veterinary extension offices, water supply networks, tourism sites and accommodation
Landscapes	Boundaries of the six landscapes in the region
Land use	Positions of many fences enclosing large farms in Owambo, and boundaries of conservancies and conservation areas, commercial and government farms, cleared areas and townlands
Livestock	Estimates (1998) of cattle densities from crushpen counts, donkeys from aerial survey counts, and goat densities from relationships between household densities and numbers of animals per household
Population	Estimated densities of people
Topography	4100 positions and spot heights
Vegetation and soils	Distribution and descriptions of 35 different vegetation units with associated information on soils, ratings for land uses and relative abundance of 62 plant species
Water resources	Position of the oshanas, pans and other drainage lines in the region, and the positions of boreholes and associated information on groundwater levels, yields and quality
Wildlife	Estimates of densities (1995 and 1998) from aerial censuses
OTHER RESOURCES	
Literature	A bibliography of reports, books and other publications relevant to the region; copies of many of these are lodged in the library of the Directorate of Environmental Affairs, Windhoek
Photographs	Various general and oblique aerial photographs of the area are available, as are prints and digital copies of 1:80,000 aerial photographs of the entire region (1996) and of selected areas at varying scales (1943, 1964, 1970 and 1972)



▲ ***The north-central region within Namibia***



EPP

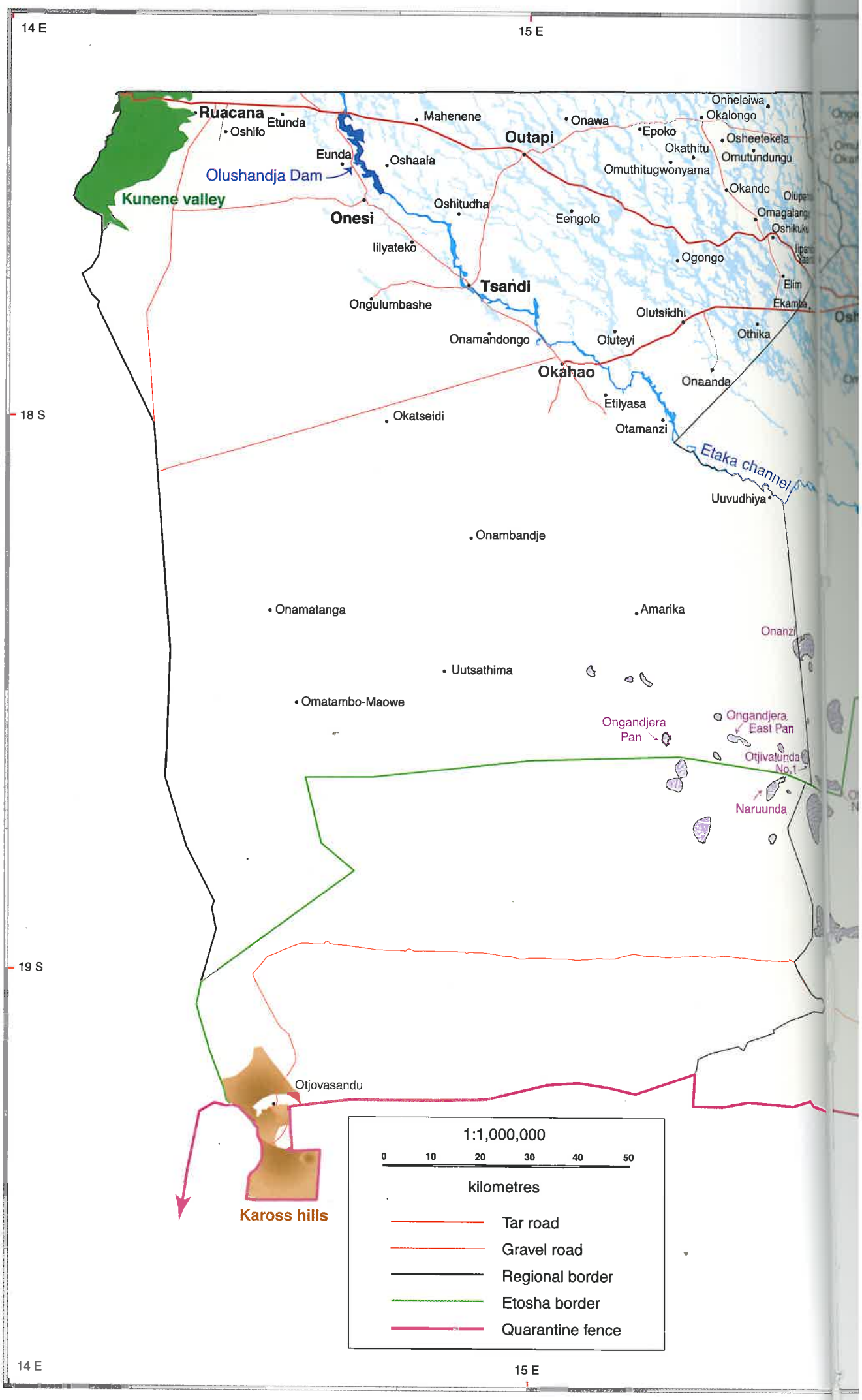
The Namibia–Angola border cuts through a village in eastern Ohangwena

Names and terms

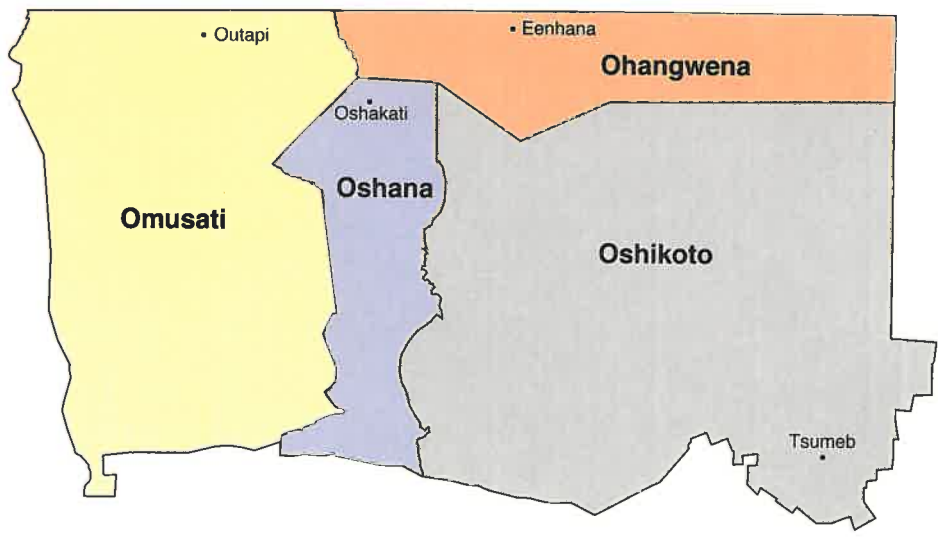
Major features and places mentioned in the book are shown on the adjacent large map. The north-central region – the area that this book covers – consists of four political regions, popularly called the 'Four O's', but formally the Oshikoto, Ohangwena, Omusati and Oshana Regions. The phrase *the region* as used in this book always refers to this north-central area unless otherwise specified. Each political region has a governor and several elected councillors to represent its interests. Although the boundaries of three of these political regions were changed halfway through the project, all the information in this book refers to the new boundaries shown on the small map to the right.

Much of the book focuses on the area that used to be called *Owambo*, simply because so many people live there and it is here that pressures on natural resources are greatest. That focus is also justified because relatively little is known about natural processes in Owambo. The term *Owambo* is used for convenience because almost everyone knows exactly what area that represents. No other concise term or suitable name exists for the area. The use of the word *Owambo* does not imply any endorsement for its widespread use by previous political systems. Other names used for broad zones are *Tsumeb farms* or *Tsumeb area* to cover the so-called commercial farming area, and *Etosha* as a short name for the Etosha National Park. The terms *communal* and *commercial* are frequently used in Namibia to distinguish, respectively, areas that were formerly homelands from those that were allocated to white farmers. The use of these terms is generally avoided in this book because they suggest that land uses and ownership remain fixed within limits implied by the two terms. Other implications of the two terms (*communal*, describing a tenure system, and *commercial*, referring to a production system) further confuse the issue.

Six separate landscapes are defined and described in the second chapter (pages 7 and 8), and these areas are referred to in many places: the Cuvelai, the karstveld, salt pans and surrounding plains, mopane shrublands, eastern Kalahari woodlands and western Kalahari woodlands.



▲ ***Finding your way around the north-central region[3]***
Places mentioned in the book are shown on this map.



▲ ***The four political regions: Oshikoto, Ohangwena, Omusati and Oshana, and the regional government offices at Tsumeb, Eenhana, Outapi and Oshakati***

16 E
17 E
18 E
18 S
19 S
N

Oshikango
Ongenga
Engela
Ohaingu
Omungwelume
Okambembe
Onuno
Ohangwena
Okatope
Ondobe
Edundja
Oshandi
Epinga
Eenhana
Omundaungilo
Olukula
Onekwaya
Endola
Ohalushu
Ongha
Epalala
Ohaukelo
Onangolo
Oshikunde
Okongo
Onambutu
Onamukulo
Ongulayanetanga
Ekoka
Okatana
Onamutayia
Ongwediva
Okaku
Oshigambo
Epembe
Oshakati
Omege
Ondangwa
Enkono
Ompundja
Eheke
Oniipa
Onayena
Okankolo
Onkumbula
Ehafo
Olukonda
Onethindi
Uukwiyuushona
Ontananga
Onyaanya
Onyuulae
Onamishu
Omadhiya lakes
Ekuma River
Onakazizi
Onankali
Omuramba Oshigambo
Omuntele
Omuthiya
Amilema
Okashana
Omutsegwonime
Ondangwa Pan
Onanke
Andoni grasslands
Mangetti farms
Okapya
Naktukanaoka Pan
Beiseb Pan
Oshivelo
Otjivalunda No.2
Fischer's Pan
Omuramba Owambo
Tsintsabis
Etosha Pan
Namutoni
Adamax Pan
Halali
Okaukuejo
Lake Guinas
Lake Otjikoto
Tsumeb
Tsumeb hills

▲ ***Positions of Etosha, Owambo and the Tsumeb area***

The Omuramba Owambo snakes its way towards Fischer's Pan

A summary

This book is roughly divided into two parts. The first deals mainly with resources that are available, while the second looks at what demands are placed on those resources. The following paragraphs summarise the main points in each chapter.

The shape of the land: North-central Namibia is part of the Owambo Basin, an ancient depression filled with sediments and surrounded by a rim of hills in the south and west. The deepest sediments were deposited when the region first formed part of a rift valley and, later, when it lay in a shallow sea. Subsequently, large rivers and strong winds carried in more sediments. Long periods of flooding, sand deposition and reworking of the deposits produced the mixture of soils that forms the basis of the region. These processes also did much to fashion six distinct landscapes. The known mineral resources are limited, and even those in the Tsumeb area now have limited value. Pollution caused by the mine and smelter at Tsumeb still needs to be cleaned up.

Climate: The semi-arid climate is characterised by rain that varies greatly in amount and timing. Almost all of the rain falls during the summer months (roughly November to April), and over two-thirds of it falls in January, February and March. Eastern areas receive higher and more reliable rainfalls than the west, but much of the region is too dry for crop production. Rainfalls over the past 20 years have been generally lower than during the 1970s which, in turn, were wetter than the 1960s. The high degree of variation in rainfall means farming is a risky business. Good yields may be had in some years, but crops often fail as a result of inadequate or badly timed rainfalls. High evaporation rates and temperatures aggravate the effects of limited rainfall.

Water: The huge Cuvelai delta, draining part of southern Angola, brings both water and fish into the region when it flows. A medium or high flow, or *efundja* occurs in about four out of every ten years on average. A good deal of surface water in the region also forms as a result of local rainfall. The availability of water had, and continues to have, a major impact on where people live, and it was access to water in the Cuvelai that allowed people to settle there permanently, hundreds of years ago. Until a few decades ago, people depended entirely on water drawn from shallow wells during dry periods. More recently, an extensive network of pipelines supplying water from the Kunene River provides a large proportion of the population with water, while other people obtain it from deep boreholes. About 15% of the population live beyond the reach of the existing and planned network of pipelines and boreholes. The boreholes tap water from a variety of different aquifers, but the main aquifers in the central areas hold water that is generally too salty for human consumption.

Vegetation and soils: The nine major types of soils are largely dominated by sands and clays which have been reworked and mixed by the action of water and wind. Their potential for crop cultivation is low in most areas for several reasons: poor water-holding capacity, low nutrient content, high salt content and hard layers of clay below the surface. Most plants characteristically grow on certain types of soils, so those in the eastern and western Kalahari sands are quite different from those in the Cuvelai and other landscapes. Thirty-five different vegetation types are recognised and described. Mopane and various other trees provide important sources of wood, used predominantly for housing, fencing and fuel. Large areas have been deforested as a result of the heavy demands for wood. Fruit and many other products are harvested, which are of greatest value to the poorest people. Grasses and shrubs feed large numbers of domestic stock, but high grazing pressures in the Cuvelai and elsewhere have resulted in a reduction in the availability and quality of pastures. In the Tsumeb area, many farms have become badly encroached by dense thickets, making the farms much less productive for cattle ranching than they were before.

Wildlife and tourism: Very little remains of the abundance of wildlife that used to be in Owambo, in contrast to Etosha that now holds a high proportion of Namibia's large mammals. Populations of zebra, springbok and blue wildebeest in Etosha have declined in recent decades, probably as a result of high rates of predation and anthrax. The population of lion has also declined. The fence around Etosha has stopped many species from migrating outside the park to graze on new pastures that result from sporadic rains. However, many elephants and lions leave Etosha, causing a variety of problems for farmers around the park. Etosha is Namibia's premier tourist attraction, directly and indirectly earning large amounts of money for the country. Although numbers of tourists visiting the park have increased rapidly, it is clear that Etosha could be put to better and greater use for tourism.

People, their health and education: Almost half of the people in Namibia live in the region, largely in rural households. Most of the population is packed into the Cuvelai, and in small, old pan systems in the north-east. Massive famines reduced the population by tens of thousands in the past, but very large numbers of people also moved into the region from Angola. Relatively high growth rates of just less than 3% in recent decades have produced a population dominated by young people. But the structure of the population is also skewed by high rural-to-urban migration rates, particularly of working-age people to towns elsewhere in Namibia. Fertility rates have decreased in recent years, and death rates are expected to increase dramatically because about one in four people now carries HIV, the virus that causes AIDS. AIDS, malaria and tuberculosis are the most important diseases. Very high demands for education result in high enrolment rates, but many young people, especially boys, drop out of secondary school to go off in search of jobs.

Land and governance: The many different levels of authority and users complicate the use and control of much of the land. About 70% of the region is used for agriculture (30% for small-scale farming, 20% for communal grazing, 9% for large farms in the Tsumeb area, 11% by the Mangetti farmers and people that have fenced off large 'informal' farms in Owambo) and about 30% for conservation (largely the government-controlled Etosha). Growing demands for land and the shortage of land suitable for crop cultivation mean that few areas now remain open where people can establish new small farms for themselves. Common property resources, such as grazing pastures, are diminishing as a result of increasing competition and because they are being enclosed in fenced farms. Certain urban areas are growing rapidly, but most people that live in towns in Owambo retain close links and rights to resources for farming in rural areas.

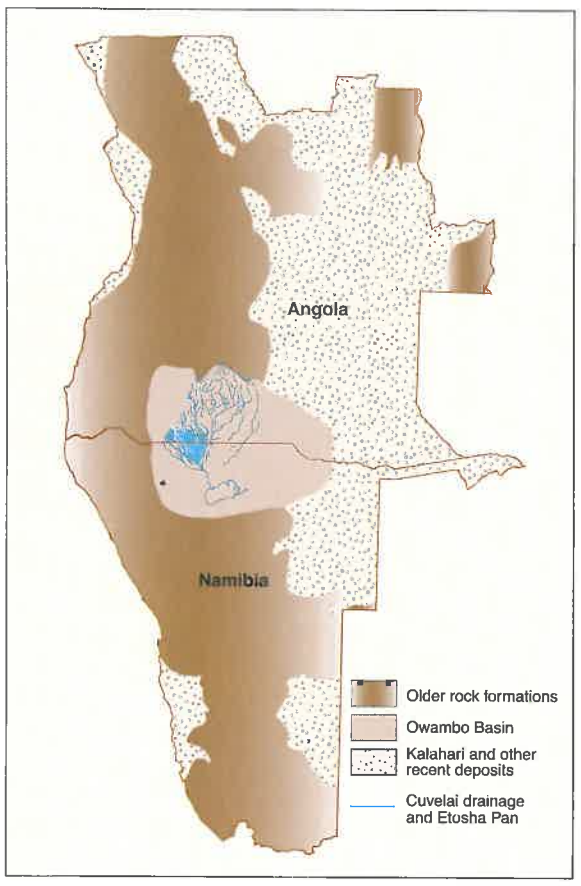
Farming: Mahangu (pearl millet) and sorghum are the most important crops, while livestock numbers are dominated by cattle, goats, donkeys and poultry. Almost every rural household grows these crops and most of them also have poultry and goats. Cattle ownership, however, is unequal, with about 80% of the cattle being owned by 20% of the households. Labour is the most important input to crop cultivation, especially in having adequate labour during critical periods when fields must be ploughed, planted, weeded or harvested. Rainfall and soil fertility have a major effect on crop yields, but crop and livestock production is also heavily dependent on the size and wealth of households; larger, richer families are able to contribute more labour and pay for seed, ploughs and other inputs. Farming contributes very little to the cash incomes of the majority of households because few farm products are sold. While farm products are a vital source of food for poor households, farming serves largely as an investment for wealthier households. Even though an estimated 30% of cattle are moved to seasonal grazing pastures, stocking densities remain very high throughout the year in many areas.

Household economies: Diversity and vigour are the main features of the region's economy now to be seen in the many and increasing numbers of businesses, entrepreneurs and trading activities. Perceptions of a single subsistence economy are thus wrong. The vibrant economy evolved during a long history of changing environmental conditions that provided both economic opportunities and constraints. These, in turn, prompted the development of kingdoms, trade over long distances, and migrant labour. Most households now engage in a variety of economic activities, with incomes from subsistence, employment and diverse business activities contributing to most homes. There are large disparities in wealth between households: big households with many family members are much wealthier than small ones. Large households also have a greater diversity of incomes, more labour, more livestock, bigger fields and more access to cash than poor homes. They are thus exposed to less risk in the event of mishap or disaster, but they also consume far more natural resources than anyone else.

Looking to the future, from the past and present: Environmental conditions have largely fashioned the uses of land, farming practices and social and economic circumstances that are seen today. Those conditions have also promoted a need to diversify and increase sources of income which, along with a large population of people and the shortage of land on which to farm, have resulted in severe demands on natural resources. High levels of degradation, shortages of natural resources and competition for remaining resources are a consequence of these demands. Poor households, most of which are squeezed into the Cuvelai where resources are in shortest supply, suffer most because they seldom have alternative sources of income. There are few options for making changes to the use of land by zoning it for different purposes, but there is a great need for change in the policies, practices and attitudes towards land use. The future of both people and the natural environment can be expected to improve if those changes are made.

PHOTOGRAPH: KR

The shape of the land



▲ ***Owambo Basin***
The Owambo Basin is part of the much larger Kalahari Basin. The northern, western and southern rim of the Owambo Basin is made up of highlands of older rock formations, while the eastern limits of the basin are thought to be close to Rundu.[2]

Geological history

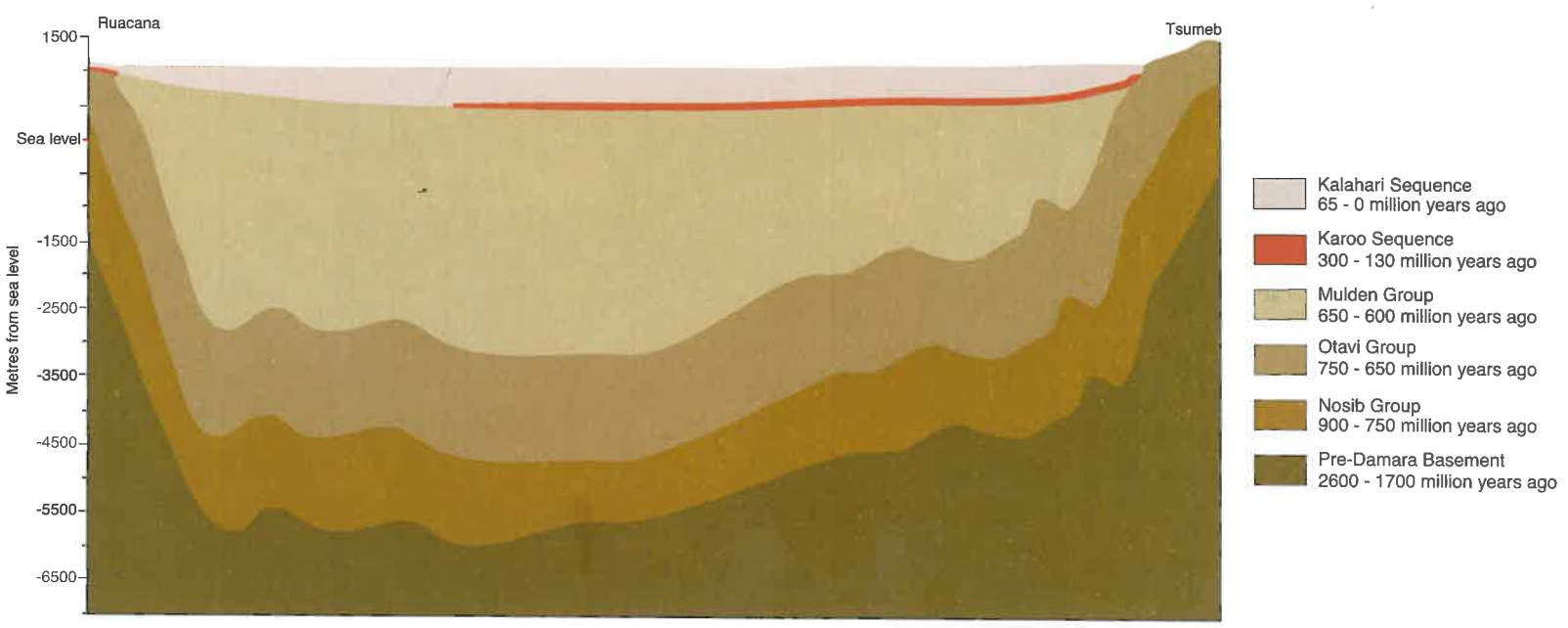
The north-central region has at times had a turbulent history over the past centuries, with intermittent periods of rule by ruthless kings, famines, droughts, and a long war of liberation (see pages 62 and 63). Its geological history has likewise been turbulent. The continent has been split asunder, the region submerged under oceans or covered by glaciers at different times, partly flooded by rivers, and blanketed with sand. These events, however, took place over hundreds of millions of years, unlike the relatively short history of people in Namibia.[1]

The region lies on an old continental base of granites, gneisses and volcanic rocks. Almost all of these basement rocks, which were formed between 2600 and 1700 million years ago, now lie thousands of metres below the present landscape. Only in the Kamanjab area and north into Kaross in the south-western corner of Etosha are some of these rocks visible as remnant hills. These are the oldest exposed rocks in the north-central region.

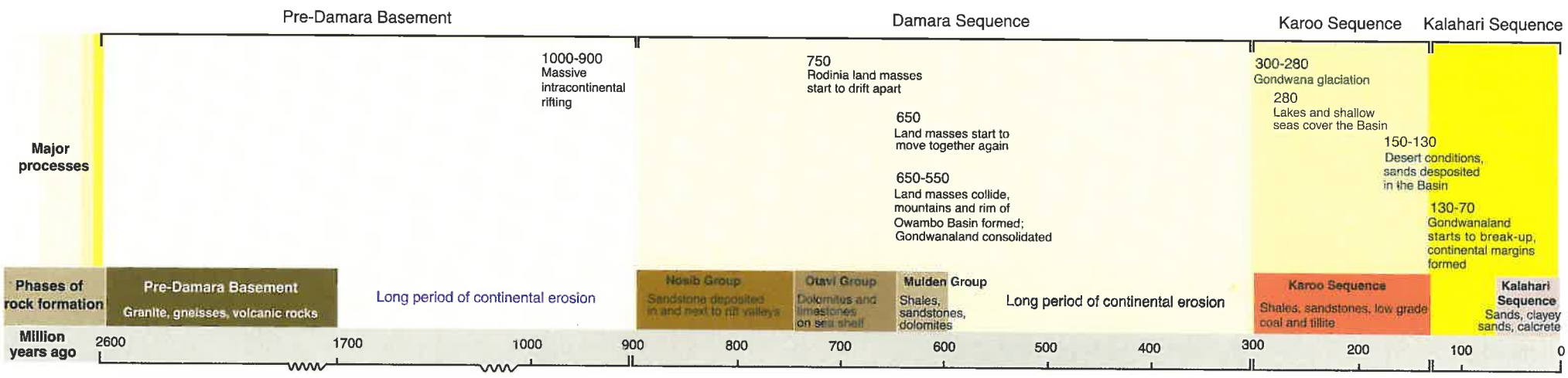
Southern Africa was then part of a much bigger continent known as Rodinia, of which South America, Antarctica, India and Australia were part. A dramatic period started about 1000 million years ago when massive rifting began, opening up deep valleys. Sandstones known as the Nosib Group were deposited in those rift valleys on top of the basement of granites and volcanic rocks that formed so much earlier. The rifting eventually caused fragments of Rodinia to drift apart some 750 million years ago, with broad oceans forming between the land masses. One ocean separated northern Namibia and countries to the north from southern Namibia and South Africa, and a broad, shallow shelf formed on the southern edge of the northern land mass. Deposits of dolomites and limestones up to seven kilometres thick accumulated on the shelf, and they remain today as hard sedimentary Otavi Group rocks. The old sea shelf is what we now call the Owambo Basin.

For some reason that is not well understood, the direction of movement of the continents reversed some 650 million years ago. Instead of continuing to drift apart they began to move together again, eventually colliding with each other, at first on the western side of the Owambo Basin and later to the south. The new resulting supercontinent was called Gondwanaland. Sediments that had been deposited on the edges of the oceans along the old continental margins were crumpled and squeezed up between the colliding continents. In the same way as the collision between India and Asia lifted the Himalayas, so too were a whole series of high mountains raised up along the west coast and in central Namibia.

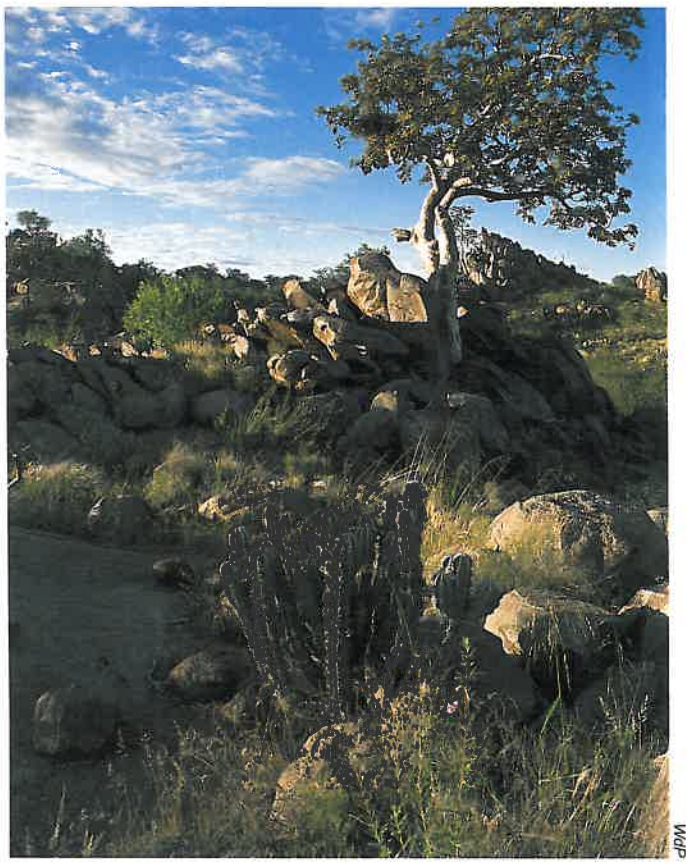
The collision of continental fragments caused the dolomites and limestones along the edge of the Owambo Basin to be folded and tilted upwards to form a rim to the basin. That rim now forms the hills around Tsumeb, Otavi and Grootfontein, and odd isolated hills such as the ones at Halali. From there, the rim extends as ranges of hills west to just north of Kamanjab and then north up to Ruacana along the western border of Omusati, forming the eastern edge of the Kaokoveld escarpment.



▲ ***A cross-section from Ruacana to Tsumeb showing the succession of geological deposits and their relative depths extending to about 7000 metres below sea level***



▲ ***Geological history of north-central Namibia***



The Kaross hills in south-western Etosha

WWF

Erosion of the mountain belts produced sediments of the Mulden Group which were deposited on top of the Otavi dolomites in the Ovambo Basin. The name Damara Sequence is given to the whole group of rocks formed between the formation of rift valleys 1000 million years ago and the laying down of the Mulden Group.

A long period of continental erosion, between 550 and 300 million years ago, was followed by a new period of deposition called the Karoo Sequence. This started about 300 million years ago during an almost worldwide period of glaciation – the Dwyka glacial period. Remnants of this glacial period can be found on all the southern hemisphere continents as well as in India. In Namibia, the glaciers cut deep valleys from the western edge of the Owambo Basin across the Kunene Region to the Atlantic Ocean; the Kunene River follows one such glacial valley. The cold period of glaciation was short-lived, however. As conditions began to warm up 280 million years ago, the ice sheets and glaciers melted and retreated and shallow seas began to encroach onto the continents. Shales, sandstones and beds of organic material derived from plants were laid down in the shallow sea that covered the Owambo Basin. Some of that organic material was later transformed into seams of coal.

The shallow seas dried up some time after 280 million years ago, but there is no geological record in the basin to tell us when that happened. About 150 to 130 million years ago much of Gondwanaland had become a vast desert covered in dunes and wind-blown sand, and deposits of the sands remain buried deep below the surface in the north-central region. The same formations are exposed as the layers of sandstone that cap the Waterberg and Etjo hills.

When Africa and South America started to drift apart about 130 million years ago, the margins of southern Africa were lifted up and became deeply eroded. By about 70 million years ago, this combined effect of uplift and erosion had produced a broad marginal plain, known to us today as the Namib, rising from the coast to the high escarpment about 100 kilometres inland. The same marginal plain and escarpment extends around most of southern Africa. At the same time a broad depression, the Kalahari Basin, formed in the centre of the subcontinent, extending from the northern Cape, through Botswana, eastern Namibia and over Caprivi, into Zambia and Angola, and then north into the Democratic Republic of the Congo. The Owambo Basin now forms a small western lobe of the greater Kalahari Basin.

For the past 70 million years the Owambo Basin has been filling up with sand, silt and clay washed and blown in from the higher ground surrounding the basin. Cycles of much wetter and drier periods have followed each other. Big rivers drained into the basin during higher rainfall periods lasting tens or hundreds of thousands of years to form large, shallow lakes, some of which are known by deposits called the Beiseb, Ombalantu and Andoni Formations. The last one to be formed filled what is called the Etosha Basin, a huge lake extending from the southern boundary of the region northwards into Angola. All these lakes disappeared during long dry phases, when wind-blown sand was carried into the basin to be mixed and churned with the water-borne clay sediments. More wet and dry cycles followed. The Kunene River was probably one of those large rivers feeding sediments into the basin, flowing south-eastwards in much the same way as the Okavango River now drains into the Okavango Swamps. The cycles of water-borne and wind-borne deposition laid down the massive Kalahari Sequence sediments, some of which are over 500 metres thick.

The remains of the large lakes now lie buried as layers of clay, from Ruacana to the Etosha Pan and beyond. Water in those shallow lakes often evaporated rapidly because the climate was hot and dry for much of the time, and that evaporation left behind concentrations of salts that are responsible for so much of the groundwater being brackish. The flow of the Kunene River into the Owambo Basin probably came to an end about two million years ago when it changed direction near Ruacana to find its way to the sea. We are now in a comparatively dry phase, and the present Cuvelai network of oshanas is really the only remaining drainage system bringing in water and sedimentary deposits from higher areas in Angola.

Mining and mineral resources

Most mineral deposits have been found where older rocks have been pushed close to the surface, especially in the Tsumeb area. The Otavi Group rocks in this area hold a large variety of metals: antimony, arsenic, cadmium, cobalt, copper, gallium, germanium, iron, lead, mercury, molybdenum, nickel, silver, tin, tungsten, vanadium and zinc.

Until the mine closed in the early 1990s, most of the mining enterprise at Tsumeb concentrated on extracting copper, lead and silver ores. More recently the Tsumeb smelter complex, a quite separate operation established to process ore from both Tsumeb and elsewhere, was also closed. Both closures had a marked affect on the economy of Tsumeb which grew around and in support of this mining industry. New owners have now taken over the industry, and the smelter started operating again in June 2000.

Pollution generated by the mine and smelter has been, and remains, a concern. A variety of toxic heavy metals including arsenic are concentrated in the mine dumps and tailings surrounding the smelter, which clearly pose health risks for people inhaling the dusts on a regular basis. The dry and windy conditions that prevail for much of the year aggravate this problem of dust pollution. In addition to causing direct health problems, there is concern that high concentrations of heavy metals and arsenic will accumulate in the soils and plants in the area, or seep into the groundwater, polluting the valuable water reserves in that area.

Recommendations have been made that the mine area be cleaned up and closed for good, since there is little chance of the mine becoming operational again. Costs estimated in 1998 to clean up the area so that pollution and other environmental hazards are reduced to acceptable levels amount to about N$44 million. When anyone will ever pay that money to clean up the mess remains to be seen!

Associated with the metal resources mined at Tsumeb are an array of prospecting licences and claims around the town. Prospecting licences have also been declared in the Kaross area in south-western Etosha where it is thought that there might be deposits of low-grade gold, copper, lead and zinc; no commercial ventures have been established to extract the ores so far. Similar prospecting interests in an area south of Ruacana hold a possible commercial future if large deposits of copper, lead and zinc are found.

Over the years there has been speculative interest (and heated debate) about possible oil reserves in Etosha and elsewhere in the region. Current research on the topic suggests that there are no commercially viable oil reserves in the area. Investigations of the coal-beds in the Karoo rocks have found that they, too, have little or no economic value. Of greater possible interest are small pockets of methane gas, trapped and associated with the same beds of coal. Suggestions have been made that these could be mined to fuel small, local power stations that could provide electricity to local communities. However, much work needs to be done to establish the nature of the methane reserves, and the viability of that method of producing and ways of paying for electricity.

Seven of the saline pans in and north of Etosha have sizeable deposits of salts and other minerals.[3] People in the region have harvested the salt on a small scale for many years. Those with salt are the Ongandjera and Ongandjera East Pans, the Otjivalunda Pans (1 and 2), and the Ondangwa Pan. In addition, the first four of these pans contain deposits of thernadite (used for dyes in the chemical industry) and soda ash, while the Naruunda and Onanzi Pans have layers of enriched sodium salts. Some commercial interest has been shown in some of these salt and other deposits, but none have proved viable.

Many homes are at least partly built using clay moulded into sun-dried bricks, and a number of attempts have been made to investigate the use of clays in the oshanas for making burnt bricks on a commercial basis. Some deposits in certain areas could be used for making bricks suited to the construction of small, single-storey buildings, but none of these investigations has reached a stage where brick-making has been turned into an enterprise of any notable size.

The Tsumeb smelter and tailings dam

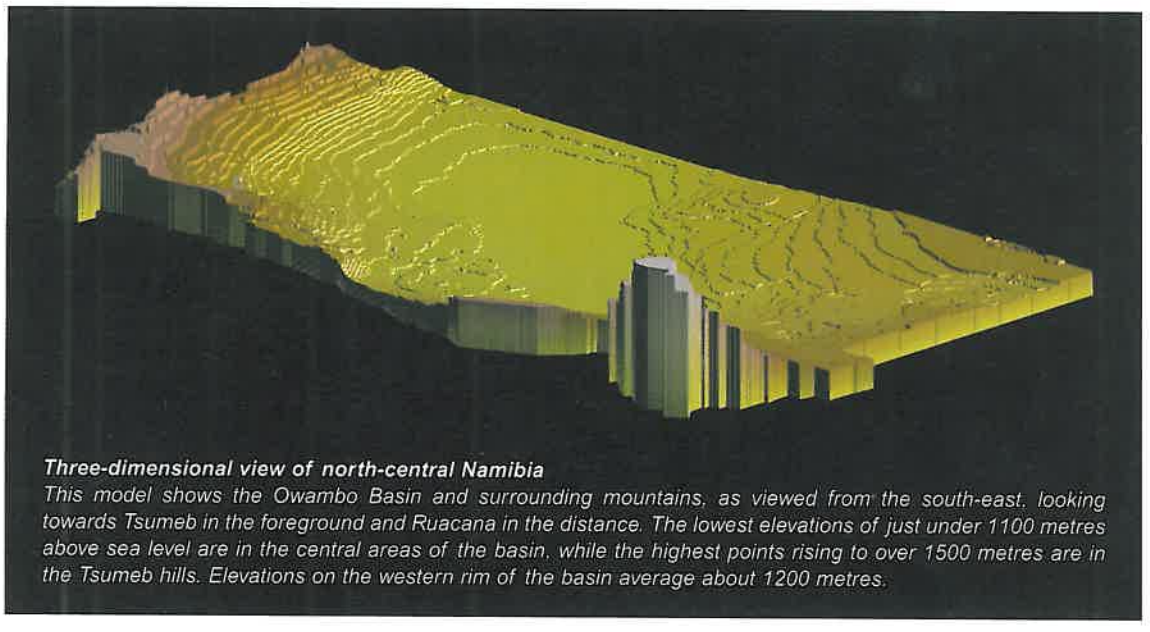
IABG

EPP

One of the many salt pans in the region

EPP

Clay pans are important centres of settlement in Ohangwena



Three-dimensional view of north-central Namibia
This model shows the Owambo Basin and surrounding mountains, as viewed from the south-east, looking towards Tsumeb in the foreground and Ruacana in the distance. The lowest elevations of just under 1100 metres above sea level are in the central areas of the basin, while the highest points rising to over 1500 metres are in the Tsumeb hills. Elevations on the western rim of the basin average about 1200 metres.

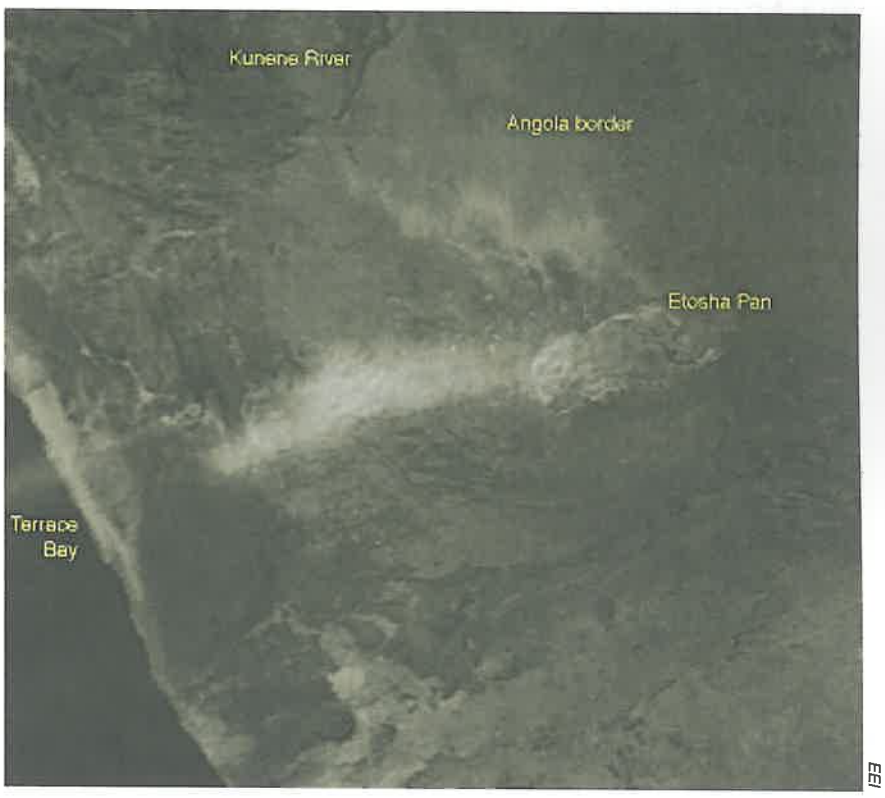
Pans

While the Etosha Pan stands out as a huge and dominant mark on the surface of the earth, it is only one of many thousands of pans in the region. Not only are these pans spectacular, but they are important in providing a variety of resources. Broadly speaking, there are two types of pans: salt and clay.

Saline or salt pans lie on a basement of impermeable limestone formed from sediments washed in by run-off from the Otavi mountains to the south.[4] Most of the water that now drains onto the pans is trapped by this layer of limestone, and later evaporates leaving behind high concentrations of salts. In fact, what we now see as the Etosha Pan is a depression that has been scoured out by wind during hundreds of thousands of dry, windy seasons. The pan was thus probably never a permanent lake. Animals trampling down the sides and walking across the surface of the pan have added to the erosion by loosening the sediments so that the lighter particles are blown away more easily. Other local centres of erosion have produced the many other, smaller salt pans in the area. While much of the eroded material has blown far away, distinctive dunes of wind-blown deposits have also been formed on the western edges of many of the larger pans.

Clay pans, by contrast, are much smaller depressions in sandy areas where much of the water and minerals drain into the sand below. The surface consists largely of clayey soils on which a variety of plants grow, making the soils relatively rich in nutrients. The clay pans are important settlement centres, supplying good soils for crop cultivation and groundwater trapped by an underlying harder layer. The large clay pans in Ohangwena and Omusati support relatively large numbers of people, while the many thousands of tiny pans in Oshikoto and southern Ohangwena provide places for smaller numbers of people to live.

In southern Etosha there are a few turf clay pans which provide important grazing areas for wildlife. These are local depressions of heavy, dark clays on a calcrete base into which water drains from rains in the vicinity. Some of the larger pans have been mapped (see the map of vegetation types, pages 22 and 23), but there are many other, smaller ones in this karstveld landscape.



EEI

A satellite image taken in August 1999 shows the power of wind erosion, with a cloud of dust off the Etosha Pan being carried 300 kilometres to the west

Landscapes

The various deposits that have filled the Owambo Basin have produced a very flat landscape and it is only at the margins, where some rocks have been pushed to the surface, that there are any hills of note.

Erosional and depositional processes and the resultant differences in elevation, soil and vegetation have created six distinct landscapes in the region, as shown in the map on the following page.

The **Cuvelai** lies on sediments of silt, clay, limestone and sandstone. The area is characterised by thousands of drainage channels or oshanas, which funnel towards the Etosha Pan. During the wet season they often fill with water and cut into the underlying sediments. When dry, most oshanas are covered by grass, while on the higher ground between the drainage channels, saline Kalahari sands support mopane scrub and various larger trees. These raised areas also support much of the crop production in the region. The southern reaches of the Cuvelai flatten out into a saline grassland area which is underlain with a shallow layer of saline sand. Various saline grasses dominate the vegetation, and trees and shrubs are largely absent because of the poor structure, shallow depth and high salinity of the soil. This southern area is used for grazing cattle mostly during the rainy season.

The **karstveld** lies on massive deposits of calcrete and dolomite. These dolomites represent the remnants of the rim of the Owambo Basin folded upwards during the formation of Gondwanaland. Dolomite outcrops are common in the south-east, but less so along the southern border. Extensions of the Kaokoveld escarpment zone occur as scattered hills in western Omusati. The soils vary from loams and clays in the west and centre, to more sandy soils in the south-east, some of which are cultivated by commercial farmers. There are also many turf clay pans in low-lying areas. The landscape is fairly heavily wooded. Mopane trees and shrubs, and various acacia species and *Catophractes alexandri* occur in the lowlands. The dolomite hills are characterised by tall trees, with marula, *Kirkia acuminata*, *Moringa ovalifolia* and *Lannea discolor* being common. Other outlying hills of the Kaokoveld escarpment zone in south-western Etosha form an undulating landscape of isolated hills of granite, quartzite, calcrete and dolomite. Around these hills the soils are very shallow, and sandy to loamy in character. Open shrubs and low trees of acacia species, mopane, purple-pod terminalia and *Combretum apiculatum* dominate the vegetation.

The **salt pans and surrounding plains** form a distinct landscape. The pans are dry for most of the year and support few plant species on their very saline silts. The surrounding plains are mostly treeless, except for a few acacia and *Catophractes alexandri* shrubs on degraded parts of these plains. The grass and dwarf-shrub plains surrounding the Etosha Pan are favoured by grazing antelope and zebra in Etosha.

The **mopane shrublands** form a large and uniform landscape dominated by mopane growing as shrubs and low trees. The soils consist of loams and saline sandy loams, and are deeper than those of the saline grasslands in the Cuvelai. There are also many small clayey depressions in the area, as well as a number of larger salt pans. Although grass production can be high during years with good rain, wildlife and cattle do not favour the area, and it is not cultivated.

The **eastern Kalahari woodlands** are dominated by a huge expanse of deep Kalahari sands. Scattered clay pans dot the landscape, and a few ancient drainage lines coming in from the north-east cross the area. There are also some parallel ridges of dunes running east to west near the Kavango Region's border. These pans, drainage lines and interdune valleys are the only places in this landscape type where crops can be grown because their soils are more clayey. The southern boundary is marked by the Omuramba Owambo, which appears to prevent the spread of Kalahari sands to the south. Apart from soils in the pans, drainage lines and interdune valleys, the deep soils are relatively sterile, grey Kalahari sands, through which rainwater rapidly drains. Thus, large trees and shrubs that have deep roots extending down to moisture in the deeper layers dominate the vegetation.

Another broad zone of sands makes up the **western Kalahari woodlands**, sandwiched between the Kaokoveld escarpment zone to the west and the Cuvelai and mopane shrubland landscapes to the east. Compared with the eastern Kalahari, this landscape has been subjected to much more surface water flow and erosion. There are thus many more old drainage lines and other remnants of surface flow during wetter periods. The vegetation is dominated by shrub-and-tree savanna, growing on moderately deep sands and shallower sandy loams. Although the soils in some areas are moderately fertile, the whole zone receives less rainfall than areas to the east, so the potential for crop production is poor. The only surface water lies in clay pans that are filled after occasional good rains.

DD

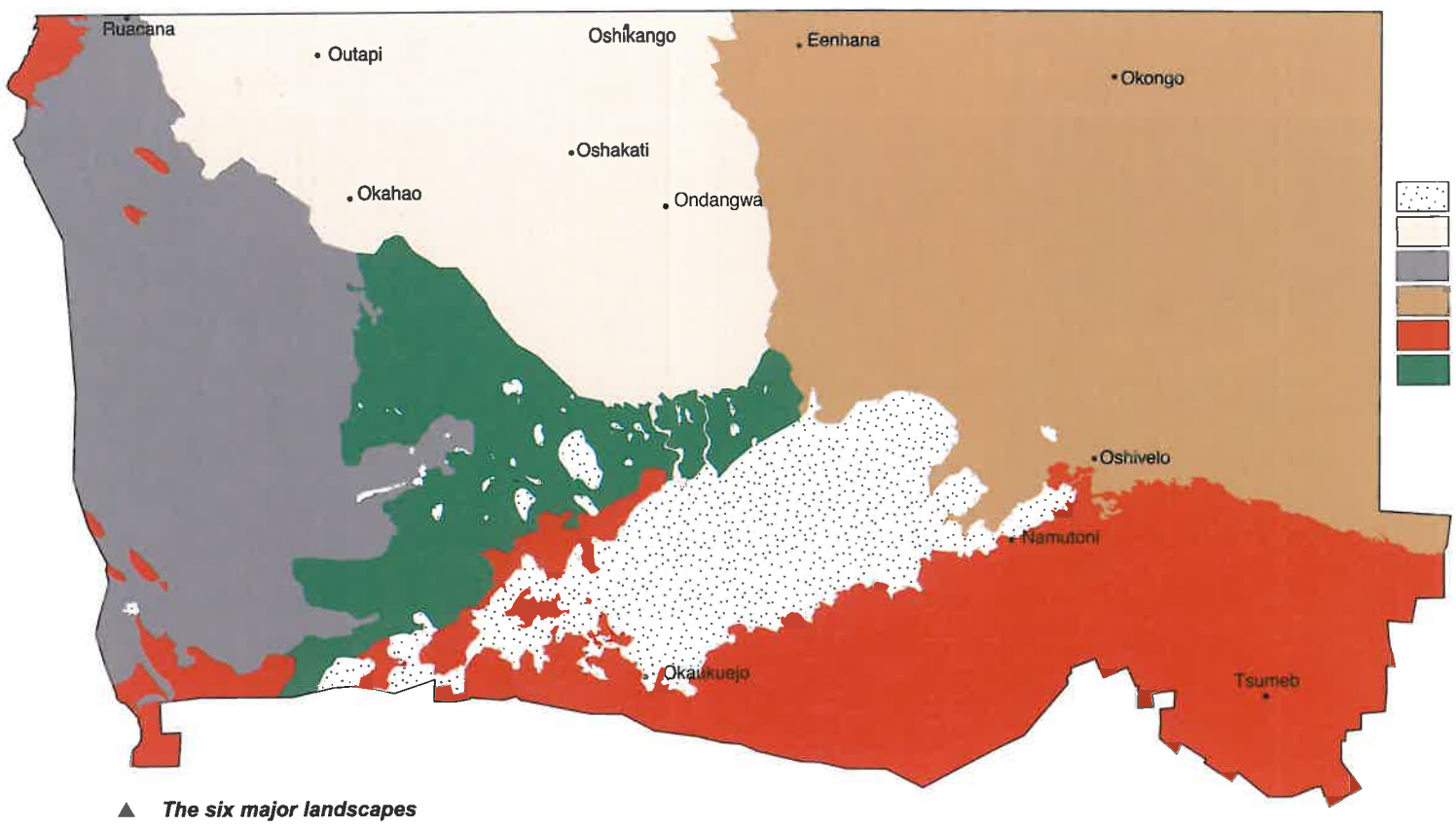
Part of the massive Cuvelai drainage system

EPP

The karstveld

WdP

Salt pans and surrounding plains



▲ ***The six major landscapes***

EPP

Mopane shrublands

HD

Eastern Kalahari woodlands

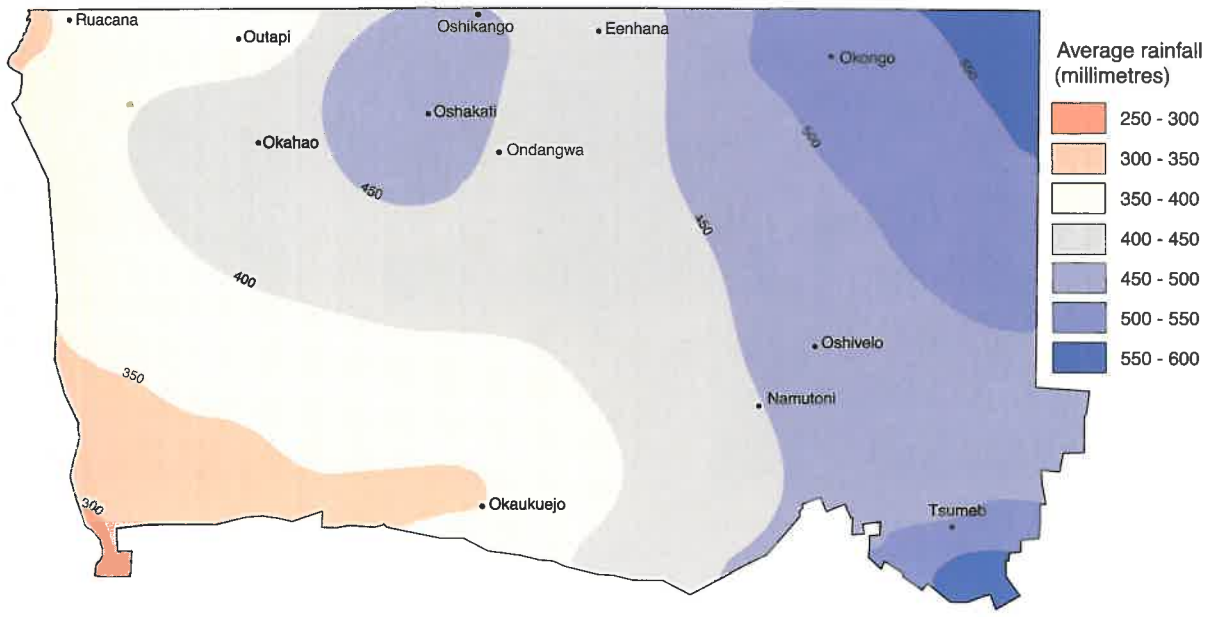
EPP

Western Kalahari woodlands

Climate

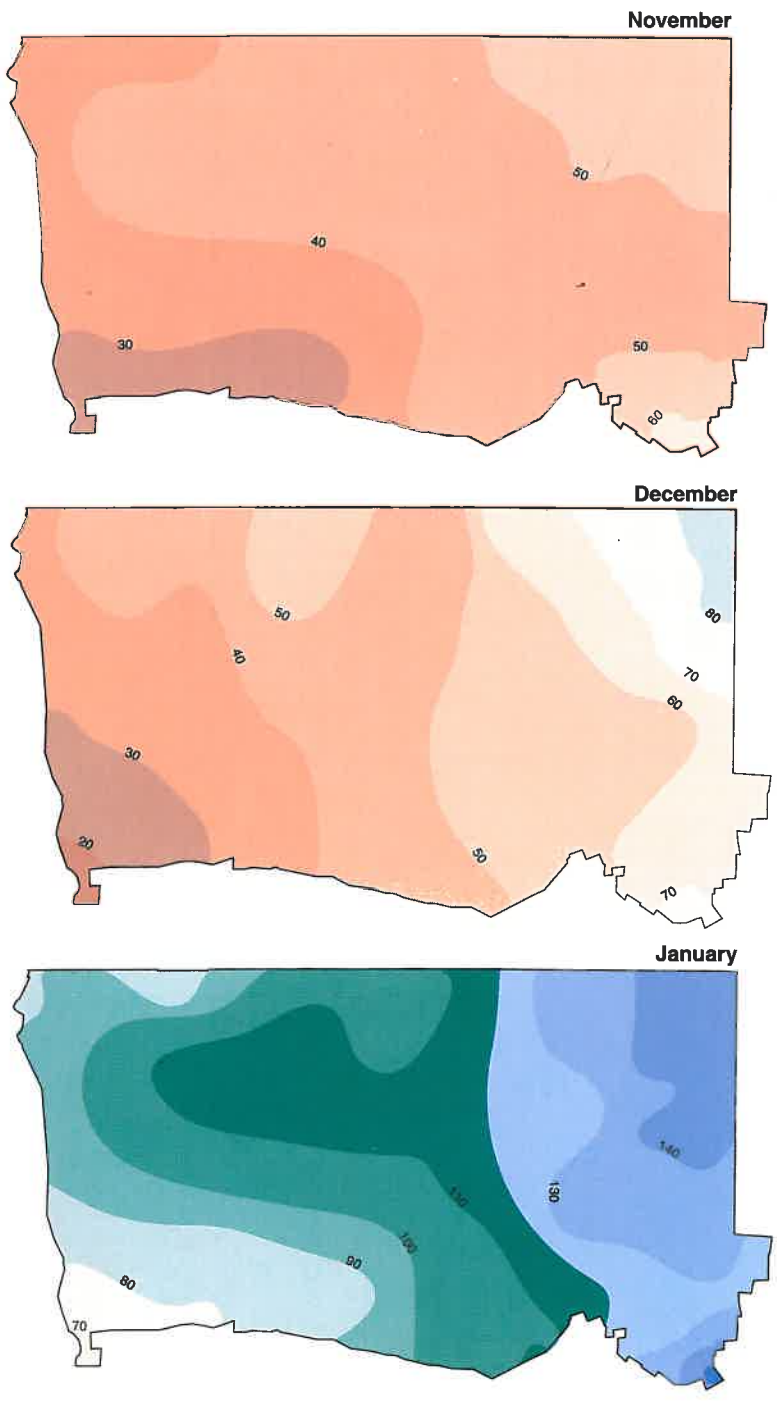
The climate of the region ultimately governs many of its features. Over many years it has shaped the landscape and is fundamental in determining the availability of water, both on the surface and below the ground. Together with the soils, climatic features such as rainfall, temperature and humidity influence which types of plants can grow, when they grow, and what limits are imposed on their growth, thus affecting the production of crops, as well as pastures and browse for livestock and wildlife.

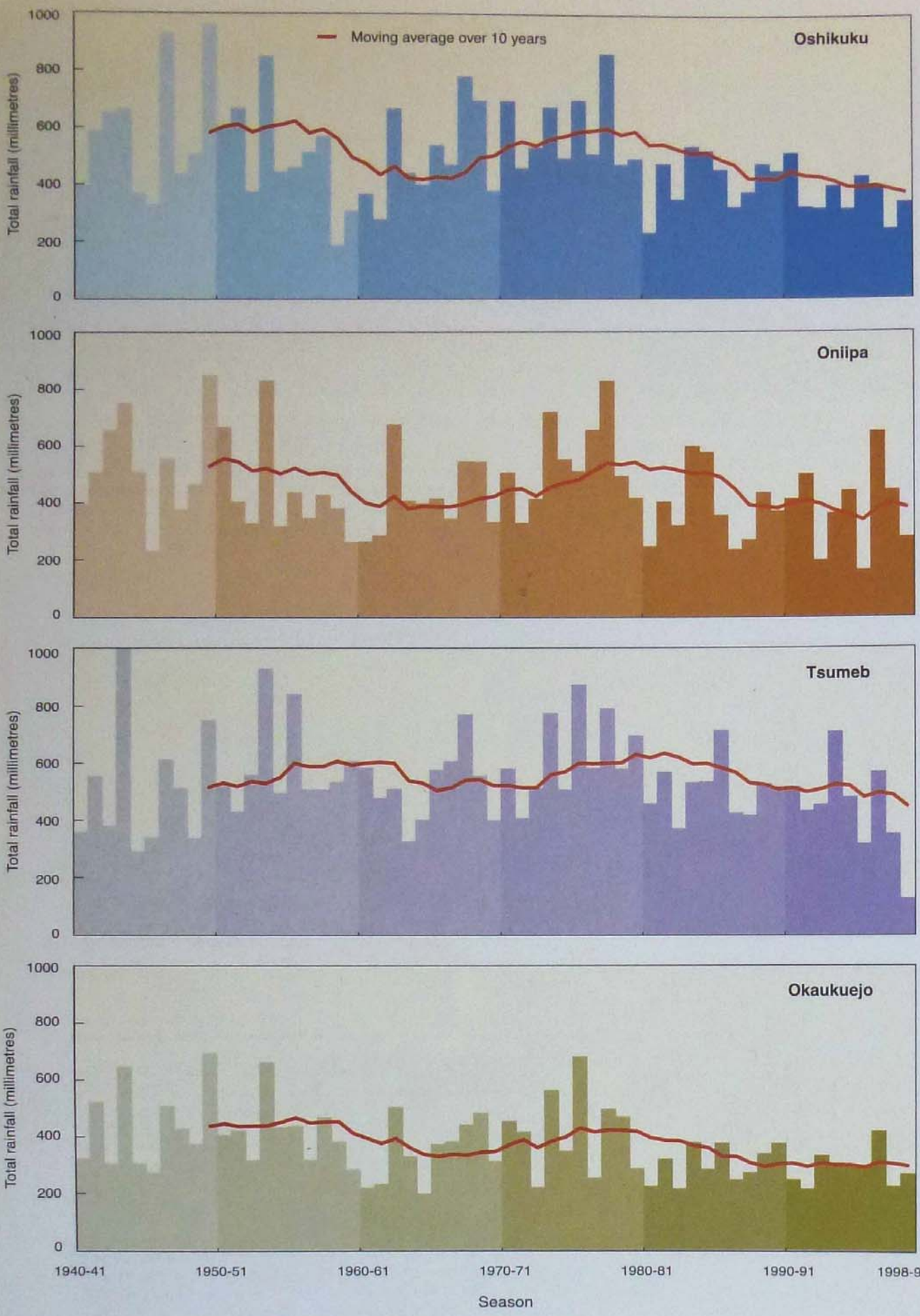
In broad terms, the climate can be described as semi-arid, with the only rains falling in the summer months when temperatures are highest. Water coming into the region, either as rainfall or flowing surface water, rapidly evaporates or seeps into the sandy ground. Although there have been both wetter and drier periods in the past, the climate has been more or less like this for millions of years. Rainfall is highly variable – not only in the amount that falls, but also when it falls within the rain season. Everyone knows that there are good years and bad years, bumper crops and famines or droughts, but we fail to recognise that these variations in rainfall are normal, something that is to be expected and accepted! The high degree of variation in rainfall also means that activities dependent on water – such as farming – are very risky.

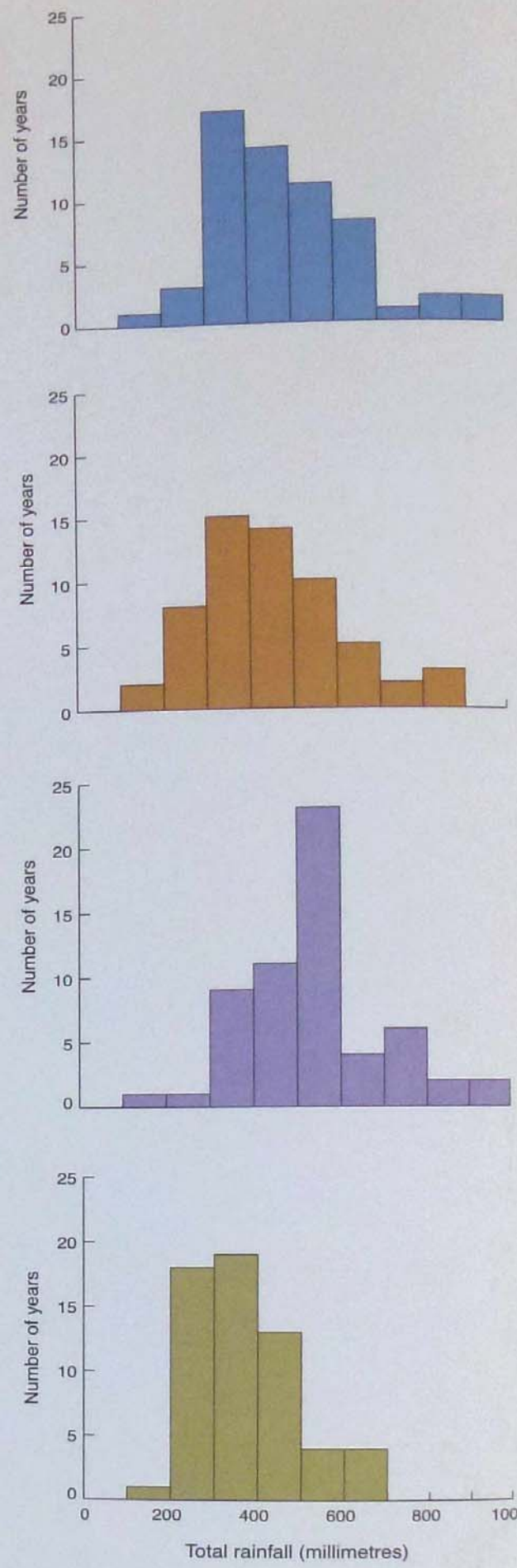


◀ ***Average rainfall each year[1]***
There is a huge gradient of rainfall across the region. The annual average rainfall varies from 550–600 millimetres per year in the wettest areas in the north-east and around Tsumeb, to less than half in the south-western corner of Etosha where averages are 250–300 millimetres per year. Most of the moist, rain-carrying air blows in from the north-east and north, so these areas not only receive rain first, they also receive more of it, thus leaving less moisture available to fall further south and west. The zone of higher rainfall around Tsumeb is the result of the hills forcing incoming air upwards where it cools, condensing the water vapour and producing greater falls of rain in that area.

▼ ***Average rainfall in the summer months[1]***.
On average, 96% of all rain falls during the six months from November to April. In fact, most rain is concentrated in January, February and March, when an average of over two-thirds of the year's rain falls. These are usually the only productive months with enough rain for crop and pasture growth.







▲ ***Total annual rainfall from 1940–41 to 1998–99***

Total annual falls of rain at Oshikuku, Oniipa, Tsumeb and Okaukuejo over the past six decades illustrate the most important feature of rainfall in the area: its variability. Almost every year differs from the one before or after it, and the best years may have totals that are three or four times higher than those of the driest years. The ten-year moving averages show the longer-term cycles of rainfall, which are similar at each place. Thus, the 1950s generally saw good falls whereas the 1960s were drier; good years followed in the 1970s, and then a succession of dry years occurred from the early 1980s into the 1990s.

There were also changes in the number of days with productive rain. Remarkably, those changes are more apparent in the January, February and March falls than the earlier (November and December) or later (April) ones. In the 1970s the number of productive days between January and March was roughly 25–50% higher than in the 1980s and 1990s. For example, during the 1970s Oshikuku saw about 12 days in January, 10 days in February and 10 days in March with ten or more millimetres of rain. In the 1980s and 1990s these figures had dropped to eight days in each of January, February and March. It is reasonable to assume that mahangu and other harvests have been substantially smaller on average during the 1980s and 1990s as a result of these lower falls of productive rain.

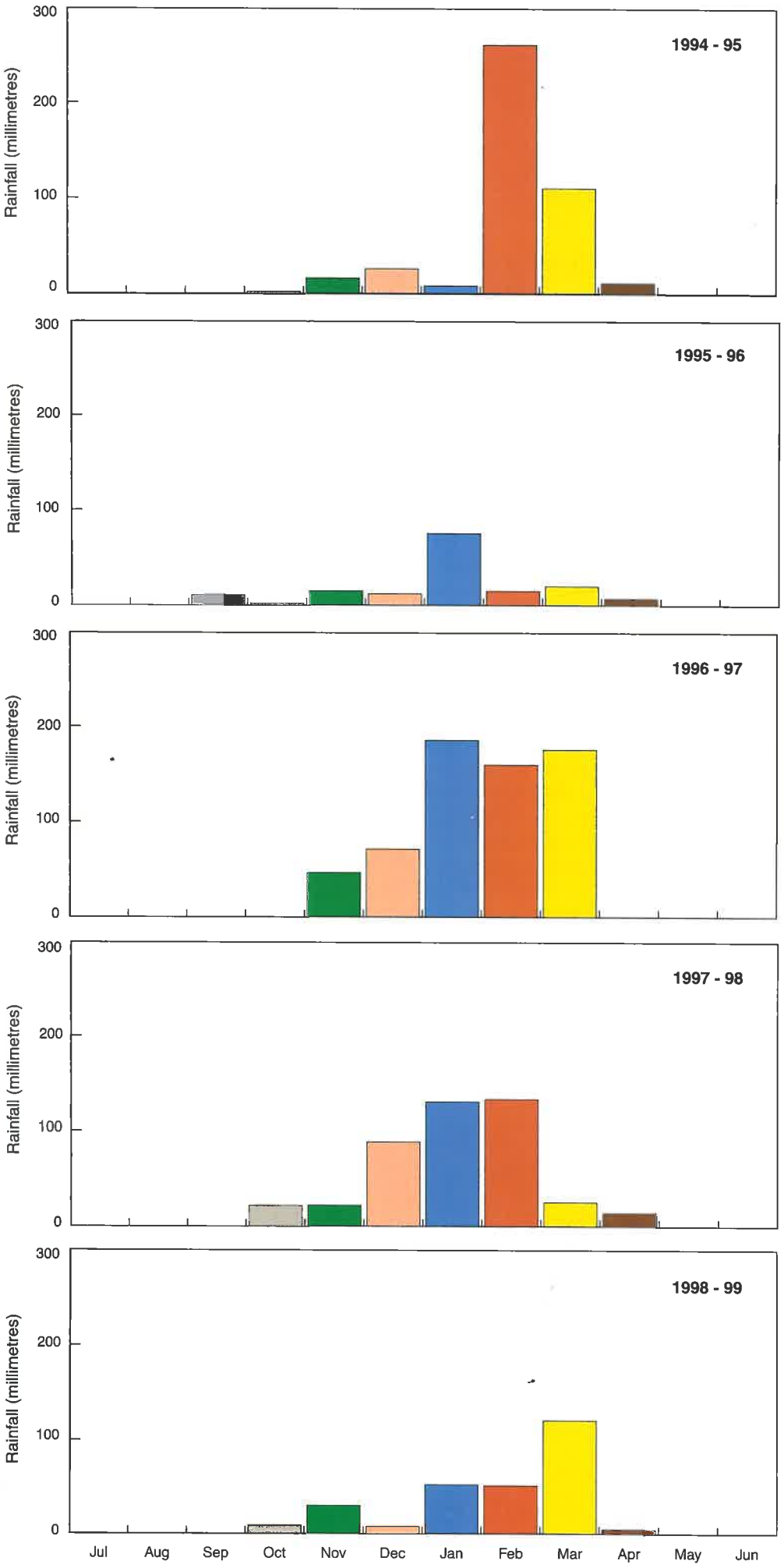
▲ ***Frequencies of different rainfall totals for Oshikuku, Oniipa, Tsumeb and Okaukuejo***

These graphs show how many years (July to June) of the past 59 saw different annual rainfalls. Each place has had one or two years of less than 200 millimetres, and each had several years of exceptionally high rainfall. In at least 39 of the 59 years, annual totals were between 300 and 600 millimetres at Oshikuku, Oniipa and Tsumeb while Okaukuejo received between 200 and 500 millimetres in 50 out of 59 years.

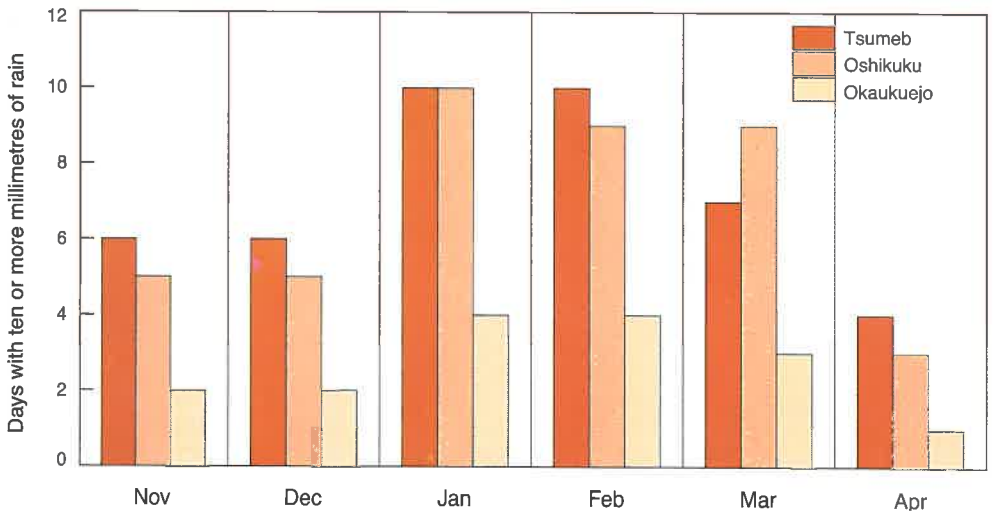
Rain storms sweeping across the flat landscape are often spectacular EPP

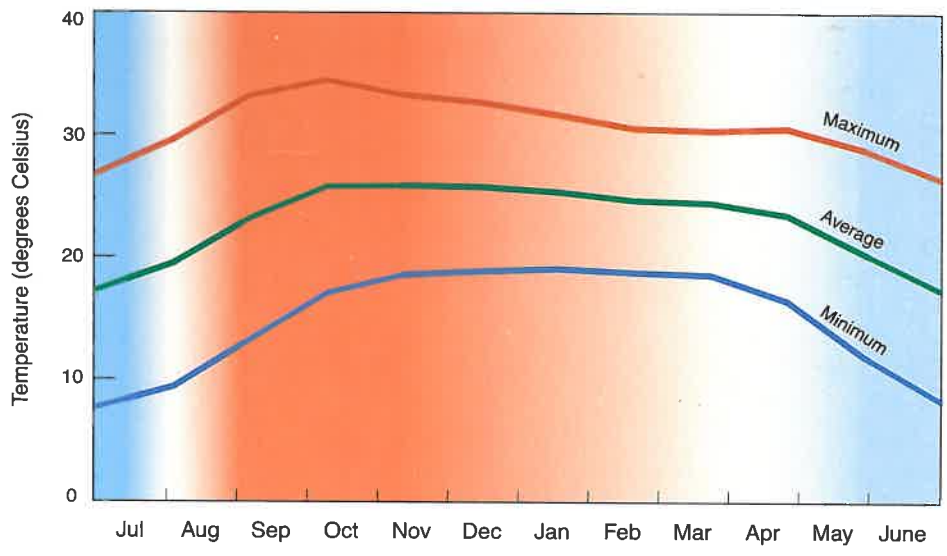
Average number of days with productive rainfall in Tsumeb, Oshikuku and Okaukuejo during each month of the rain season

Small, isolated showers of rain are not necessarily productive because the water evaporates or runs off almost as soon as it falls. One measure of productive rain assumes that only falls of ten millimetres or more in one day will have noticeable effects on plant growth, especially the growth of crops. On average, we can expect six or fewer such days in November and December, and only in January, February and March do productive falls occur more frequently. The progression of rain from east to west during the summer months means that areas in the north and east have more productive rainfalls than those in the south-west. On average, Tsumeb and Oshikuku have at least three months in which six or more days of productive rainfall occur, while Okaukuejo receives four or fewer days of productive rainfall per month.

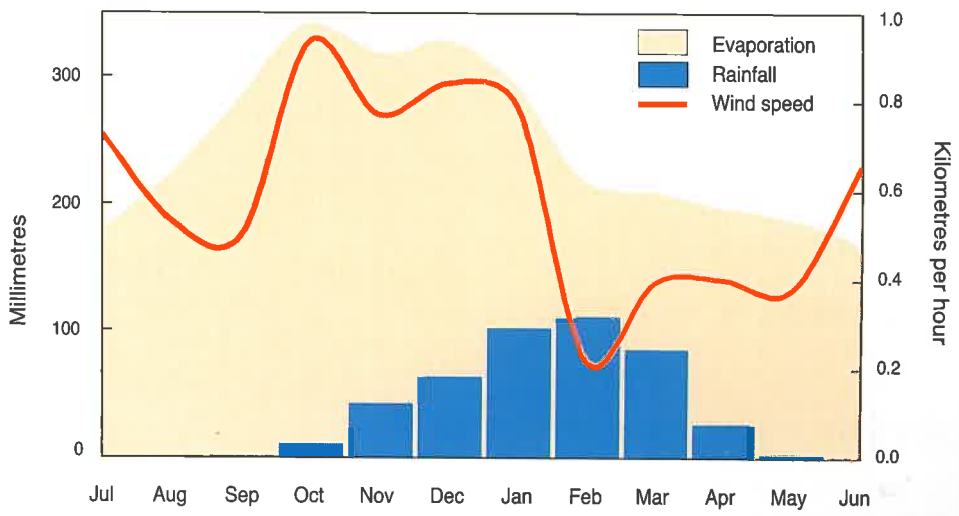


▲ ***Monthly rainfall at Oniipa over five seasons***
Not only do the total amounts of rain vary but the timing of rainfall within the rainy season also varies a great deal, as shown by the monthly totals in these graphs. Each of the five years differs from all the others, one year having peak rains in January, and others in February or March. The years also vary in the number of months getting good falls, with good rains being spread over one, two, three or four months. All of that variation determines when farmers can plant their crops, and what their chances of a reasonable harvest will be. Some years may start off with good rains, but crops will fail if they are followed by long, hot and dry periods.





▲ ***Average daily, minimum and maximum temperatures at Ondangwa[2]***
Average daily temperatures rise from about 17° Celsius in June and July to about 25° Celsius in October, November and December. These three months and September also have the highest maximum temperatures for the year of between 30° and 35° Celsius. The summer months that follow are generally cooler due to the effects of cooling rain and greater cloud cover. Average minimum winter temperatures drop to about 7° or 8° Celsius and very few days with temperatures close to zero are encountered. Frost may occur very occasionally further south in the region.



▲ ***Average evaporation rate (millimetres) at Mahenene, and wind speed (kilometres per hour) and rainfall (millimetres) at Ondangwa each month***
The most important factors determining evaporation rates are temperature, humidity, wind and vegetation cover. On average, about 2500 millimetres of water evaporates each year. That is equivalent to a pool 2.5 metres in depth losing all its water in a year as a result of evaporation (assuming nothing is added by rainfall). Since the amount of rain over much of the region is 400–500 millimetres per year, five to six times more water evaporates than falls. It is this difference between low rainfall and high evaporation rates that produces the region's arid environment. Many other places in the world receive just as little rain, but high humidity, frequent cloud cover and low wind speeds mean that much of the falling rain remains available for plant growth.

Evaporation rates are highest between September and January because it is hot and generally windy, and it is in these months that most of the water standing in the oshanas is lost. Higher humidity and stiller and cooler conditions result in lower water losses from February onwards. The two periods with the highest wind speeds are between June and July, and October and January.

Shortages of rain often result in crop failure, in this case a withered crop of mahangu

MIB

Water

NAN

In a country as dry as Namibia, water captures everyone's imagination. We are interested in water first and foremost simply because there is so little of it. Its availability shapes almost every aspect of land use, affecting where people can live, where livestock can be watered and where a good deal of wildlife will occur. But water is also fascinating because its presence is so erratic. In most places, it is suddenly delivered in buckets of rain, only to disappear almost overnight. In some special places, water also arrives in irregular floods. One such place is the massive Cuvelai system of winding and interconnected channels, creating a dramatic landscape during times of flood as well as during those starkly contrasting times when the land is parched and thirsty. This system not only dominates much of the landscape, but is also the most important wetland in Namibia because so many people benefit from the Cuvelai.

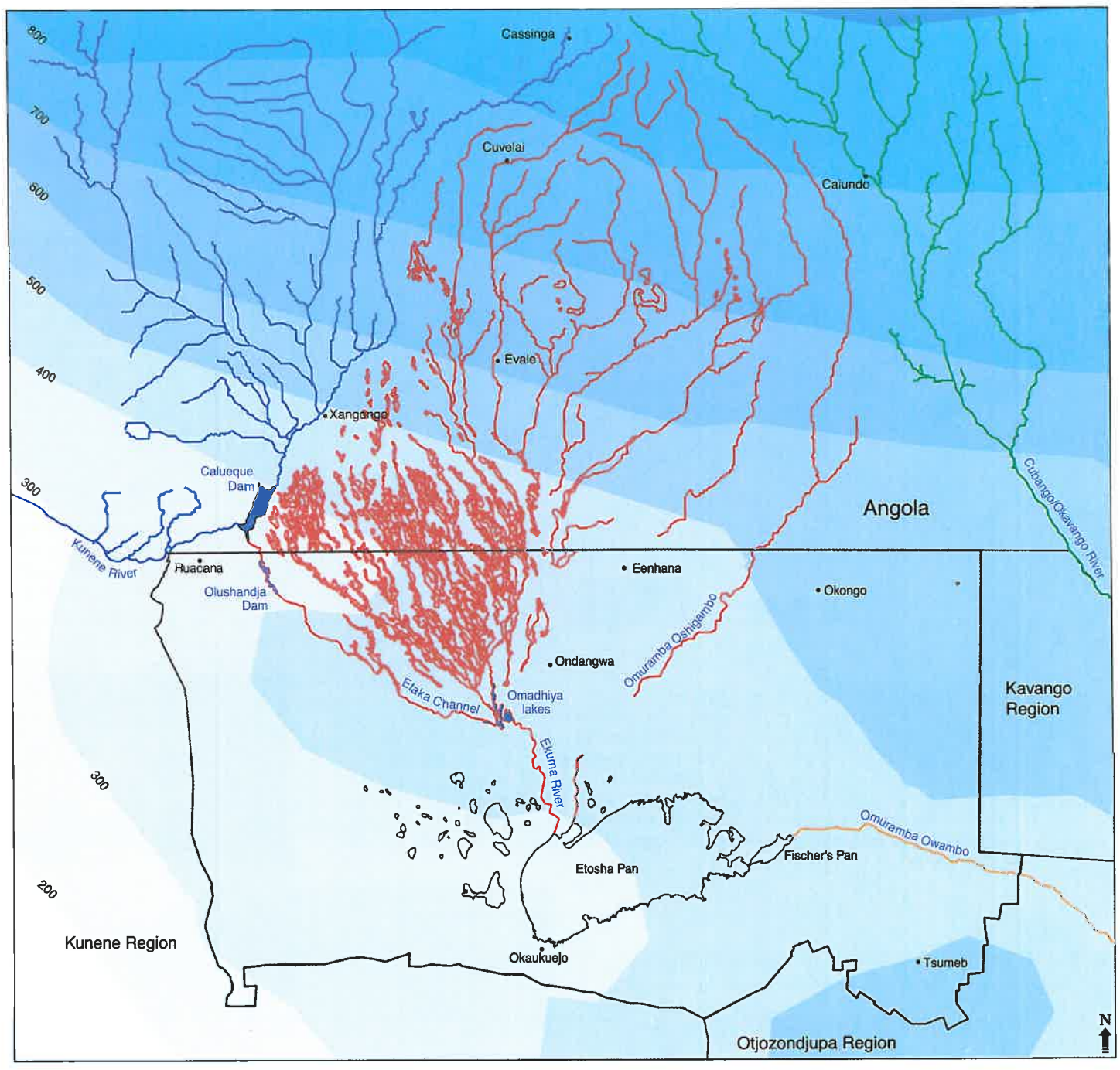
Surface water and the Cuvelai

The Cuvelai originates in Angola, its catchment falling between those of the Kunene River in the west and the Cubango/Okavango River in the east. The system is fed by a number of rivers, some of which have their headwaters as far north as the Encoco highlands in Angola, which receive on average over 800 millimetres of rain a year. As these seasonal waters move further south, the land becomes flatter, and the rivers and channels (oshanas) meandering toward the Namibian border feed into each other at some places and part ways at others, forming a massive inland delta. These seasonal flows provide fishing grounds, renew pastures and recharge groundwater supplies. They are, indeed, the foundation on which many people's culture and livelihood have been built.

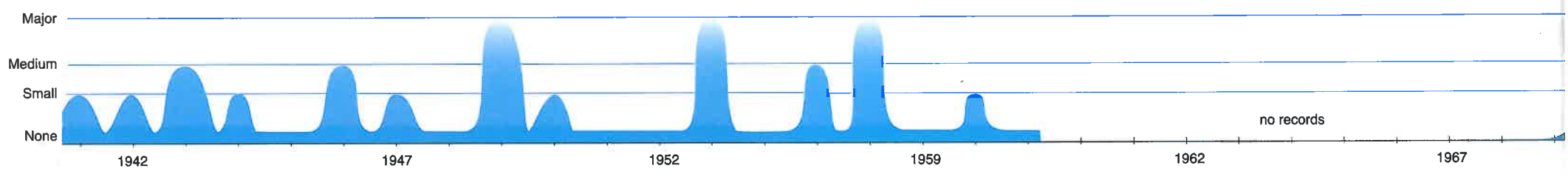
The nature and pattern of water flows in the oshanas are extremely variable. The flow of water depends on how much, and where, rain has fallen in Angola and locally. The rivers that feed the oshanas flow from an area covering about 50,000 square kilometres in Angola, and what comes down those channels depends very much on what rain has fallen where in the catchment. A good deal of water within the oshanas also drains in from heavy, local rainfalls. When good rains fall over the entire catchment area, a large flood, or *efundja*, comes down bringing large numbers of fish with it.

Oshanas in the western areas are much broader and flatter than further east where there are many more, narrower channels closer to each other. Some channels seem to disappear into the middle of nowhere, but most come together further south in a few main watercourses that feed into the Omadhiya lakes. Lake Oponono is the best known of this series of interconnected lakes and pans, which fill from waters coming in from the northwestern, northern or north-eastern sections of the delta. The Ekuma River flows out of one of these pans, Oshituntu, from where it makes its way south into the Etosha Pan.

Flows of water into the Omadhiya lakes depend very much on the volume and force of water flow in the oshanas, and the lakes probably only fill properly during medium to large floods. Thus, in an average period of 20 years there might be only eight years when good flows make their way into the lakes and some water reaches Etosha Pan. In only three of those years do really large amounts of water flood Etosha Pan. However, in many years, Etosha Pan receives some water in its eastern section from the Omuramba Owambo, which feeds into Fischer's Pan.



▲ ***The Cuvelai, and neighbouring Kunene and Cubango/Okavango drainage systems, and zones of annual average rainfall (millimetres)***



Like the Omuramba Owambo, the Etaka channel is not connected to the main Cuvelai delta and, thus, does not carry water from the Angolan highlands. The Etaka is a relatively deep channel, and may represent the remains of the main course of the Kunene River when it apparently drained into the region up until about two million years ago. The Olushandja Dam has been built on the channel and water is released down the Etaka from time to time for the use of livestock in areas around Tsandi and Okahao.

Fish and fishing

A variety of fish are delivered to the region during the periodic flows of the oshanas, and the higher and longer the flood the more fish there are available.[1] In one fishing bonanza in March 1976, 123 people caught 4200 kilograms' worth along the road between Ondangwa and Oshakati alone. Although conditions are seldom like this, fish caught in the oshanas provide households with a temporary supplement of protein in most years. Some fish are also sold in markets where they fetch higher prices than fish brought in from the coast, suggesting that people perhaps have a higher regard for the freshwater fish.

Almost all the fish carried down the oshanas from permanent water in streams and rivers 200 kilometres north of the border and beyond, are young individuals. Seventeen species of fish were originally recorded in the Cuvelai system, mostly catfish, barbs and *Tilapia*. To these at least another 46 species have been added, which have come into the oshanas from the Kunene River via the pump and canal systems that feed the water supply system. The diversity of species decreases the further south the waters flow.

Many fish make their way down to the Omadhiya lakes in years when the oshanas flow strongly and large numbers of fish-eating birds converge on the pans in such exceptional years.

EPP

Catfish for sale near Outapi

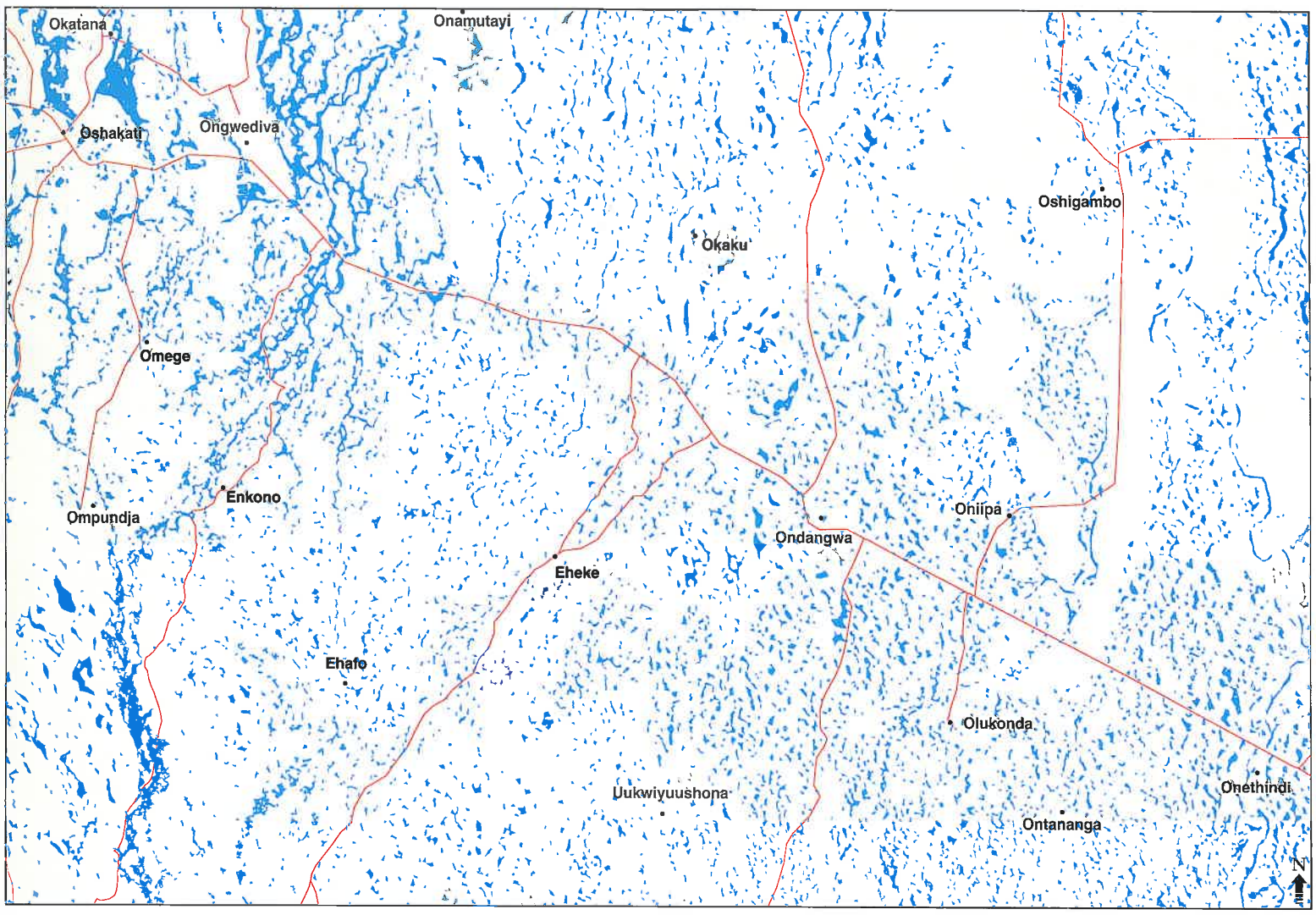
In 1969, breeding white pelicans and other fish-eaters were estimated to have consumed 975 tonnes of fish in those pans. Most fish in the oshanas and lakes die off as the water dries up, although catfish bury themselves in the mud until water flows again in another year. The first species to die off are those least able to survive in the increasingly salty and turbid water. The last survivors are the really hardy species but they, too, die when the last remaining pools evaporate. The most important point about the fish resource is that it is renewed whenever the oshanas flow and its continued availability depends on the river systems in Angola remaining healthy.

MIB

Traditional basket fishing in the oshanas

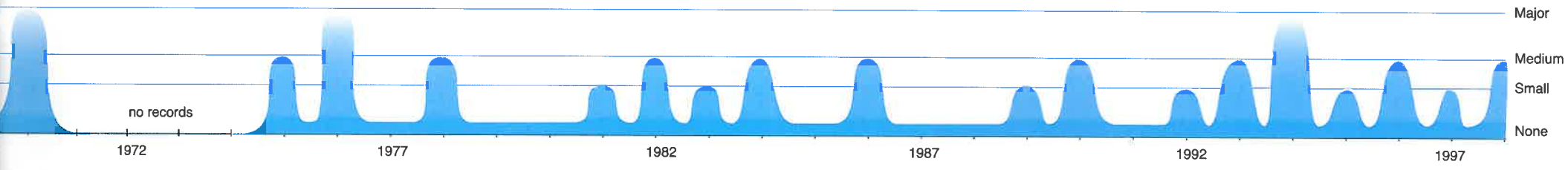
MIB

Nets are often used to catch fish in the oshanas. This modern, more efficient method of fishing will reduce the numbers of fish available to people living downstream and could affect populations of catfish which are able to survive the dry periods.



◀ ***Surface waters around Oshakati and Ondangwa, April 1997***
A year with a moderate flow of water in the oshanas shows water from two sources: dark patches of water in the channels of oshanas which has flowed in from upstream, and pans filled with rainwater which has fallen locally.

▼ ***Flow in the Cuvelai delta for 44 of the past 58 years***
A series of records, compiled over the past 58 years, is the best information available to reflect the varying flow of water from year to year.[2] Although information for 14 of those years is missing, the records can be divided into four groups of years with no, small, medium or major flows. From this we can expect that over 20 years there will be no flow in seven, a small flow in five, a medium flow in five and a major flow in three of the years. Only a flow which is medium or major would be considered an efundja.



Groundwater resources

Since surface waters are only available for certain periods in the Cuvelai and in pans elsewhere, people have had to rely on other sources of water during dry periods. Traditionally, they tapped groundwater by means of wells, and access to water underground must have been the key factor enabling people to settle in the Cuvelai many hundreds of years ago. Those wells tap into part of a complex system of aquifers that stores varying amounts of water at different depths below the surface.[3]

Aquifers are relatively stable sources of water, especially if they hold water that has accumulated over a long time. The many thousands of boreholes drilled over the years have shown that groundwater with yields of 1–5 cubic metres per hour, enough to supply a small village, can be found in almost all areas of the region. There are also aquifers that provide higher yields; for example, a large body of groundwater near Oshivelo is being held as a reserve source of water that could be pumped north-westwards to supply people in the Omutsegwonime, Omuthiya and Okankolo area. Despite the reasonable yields found in most areas, however, the quality of the water varies a great deal, and is poor in many places due to the high concentrations of salts that have accumulated over hundreds of thousands of years.

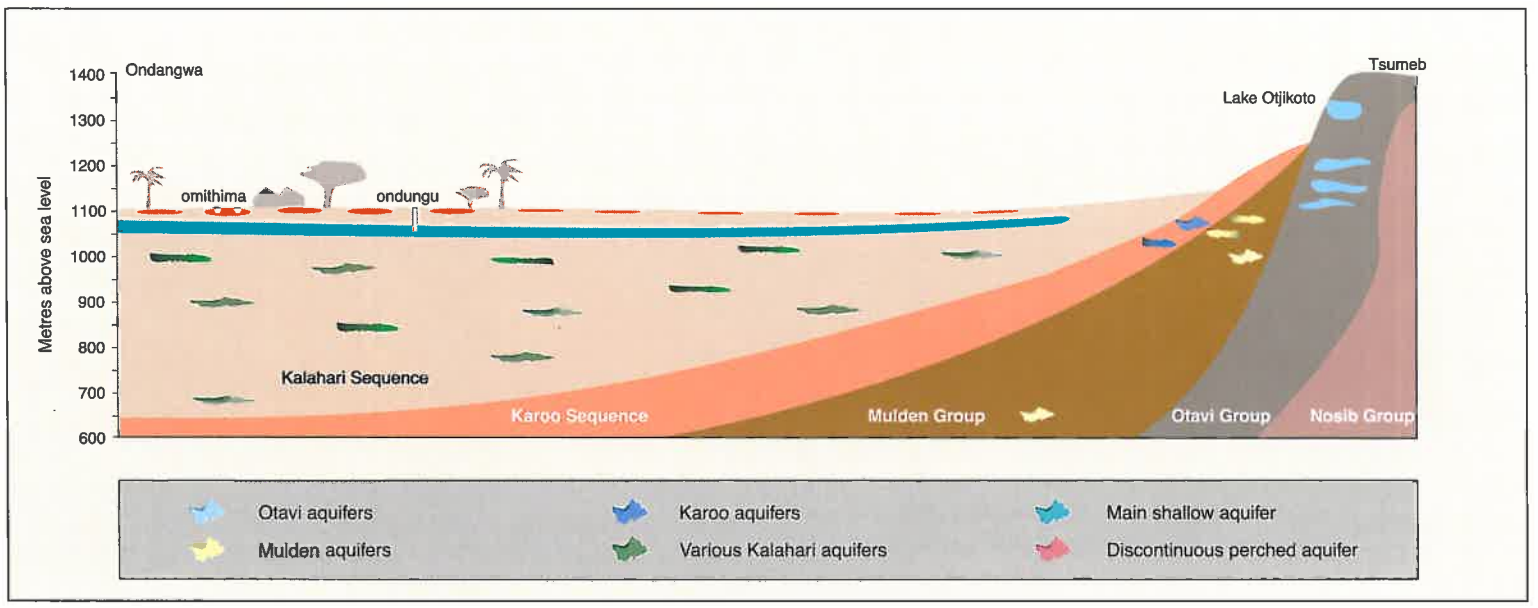
The shallowest aquifer in the Cuvelai depends entirely on seasonal rainfall and floods to keep it charged. The water percolates through a layer of sand and is trapped by an underlying layer of clay or other hard material. The aquifer is known as the Discontinuous Perched Aquifer: *discontinuous* because useful amounts of water are found only in certain places, and *perched* because it lies on top of a layer of less permeable ground. Ever since people first settled in the Cuvelai, they have dug shallow wells, locally known as *omithima*, into this aquifer to provide water through the dry season. While not as reliable a source as some of the deeper aquifers, the Discontinuous Perched Aquifer is one of the few that readily provides fresh water, especially after good rains. The hard layers of ground that trap water in this aquifer are not completely watertight, however, and much of the water seeps away or evaporates towards the end of the dry season. Thousands upon thousands of such shallow wells have been dug over the years, often in groups of five, six or more. Fences are often erected around these wells to prevent access to livestock who would otherwise contaminate the water with their droppings.

A little deeper, there is a widely distributed body of water underlying the whole Cuvelai and extending south to the northern Etosha fence. Known as the Main Shallow (or Saline) Aquifer, it is characteristically between 20 and 40 metres below ground level and very salty. It is also used extensively, and thousands of deep wells, known as *oondungu*, have been dug to reach these waters, again usually in groups, with each well belonging to a different family. In a few areas, such as Okashana, the water is under such natural pressure that it appears at the surface as artesian water.

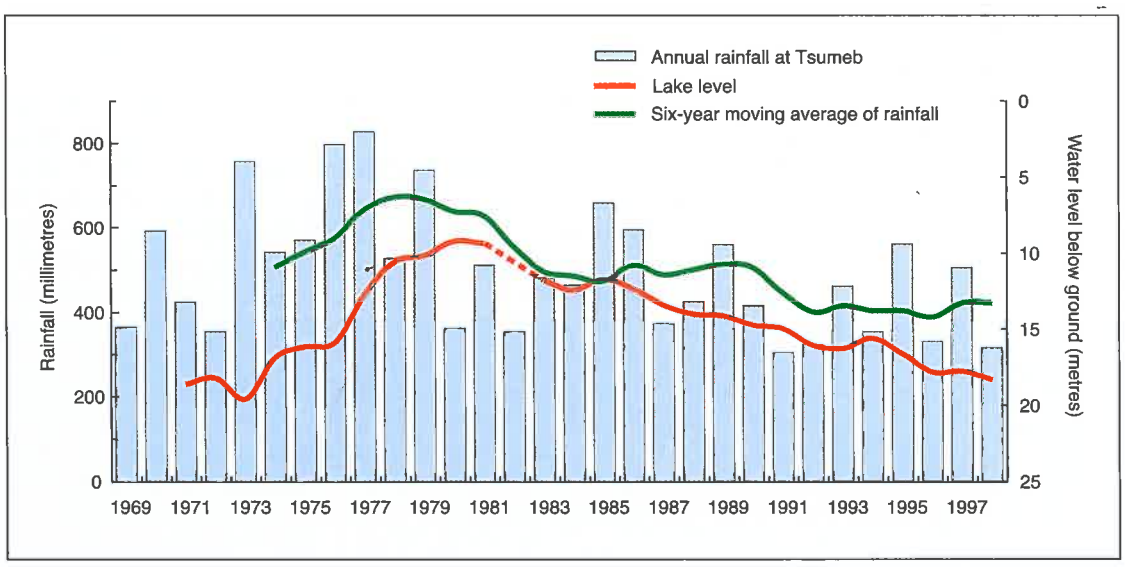
The water in the Main Shallow Aquifer is often too brackish for people to drink, and in some areas, such as southern Oshana and south-eastern Omusati, it may even be too salty for livestock. In other places, however, the aquifer is recharged each summer with fresh water which percolates down from the oshanas through cracks in the ground and settles in a layer on top of the denser salt water.

Both the Discontinuous Perched and Main Shallow Aquifers lie in Kalahari deposits comprised largely of sand and clays. Lying below these two aquifers is a whole series of others in that same massive body of Kalahari sediments. However, much less is known about how all these aquifers fit together and relate to each other in a regional context. Where they have been studied, a complex picture emerges, with different aquifers lying in layers on top of each other, each in place as a result of a different confining rock system, and each holding water with different qualities. The same aquifer, traced from one area to another, can provide fresh water from one borehole and brackish water from the next.

The Kalahari sediments of sands and water-borne clays, mudstones, shales and the likes were deposited on top of rocks in the Karoo and the Damara Sequences formed much earlier and lying much deeper down, as described on pages 5 and 6. Three groups of aquifers have been identified in these older rocks in the southern and western zones of the region. The shallowest of these aquifers lies in Karoo Sequence rocks, at depths varying between 30 and 140 metres below the ground. Water pumped from that aquifer is typically rather brackish but still useable for drinking purposes. The next aquifer, situated in the Damara Sequence and below that of the Karoo, is associated with Mulden Group rocks. Its waters may be found at depths as great as 670 metres below the surface. The quality of water varies from being saline in some areas to slightly brackish elsewhere; the water supplied at Okaukuejo is from that aquifer. The third, the Otavi Dolomite Aquifer, is associated with the karstveld reserves in the Tsumeb area. It typically yields fresh water, often in large quantities, and is used to supply the town of Tsumeb and the crop irrigation schemes near the town.



▲ ***A cross-section between Ondangwa and Tsumeb showing the different aquifers***

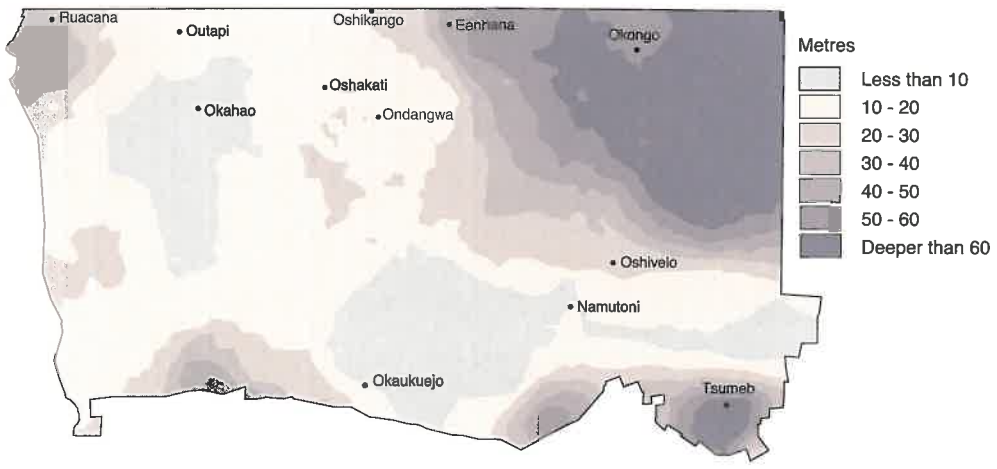


▲ ***Water levels in Lake Otjikoto***
The way and rate at which aquifers are recharged is important in determining how much water can be pumped out of them. If water is pumped at a rate that is greater than the flow of new water, aquifer levels can drop and pumps run dry. The very low water levels in Otjikoto during the early 1970s probably resulted from excessive pumping for irrigation, whereas levels had risen to about nine metres below the surface by the end of the wet years in the 1970s. However, the succession of dry years during the 1980s and 1990s has meant that the surface level of the water has steadily dropped by about ten metres, and now lies approximately 18 metres below ground level.

An aerial view of Lake Otjikoto
Large underground lakes have formed in some parts of the Otavi Dolomite Aquifer. Both Lakes Otjikoto and Guinas contain water from this aquifer, the rock ceilings to the aquifer having collapsed to expose the water. A number of interesting animals, such as fish and crustaceans, live in those underground lakes, and these particular species occur nowhere else in the world. Their continued survival thus depends on the preservation of these underground lakes. Otjikoto also has a rich history, being the burial place for ammunition, cannons and other guns dumped there during the First World War by German troops. It was also an important place for early traders who stopped there on their long journeys to and from Owambo (see page 62). The lake has a depth of at least 145 metres, and is connected with other large bodies of water in the surrounding areas.

EPP

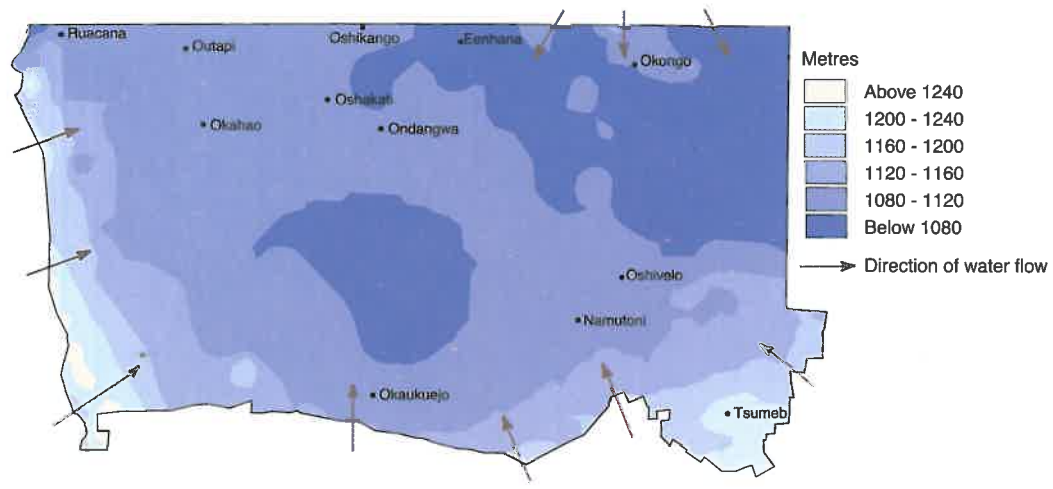
Water level below ground



◀ ***Levels of water below the ground***[4]

Over much of the region, groundwater reserves can be found at depths of less than 25 metres, which is as far down as many hand-dug wells reach. But in the north-eastern Kalahari area, around the town of Tsumeb, south of Ruacana, and south-west of Okaukuejo, most of the water is at much deeper levels, generally 50–100 metres below the surface. Some of these areas are hilly, so deeper boreholes have to be sunk to reach water that is otherwise at the same level in lower-lying areas. The greater depths also indicate that they are tapping deeper aquifers in older rock sequences.

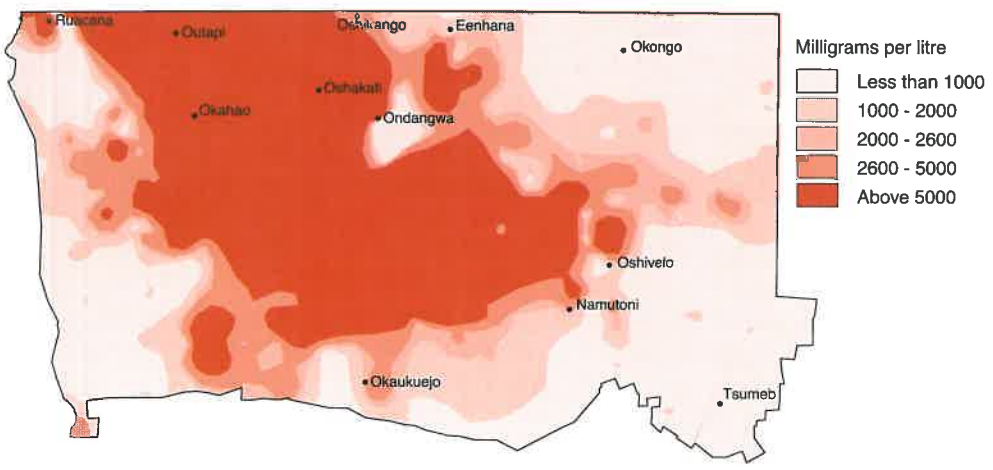
Water level above sea level



◀ ***Elevation of the water table above sea level and the direction of groundwater flow***[4]

Whereas the map of water levels above shows the depth of water below the ground, another way of looking at the positions of aquifers is in relation to sea level. This perspective provides an understanding of how water flows under the ground and how aquifers are recharged. In the map here, the higher elevations along the western border of the region indicate that aquifers in western Omusati receive water seeping in from even higher ground in the Kunene Region to the west. Similarly, water flows northwards off the higher ground in the south of the region into aquifers in Etosha and Oshikoto, and elevated water levels to the north and around Okongo indicate that the deeper aquifers in Ohangwena are recharged by water seeping in from southern Angola.

Total dissolved solids

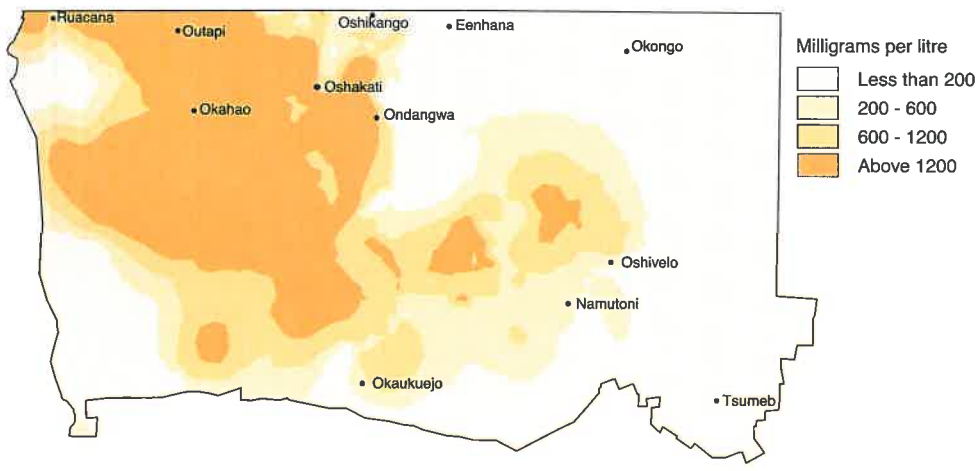


◀ ***Groundwater quality***[4]

The quality of groundwater over much of the region is extremely poor and severely limits its usefulness. The most frequent and immediate measure of the quality of groundwater is the concentration of total dissolved solids. As salt makes up most of the dissolved solids, this value also gives us a good idea of the salinity of water. Any water with a value of 2600 milligrams per litre or higher is not fit for human use, while total dissolved solid values above 5000 milligrams per litre are harmful to livestock. Water quality is especially poor in the central areas extending south from the Angolan border in a south-easterly direction towards Oshivelo. This broad zone of poor water corresponds largely with the distribution of the Main Shallow Aquifer, and except for brief periods when fresh water flows into that aquifer, these water reserves are of very limited use. In essence, any water used in that whole area must come from alternative sources, such as pipelines, dams or the Discontinuous Perched Aquifer.

Water quality improves as one moves eastwards, westwards and south from that central zone of very brackish water. The best quality groundwater is available in much of the Tsumeb area, in the entire north-eastern area of Ohangwena and Oshikoto, in south-western Omusati and Etosha, and in the Uukwaluudhi area northwards up to Ruacana. In the same way that relatively fresh water can sometimes be found in the brackish central area, some salty waters are encountered in those areas which usually provide fresher water. Much of this patchiness is due to the fact that separate aquifers in the same area can have very different qualities of water. Thus, a borehole may reach one aquifer 50 metres below the ground that has sweet water, but then be extended deeper to another at 100 metres that provides brackish water.

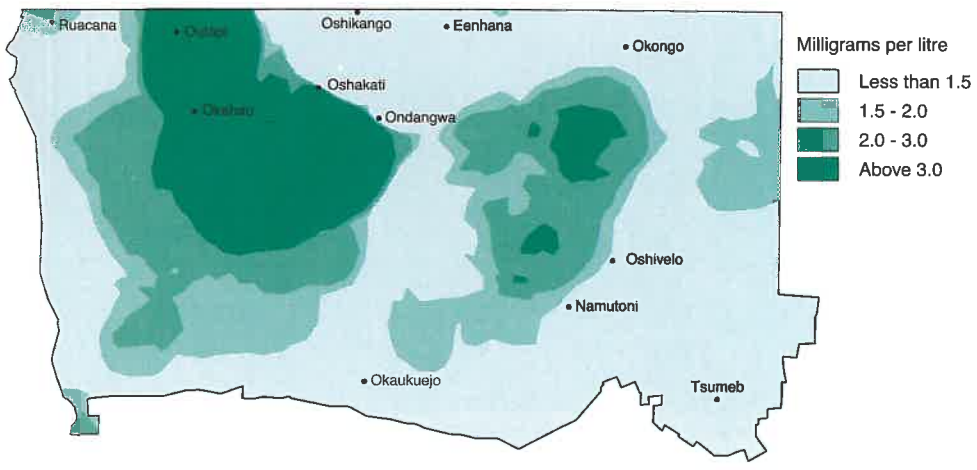
Sulphates



◀ ***Concentration of sulphates***[4]

Concentrations of sulphates above 1200 milligrams per litre can have a laxative effect on humans, and much of the Oshana and Omusati Regions have levels above that figure, especially in the densely populated areas of those regions.

Fluoride



◀ ***Concentration of fluoride***[4]

Fluoride levels above three milligrams per litre are considered detrimental because they cause abnormal development of the skeleton in children. Particularly high flouride levels are found in a belt running south-eastwards from Outapi towards Ondangwa, and south to Okahao and beyond in the eastern half of Omusati. High fluoride levels also cause teeth to become mottled and, where concentrations are really high, the teeth of both humans and livestock may rapidly wear away.

Water supply

For many years, people in much of the region depended on surface water for their needs during the rainy season, and on hand-dug wells during the dry periods. However, as the population grew, these sources of water could no longer meet demands, they became increasingly susceptible to pollution and contamination, and it was important for people to be supplied with clean water.[5]

An early, large-scale attempt at supplying water to the region was made during the famous 'Famine of the Dams' in 1929 and 1930, when thousands of people, especially women and children, were given food in return for their labour in excavating shallow dams. Much later, in the 1950s and 1960s, the building of large numbers of dams began, and by 1971 the Department of Water Affairs had excavated 320 dams across the region. Each of these had a capacity of 30,000 cubic metres, and was designed to be filled by water flowing down the oshanas. About another 65 pump-storage dams were built at elevated sites, and pumps were installed to lift water from the oshanas into the dams. Some were fitted with filtration plants. Fences were also placed around pump-storage dams to stop livestock from drinking and contaminating the water. Most of these dams have fallen into disrepair over the years, and many of the excavation dams have silted up. The pumps and filtration equipment have either broken or been stolen, and the protective fences have gone. Recently, several new efforts have been made to rekindle the concept and use of dams, mainly for livestock, either by excavating new ones or renovating some of the older ones. However, with its gently sloping landscape and high evaporation rates, the region is not well suited to storing water in dams.

Today, safe water is supplied to most people either by pipeline or borehole. In the less densely populated areas of the eastern and western Kalahari woodlands and the karstveld, the aquifers are relatively strong, and the water they yield less saline than the Main Shallow Aquifer in the central area. Boreholes are thus used to supply safe water to the people in those areas, as well as to tourist camps and many of the water points in Etosha. Over the years, great numbers of boreholes have been drilled in the Tsumeb area, which to some degree reflects the availability of subsidies for drilling on commercial farms in the past. However, it also reflects the absence of surface water, the presence of a healthy aquifer, and the need to supply the town and mining industry at Tsumeb.

In recent years, the development and construction of a pipeline system to supply safe water to within 2.5 kilometres of each household in the central area of the region has been a priority. Most pipelines serve the densely populated areas, although one branch going south to the Uuvudhiya area serves to supply livestock. The system distributes water from the Kunene River in Angola via a complex network of dams, canals, purification works and pipelines to thousands of water points throughout this densely populated area. The current net work of pipelines is about 2600 kilometres long, and another 2000 kilometres of lines are planned to extend the coverage in the Oshivelo–Omuthiya, Engela–Endola, Ondobe–Eenhana–Okankolo–Oshigambo and Outapi areas. (At the time of writing, the Endola–Engela and Outapi networks were being laid.) Treatment works at Olushandja, Outapi, Ogongo and Oshakati purify the water before it is distributed through the network of pipelines. Most of the water is distributed to storage tanks at schools and clinics, to government buildings and businesses in the major towns, and to taps spaced along the pipelines.

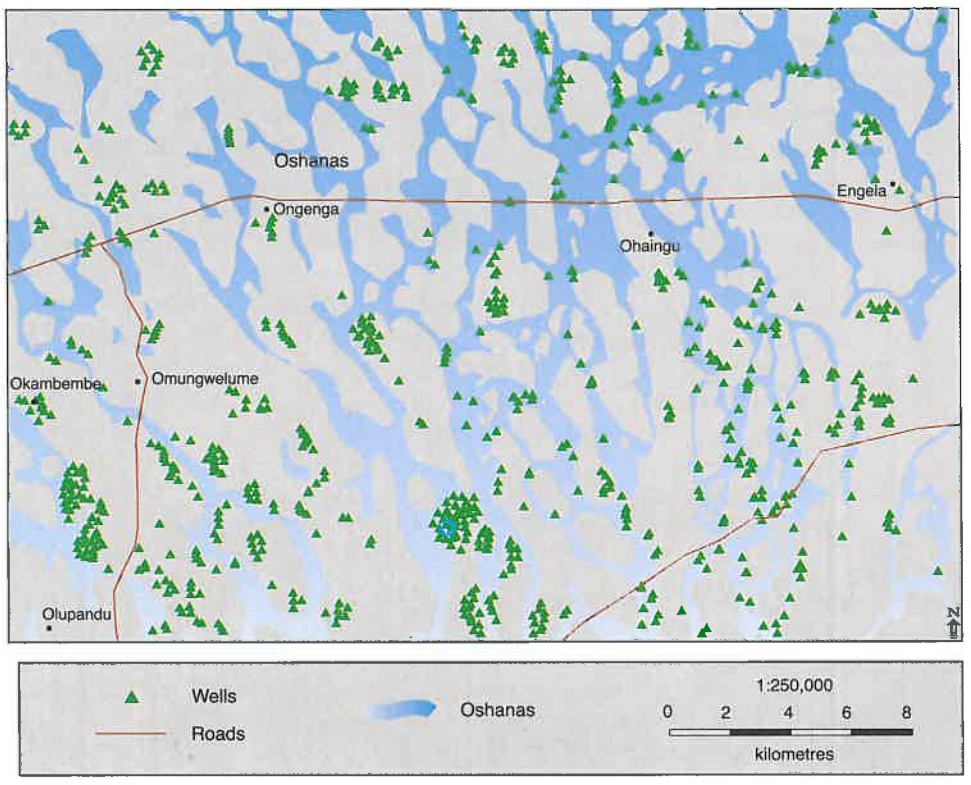
In addition, water tankers supply some small, scattered villages that do not have pumped water, especially those that have clinics and schools. Adding up the numbers of households lying outside the existing and planned area of coverage (see the map of access to safe water opposite) indicates that about 14,000 households or about 110,000 people live further than the desirable 2.5 kilometres from safe water. Those 110,000 people represent about 15% of the total population. These figures are obviously approximates, but they give a reliable overall estimate of how effectively water systems have been planned to provide access to safe water. A key assumption in this kind of planning is the hope that people within 2.5 kilometres of safe water will indeed use that water. However, it is clear that the chance of contamination is often less important than distance, and many people continue to use water from open wells and the oshanas closer to their homes, despite the increased risk of that water being contaminated. Under such circumstances people will continue to suffer from diseases carried in dirty water, resulting, for example, in high rates of diarrhoea within areas covered by pipelines (see page 42).

A shallow, hand-dug well, or omithima

Olushandja Dam was built in 1973 to store water for the general purpose of supplying water to settlements in the region. The dam was constructed on the old Etaka channel by building dam walls at the southern and northern ends of what is now the dam. It is 20 kilometres long and varies between 200 metres and two kilometres in width. More specifically, its aim was to store water during excess flows of the Kunene River, and to provide a strategic reserve in the event of supplies from Angola being interrupted. It was also designed so that water could be released periodically into the Etaka canal, and it was hoped that the dam would stimulate the development of a local fishing industry. In recent years, the capacity of the dam has been held at about 50% and, since its construction, about 100 households have been built in areas that would be flooded if the dam was filled.

Both the Calueque and Olushandja Dams were damaged during the liberation war, and various efforts have been made since independence to repair and upgrade infrastructure at and between the dams. The pump system from Calueque is also being upgraded to allow water to be supplied at a rate of six cubic metres per second, which is the maximum rate stipulated in agreements between Namibia and Angola. Current pumping rates vary between about 1.5–2.0 cubic metres per second, well below the agreed levels and the supply potential of the new infrastructure.

Water has generally been supplied free of charge, but a new programme of community-based water management aims to put in place mechanisms for users to pay for water, and for local committees to manage local aspects of water distribution. This effort to stimulate greater levels of local responsibility for water may reduce the large number of illegal connections to pipelines. Another management problem, and one that is much more difficult to resolve, is that many of the boreholes in eastern Oshikoto have now been fenced off by wealthy people that have claimed large areas of land for themselves (see page 48). Most of those boreholes were drilled and fitted with pumps to provide water for seasonal grazing in those areas, especially as part of the 1992–93 drought relief programme.



▲ ***There are close to 800 hand-dug wells in this area of about 650 square kilometres to the west of Engela***

Each well in this group of hand-dug wells (oondungu) *is owned by a different family. Buckets are lowered on long ropes to draw water lying 20–30 metres below the surface.*

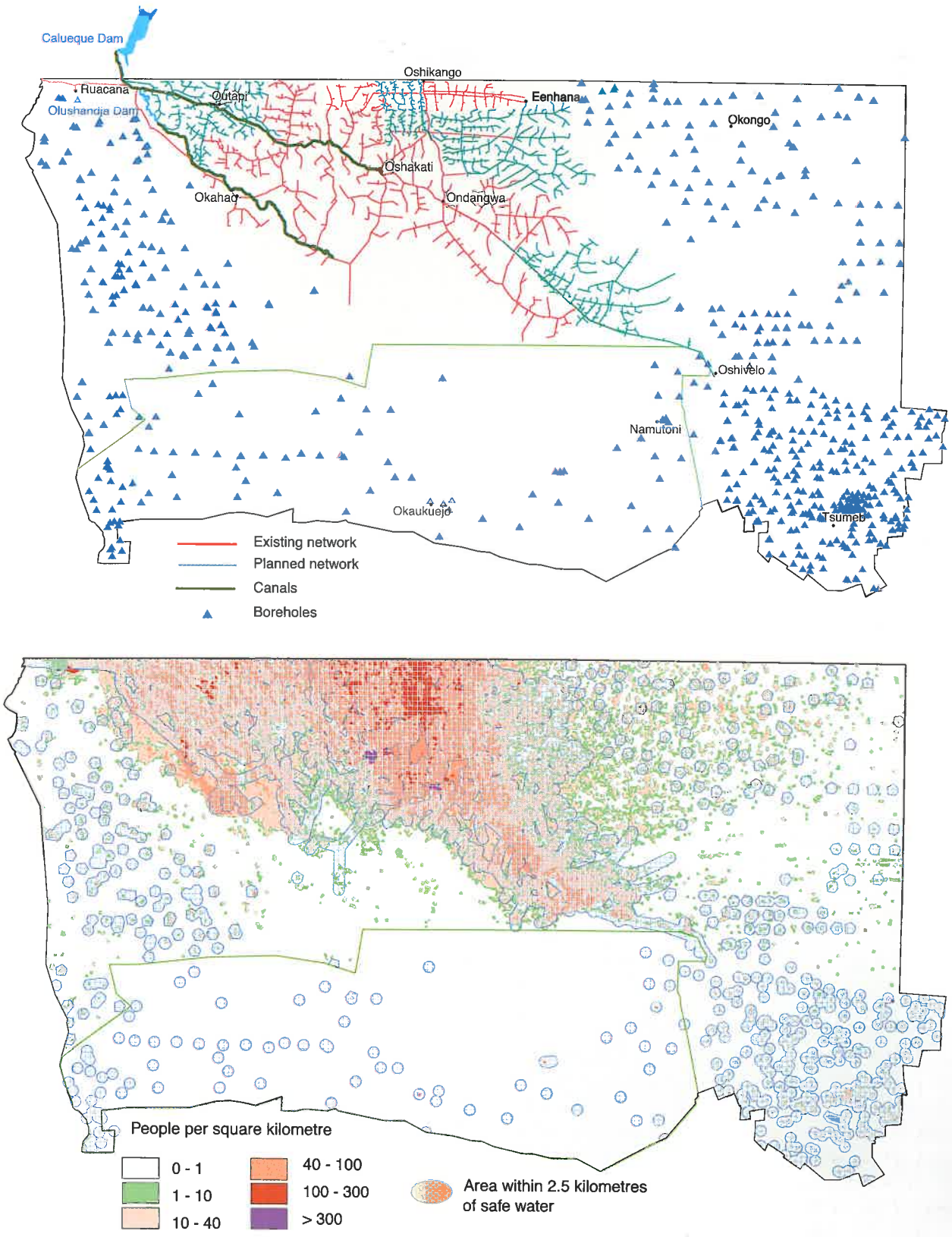
Water supply[6]

The western, southern and eastern areas of the region are supplied with groundwater tapped using boreholes. A network of canals and pipelines supply water to the central, Cuvelai area from the Kunene River. Water is pumped from the Calueque Dam on the Kunene River just north of the Namibia–Angola border along a canal towards Olushandja. Some of the water is pumped into the Olushandja Dam and the rest flows south-westwards in the main canal to Oshakati. Water released from Olushandja's southern wall also flows down the earth-lined Etaka canal to Tsandi and Okahao. The primary purpose of the Etaka canal is to provide water for livestock between Olushandja and Okahao, but there is also a pipeline from the treatment works at Olushandja which supplies water to Tsandi and Okahao.

Access to safe water[5]

Combining information on the distribution of pipelines and boreholes that are recorded as having pumps fitted to them, provides a measure of the areas and numbers of people that have access to safe water. The positions of the pipelines (both existing and planned) are considered to be accurate, but some boreholes that are used to pump water may not have been mapped. Likewise, some boreholes shown on this map may not be in use because the pumps no longer work. However, these gaps are not significant in terms of seeing the broad areas and numbers of people that are adequately provided with safe water.

In this analysis, all areas within 2.5 kilometres of all pipelines and boreholes are considered as having access to safe water. Overlaying that kind of coverage indicates that much of the densely populated area is, or will be, supplied with water once the new networks are complete. Most of the large gaps within the broad area covered by the network are in places where the pipelines are further than 2.5 kilometres from people's homes. There are also substantial numbers of people on the fringes of the pipeline network, especially around Okahao, Tsandi and Onaanda, and south of Onethindi, Onankali and Onyaanya.



NAN

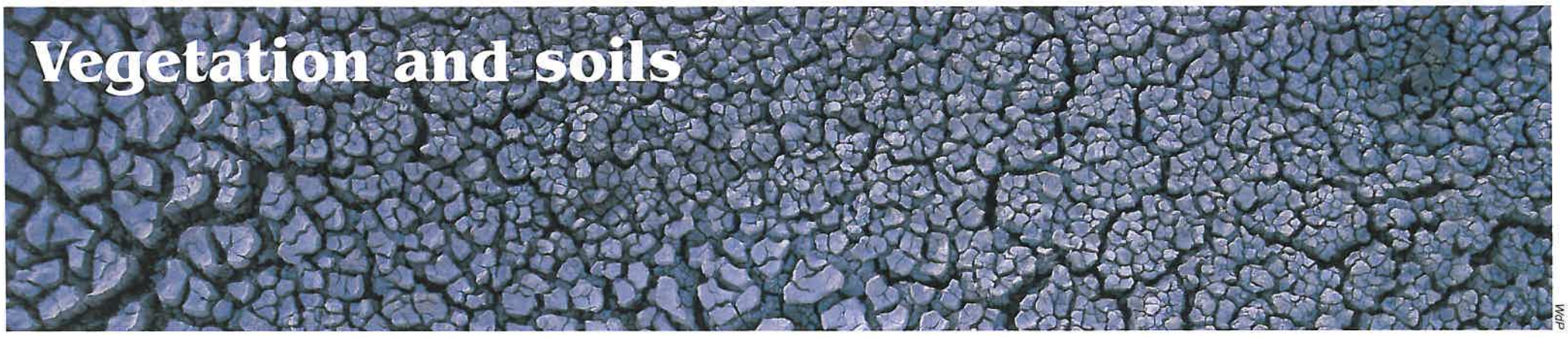
The labour of thousands of people was engaged to excavate dams during the 'Famine of the Dams' between 1929 and 1931

EPP

Calueque Dam was built in the early 1970s on the Kunene River just north of the Angola–Namibia border to regulate the flow of water to the hydroelectric scheme at Ruacana Falls, and to store water to be fed into the canal and pipeline system serving north-central Namibia

HR

One of thousands of water points along the network of pipelines



Vegetation and soils

The variety of soils and vegetation in the region is a product of many processes, some of which are complex and others simple. In a general sense, though, the nature of soils in any area is a product of thousands or millions of years of deposition and erosion. In a similar way, the types of plants that grow there are largely a product of the kinds of soils present. This is particularly true on a local scale where differences in soils explain much of the local variation in plant life. Climatic factors, especially water availability (from rainfall) and heat (as a result of sunshine) also have major impacts on plant life, but these effects are usually more wide-ranging than those on a local scale.

Close linkages between soils and vegetation are evident in many places. For example, tall woodlands are found on deep sands, shallow saline soils only support grasslands and shrubs, and a variety of tree species only grow in soils on dolomite hills. The availability of natural resources to people also depends strongly on the quality and nature of the soils and plants: some areas provide good soils for crop cultivation, others have good pastures for livestock, and yet others provide valuable wood for building homes. The opposite is also true: some resources are not available from certain types of soils and vegetation, thus limiting where people can live and where their livestock can graze. In other areas, resources have been lost as a result of cutting trees and overgrazing.

Soils

Almost all the soils in the Owambo Basin have been carried there by water and wind. Most of those laid down by water are fine-grained clays and silts, while vast layers of sand were deposited by wind. Water and wind forces have also acted like big mixing spoons within the basin, churning, cutting and shaping these deposits into long features (such as dunes and oshanas), circles (such as pans) and layers of different soils. The powerful erosive actions of water and wind have thus reworked the original deposits, so that any one area now often consists of a mosaic of different kinds of soils. Sands have generally remained where they were originally deposited or have been piled up on higher ground, while the silts and clays lie in the pans. Some sands may later be carried down into depressions by local winds, where they get mixed into the clays when sheets of water next form during wet summer seasons. Sands also form the base of drainage lines, such as in the oshanas and the Ekuma and Oshigambo, because the flowing water carries away the finer clays and silts.

A mopane leaf in autumn colour

Over and above being products of the strong moulding forces of wind and water, the soils in the region are typically those of an arid environment. Their fertility is generally low because the sparse growth of plants in a dry climate means that little organic material finds its way into the soil. In many areas they are also very salty as a result of repeated flooding and the evaporation of water. Rates of soil formation are also low, unlike higher rainfall areas where more water percolates into and breaks up rock to form soil. Thus, the soils are often shallow, another characteristic of soils in arid environments.

Nine different types of soils are recognised. They are described below and their distribution shown in the map on the adjacent page. The soil types differ in their potential for crop cultivation. That potential depends on many factors, including depth, nutrient content, water-holding capacity, salinity and other chemical aspects such as acidity or alkalinity. Many soils have one or two desirable qualities but then lack other features needed for crop cultivation. For example, some soils may be fertile but they are too shallow for root growth, and the shallow soils retain little water. Conversely, deep sandy soils usually have a low nutrient content.

The **deep Kalahari sands** in the eastern and western areas of the region were deposited and shaped by strong winds, as shown by the long parallel dunes near the Kavango border. Red and brown sands predominate in the west while grey sands characterise the east. Most of the large trees that dominate the vegetation have deep roots to tap water and nutrients lying deep below the surface. Their potential for crop cultivation is generally low because they contain few nutrients and water drains through them rapidly. In the western areas of the eastern Kalahari woodlands there are many patches of slightly more clayey soils, which are better for crop production, and it is here that new homes and farms are being established. Some areas in Omusati, having better potential for crop growth, usually receive too little rain to make crop production viable.

Within those expanses of deep sands in the east are thousands of discrete pans and interdune valleys having **clayey sands** with a richer content of clays and nutrients that make them better suited for crops. These soils also occur in the omuramba drainage lines along which water used to flow in from the east and north-east. Only the larger pans and drainage lines have been mapped. People have settled in all the larger pans and some omurambas, and farmers have also occupied many of the other smaller pans. Many other pans and most of the interdune valleys in the far east remain unoccupied.

Clayey sodic sands in the oshanas and **sodic sands** on the surrounding higher ground dominate the Cuvelai. The high sodium contents are the result of repeated flooding, when sodium and other salts were carried in by water and then left behind in the soils when the water evaporated. The clayey sodic sands in the low-lying oshanas have the highest salt contents, and only a few plant species can grow on these saline soils.

The sodic sands are found on higher areas where most crops are grown, and farmers have long occupied those that are most fertile. In some areas these sands are very salty and not suited to crop growth, such as the grasslands around the Omadhiya lake complex in the southern parts of the Cuvelai. Hard layers of clay, rich in sodium and salts, form 10–50 centimetres below the surface in other places. The 'hard-pan' layers may restrict the development of plant roots, and farmers find it difficult to plough these soils. Local flooding may occur after heavy rains because the water cannot drain through the hard-pan surface. Salts in the hard layers dissolve when it rains and move upward to make the sandy soils even more saline.

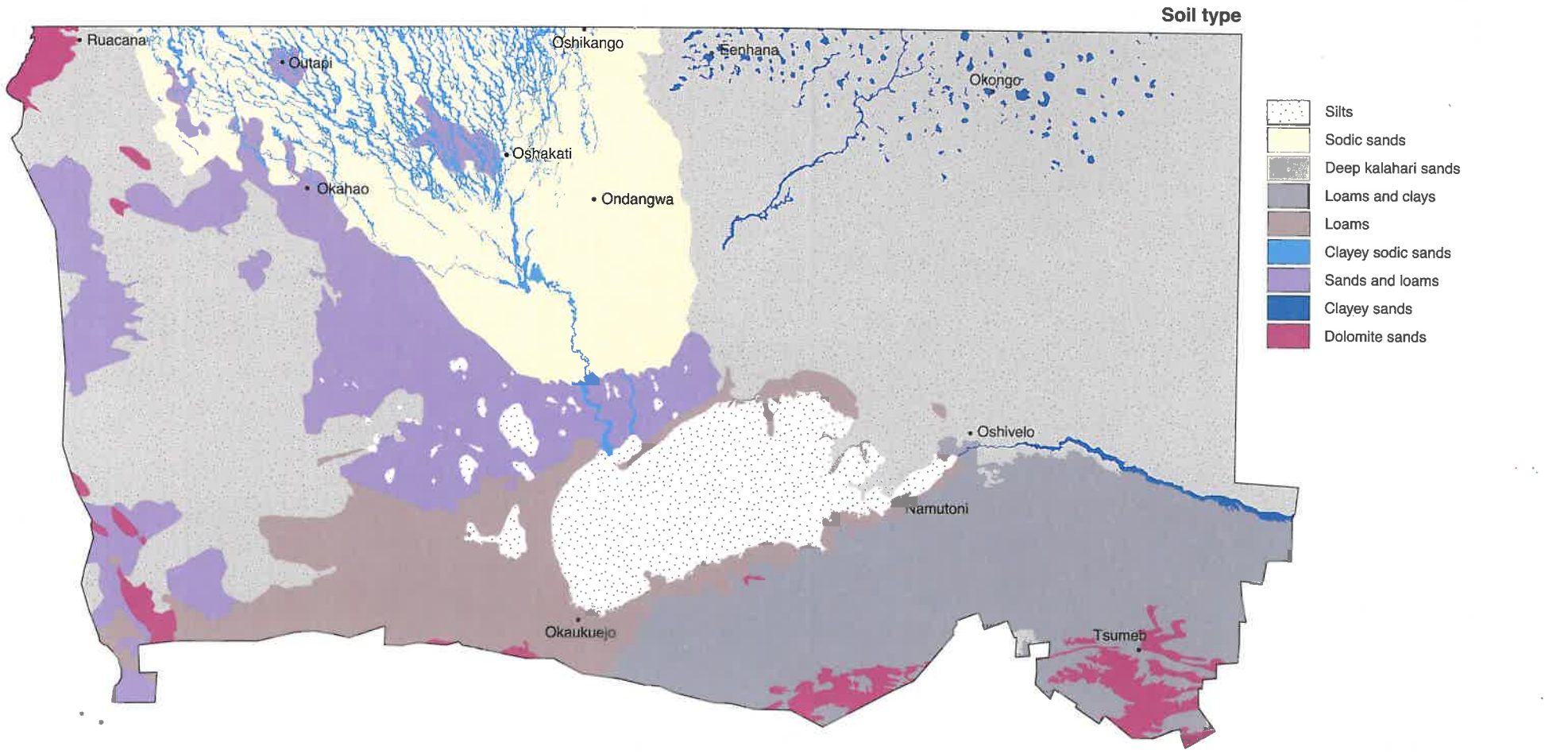
Repeated flooding and evaporation has produced even finer and saltier **silts** in the Etosha Pan and the other pans that surround it. The depressions were formed by wind erosion, the wind blowing away fine dust (see the image of dust blowing off Etosha Pan on page 7). Salts and fine silt particles were then washed into those depressions during hundreds of thousands of wet seasons and left behind when the shallow waters evaporated during each dry season. Concentrations of salts in these pans are thus extremely high.

Soils categorised as **sands and loams** to the south and west of the Cuvelai make up large areas where wind and water have repeatedly reworked the soil to create a mixture of deposits. The soils are generally saline in those areas, again as a result of salts being left behind by evaporation, and mopane dominates the rather small number of plant species that can grow on these soils. Further north in the Cuvelai, however, are other sands and loams which are not as saline and provide good soils for crop growth. These are found in areas around the early settlements of Oshikuku, Okahao, Tsandi and Outapi. Some other smaller areas in south-western Etosha also have such soils, but these are largely the products of wind-blown sand being mixed with soils formed from nearby dolomite and quartzite rocks.

The broad area of **loams** surrounding and to the west of Etosha Pan is also salty as a result of repeated flooding and evaporation. However, these soils are very saline because high concentrations of salt in dust blown out of the nearby salt pans have been deposited onto them. The soils, therefore, have very low potentials for crop growth. A few small turf clay pans in southern Etosha have been included in this soil type because loams surround these turf pans.

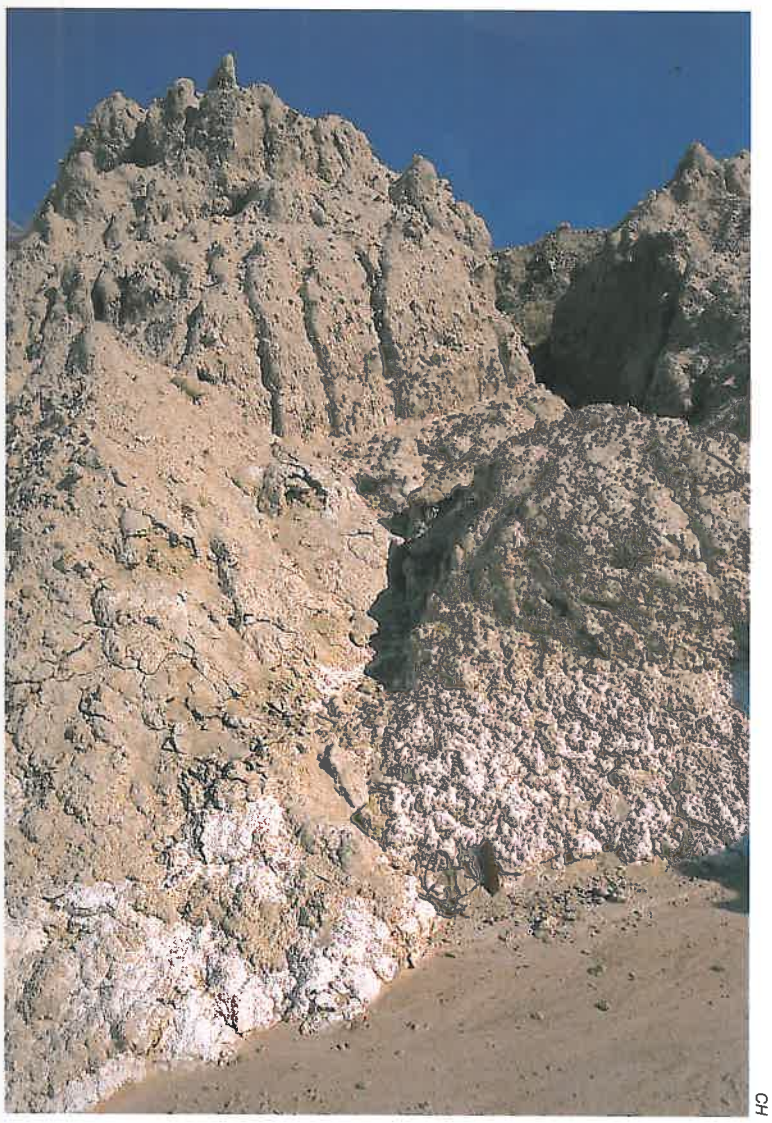
Wind and water have deposited – and often mixed up – all the soils described so far, but the remaining two categories (loams and clays, and dolomite sands) have been formed from underlying or nearby rock formations. The **loams and clays** in southern Etosha and the Tsumeb area were formed from limestone laid down as part of the Etosha Basin lake. The general area is often called the karstveld, and is characterised by substantial deposits of calcrete rocks or nodules formed within the soil profile as a result of the evaporation of water with high concentrations of carbonates. Although the soils are often relatively rich in nutrients, their potential for crops is limited in most areas by their rocky and shallow nature. Around Tsumeb, crops are grown in deeper pockets of soil, consisting of higher proportions of sand deposited there.

Dolomite sands dominate in areas immediately around the dolomite hills near Tsumeb, hills along the southern and western border, and in the Kunene River valley. The soils are typically shallow on the hills, lying in crevices between the rock outcrops, but deeper deposits occur around and below the hills. Their potential for crop growth is low because they hold few nutrients and water drains through them rapidly. They also contain few salts.

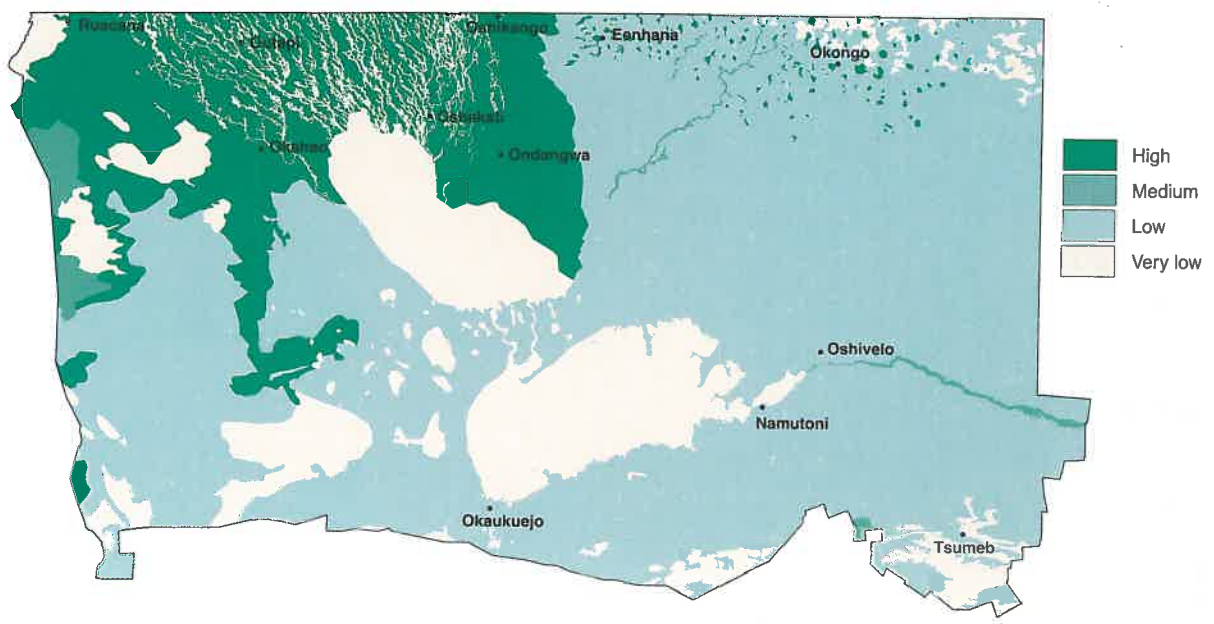


▲ ***Distribution of soil types[1]***

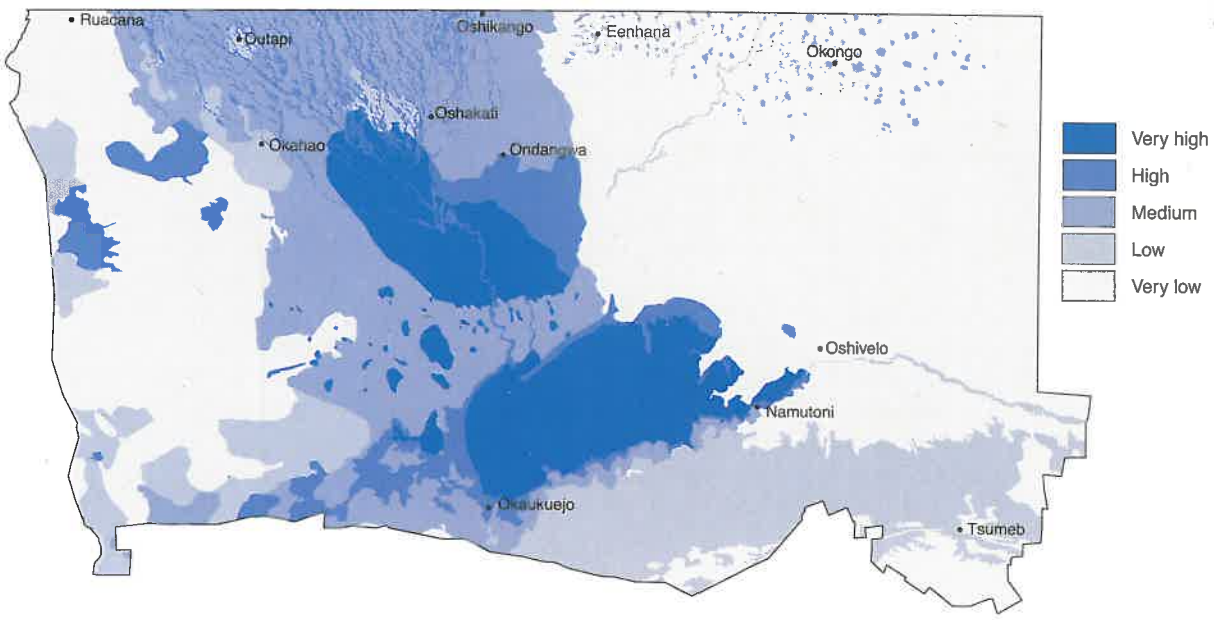
Soils in the interdune valleys provide one of the few places in the eastern Kalahari where crops can be grown



Soils in many areas are characterised by high levels of salts which are often concentrated below the surface

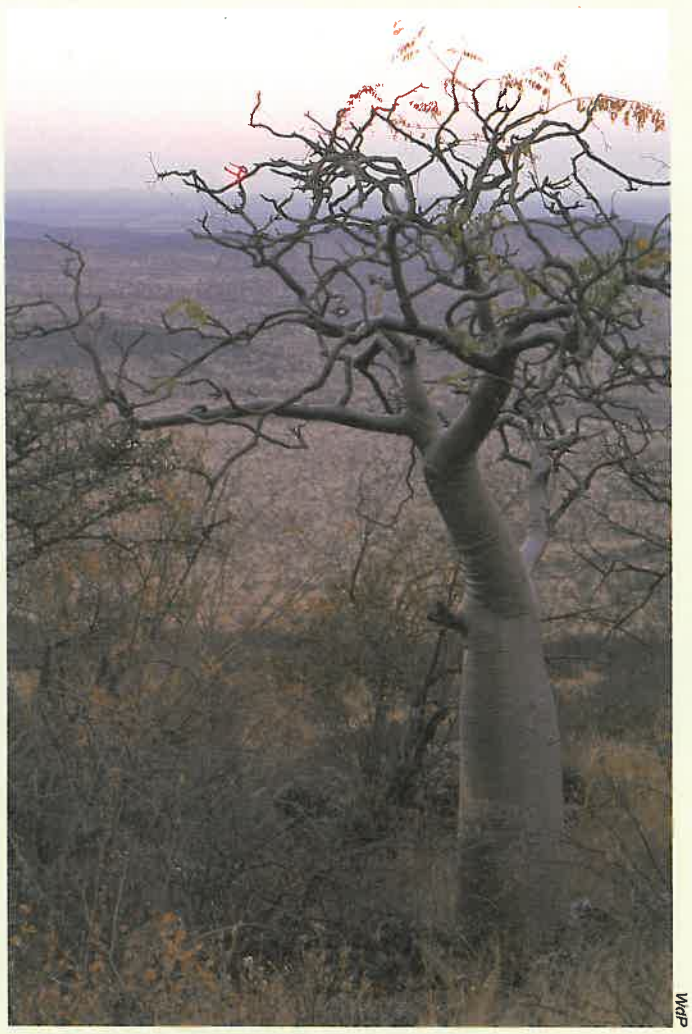


▲ ***Suitability of soils for crop cultivation[1]***
The soils have been divided into four categories based on their suitability for crop cultivation. These categories range from very low to high. However, there is a high degree of local, small-scale variation within each area. For example, large areas of Kalahari sand in the east and west are rated as low, reflecting the fact that crops can usually not be grown on the sands, but crops do grow on the clay soils in the interdune valleys and in the many thousands of tiny pans within those large sandy units.



▲ ***Concentrations of salts in the soil[1]***
The soils differ in their concentrations of salts, largely as a result of how frequently they have been subjected to cycles of flooding and evaporation over hundreds of thousands of years. Soils with the highest salt levels occur in the pans which continue to be flooded, while those with the lowest salt levels are in areas that have never been subjected to repeated flooding. Intermediate salt levels are in areas that were previously repeatedly flooded during much wetter periods, and the salty soils have since been mixed into other soils.

Vegetation types



A moringa tree (Moringa ovalifolia) *on a dolomite hill*

A total of 35 different vegetation units have been recognised and described, mainly on the basis of differences in the structure of woody plant growth, plant species composition and soil type.[2] Many of the units are mosaics of smaller, discrete vegetation types. The boundaries of the 35 units accord with the borders of the nine soil types (described on page 18) and the six landscapes described in the second chapter (pages 7 and 8).

Summary information on estimated numbers and densities of people living in each unit, densities of large livestock units, areas that are cultivated and that have been cleared, and densities of large wild animals is given in the table below. A broad description of the vegetation in each landscape together with a brief description of each vegetation unit follows.

CUVELAI

The oshanas and surrounding lowlands of the Cuvelai are underlain by silt, clay, limestone and sandstone, and are mostly covered by a variety of grass species. The saline Kalahari sands on higher ground between the drainage channels support large numbers of *Colophospermum mopane* shrubs and trees, and a variety of woodland tree species more typical of the Kalahari woodlands to the east. A shallow layer of saline sand covers the area of flat grasslands in the south of the Cuvelai system. Various saline grasses are dominant, and the almost complete absence of trees and shrubs is due to the poor structure of the soil, its shallow depth and high salinity. Since this area is very densely populated, a large proportion of the area is under cultivation and it is consequently degraded to a great extent.

1. Cuvelai palms and fruit-trees on loamy sands

These are slightly raised areas that are characterised by dense settlements and intensive cultivation. Other than the Ondangwa area, these areas were the places which were first settled and it is here that the larger towns of Outapi, Okahao, Oshikuku, Tsandi and Oshakati developed. Water in shallow wells here is apparently fresher than the saltier water elsewhere in the Cuvelai. The soils on these units are loamy sands, rather than the sodic sands found in other higher areas in the Cuvelai drainage system. Of the few large trees present, *Hyphaene petersiana, Sclerocarya birrea, Berchemia discolor* and *Diospyros mespiliformis* predominate. This is the only unit in which *Adansonia digitata* is relatively common.

Disturbed areas are characterised by *Pechuel-Loeschea leubnitziae* and *Acacia arenaria*. The most important grasses are *Schmidtia kalahariensis, Odyssea paucinervis, Sporobolus tenellus, Willkommia sarmentosa* and *Tricholaena monachne*.

2. Mopane–fruit-tree–oshana mosaic

Oshanas cutting through this unit of higher ground are much broader than those in the oshana–Kalahari mosaic to the east. The soils are also less sandy, tall *C. mopane* dominate the landscape and fewer Kalahari sand species are present. However, the highest patches are heavily cultivated and many fruit-trees grow here: *Sclerocarya birrea, Schinziophyton rautanenii* and *Berchemia discolor. Hyphaene petersiana* also grow on the highest areas. Large stands of *Acacia kirkii* grow in some of the oshanas in the north-west of this unit.

Characteristics of 35 vegetation units

Vegetation type		Total area (square kilometres)	Soil type	Estimated population	Cultivated area (hectares)	Cleared or fenced area (hectares)	% cleared or fenced	Large stock units per square kilometre	Large wild animals per square kilometre
Cuvelai									
1.	Cuvelai palms and fruit-trees on loamy sands	1,052	sands and loams	58,000	20,736	62,208	59	34	0
2.	Mopane–fruit-tree–oshana mosaic	1,706	sodic sands	78,300	27,720	83,160	49	22	0
3.	Mopane shrub and low trees on oshanas	1,956	sodic sands	52,600	19,740	59,220	30	33	0
4.	Oponono and Ekuma saline grasslands	3,324	sodic sands	15,600	5,895	22,598	7	6	0
5.	Oshana–Kalahari mosaic	3,594	sodic sands	320,300	104,406	313,218	87	30	0
6.	Oshanas	1,818	clayey sodic sands	0	0	0	0	23	0
7.	Palms–and–pans mosaic	1,323	sodic sands	38,500	14,430	55,315	42	28	0
Karstveld									
8.	*Combretum apiculatum* open woodlands	35	deep sands	50	6	23	1	1	0
9.	Kunene valley	318	dolomite sands	200	69	265	1	5	0
10.	Dolomite hills	1,607	dolomite sands	800	93	357	0	3	1
11.	Etosha mixed low trees on calcrete	2,841	loams	300	6	23	0	0	2
12.	Etosha turf clay pans on karstveld	49	loams and clays	0	0	0	0	0	3
13.	Kaross granite hills	140	sands and loams	100	3	12	0	0	1
14.	Otjovasandu quartzite hills	131	loams	0	0	0	0	0	3
15.	Tall mopane savanna on karstveld	4,120	loams and clays	0	0	0	0	0	1
16.	*Terminalia prunioides–Combretum apiculatum* woodlands	3,604	loams and clays	23,800	435	1,668	0	3	0
17.	*Terminalia prunioides* woodlands on calcrete	3,311	loams and clays	2,200	252	966	0	2	1
Salt pans and surrounding plains									
18.	Etosha plains and pan edge	2,196	loams	700	39	150	0	13	2
19.	Large salt pans	5,383	silts	0	0	0	0	2	0
Mopane shrublands									
20.	Mopane shrubs and low trees on fluvial loams	1,483	loams	0	0	0	0	0	1
21.	Mopane shrubs and low trees on loamy sands	5,256	sands and loams	7,800	2,985	11,443	2	4	0
Eastern Kalahari woodlands									
22.	*Burkea–Baikiaea* woodlands on grey sands	9,536	deep sands	31,600	11,853	51,363	5	7	0
23.	*Burkea–Combretum* savanna	3,981	deep sands	42,400	15,894	68,874	17	11	0
24.	*Burkea–Terminalia sericea* shrublands	4,424	deep sands	11,200	3,723	16,133	4	7	0
25.	Dense *Baikiaea* woodlands	652	deep sands	500	177	767	1	8	0
26.	Mixed *Acacia* Kalahari woodlands	1,173	deep sands	1,100	423	1,622	1	5	3
27.	North-eastern pans	390	clayey sands	16,200	6,090	26,390	68	12	0
28.	Omuramba drainage	305	clayey sands	4,000	1,473	5,647	19	6	0
29.	*Terminalia prunioides–T. sericea* wood- and shrublands	5,259	deep sands	33,000	12,372	47,426	9	9	0
Western Kalahari woodlands									
30.	Mixed broadleaf woodlands on red dolomite sands	923	sands and loams	100	36	138	0	0	4
31.	Mixed savanna on loamy to sandy soils	753	sands and loams	300	102	391	1	2	0
32.	Mopane–*Combretum* savanna on sandy soils	3,709	deep sands	4,700	1,761	7,631	2	7	1
33.	Ruacana sand plateau	1,403	deep sands	6,000	1,545	5,923	4	5	0
34.	Western mopane–pan mosaic	1,061	sands and loams	2,800	1,023	3,922	4	7	0
35.	Western sand plains	5,792	deep sands	2,100	795	3,048	1	7	2
	TOTAL	84,608		755,250	254,082	849,901			

The size (in square kilometres) and soil type of each unit is given together with the estimated numbers of people living there, the area of land under cultivation (in hectares), the amount (hectares) and percentage of the land cleared, and the densities (per square kilometre) of large livestock units (see page 59) and large wild animals (see page 31) living there.[3]

The tall *C. mopane* also set this unit apart from the mopane shrub and low trees on oshanas to the south. The shrub layer consists of *C. mopane* and, in disturbed areas, of *Pechuel-Loeschea leubnitziae* and *Acacia arenaria*. Dominant grasses include *Schmidtia kalahariensis, Sporobolus tenellus* and *Willkommia sarmentosa*.

3. Mopane shrub and low trees on oshanas

Broad, open oshanas cut through this unit which differs from the mopane–fruit-tree–oshana mosaic to the north in its much shorter growth of *C. mopane*. However, the boundaries between the much taller growth of *C. mopane* trees and the extensive areas of *C. mopane* shrub in this unit are not always clear. Much of this area is also intensively cultivated on the highest ground, where fruit-trees (especially *Sclerocarya birrea* and *Berchemia discolor*) and palms (*Hyphaene petersiana*) also grow.

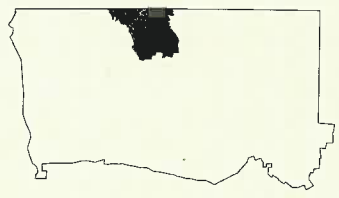
Saline sands cover the area, but are not as sandy as those to the west or those in oshana–Kalahari mosaic. In disturbed areas and fallow fields *Pechuel-Loeschea leubnitziae*, and *Acacia arenaria* and *A. hebeclada* predominate as shrubs, while the dominant grasses are *Odyssea paucinervis, Sporobolus tenellus* and *Willkommia sarmentosa*.

4. Oponono and Ekuma saline grasslands

The extensive grasslands surrounding the Omadhiya lakes are important grazing resources for livestock in the central areas of the region. Soils consist of calcareous sands underlain by a salty, impermeable layer of clay and sandstone hard-pan. These shallow salty soils prevent the growth of most woody species, and are unsuitable for cultivation.

Perennial grasses dominate this unit. The most predominant species are *Sporobolus ioclados* and *S. spicatus, Odyssea paucinervis, Digitaria* species, *Stipagrostis uniplumis, Anthephora pubescens, Schmidtia pappophoroides* and *Eragrostis* species. Common annuals, which can occur at high cover values, include *Enneapogon cenchroides, Schmidtia kalahariensis* and *Aristida* species. Cover values are generally between 15–40%. The species composition of any given area is variable and dependent on micro-topographic features and drainage characteristics. Where the calcareous sands are relatively deep, species such as *Odyssea paucinervis* and *Schmidtia kalahariensis* tend to dominate. *Eragrostis rotifer* dominates in wetter areas, and this species is the principal thatching grass of the region.

5. Oshana–Kalahari mosaic

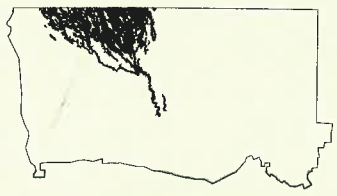


In the area north of Ondangwa, erosion processes have resulted in the development of a mosaic of low-lying and upland habitats. The higher ground in this unit is sandy, and has many species characteristic of the Kalahari further to the east. The area is heavily cultivated with little of the natural vegetation undisturbed. However, many large fruiting trees have been preserved: *Sclerocarya birrea, Berchemia discolor, Diospyros mespiliformis* and *Ficus thonningii*. Oshanas flowing through this unit are narrower than those further west.

Woody species characteristic of the Kalahari sands are *Burkea africana, Schinziophyton rautanenii, Combretum collinum, Pterocarpus angolensis* (in the eastern areas of the unit) and *Terminalia sericea*. The shrub layer consists mainly of *Combretum collinum* and *Terminalia sericea*. *Colophospermum mopane* is also present locally in dense stands of tall trees or shrubs.

Schmidtia kalahariensis, Willkommia sarmentosa, Sporobolus spicatus and *S. tenellus, Aristida* species, *Melinis repens* and *Eragrostis* species usually dominate the grass layer. The grazing resources are of little value within this unit, although livestock densities are very high.

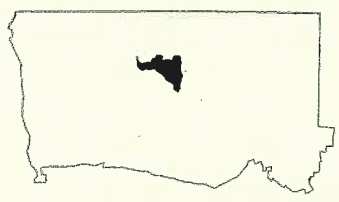
6. Oshanas



This unit comprises the mosaic of wetlands and grasslands in the main channels of the Cuvelai. Soils are generally saline clayey sands, but the upper slopes of the oshanas often have a layer of highly leached sands. The soils are unsuitable for cultivation.

Colophospermum mopane grows along the edges of the oshanas. The drier margins are dominated by the perennial grasses *Willkommia sarmentosa, Eragrostis trichophora* and *Sporobolus ioclados*. Where extensive areas of saline soils are flooded, *Sporobolus coromandelianus* is the commonest species. Perennial grasses and sedges generally dominate the wetter areas. *Diplachne species, Eragrostis rotifer* and *E. viscosa, Brachiaria deflexa* and *Elytrophorus globularis* are all common grasses in this unit. Several sedges are characteristic of these wetter seasonal habitats, including *Cyperus halpan, Kyllinga albiceps* and *Pycreus* species. Open water habitats usually have a distinct floating mat of grasses such as *Oryzidium barnardii, Echinochloa* species and *Oryza longistaminata*. A number of *Cyperus* sedges are abundant along the edges of water channels and pools. In the deepest open water habitats, *Nymphaea* species and other floating plants are common.

7. Palms–and–pans mosiac



This unit describes open, flat country characterised by the presence of *Hyphaene petersiana* and very many small pans. Some of the pans link to form short oshanas, but most remain unconnected when filled after good rains. Other than *Hyphaene petersiana*, there are relatively few other large trees. Shrub growth is prevalent, especially in disturbed areas, where shrub *C. mopane, Pechuel-Loeschea leubnitziae* and *Acacia arenaria* are the dominant species. The sodic sands have high salt concentrations. The area is densely populated, with many fields having been established on the highest ground.

Dominant grasses are *Schmidtia kalahariensis, Eragrostis porosa* and *E. annulata, Aristida adscensionis, A. rhiniochloa* and *A. stipoides, Odyssea paucinervis, Sporobolus spicatus* and *S. tenellus, Willkommia sarmentosa* and *Monelytrum luederitzianum*.

Karstveld

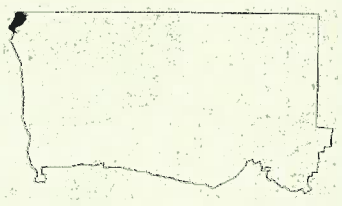
A diverse assemblage of plants is to be found in the karstveld because of the variety of topography and soils in the landscape. These range from the loams and clays on the flat areas in the south, to the Otavi mountains and isolated hills in the region, depressions of turf clay in southern Etosha and the Tsumeb area, and rocky limestones surrounding Etosha Pan. Dominant woody plants are *Colophospermum mopane* trees and shrubs, *Acacia* species and *Catophractes alexandri*. *Terminalia prunioides* and *Combretum apiculatum* woodland is more common in the south-east, an area that also suffers from considerable bush encroachment.

Elements of the Kaokoveld escarpment zone, consisting of isolated hills of granite, quartzite, calcrete and dolomite, are included in this karstveld landscape. Here the soils are shallow and sandy to loamy, with the vegetation dominated by open shrubs and low trees of *Acacia* species, *C. mopane, Terminalia prunioides* and *Combretum apiculatum*.

8. Combretum apiculatum *open woodlands*

This small unit is generally associated with pockets of red-brown sands and sandy loams to the west of Tsumeb. The soils are moderately deep (50–100 centimetres) and are underlain by calcrete. *Combretum apiculatum* and *Commiphora pyracanthoides* are the dominant woody species, and isolated large *Sclerocarya birrea* are also characteristic. *Grewia* species, *Ozoroa paniculosa* and *Combretum hereroense* dominate the shrub layer. Grass cover can be high and is dominated in some areas by palatable grazing species such as *Stipagrostis uniplumis, Schmidtia pappophoroides* and *Eragrostis rigidior*. Generally, however, the annual grasses *Urochloa brachyura, Melinis repens* and *Aristida* species are common. This unit provides good grazing resources and the soils are suited to maize production.

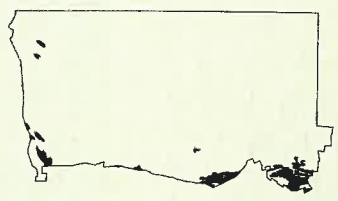
9. Kunene valley



The Kunene drainage unit, lying west of Ruacana, is characterised by steeply incised slopes and a well-defined escarpment. The underlying geology ranges from granite outcrops near Ruacana to extensive sedimentary deposits, which have been heavily eroded, further south and to the west. The soils are largely shallow, red sands.

Along the river there are tall *Faidherbia albida, Hyphaene petersiana* and large *Colophospermum mopane*. This narrow strip is best developed in areas of deep alluvial silts, which have some cultivation potential. *Colophospermum mopane* dominates the rest of the unit at varying densities and heights. Other characteristic woody species include *Terminalia prunioides, Maerua schinzii, Combretum apiculatum* and *Dichrostachys cinerea*. The grass layer is poorly developed and is usually dominated by annual *Aristida* species, and by *Stipagrostis hirtigluma* and *Schmidtia kalahariensis*.

10. Dolomite hills

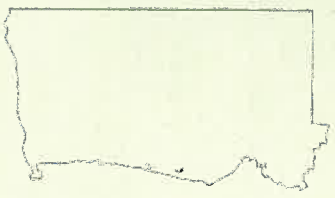


This unit comprises the range of hills around Tsumeb and those that extend westwards into the southern (at Halali, for example) and western parts of Etosha. Two isolated hills occur in the north-western part of the region. The hills are largely dolomite. Shallow soils form in pockets between large boulders and cobbles. The vegetation is characterised by tall trees, with *Kirkia acuminata, Moringa ovalifolia, Sclerocarya birrea* and *Lannea discolor* being common. There is a well-defined layer of lower trees consisting of *Commiphora glaucescens, Steganotaenia araliacea, Elephantorrhiza goetzei, Combretum apiculatum* and *Gyrocarpus americanus*. A shrub layer of species such as *Grewia bicolor* and *Croton gratissimus* is always present. Grasses are sparse and dominated by annuals such as *Melinis repens, Brachiaria deflexa* and *Aristida* species. Grazing resources are poor. The unit has the most diverse community of plants in the area, with hills in the east having a greater diversity and cover of plants than those in the west.

11. Etosha mixed low trees on calcrete

Lying on slightly higher ground than the mosaic of grass and shrublands, described as Etosha plains and pan edge, this is a mosaic of generally open tree and shrub vegetation with a variety of tree species forming patches of woodland. Soils are usually loams, silty loams and some clayey loams on top of hard-pan calcrete. By far the most abundant tree is *C. mopane*, in many places covering large areas with few other species present. *Acacia nebrownii* and, to a lesser extent, *Catophractes alexandri* also form extensive, almost single species thickets. Elsewhere, in deeper, less saline soils, more common trees are *Acacia luederitzii, A. reficiens, A. mellifera* and *A. nilotica, Dichrostachys cinerea, Croton gratissimus* and *Albizia anthelmintica*. In some areas *Catophractes alexandri* can form a noticeable understorey up to 1.5 metres in height. A mix of perennial and annual species of grass include *Cenchrus ciliaris, Eragrostis porosa* and *E. annulata, Enneapogon desvauxii* and *E. cenchroides, Stipagrostis hirtigluma* and *Monelytrum luederitzianum*.

12. Etosha turf clay pans on karstveld



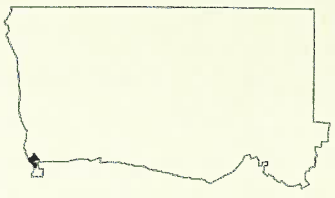
The largest of a number of depressions in southern Etosha have been mapped, but there are many smaller turf clay pans in the karstveld that have not. Few trees grow in the clay pans, which often hold water after good rains. The margins frequently support stands of *C. mopane* and *Acacia kirkii*, while *Catophractes alexandri* grows commonly in fairly dense stands in many of the pans. The pans are an important grazing resource for wildlife, with *Aristida adscensionis, Eragrostis porosa* and *E. annulata, Anthephora schinzii, Stipagrostis hirtigluma* and *Brachiaria* species providing most of the grass cover.

13. Kaross granite hills

This is a small unit based on the granite hills in the south-western corner of Etosha. The soils on the plains between the hills are sands and loams derived from granite rocks.

The most prominent trees on the plains are *C. mopane, Terminalia prunioides* and *Combretum apiculatum*, most being between two and six metres in height. Common trees growing on the granite hills are various *Commiphora* species, *Boscia albitrunca, C. mopane, Steganotaenia araliacea* and *Combretum apiculatum*. *Schmidtia kalahariensis, Eragrostis rigidior* and *E. trichophora, Enneapogon cenchroides, Aristida adscensionis* and *Stipagrostis hirtigluma* are the most important grass species.

14. Otjovasandu quartzite hills



These form a small, distinctive unit of open to moderately dense, hilly bushveld in south-western Etosha. Soils in the valleys are very shallow loams derived from the quartzite hills. The most prominent trees, growing to about four metres, are *C. mopane, Combretum apiculatum, Terminalia prunioides* and *Sesamothamnus guerichii*. The shrub layer is poorly developed. Grasses include *Eragrostis annulata, Enneapogon cenchroides, Aristida adscensionis, Anthephora schinzii* and *Stipagrostis hirtigluma*. The perennial grass *Eragrostis nindensis* is predominant on the rocky slopes.

MIB

Mopane trees produce new branches after having been cut

14 E

15 E

16 E

18 S

19 S

Ruacana

Outapi

Oshikango

Oshakati

Okahao

Ondangwa

Okaukuejo

Cuvelai

- Oponono and Ekuma saline grasslands
- Oshana–Kalahari mosaic
- Mopane shrub and low trees on oshanas
- Mopane–fruit-tree–oshana mosaic
- Palms–and–pans mosiac
- Cuvelai palms and fruit-trees on loamy sands
- Oshanas

Karstveld

- Dolomite hills
- Tall mopane savanna on karstveld
- Otjovasandu quartzite hills
- Kunene valley
- Terminalia prunioides woodlands on calcrete
- Terminalia prunioides–Combretum apiculatum woodlands
- Etosha mixed low trees on calcrete
- Etosha turf clay pans on karstveld
- Kaross granite hills
- Combretum apiculatum open woodlands

Salts pans and surrounding plains

- Large salt pans
- Etosha plains and pan edge

Mopane shrublands

- Mopane shrubs and low trees on loamy sands
- Mopane shrubs and low trees on fluvial loams

14 E

15 E

16 E

▲ ***Distribution of different vegetation types in north-central Namibia***[2]

17 E

18 E

18 S

19 S

Eenhana

Okongo

Oshivelo

Namutoni

Tsumeb

Eastern Kalahari woodlands

- Burkea–Terminalia sericea shrublands
- Burkea–Combretum savanna
- Terminalia prunioides–T. sericea wood- and shrublands
- North-eastern pans
- Mixed Acacia Kalahari woodlands
- Burkea–Baikiaea woodlands on grey sands
- Dense Baikiaea woodlands
- Omuramba drainage

Western Kalahari woodlands

- Western sand plains
- Western mopane–pan mosaic
- Mixed savanna on loamy to sandy soils
- Mopane–Combretum savanna on sandy soils
- Ruacana sand plateau
- Mixed broadleaf woodlands on red dolomite sands

1:800,000

0 10 20 30

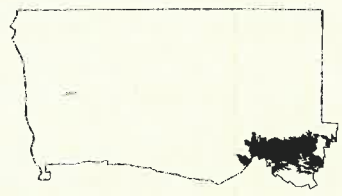
kilometres

N

15. Tall mopane savanna on karstveld

This is a large unit in the south-eastern corner of Etosha, dominated by tall *C. mopane*. *Spirostachys africana* occurs only in the eastern areas, whereas other species such as *Combretum apiculatum, Terminalia pruniodes, Acacia nilotica* and *Dichrostachys cinerea* are found throughout the unit. The trees are taller in the eastern areas, while the tree layer in the west is often only two to three metres in height. The layer of shrubs often consists of *Commiphora pyracanthoides, Grewia flava, Gymnema sylvestris, Vernonia cinerascens* and *Leucosphaera bainesii*. There is very little grass cover because the ground is covered in calcrete rubble and rocks. Sandy loams and clayey loams lie between the calcrete.

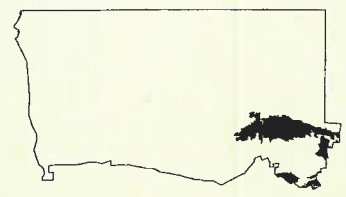
16. Terminalia prunioides–Combretum apiculatum *woodlands*



The vegetation in this unit is dominated by woody species. *Terminalia prunioides* is the most common species, but *Combretum apiculatum* and *Commiphora glandulosa* are also characteristic. In extensive shallow depressions these species become sparse, and *Combretum imberbe, Acacia mellifera* and *A. luederitzii* tend to dominate. Small trees are common and can form a distinct layer, characteristic species being *Combretum hereroense, Albizia anthelmintica, Acacia nilotica, Gymnosporia senegalensis* and *Boscia albitrunca*. The shrub layer varies in cover, with species such as *Grewia flava, Croton menyhartii* and *Dichrostachys cinerea* occurring commonly.

The grass layer is generally sparse and dominated by annual grasses such as *Enneapogon cenchroides* and *Melinis repens*. In localised areas having heavier soils the grass layer can be dominated by palatable species and provide important grazing resources in the area. However, this vegetation unit has a generally low value as a grazing resource. The soils are mostly too shallow for cultivation, although some areas have been cleared for producing maize and a variety of irrigated crops. The soils overlie calcretes and vary from calcareous sandy loams to sandy clay loams, which generally occupy lower-lying areas.

17. Terminalia prunioides *woodlands on calcrete*



This is the dominant vegetation type in the Tsumeb area. The woodlands occupy moderately deep sandy loam soils underlain by calcretes. This unit has deeper soils and generally taller trees than the *Terminalia prunioides–Combretum apiculatum* woodlands to the south.

Terminalia prunioides dominates the unit. *Spirostachys africana* and *Acacia reficiens* are the only other common large tree species. *Albizia anthelmintica, Boscia albitrunca* and *Commiphora pyracanthoides* provide a lower level of trees. The shrub layer is sparse with characteristic species such as *Croton menyhartii, Grewia bicolor* and *Acacia mellifera*. Grasses are generally annual species such as *Aristida adscensionis, Setaria verticillata* and *Brachiaria deflexa*. Grazing values are low. The sandy loam soils are often too shallow for arable agriculture, but some areas have been cleared and are irrigated or used for rain-fed maize production.

Salt pans and surrounding plains

Very few plants grow on the Etosha Pan and the other, smaller saline pans. The grasslands and dwarf shrub plains surrounding the Etosha Pan are underlain by limestone, and the shallow covering of relatively saline soils inhibits the growth of trees. Only shrubs of *Acacia* species and *Catophractes alexandri* are common, usually so on degraded parts of this plains system, which is favoured by grazing antelopes.

18. Etosha plains and pan edge

This unit comprises a mosaic of grasslands, shrublands and low woodlands that intergrade around Etosha Pan, particularly to the south and west of the pan. This is perhaps the most important grazing resource for many of the large mammals in Etosha. Soils are variable but are usually calcareous loams, silty loams and some clayey loams, all underlain by calcrete close to the surface. These soils are generally saline with a high pH. High nitrogen levels in the soils result in the grasses having a high nutrient content and forage value. The commonest and most predominant woody species are *Catophractes alexandri* and *Acacia nebrownii*. Many small shrubs occur, *Leucosphaera bainesii, Cyathula lanceolata, Monechma tonsum* and *M. genistifolium*, and *Petalidium engleranum* being the most abundant and widespread.

Grasses dominate the vegetation of the unit. *Anthephora schinzii, Aristida adscensionis, Enneapogon desvauxii, Eragrostis annulata, E. nindensis* and *E. porosa, Monelytrum luederitzianum, Odyssea paucinervis* and *Stipagrostis hirtigluma* are the dominant species.

19. Large salt pans

This unit describes the large alkaline and saline pans of the Etosha Basin. These pans are of varying size and are usually devoid of vegetation. Thirty-seven of the largest pans have been mapped. These range from the giant Etosha Pan (about 4850 square kilometres) to the smallest of about 0.4 square kilometres in size, but there are many other smaller pans too. The soils are calcareous, saline silts. Some of the pans have important salt reserves that have been exploited over the years, both for household and trade purposes.

The pans are generally devoid of all vegetation except for the annual grass *Sporobolus salsus* that grows on the pan after good rains or flooding. Along the pan margins the dominant perennial grasses are *Odyssea paucinervis, Sporobolus spicatus, S. ioclados* and *S. tenellus*. The sedge *Cyperus marginatus* is also common along the pan margins. Woody species are generally absent but the salt-loving woody dwarf shrubs, *Suaeda articulata* and *Salsola tuberculata*, are found on the pan margins.

WdP

Giraffe in Acacia woodlands near Etosha

Mopane shrublands

The large and uniform area of mopane shrubland consists largely of saline sandy loams and loams. These are deeper than those on the saline grasslands to the east, and there are many small turf clay depressions in the area. As the name suggests, the dominant woody species is *Colophospermum mopane*, growing as shrubs and low trees. Grass production can be high during years with good rain.

EPP

Attractive patterns of edible salt form on some salt pans

20. Mopane shrubs and low trees on fluvial loams

In many parts of this unit relatively tall trees are scattered in amongst the shrubs, suggesting an open woodland structure. Both the trees and shrubs are predominantly *C. mopane*, with *Catophractes alexandri* being common in the shrub layer. The grass community consists largely of *Eragrostis porosa* and *E. annulata, Enneapogon cenchroides, Aristida adscensionis, Stipagrostis hirtigluma* and *S. uniplumis*.

The loam soils, which characterise the unit, reflect the effects of flooding during a much wetter period in the past. Salt concentrations in the soils are low to medium.

21. Mopane shrubs and low trees on loamy sands

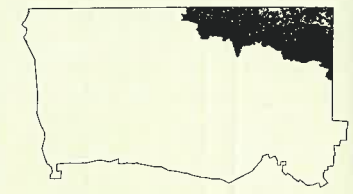
Much of this large area is covered in *C. mopane* shrub, usually about 2.5 metres or less in height. This is especially true of the area west of the Ekuma River where the soils tend to be more sandy than loamy and the shrub growth may be very dense. By contrast, soils around the Ekuma and Oshigambo drainages are loamier and support *C. mopane* growing as low trees of three to four metres in height. These woodland areas also support tall *Terminalia prunioides* trees growing up to six metres. In addition to *C. mopane, Catophractes alexandri* is an important shrub species.

Mainly *Schmidtia kalahariensis, Eragrostis porosa* and *E. annulata, Enneapogon cenchroides, Aristida adscensionis* and *Stipagrostis uniplumis* provide grass cover. While there are a number of cattle posts and fenced farms in the area, the pastures do not provide good grazing. Most cattle are watered from the complexes of deep wells that are a feature of that part of the region. Many of the large saline pans are also in this area.

Eastern Kalahari woodlands

The eastern Kalahari landscape is an area dominated by deep sands on which a diverse community of woodlands and shrubs occur. Most of the species characteristically grow on sandy soils, but the diversity of plants is increased by other species that prefer clayey soils in the scattered pans, old drainage lines and interdune valleys. *Burkea africana, Pterocarpus angolensis, Acacia erioloba* and a number of species of *Combretum* dominate the large trees, and valuable stands of *Baikiaea plurijuga* are to be found in some areas.

22. Burkea–Baikiaea *woodlands on grey sands*



These extensive woodlands are found on deep Kalahari sands in the north-east. The unit encompasses the distinctive, large, roughly circular pans that have been mapped and described as the north-eastern pans vegetation unit. The woody vegetation is very variable but clearly stratified with the tallest trees comprising *Burkea africana, Baikiaea plurijuga, Guibourtia coleosperma, Pterocarpus angolensis* and *Schinziophyton rautanenii*. *Baikiaea plurijuga* dominates in some areas, but is absent from the western areas of the unit where most large trees are *Burkea africana* and *Pterocarpus angolensis*. *Terminalia sericea, Erythrophleum africanum* and *Combretum collinum* dominate the lower tree layer. Shrub cover is variable and is mostly provided by *Bauhinia petersiana, Grewia retinervis, Croton gratissimus, Terminalia sericea* and *Baphia massaiensis*. Grasses are predominantly annuals such as *Schmidtia kalahariensis, Aristida stipoides* and *A. stipitata*, and *Eragrostis dinteri*.

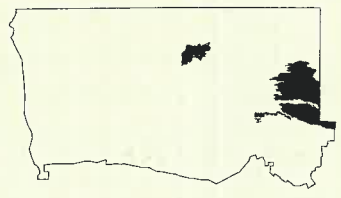
There are clearly defined dunes in the eastern areas of the unit. Loamy sands are predominant in the interdunes, with vegetation characterised by a high cover of perennial grasses such as *Stipagrostis uniplumis, Eragrostis rigidior* and *Schmidtia pappophoroides*. These interdune grasslands provide good grazing, but grazing is poor elsewhere in sandy areas. There is relatively good potential for cultivation where the interdune soils are relatively deep. Large trees are uncommon in the interdunes.

23. Burkea–Combretum *savanna*

Burkea–Combretum savanna occurs extensively in the central areas of the eastern Kalahari sands, forming a continuum with the *Burkea–Baikiaea* woodland, the *Burkea–Terminalia sericea* shrublands and the *Terminalia pruniodes–T. sericea* wood- and shrublands. In many areas it is hard to draw distinct boundaries between these units.

Tall trees are dominated by *Burkea africana* but *Combretum collinum* is also abundant. Species such as *Pterocarpus angolensis, Guibourtia coleosperma* and *Schinziophyton rautanenii* occur at low cover values or as isolated large trees. *Terminalia sericea* dominates the low tree and shrub layer, together with *Combretum collinum, Erythrophleum africanum* and *Combretum psidioides*. The shrub layer is generally open, with *Baphia massaiensis, Bauhinia petersiana, Croton gratissimus* and *Grewia* species contributing most of the cover. Annuals such as *Aristida stipitata, Eragrostis dinteri* and *Pogonarthria fleckii* dominate the low grass cover. Perennial species such as *Schmidtia pappophoroides, Panicum kalaharense, Eragrostis pallens* and *Stipagrostis uniplumis* also occur at low cover values. The soils are deep, grey sands on poorly developed dunes and sandy plains. The soils have low potentials for arable cultivation and the grazing is likely to be of moderate to poor quality.

24. Burkea–Terminalia sericea *shrublands*



These shrublands represent the driest form of woody vegetation in the eastern Kalahari sands. The sands are poor in nutrients, having little agricultural value as an arable resource. This vegetation unit dominates most of the Mangetti farms and much of it is heavily grazed. Within the large expanses of sands, there are also many small patches of heavier clayey soils, similar to patches described below in the *Terminalia pruniodes–T. sericea* wood- and shrublands unit.

Trees over three metres in height are uncommon, characteristic species being *Burkea africana, Combretum collinum, Acacia erioloba* and *Acacia reficiens*. The shrub layer is generally characterised by *Terminalia sericea, Lonchocarpus nelsii, Bauhinia petersiana, Baphia massaiensis, Croton gratissimus* and *Grewia* species. Total cover in the shrub layer can be as high as 60% in badly encroached or disturbed areas. *Dichrostachys cinerea* can contribute up to 15% of the cover in very disturbed areas. Grasses are generally unpalatable annuals or woody perennials such as *Eragrostis pallens*, and *Aristida stipoides* and *A. stipitata*.

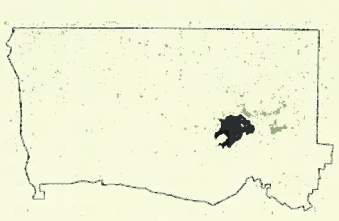
A variety of interesting plants emerge once water fills the oshanas

25. *Dense* Baikiaea *woodlands*

Dense *Baikiaea plurijuga* woodlands occur in small pockets in the north-east on deep, well-drained sandy plains and dunes. While *B. plurijuga* is dominant, other common trees are *Burkea africana, Schinziophyton rautanenii, Guibourtia coleosperma* and *Pterocarpus angolensis.* Shrubs consist largely of *Baphia massaiensis, Bauhinia petersiana* and various *Grewia* species. Most grasses are annuals, the most characteristic species being *Aristida stipitata, Eragrostis dinteri, Tricholaena monachne* and *Schmidtia kalahariensis.*

Grazing is poor in the woodlands, and they are not suited to cultivation. As a timber resource their value is moderate. The woodlands have been quite well conserved in that they have not been over-exploited for commercial timber production and have not been damaged much by fire – there is little grass to burn due to high grazing pressures in the area, so few hot fires develop. The woodlands are amongst the best *Baikiaea* woodlands in Namibia and have a high conservation value.

26. *Mixed* Acacia *Kalahari woodlands*



This unit comprises a medium to dense low tree and shrub savanna with isolated groups and bands of tall, dense *Terminalia prunioides* woodland on deep Kalahari sands. Common trees and shrubs are *Acacia erioloba* and *A. mellifera, Lonchocarpus nelsii, Terminalia sericea, Croton gratissimus, Dichrostachys cinerea* and *Catophractes alexandri.* Grass cover can be well developed in some areas, with the most important species being *Schmidtia kalahariensis, Eragrostis porosa, Enneapogon cenchroides,* and *Stipagrostis hirtigluma* and *S. uniplumis.*

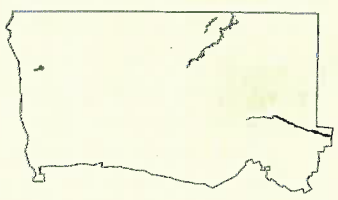
This is an important habitat for large mammals in Etosha because the variety and density of plants provide good feeding resources.

27. *North-eastern pans*

Characteristically, these pans are roughly circular features in the north-east of the region. They also provide important resources to farmers, and many people have settled to farm on these pans in recent decades. The town of Okongo is situated on one such pan. Most similar pans north of the border in Angola remain unoccupied as a result of lower human populations there. Many of the pans have a central depression that is frequently flooded. Clayey sands have formed as a result of fine particles being washed down into these lower-lying areas.

Few large trees grow on the pans, the most abundant ones being *Hyphaene petersiana, Diospyros mespiliformis* and *Acacia erioloba.* Shrub vegetation consists largely of *Acacia arenaria, Catophractes alexandri* and *Dichrostachys cinerea.* Important grasses include *Schmidtia kalahariensis, Eragrostis rigidior, E. trichophora, E. porosa* and *E. rotifer, Aristida adscensionis, Anthephora schinzii, Odyssea paucinervis, Sporobolus tenellus, Willkommia sarmentosa, Monelytrum luederitzianum* and *Panicum novemnerve.*

28. *Omuramba drainage*



This unit is similar in appearance to the oshanas, but generally more deeply incised into the surrounding upland Kalahari landscape. Water flows only after heavy local rains, whereas the oshanas also flood because of good rains in Angola. Groundwater is less available than in the oshana system. The omurambas in the central north-east drain towards the Omuramba Oshigambo that flows into Etosha Pan, while the Omuramba Owambo in the east drains into Fischer's Pan. The soils are sandy loams and clays, and much less salty than in the oshana system. The soils have limited agricultural potential.

Trees and shrubs are generally absent, but clumps of *Acacia erioloba* and *A. hebeclada, Combretum imberbe, Terminalia sericea, Hyphaene petersiana* and *Diospyros mespiliformis* are found. *Pechuel-Loeschea leubnitziae* is common in degraded areas where settlements occur close to the omurambas. Grasses are similar to those in the oshana system, with perennials such as *Eragrostis rotifer* and *Diplachne* species being more abundant because of the clayey nature of the soils.

29. Terminalia pruniodes–T. sericea *wood- and shrublands*

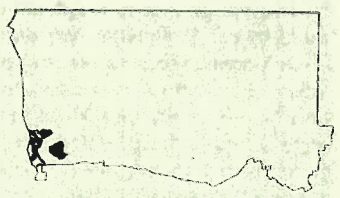
This is a mosaic of extensive shrubland dominated by *Terminalia sericea,* and isolated patches of tall, dense *Terminalia prunioides* woodland. These two structural units are separated as a result of differences in soils. Shrublands, on Kalahari sands poor in nutrients, are dominated by *Terminalia sericea, Bauhinia petersiana, Lonchocarpus nelsii* and *Croton gratissimus.* The poisonous shrub *Dichapetalum cymosum* is common in heavily disturbed areas. Annuals such as *Urochloa brachyura, Melinis repens, Aristida stipitata* and *Pogonarthria fleckii* dominate the grass layer. Perennials such as *Eragrostis pallens, Schmidtia pappophoroides* and *Stipagrostis uniplumis* are not abundant.

The patches of heavier soils – mainly sandy loams or sand-clay loams – may represent old pan soils or interdunes. They are dominated by tall, dense stands of *Terminalia prunioides,* with *Acacia erioloba* and *A. reficiens* and *Albizia anthelmintica* on the margins of the stands. These clay-rich soils have limited agricultural potential, as they are prone to waterlogging. A sparse shrub layer of *Grewia bicolor, Croton menyhartii* and *Ximenia americana* may be present. The sparse grass layer is characterised by unpalatable annual species. These woodlands have very low grazing potentials.

Western Kalahari woodlands

The western Kalahari is much more arid than the eastern Kalahari, so the woody growth consists more of shrubs and open tree savanna. Again, the soils are mostly deep Kalahari sands, while the many small pans have more clayey soils. The vegetation changes from a community of open, short shrubs dominated by *Acacia* species and *Colophospermum mopane* in the south-west, to a heterogeneous savanna of taller *C. mopane, Commiphora species, Combretum apiculatum* and *Terminalia prunioides* in the far north-west.

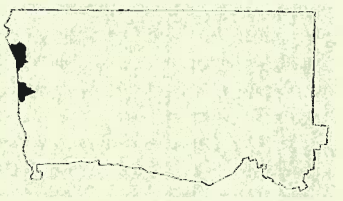
30. *Mixed broadleaf woodlands on red dolomite sands*



This unit, in a karstveld area in western Etosha, has a mixture of trees and shrubs providing a diverse community of woody species. The area is slightly elevated above the surrounding landscape, and the soils are sands and loams derived from the underlying dolomite and calcrete rocks close to the surface. Iron traces in these dolomite sands give it a red colour. Many small, turf clay pans in the area hold water during the rainy season.

The predominant trees are *C. mopane, Acacia reficiens, Terminalia prunioides, Sesamothamnus guerichii* and *Combretum apiculatum,* while important shrubs are *C. mopane* and *Catophractes alexandri. Leucosphaera bainesii* is a common dwarf shrub. *Schmidtia kalahariensis, Eragrostis rigidior* and *E. trichophora, Enneapogon cenchroides* and *E. desvauxii,* and *Stipagrostis hirtigluma* and *S. uniplumis* are the most abundant grasses.

31. *Mixed savanna on loamy to sandy soils*



These are medium to dense savanna woodlands, containing a variety of species growing on sandy to loamy soils. There is a low to medium cover of calcrete rocks on the surface. Predominant trees are *C. mopane, Terminalia prunioides, Acacia reficiens* and *A. luederitzii, Combretum apiculatum* and *Sesamothamnus guerichii.* The shrub layer consists mainly of *C. mopane, Acacia nebrownii, Catophractes alexandri, Euclea pseudebenus, Leucosphaera bainesii* and *Petalidium engleranum* (the last as the dominant dwarf shrub).

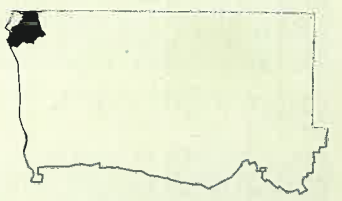
Grasses provide pastures of average quality, the main species being *Schmidtia kalahariensis, Stipagrostis uniplumis, Eragrostis porosa* and *E. annulata,* and *Enneapogon cenchroides.* The area is used only for cattle pastures, with many of the animals moving in on a seasonal basis.

32. *Mopane*–Combretum *savanna on sandy soils*

Structurally, much of the unit is open savanna. *Colophospermum mopane, Combretum apiculatum, Terminalia prunioides* and *T. sericea,* and *Lonchocarpus nelsii* are the most important tree species. Predominant shrubs and short trees include *Dichrostachys cinerea, Croton gratissimus, Rhigozum brevispinosum* and various *Commiphora* species. The most important grass species are *Schmidtia kalahariensis* and *S. pappophoroides, Pogonarthria fleckii, Aristida stipoides* and *A. meridionalis, Eragrostis porosa, Enneapogon cenchroides,* and *Stipagrostis hirtigluma* and *S. uniplumis.*

While some areas, especially depressions where the soils have higher loam contents, may be suited to cultivation, the low rainfall in the area makes the growing of crops difficult. Soils generally consist of red sands, but the sands are coarse and acid in the western Etosha section of the unit.

33. *Ruacana sand plateau*



Lying west of the Cuvelai and south of Ruacana, this area of deep Kalahari sand is isolated from similar vegetation types far to the east. Woody species form a mosaic of distinct, patchy vegetation types. Well-developed dune structures and deeper sands are dominated by tall *Baikiaea plurijuga* with a distinct understorey of fairly tall *Combretum apiculatum.* Other characteristic trees include *Terminalia sericea, Commiphora glandulosa, Combretum collinum* and *Combretum psidioides.* This form of woodland becomes shorter and more open towards the south and west. *Baphia massaiensis, Grewia retinervis* and *Bauhinia petersiana* dominate the shrub layer. The grass layer is characterised by annuals, with *Schmidtia kalahariensis* being the dominant species.

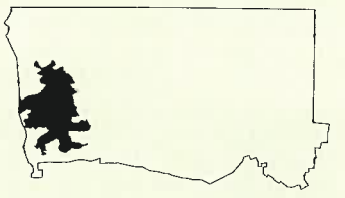
Within the mosaic of woodland types in this unit, *Combretum apiculatum* dominates areas on moderately deep, sandy soils overlying calcretes and other rocky substrates. *Terminalia prunioides* is more abundant where the calcretes are on the surface. Patches of scrub *Colophospermum mopane* are characteristic of heavier, sand-clay loams found on old pans and drainage lines.

34. *Western mopane–pan mosaic*

This is a spectacular mosaic of thousands of small pans and some larger ones, surrounded by higher ground supporting copses of woody species. The most dominant species are *C. mopane, Catophractes alexandri, Acacia nebrownii, A. reficiens* and *A. luederitzii,* and *Terminalia prunioides.* The loams and loamy sands have high salt concentrations.

The most important grass species in the unit are *Eragrostis porosa* and *E. annulata, Odyssea paucinervis, Sporobolus tenellus, Willkommia sarmentosa, Stipagrostis hirtigluma* and *S. uniplumis,* and *Monelytrum luederitzianum.* Many of these species provide good quality grazing.

35. *Western sand plains*



This large flat area of red and brown sands is characterised by a mixture of woody species in a monotonous savanna with low cover. There are relatively few calcrete outcrops, and also few small pans or other drainage features. There are a number of isolated permanent settlements such as Uutsathima and Onambandje in the area, as well as many cattle posts.

The most predominant species are *Acacia erioloba* and *A. reficiens, Lonchocarpus nelsii* and *Terminalia sericea.* A variety of shrubs are found, especially *Catophractes alexandri, Acacia mellifera, Croton gratissimus* and *Grewia flava.* Pastures provide moderate grazing values; the most abundant grass species are *Schmidtia kalahariensis, Aristida stipoides* and *A. meridionalis, Eragrostis porosa* and *E. annulata, Enneapogon cenchroides,* and *Stipagrostis hirtigluma* and *S. uniplumis.*

Some of the huge expanses of open grasslands around Etosha Pan

Large quantities of wood are harvested elsewhere in the region and then sold in the densely populated areas of the Cuvelai

Freshly cut poles being added to a new fence

A giant marula tree provides shelter to a market

Extracting juice from marula fruit

Use and abuse of vegetation resources

Plants provide a huge variety of products that people directly harvest and use, for example firewood, fruits and thatching grass. They also provide many other products that are not harvested directly by people, such as natural pastures for livestock, habitats for wildlife, and nutrients to the soil. Aspects of those values are treated in more depth in later chapters (see chapters on wildlife and tourism, and farming), while here we focus on vegetation products that are harvested directly by people.

By far the greatest demands placed on natural vegetation are through the use of wood for building houses, making fences, and for firewood. Information collected during the 1991 Population and Housing Census indicates just how many people use wood for these purposes. Of all households in Owambo, 84% were built primarily of wood, and 96% used wood for cooking. Some of these percentages may have decreased in recent years as more houses are built of bricks and more homes have electricity. However, the total number of households in the region has also increased, so the overall demands for building timber and firewood have not decreased.

Mopane (*Colophospermum mopane*) is favoured for building homes and the construction of palisade walls, although terminalia (*Terminalia sericea* and *T. prunioides*) poles are also used. Estimates of the numbers of poles (1.5 to 2.0 metres long) used for the construction of walls, roofs and palisade walls vary between about 4000 and 11,000 per household, depending on the numbers of individual rooms or huts within the household. At least 1000 or more trees would thus have to be cut down to assemble a single home. Mopane and terminalia poles are selected because of their hardness and relative resistance to termite and other insect damage. The poles have to be replaced from time to time nevertheless, with thinner ones requiring replacement every six years or so, while thicker mopane poles may last several decades. Large poles are also needed to build stockades, or kraals, in which cattle, goats and donkeys are held, and each stockade consists of several hundred poles or more.

The use of wood for fencing is substantial. No one has added up all the lengths of fencing in the region, but simple estimates based on the sizes of cleared areas in and around each farm show that there are hundreds of thousands of kilometres of fences. Large poles are interspersed with smaller twigs, palm fronds and pieces of brush. More and more farmers now use wire for fencing. Some fences put up by wealthy people consist entirely of wire and treated poles produced in plantations elsewhere, but most wire fences are held up with thicker mopane or terminalia poles and reinforced with smaller sticks and brush to fill gaps between the strands.

Locally collected firewood is another major use of wood, and it is most important as a resource to households that cannot afford other fuels or firewood sold in markets. Women and children spend considerable amounts of time collecting wood near their homes. Most of that wood has poor value as fuel because it generally consists of thinner twigs or softwood, which burn rapidly. The roots of mopane shrubs cleared from fields are now often sold for fuel.

Other than the use of wood for building, fencing and fuel, many trees provide other resources. These include materials for the production of baskets (including storage containers for mahangu), wooden utensils and furniture, toys, fish traps, mortars and pestles, alcoholic beverages, oils, fruits for consumption, medicinal remedies, and the making of sledges. Alan Marsh (1994)[4] provides a thorough description of the many uses and products of trees in the region. What is most important to recognise is that it is the poorest homes that depend to the greatest extent on these natural products. Unlike wealthier people, they cannot afford household furniture, commercially produced beer and other modern substitutes for natural products. And, since they rely on natural products to such an extent, the availability of natural vegetation has a major impact on the quality of their lives.

Six types of trees stand out as being particularly valuable: mopane, silver terminalia (*Terminalia sericea*), purple-pod terminalia (*Terminalia prunioides*), marula (*Sclerocarya birrea*), makalani palms (*Hyphaene petersiana*) and berchemia (*Berchemia discolor*). The value of mopane and the two terminalias is largely in their use as building and fencing materials, but the hardness of mopane wood also means that it is favoured for use as firewood and for making utensils. Mopane and silver ter-

The palisade walls of a traditional home behind a woman with a newly woven beer strainer

minalia also have medicinal uses. Makalani palms provide materials to make baskets and hats, their sap is used to produce wine, their trunks make useful drinking troughs for livestock, and their fronds are used to make fish traps and for fencing. Marula fruits are consumed, used to produce various drinks, and oil is extracted from their seed kernels. Oil extraction is, in fact, turning into a commercial activity for a group of about 1000 women, who collect the seeds and remove the kernels.[5] The kernels are sent to Windhoek where the oil is extracted. There is potential for marula oil to be exported for use in the cosmetics industry in Europe and elsewhere. Plans are also being considered for the commercial production of marula juice.

The bark of berchemia trees is used to produce dyes to decorate baskets. These trees also produce large volumes of fruit that is consumed at home and sold in markets. Other important fruiting trees are jackal berries (*Diospyros mespiliformis*), wild figs (*Ficus* species) and baobabs (*Adansonia digitata*). Furniture is often produced from kiaat (*Pterocarpus angolensis*) and teak (*Baikiaea plurijuga*). Although there are scattered mangetti trees (*Schinziophyton rautanenii*) in the Cuvelai, most of these important nut-bearing trees are in the eastern Kalahari woodlands. Finally, many of the large, leafy trees provide shade. This may not seem too important to readers unfamiliar with the region, but people and animals need protection from the fierce heat of the sun for many months of the year. Life in the shade of a large fig, marula, berchemia or jackal berry tree is certainly much more agreeable!

The stark contrast in vegetation cover on either side of the fence of Ogongo Agricultural College
Note, also, the tall, green oshana grass inside the fence of the college compared with heavily grazed pastures outside.

EPP

The bareness, perhaps even desolation, of much of the Cuvelai where so many people live is certainly its most glaring feature. All of that is due to the high rates at which trees have been cut down and killed, and the high rates of grazing and browsing by livestock. Of the 35 vegetation types in the region, five of those under the highest pressure are in the Cuvelai, as assessed from measures of population and livestock densities, and areas of natural vegetation that have been cleared. The most densely populated units, and those where more than 30% of the area has been cleared are:

- Cuvelai palms and fruit-trees on loamy sands
- Mopane–fruit-tree–oshana mosaic
- Mopane shrub and low trees on oshanas
- Oshana–Kalahari mosaic
- Palms–and–pans mosaic
- North-eastern pans

The sixth unit, in the eastern Kalahari woodlands, represents the old pans in Ohangwena on which so many people live. All six units also have the highest densities of livestock, although high livestock numbers also occur on the oshanas unit as well as the Etosha plains and pan edge unit (outside Etosha in the Andoni area).

Many reports from previous decades and accounts given by older folk confirm that the Cuvelai used to be much more wooded and well-endowed with useful natural resources. The contrast between the density of mopane trees within the Ogongo Agricultural College farm and the surrounding areas, where almost all large trees have been cut down, provides a dramatic illustration of this kind of deforestation. Another striking difference is, of course, the border line between Angola and the Cuvelai in Namibia shown in the picture on the back cover.

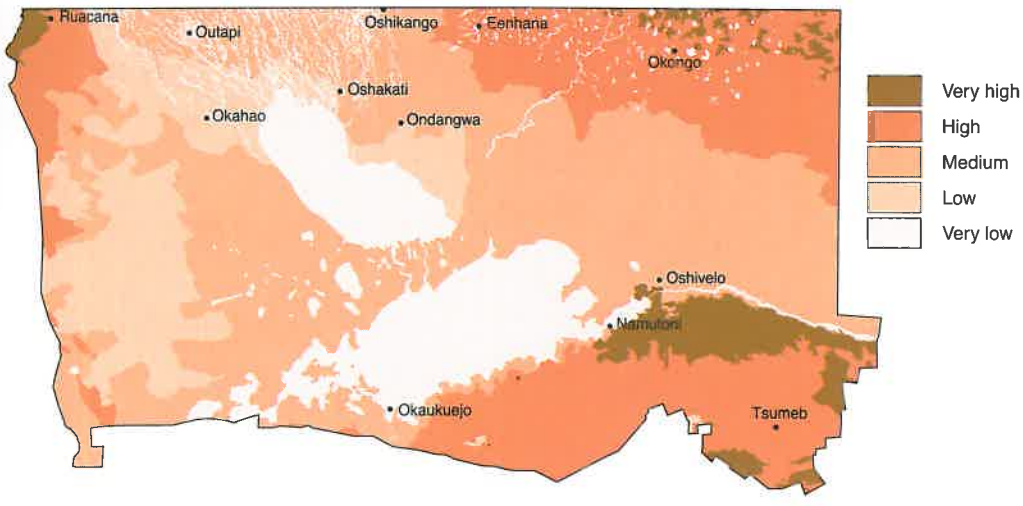
In the virtual absence of tall mopane and terminalia trees as well as firewood in the densely settled areas, people need suitable alternatives. These are mostly available only to the wealthier people, because it is only they that can buy other fuel or wood at markets, or who have cars or carts to transport wood collected further away from their homes. Most of that wood is collected in the eastern and western Kalahari woodlands. The supply of wood for building poles and fuel has also become a substantial business, with many people now harvesting, transporting and selling the wood in markets and along major roads. While woodlands in the eastern and western Kalahari remain fairly well wooded now, the longer-term effects of harvesting need to be assessed.

Another consequence of the loss of natural vegetation resources is that people are forced to use inferior materials, for example, cattle dung as fuel, and mahangu stalks and palm fronds for fencing. Again, it is the poorer households that have to make most use of those alternatives.

Vegetation in the oshanas is typically associated with periodic flooding and growth, followed by die-back during the dry season. We might, thus, expect these grasslands to be resilient to heavy grazing pressures, so that it matters little if the grass is eaten or dies back. Before the huge increase in numbers of people and livestock, those grasslands would also have been subjected to large numbers of antelope and other grazing wildlife. However, the current very high grazing pressures (as described on pages 58 and 59) have probably led to a reduction in the availability of high quality perennial grasses. Annual grasses, that have less value to grazing animals, are now probably more abundant.

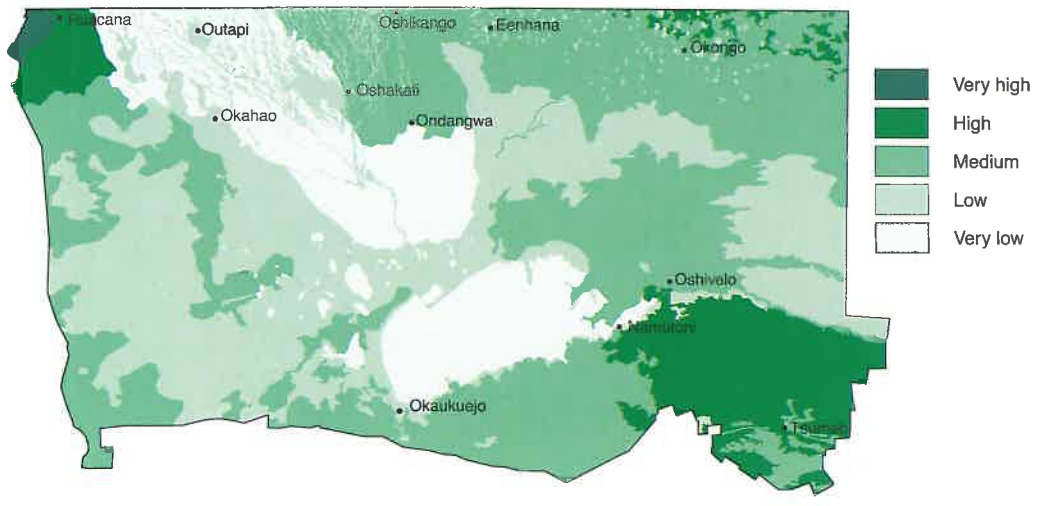
While the extent of deforestation is enormous, all is not gloom. Some people plant fruit-trees such as marula and berchemia on their farms. The young trees are protected so that goats do not eat the new leaves and stems. Likewise, mopane trees cut at the base of their stems rapidly coppice and produce new stems, and some farmers protect the new growth to ensure that good, strong and straight poles are available from those mopane trees after a number of years. Just what proportion of farmers look after trees in these ways is unknown, but every effort should be made to encourage more to follow their example.

Woodland resources

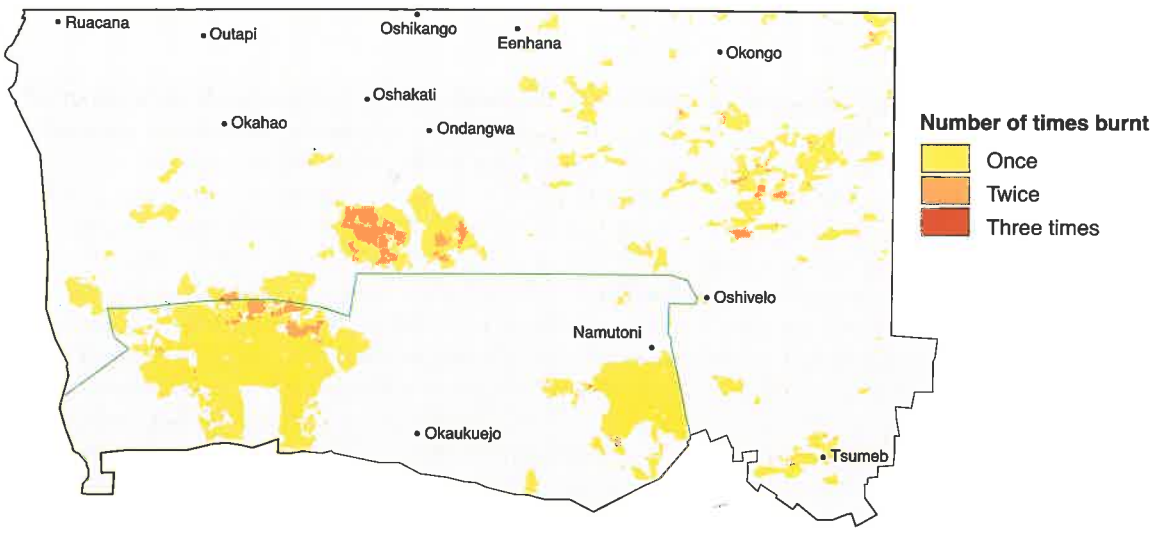


▲ ***Woodland resources***[2]
Areas and units with highest values for woodland resources are in the north-eastern and north-western Kalahari because of the density of large and valuable trees, such as teak, kiaat and burkea. High values in the Tsumeb area and in southern Etosha reflect the abundance of mopane and purple-pod terminalia, while a medium rating reflects the presence of taller mopanes in the north-western Cuvelai. The lowest values for woodland resources are given to those units where there are few, if any, trees – let alone sizeable or valuable ones.

Plant diversity



▲ ***Plant diversity***[2]
The Kunene valley has the highest diversity of plants because of the variety of soils and topography in that unit. Other units with relatively higher values are the patches of dense Baikiaea *woodland in the north-east, the Ruacana sand plateau, the* Terminalia prunioides *woodlands on calcrete, and the* Terminalia prunioides–Combretum apiculatum *woodlands in the Tsumeb area.*



▲ *Distribution and numbers of fires over five years, 1994–98*[6]

Fire

Fire has always been a feature of the landscape, and we can imagine that large natural fires started by lightning must have burnt huge areas in some years. The biggest fires would have occurred in the dry months following a good rainy season when there was ample standing grass to burn. These days, however, most fires are started by people to stimulate the growth of new grass in farming areas, while park managers have a regular programme of burning in Etosha to ensure that a diversity of plant species is maintained.

The adjacent map is a compilation of information on fire scars detected on satellite images over a five-year period, from 1994 to 1998. Much of the region never burnt during those years, while large areas in Etosha burnt once. Most of the Etosha fire scars were due to controlled burns by park managers, but one very large fire raged out of control in the western section of the park in 1997. Other, smaller areas that burnt once are mostly in the eastern and western Kalahari woodlands. The only large areas that burnt two or three times in the five-year period are the grasslands to the north of Etosha, where cattle herders probably started fires to promote grass growth.

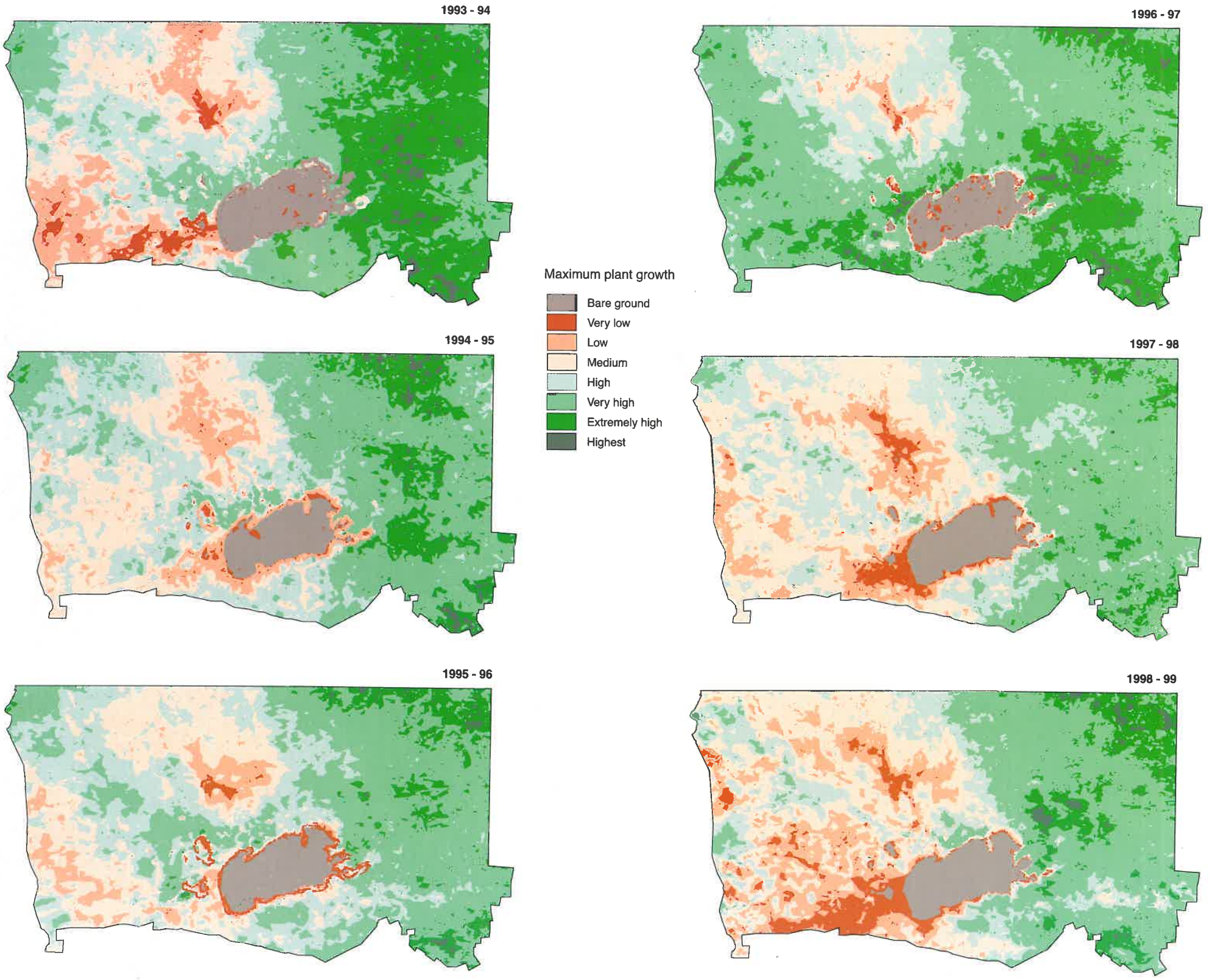
Maximum plant growth

The high degree of variation in rainfall, both from year to year and from month to month (see pages 9–11), has a substantial impact on plant growth. The series of images below shows the maximum amount of plant growth in each of six summer growing periods, providing a dramatic portrayal of how plant production varies. The different colours represent different maximum amounts of vegetation growth – or biomass – measured for different areas during each of those six seasons. Grey-brown shows those areas, such as Etosha Pan, with almost no biomass, brown and beige show those areas with little vegetation growth, and dark green shows areas with substantial biomass.

The eastern areas normally have the highest plant growth. The western half of the region usually falls into the low growth category because it receives less rainfall than areas to the east. Even though every season differs from the others in many respects, four of the seasons (1994–95, 1995–96, 1997–98 and 1998–99) were rather similar. In each of those seasons, the region was essentially split into a drier western and wetter eastern half. The season in 1993–94 showed a similar pattern, but much higher rains and plant growth occurred in the east, while good rains evidently fell over the whole area in 1996–97.

While most of the changes from year to year are due to variation in rainfall, vegetation types that are heavily wooded always have a greater plant biomass. This is simply because some trees keep their leaves throughout the year and others grow new leaves early in the summer, whether it has rained or not. The green colours during most seasons in the north-western corner are largely due to the denser and taller woodland in the Kunene valley and Ruacana sand plateau vegetation units. However, the north-western area may get slightly more rain than further south (see page 9).

The densely populated Cuvelai appears as having very little plant growth in any year – despite the many fields of crops. This reflects the very little vegetation that remains in the northern parts of the Cuvelai, and also the sparse plant growth in the southern area of saline grasslands.



▲ *Maximum plant growth over six growing seasons, 1993–94 to 1998–99*[7]

WdP

Bush encroachment

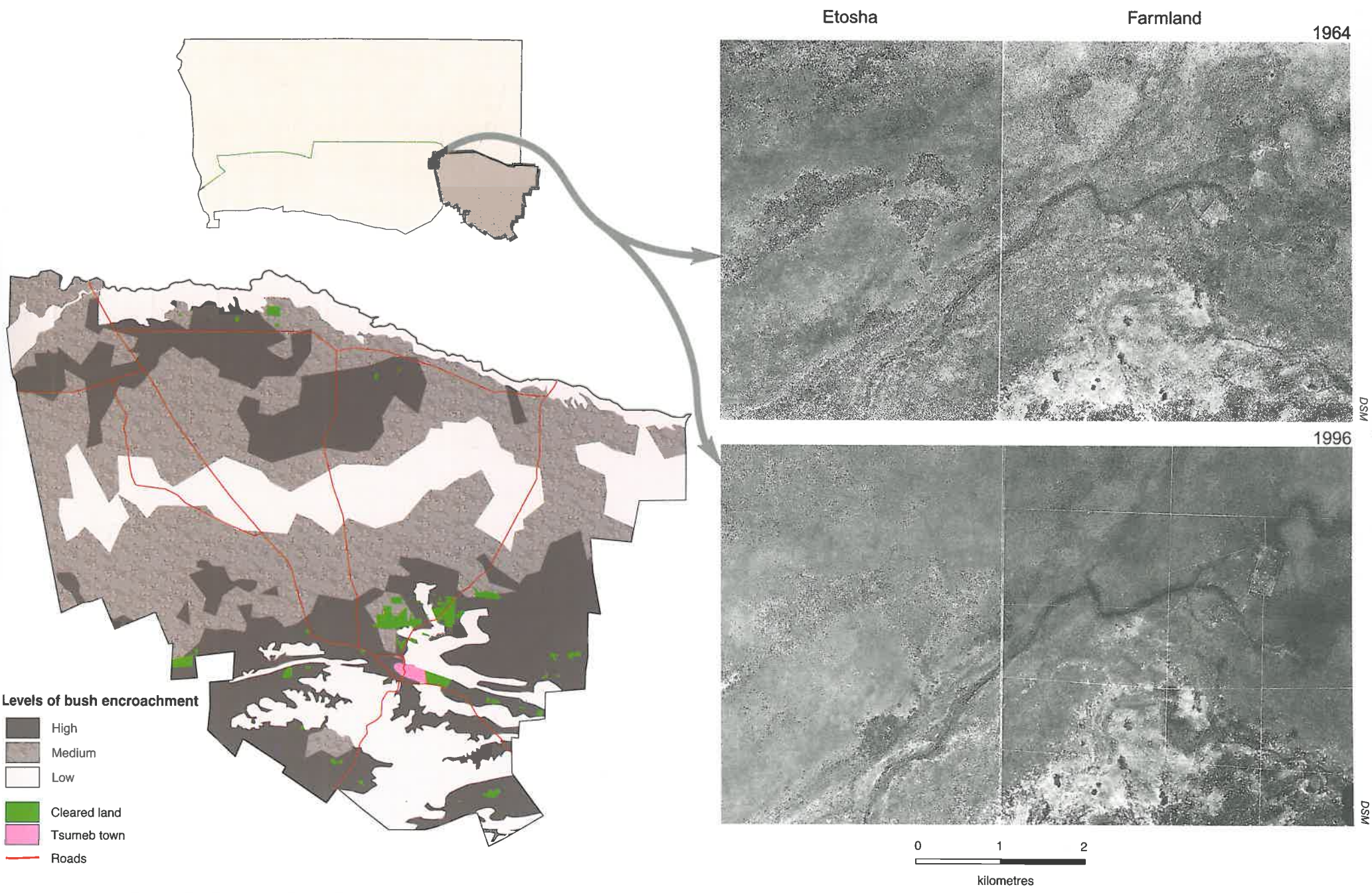
Much is said about the problem of bush encroachment in Namibia, but rather little information is available on the extent and magnitude of the problem. In the north-central region, it is clear that the problem is largely confined to, and is most severe in, the Tsumeb area. This is particularly the case for vegetation types growing on loam and clay soils. Other examples of bush encroachment can be found in Etosha and in the Kalahari woodland areas further north. In Etosha, dense thickets of *Acacia nebrownii* develop around waterholes as a result of the concentration of game numbers. The dense shrub in some parts of the Kalahari woodlands has probably developed as a result of frequent fires which have killed fire-sensitive trees, allowing the growth of more resistant plants such as *Baphia,* and silver and purple-pod terminalias.

A number of theories are bandied about to explain encroachment. Some probably apply quite usefully in certain areas, and a combination of factors probably applies in others. Firstly, there are few hot fires these days, especially in the so-called commercial farming area, and these fires are needed occasionally to kill off shrubs. Secondly, lower rainfall in recent years may have resulted in sparse grass cover, and in the absence of competition from grass, some woody plants have been able to grow more rapidly. Thirdly (and this is the most popular idea), overgrazing on overstocked farms has resulted in the loss of grass, again promoting the growth of woody plants. Fourthly, some people claim that large numbers of tamboti (*Spirostachys africana*) felled to provide wood for mining operations in the Tsumeb area contributed to encroachment because the growth of other species was previously retarded by poisons produced by these trees. Finally, the clearing of some areas for cultivation has obviously led to those fields becoming encroached once they were abandoned.

A number of attempts are now being made by some farmers to clear bush and recover pastures for grazing their cattle. Some of these attempts use chemicals that selectively kill certain kinds of plants, while others use mechanical or manual methods to get rid of the bush. It is important that the roots are either killed or removed, otherwise the bush simply grows again. A number of charcoal factories now selectively harvest the encroaching species. Most of the charcoal is exported to South Africa, but other markets are needed before the volume of charcoal – and, thus, harvested bush – can be increased to make any difference. Many areas cleared for charcoal production simply become choked within a few years when the bush grows back. Other measures to reduce encroachment include the harvesting of purple-pod terminalia for fencing poles, and increased goat farming. Many farmers have increased their herds of goats (see page 56) because these animals can penetrate and browse the bush and also because there is so little grass available for cattle.

Satellite images reflecting average maximum values of green vegetation were used to map the approximate boundaries of areas with different levels of bush encroachment around Tsumeb (bottom left).[8] While the dolomite hills clearly do not suffer from the problem to any great degree, the most severely encroached areas are in the valleys around those hills and to the north of the town. Many of these areas have been cleared previously for cultivation and are now completely covered in thickets of *Dichrostachys cinerea* and purple-pod terminalia. Further north, there is a swathe running east and west on which there is rather little encroachment, largely because the soils in that area are too shallow for woody plants. North of that band there are other large areas that are badly encroached.

In total, about 30% of the Tsumeb farming area can be said to suffer from 'high' levels of encroachment, about 40% from 'medium' levels and 29% from 'low' levels. The remaining 1% comprises cultivated land and the town of Tsumeb. What this means in terms of environmental degradation and loss of productivity is difficult to assess. However, those areas with high levels of encroachment have probably lost 50% to 80% of their potential to support livestock. The bush is simply so thick that most areas cannot be penetrated, and there is very little grass to graze. Areas rated as 'medium' have probably lost about 30% of their potential.



▲ ***Levels of bush encroachment around Tsumeb[8]***
The small map (top) shows the Tsumeb farming area where assessments were made of levels of encroachment, as well as the small area along the boundary between Etosha and adjoining farms just north of Fischer's Pan, photographed in 1964 and 1996. The white line running through the centre of each photograph is the Etosha fence. In the 1996 photograph (bottom) the commercial farms, covered in denser bush, appear darker than Etosha, which has more open vegetation. In 1964 (top photograph), there was no such difference in bush cover between the two areas.

Wildlife and tourism

WWF

Much of this book concentrates on the Owambo area, where so many people live, and where many make direct use of natural resources to provide them with food and security. Thus, environmental pressures and degradation are severe, to the extent that for many people there seem to be few natural attractions remaining in Owambo. All of this stands in the greatest of contrasts to the area on which this chapter focuses: the Etosha National Park, its abundance of wildlife and the appeal that it holds for tourists.

Etosha is one of those wonders of the world, the centrepiece in a suite of attractions that draws so many visitors to Namibia each year. In this dry country, where the availability of water and grazing places a limit on animal numbers, and where much of the country has been cleared of large game, Etosha provides a home to some of the biggest populations of wildlife. Most of Namibia's lion, elephant, rhino and many other large animals find protection here. And, in drawing hundreds of thousands of tourists to Namibia, Etosha generates a significant amount of foreign revenue for the country.

There are also other ways in which Etosha differs from the rest of the region. Unlike Owambo, which 'belongs to the people', and the Tsumeb farms, which are owned by private individuals, Etosha belongs to and is managed by the government. People living in Owambo and the Tsumeb area are to a greater extent the users of natural resources in those parts of the region, but the main users of resources in Etosha are people who normally live far away, often on different continents. Finally, Etosha protects animals that for most people in the region are regarded as either a nuisance or a good source of food.

Distribution of large animals

From low-flying aeroplanes, staff of the Ministry of Environment and Tourism have carried out aerial surveys of large animals over many years. Animals seen within specified distances of the aeroplanes are counted. Reliable estimates of population sizes and distributions can only be obtained for large, conspicuous animals because smaller species, such as warthog and steenbok, and species that prefer woody habitats, such as black-faced impala, are often missed. Animals that are only active at night are also not counted. Nevertheless, the censuses provide useful information on the relative abundance of many species in different areas and years, and with reliable sampling methods they also give us estimates of the total population sizes. The most recent comprehensive aerial surveys were done of Etosha in 1995, and for the whole north-central region in 1998. They provide perspectives on the relative numbers of wildlife inside and outside Etosha, and in different areas within the park.

During the 1998 survey the vast majority of animals were recorded in Etosha, confirming the fact that relatively few wild animals live outside the park in Owambo and on the Tsumeb farms. Animals were seen outside Etosha in south-western Omusati, on the Andoni plains north of the Etosha fence and south of Okashana, and on some of the farms in the Tsumeb area. Most of these sightings were of ostrich, springbok, kudu and blue wildebeest. Estimates from these counts suggest that there might be total populations of roughly 3000 ostrich and 1500 springbok in Owambo.

Within Etosha, densities of large animals are clearly much higher in some areas than others, especially the areas flanking the main pan to the east, south and west. There are also several areas in the far west where big numbers of large animals occur. Most of the highest densities are in areas where there are several waterholes, reflecting the fact that many species are attracted by the availability of water. However, waterholes have also been placed in areas where there is already an abundance of wildlife, and it is unclear just how many of the differences in density are due to the presence of water or to other factors.

One obvious factor that affects wildlife densities is the availability of grazing and browse in different types of vegetation. Overlaying these estimates of densities on the map of vegetation types shows that numbers are concentrated in seven of the 14 vegetation units in Etosha (see the table on page 20). These are mixed broadleaf woodlands on red dolomite sands and Otjovasandu quartzite hills in the extreme west of the park, mixed *Acacia* Kalahari woodlands north of Namutoni, Etosha turf clay pans on karstveld in the south, and Etosha plains and pan edge, western sand plains and Etosha mixed low trees on calcrete surrounding the main pan. Densities of large animals averaged two or more animals per square kilometre in these six habitats.

Maps of the densities of eight of the more common species show that most of them are widely distributed across the breadth of Etosha. This is especially true of oryx, giraffe and Burchell's zebra, while springbok and ostrich are more abundant in the west. Kudu, blue wildebeest and elephant are more concentrated in the east. Most of the pockets of higher densities reflect the preferences of each species for small areas of more suitable habitat, and concentrations around waterholes.

WWF

Deserted flamingo nests on Etosha Pan

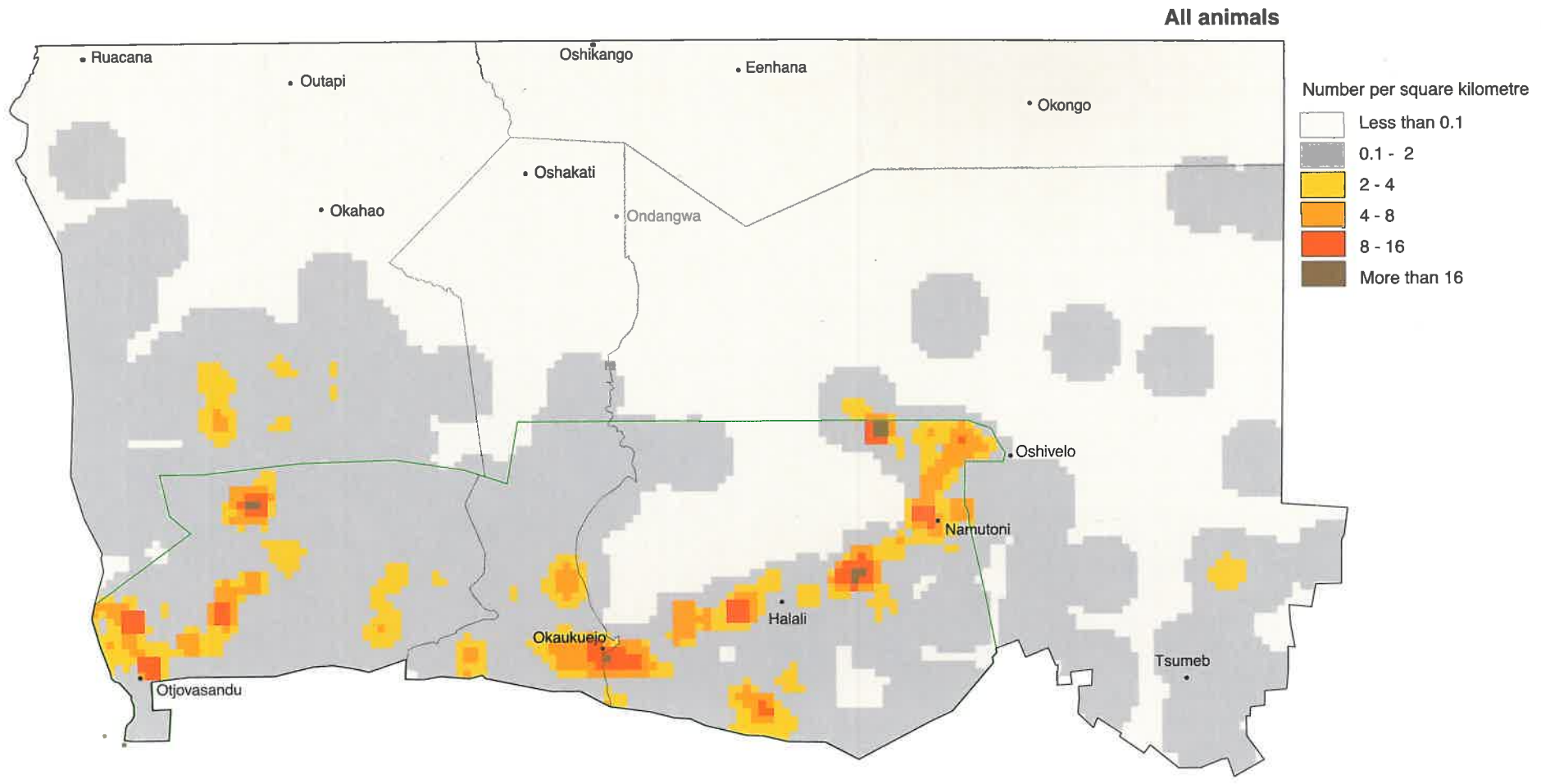
Etosha Pan is the only place in Namibia where greater and lesser flamingos breed. However, they only breed during those few and irregular years when large amounts of water flow into the pan or there are exceptionally heavy falls of rain on the pan. Only then are islands formed on which flamingos are safe from predators. Tens, or hundreds, of thousands of birds arrive – almost overnight – from Walvis Bay and perhaps elsewhere in southern Africa. The highest number of flamingos ever estimated here was over a million birds, mostly lesser flamingos.

The birds have attempted to breed during only 17 of the past 40 years.[1] Most of those attempts failed, and young birds were only produced successfully in five of the 17 years, although some young possibly survived in three other years. Nests have been flooded in some years, but most failures were due to water in the pan evaporating rapidly, leaving the young birds abandoned on the dry pan with nothing to eat. About 100,000 abandoned young birds were found in 1969, and some 20,000 of these were caught by Etosha staff and saved; the remaining 80,000 chicks died.

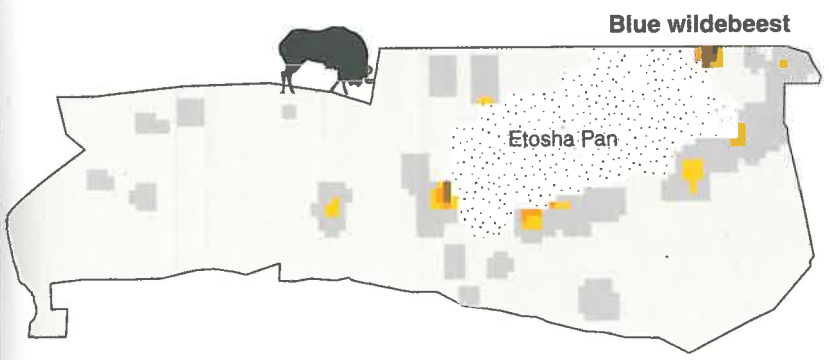
Migration of animals

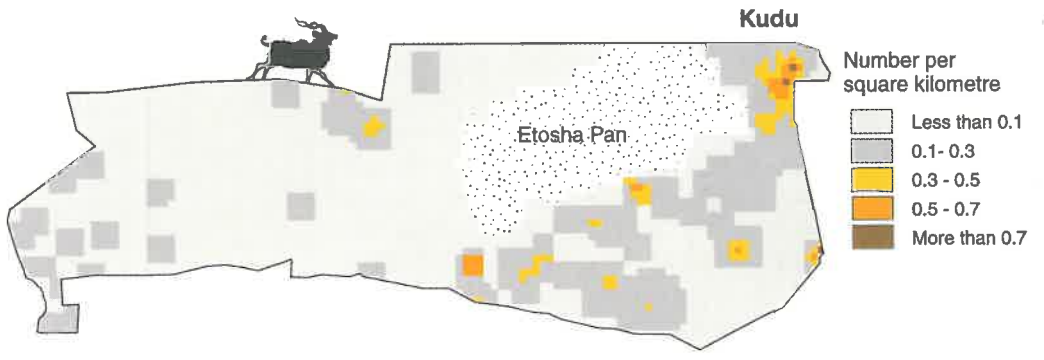
The fencing and isolation of Etosha must have had a massive impact on the behaviour and size of populations of many species. In times gone by, tens of thousands of animals could have migrated north to graze in the Cuvelai or anywhere else where good rains might have fallen to produce lush pastures. Indeed, there is one report of 18,000 wildebeest on the Andoni plains. Movements of wildlife were tempered as human populations increased in the Cuvelai and were later abruptly stopped by the erection of game-proof fences around Etosha between 1961 and 1973.[2]

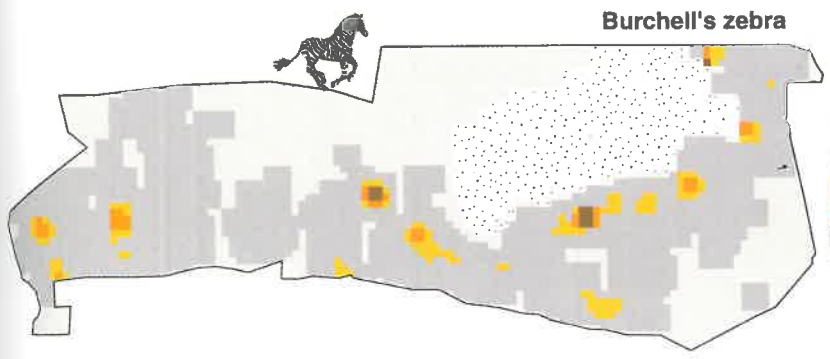
Although big herds of antelope and zebra are now confined to Etosha, a few animals still break out onto the

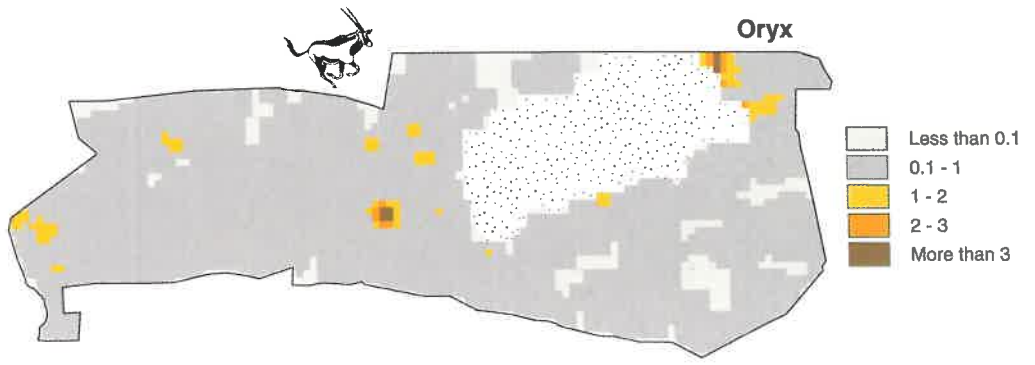


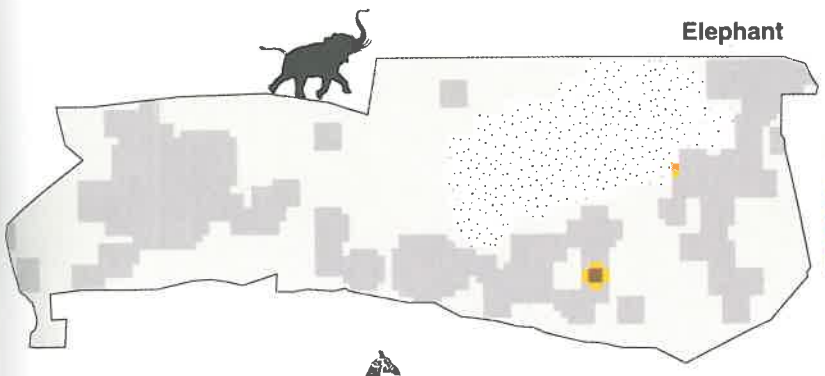
▲ ***Densities of wildlife estimated from an aerial census in 1998***

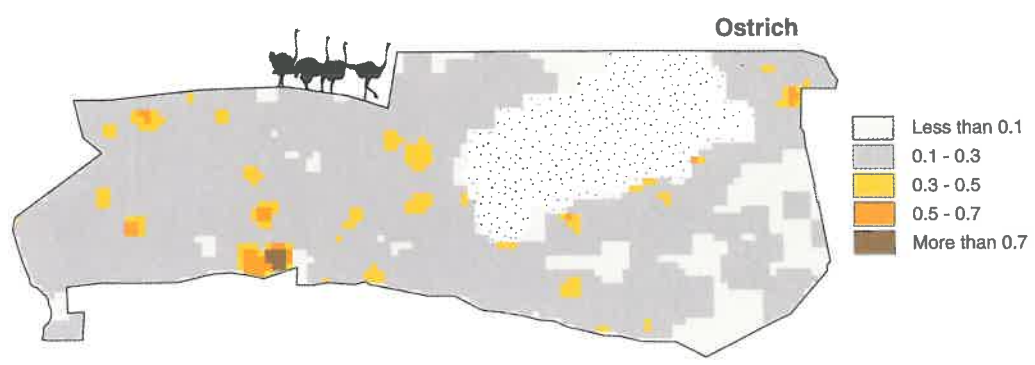


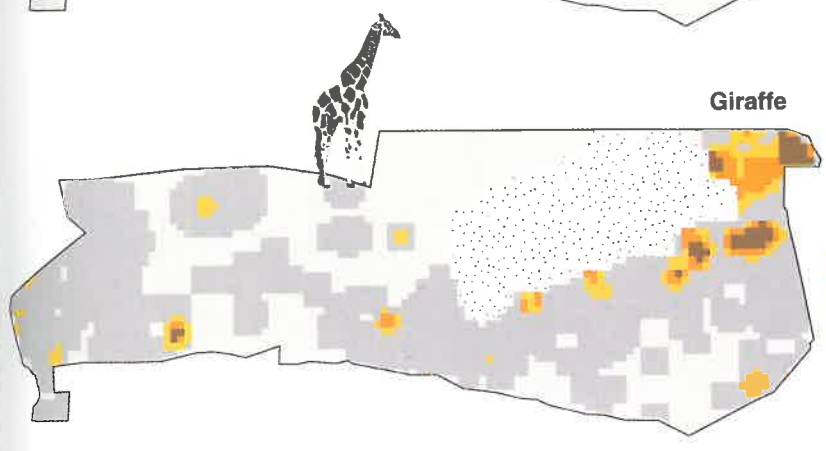


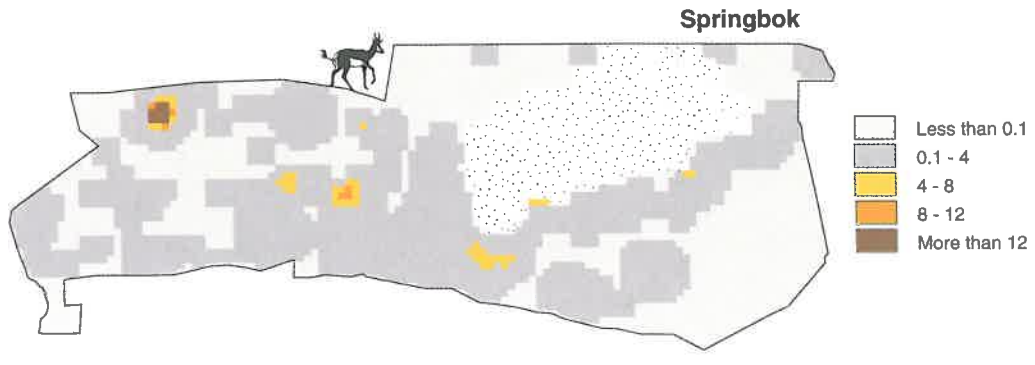












▲ ***Estimated densities of various large mammals and ostrich in Etosha, averaged from the 1995 and 1998 aerial surveys[3]***

neighbouring farms and into Owambo to the north. Some of these cause damage to livestock and crops, an aspect discussed below. Elephant are among those that regularly leave, and in 1987 and 1988 three females were fitted with radio transmitters that send signals to satellites, enabling their positions to be tracked for up to six months. As shown in the map below, the areas covered by the three cows were impressive and give an idea of what distances these animals can, and probably need to, cover under ideal circumstances. Other elephants are known to leave Etosha regularly, going north-west to the Uukwaluudhi area, east towards Omuthiya and the Mangetti and Tsumeb farms, or south onto the farms in the Otavi and Outjo districts.

There are also regular movements, corresponding to the wet summer and dry winter months, by some of the species that are now confined to the park. The biggest of these movements is by thousands of springbok, wildebeest and zebra that move onto favoured grazing areas between Okaukuejo and Adamax once good rains have fallen, and remain there for much of the summer. Most then move off during the dry season, largely to areas along the southern edge of the pan where there are many waterholes.

There are a few natural springs in Etosha, but about 90 artificial waterholes have been placed in areas where there were no natural sources of water permanently available to wildlife. This seems like a good thing to do, but the provision of water for wildlife is a controversial issue. On the positive side, animals should have access to water if fences have denied them the opportunity of moving to areas where water is naturally available. Also, regardless of fences, making water available should help animal populations to increase if the availability of water should ever limit their ability to produce young and survive. Waterholes also provide tourists with good places to see concentrations of wildlife, and it is indeed important that the needs of visitors be met.

However, such concentrations of animals also have several negative effects. The most important and simplest of these is that vegetation around the waterholes is subjected to severe grazing pressure, causing degradation of the vegetation and erosion of the soils. The increased number of artificial waterholes also contributes to the spread of anthrax, botulism and other diseases, since animals become infected by drinking contaminated water.

WdP

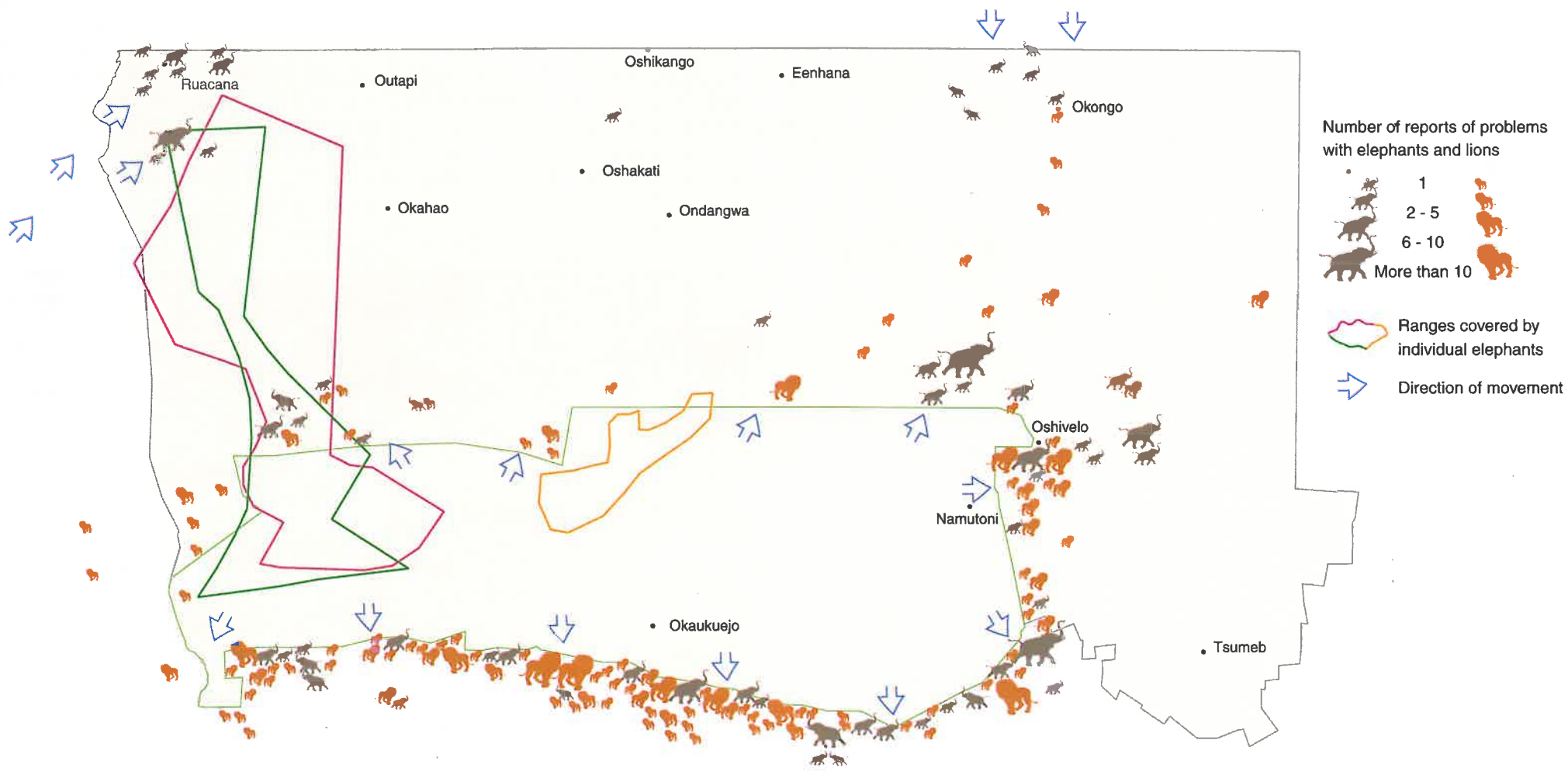
Local erosion caused by high concentrations of wildlife around artificial waterholes has detrimental effects on the plants and soils
There are virtually no perennial grasses to be found within areas of several kilometres around some of these watering points, simply because all these plants have been grazed away. Some plant species are wiped out of those areas, producing a desolate landscape, or they are replaced by invasive species that so dominate the ground that little else can grow. Some of the expanses of Acacia nebrownii *thickets in many areas of Etosha are almost certainly a result of overgrazing. Apart from the direct loss of vegetation, high grazing and trampling pressures in Etosha also lead to a greater loss of topsoil. Although erosion by water occurs after heavy rains, most topsoil is lost as a result of wind erosion once the protective cover provided by plants is removed. As might be imagined, all of this leads to a cycle of loss: the more plants are lost, the more wind and water erode the topsoil, and the poorer the chances of new plants growing on that bare ground.*

Problem animals

Despite the fences that enclose Etosha, many animals still move out of the park into neighbouring areas where they may cause problems to park neighbours. These 'problems' present themselves in several ways. Succulent crops of mahangu, melons and other crops may be destroyed, and cattle and other livestock are easily killed because they do not recognise the danger posed by lions, leopards and other large predators. Local farmers may also overreact to the presence of wild animals even though they pose no immediate threat, and staff of the Ministry of Environment and Tourism are called away from their main responsibilities to deal with the problems.

Elephants and lions in areas immediately around the park cause most problems, with more occasional incidents blamed on hyaenas, leopards and cheetahs. A few wild dogs appear in the area north of the Mangetti farms from time to time, probably coming in from Kavango. The concentrations of lion reported as problems along the southern boundary of the park reflect the fact that farmers there are quick to report the presence of these predators. Along the northern border, by contrast, there are fewer livestock owners and poorer communication channels, so fewer problems get reported. Most of the incidents in the Uukwaluudhi area involve elephants that move up from Etosha or from the Kunene Region in the west. Elephant used to migrate through that area to Angola, and conflicts arise as a result of the increasing numbers of people that have settled in their way. Other incidents in the Okongo area occurred in the early 1990s, involving elephant that probably came down from Angola.

Some lions move onto neighbouring farms along the southern border every year. Most are sub-adult males that have left their prides in search of places in other prides where they can rise to dominance and breed. Since 1982, about 500 lions have been killed on those farms, the largest number being 79 lions in 1982. Numbers of 'problem' lions killed every year outside Etosha have dropped to about 20 or 30 in recent years, presumably because there are fewer young males coming out of the smaller population in the park.



▲ ***Areas covered by three elephant cows fitted with satellite tracking devices in 1987 and 1988, and recorded incidents with problem elephant and lion over the past 25 years***
The areas covered by the three collared elephants give an indication of the range that these animals can cover. The smallest range, in the centre of Etosha and just north of the border, covered an area of about 2800 square kilometres, but the ranges of the other two females covered much larger areas up to 18,600 square kilometres.[4] Unfortunately, animals breaking out of the park usually clash with park neighbours and are labelled – and sometimes shot – as 'problem animals'.[5]

Changes in numbers of wildlife

'... we fell in with immense numbers of animals beyond anything I had yet seen. I would scarcely be believed, if I should state there were thousands of them to be seen at a sight. Gnus in herds like the buffalo on the plains [of North America], *hundreds of zebras, beautiful in their striped coats, springboks by tens of thousands, ostriches, gemsboks, steenbok, hartebeeste and elands. Water and grass were plentiful and they seemed to be having an easy time of it ...'*[6]

Thus wrote McKiernan, a traveller to Owambo in 1876. Even 80 years ago, Owambo probably had more wildlife than Etosha. The situation is quite different today, and wildlife no longer has 'an easy time of it'. Species that are not found in Etosha, for example, buffalo, hippo, oribi and reedbuck, which used to be found in the wetter habitats of Owambo, have disappeared entirely from north-central Namibia. In the 1920s, there were no elephant in what was to become Etosha, and one account suggests that the last herd was killed in 1881 during the boom in ivory trade (see page 63). While some elephant must have roamed into the Etosha area from time to time, it was only in the 1950s that they became established in the park. Since then, a population of between 1500 and 2500 has been resident in the park. Other animals have come and gone. Wild dogs are no longer present, although odd packs might come into the park occasionally. Populations of eland dropped from roughly 3000 in the 1950s to about 500 today. By contrast, giraffe numbers are now much higher than before, and white rhino were introduced as a species new to the park.

One of the biggest and worrying decreases has been in the populations of the most abundant and conspicuous animals that live on the open plains of Etosha: Burchell's zebra, springbok and blue wildebeest.[7] Several studies have analysed these changes to try to understand what causes them. Total populations of 25,000 to 30,000 blue wildebeest were present in the central and eastern area of Etosha during the 1950s and 1960s. From those teeming herds, numbers dropped to some 5000 in 1969, and continued to decline until reaching levels of about 2000–2500 between 1978 and 1993 in the same area, roughly less than a tenth of what they had been 20 to 30 years before. Recent counts in 1995 and 1998 suggest that numbers of wildebeest may be increasing slightly, but whether that trend will continue remains to be seen.

In the case of Burchell's zebra, numbers fell from about 23,000 in 1955 to around 12,000 in the early 1970s and to a low of under 4000 in 1987. Again, recent counts suggest an upturn to the most recent estimate of some 5000 in 1998 in the central and eastern areas. Springbok numbers, by contrast, increased from 5000 to 6000 in the early 1970s to about 13,000 or 14,000 in the early 1980s, and then steadily dropped to between 4000 and 5000 in the last few years.

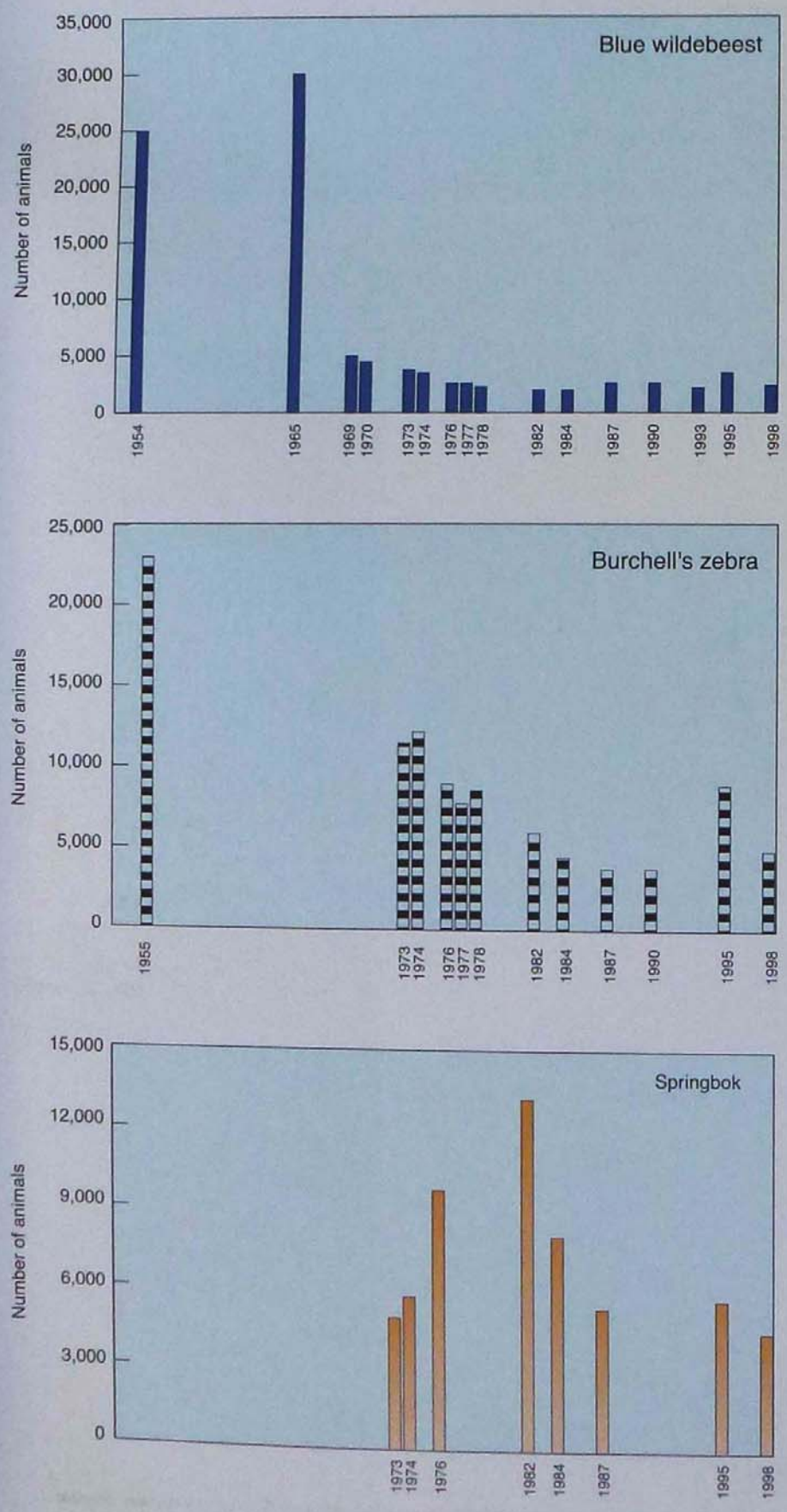
Changes in springbok numbers would seem to be linked to rainfall, with numbers increasing during the higher rainfall years in the 1970s and then declining in the drier 1980s and 1990s (see page 10). These are the kinds of changes we would expect in arid environments, where good rains produce an abundance of food, better survival and the production of more young animals. By contrast, less food is available in dry years when populations are expected to decline. However, studies of pregnancy, birth and death rates, and the body condition of springbok in Etosha have shown that these were not related to changes in rainfall. There was also no relationship between rainfall and these features in zebra and wildebeest.

Another explanation is that the animals moved away from the central and eastern areas of Etosha. This idea has possible merit in explaining the big drop in the wildebeest population in the 1950s and 1960s, when large numbers would move out of Etosha on a seasonal basis. Reports from then suggest that many wildebeest were trapped outside when fencing of the park started. However, zebra and springbok did not move out of the park to the same degree and some of the major changes in their numbers happened after 1973, the year when fencing of the park was completed. Counts of animals elsewhere in the park have also not shown any large movements out of the central and eastern areas.

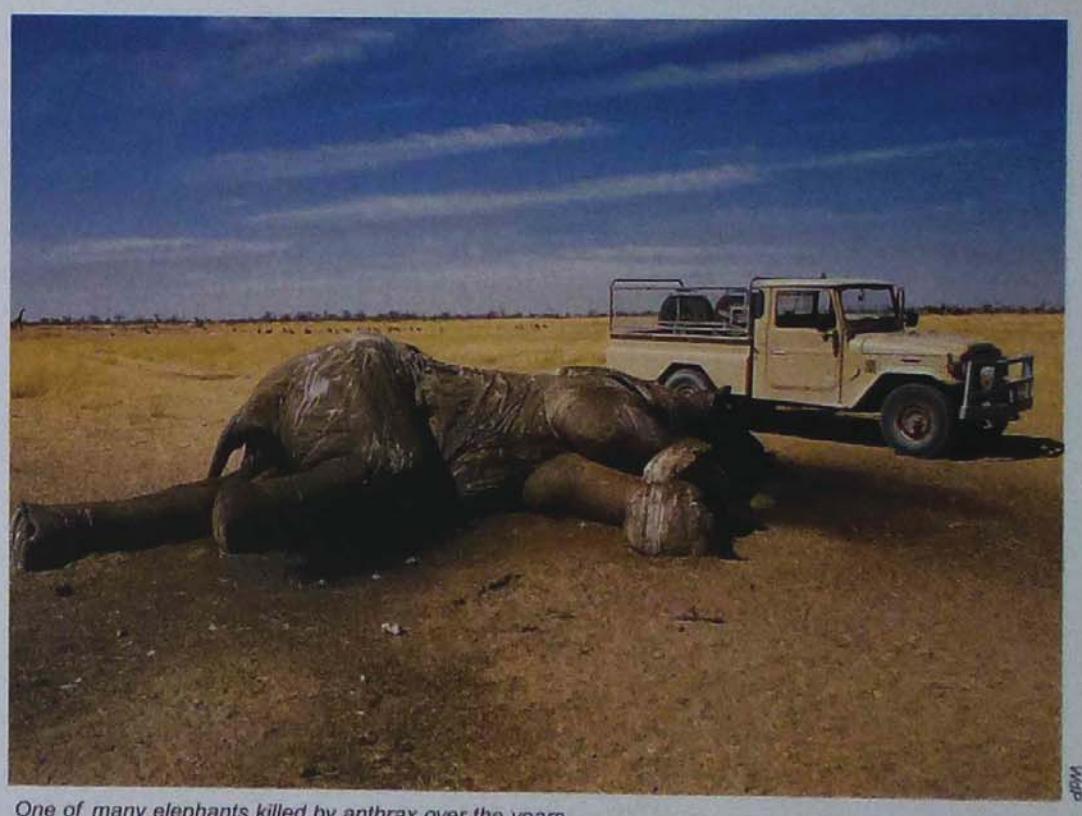
What explanations remain if these huge population changes are not related to rainfall or food availability, and are not the result of large-scale movements? The best conclusion is that much of the decline has been due to the effects of predators and disease. The main predators of these three species are lion, leopard and hyeana, while anthrax is the main killer disease. This bacterial disease occurs naturally in Etosha and, indeed, in Owambo, where cattle are regularly inoculated against anthrax. Humans are also affected, and about 200 people died of anthrax during an outbreak in Owambo during 1939 and 1941. Between 1966 and 1974, over 1600 animals were found to have been killed by anthrax in Etosha, probably a very small proportion of those killed and whose carcasses were not found. Anthrax affects zebra and wildebeest much more than other species, which include springbok, elephant, oryx, kudu, black rhino, ostrich, giraffe, eland and cheetah. Some animals die every year, but there are also outbreaks when large numbers are killed. For example, about 200 elephants died between November 1981 and January 1982, and anthrax killed another 100 between October and December 1989. Numbers of recorded anthrax deaths have dropped in recent years, but the spores lie dormant in soil and water for many years and higher rates of infection and outbreaks are certain to occur again.[8]

Namibia has only one viable population of lion – those in Etosha. The population is also the only one in the world free of feline immune deficiency virus (a disease similar to the HIV/AIDS that inflicts humans). Sadly, lion numbers have also dropped drastically in Etosha. In the 1970s there were about 400–500 lions in the central and eastern plains of the park alone, but only some 200 lions remained in that area of the park in 1989. In fact, the total population in the whole of Etosha now amounts to roughly 200–250 individuals. The decline has affected both the number and size of prides, so the park now has fewer prides than before, and the large prides of 40 or more lions seen during the 1970s are a thing of the past.

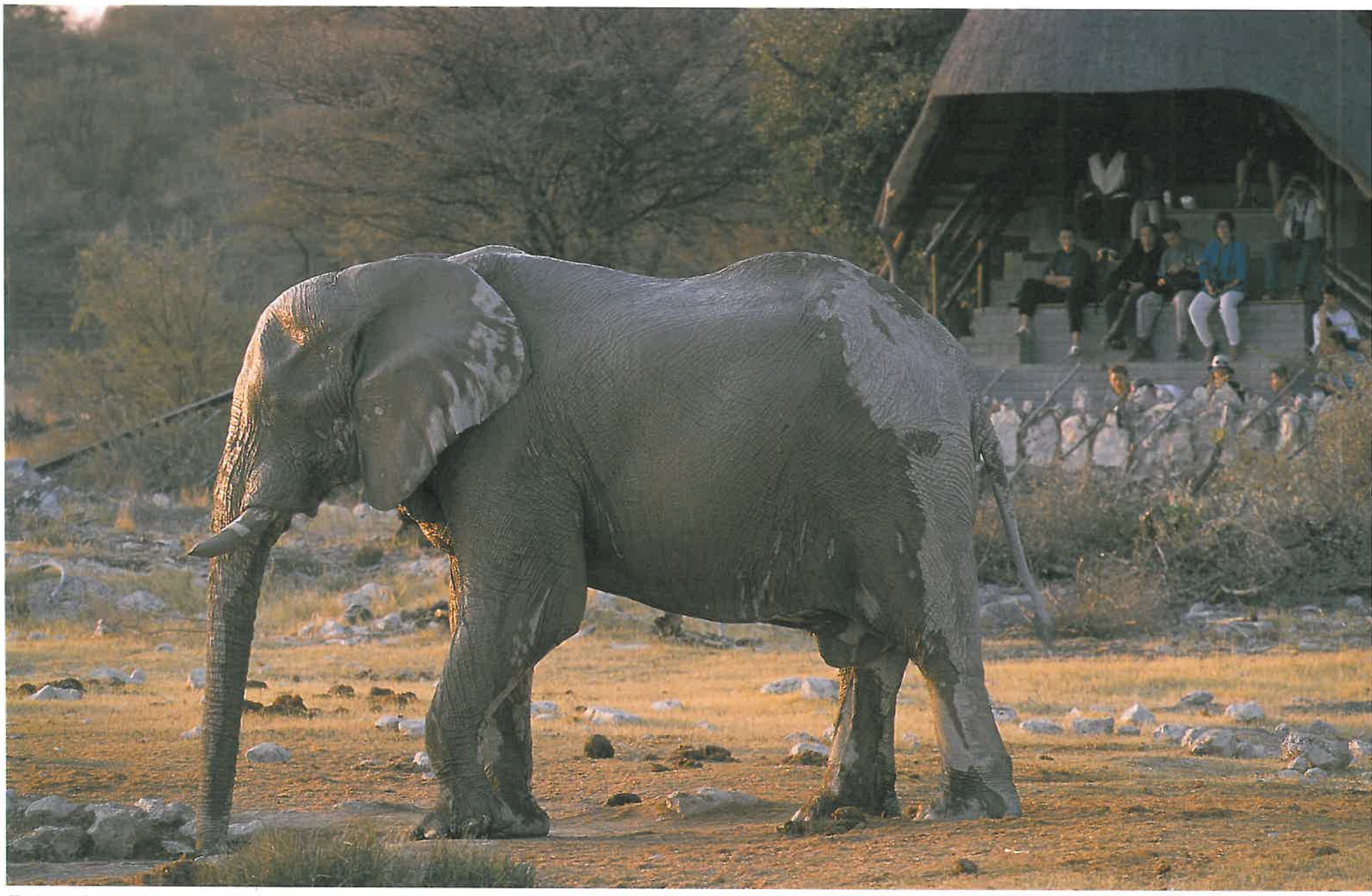
Why the number of lions has dropped so much is not known. It is also ironic that staff in Etosha once considered methods of reducing the lion population because it was thought that there were too many in the park. The most likely explanation of the decline in number is the lower numbers of prey (especially Burchell's zebra, blue wildebeest and springbok) now available to them. The shooting and poisoning of the many 'problem' lions on neighbouring farms (see page 32) has probably not had any impact on the size of the population because most of those that leave the park are young males that are driven out of the prides in which they were born.



▲ ***Estimated numbers of blue wildebeest, Burchell's zebra and springbok in central and eastern Etosha, 1954 to 1998***



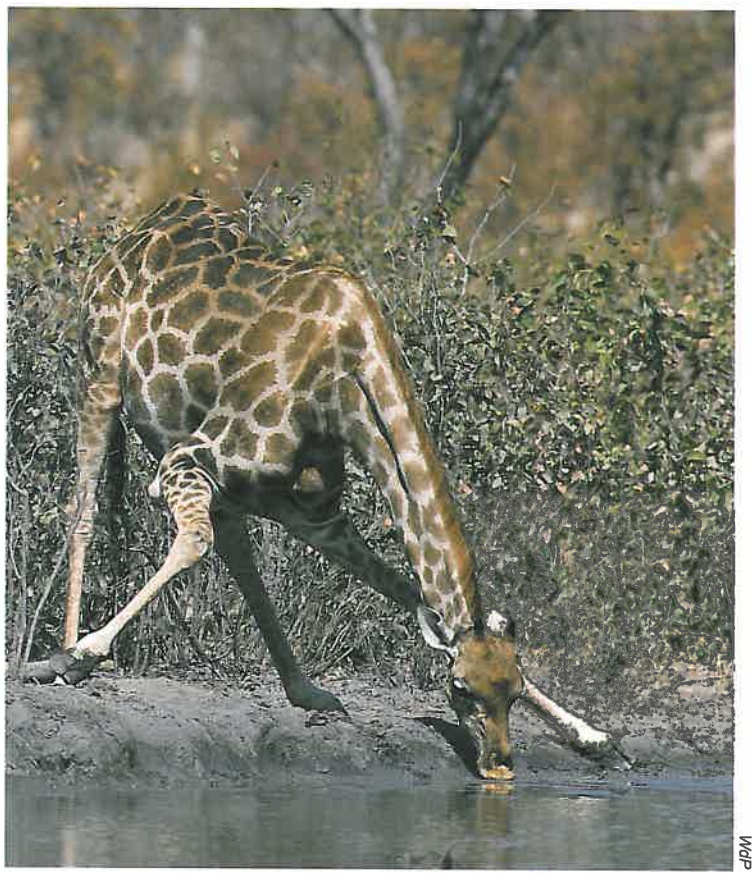
One of many elephants killed by anthrax over the years



Tourists at the famous waterhole at Okaukuejo

Tourism

Tourism is an important economic activity in the region because it generates large amounts of money for the country, and many people believe that it could provide significant amounts to the region itself. Almost all tourism is now centred on Etosha, which is the premier tourist attraction in Namibia. Several guest farms and lodges in the Tsumeb area attract a few tourists in their own right, but most visitors combine their trips to guest farms with visits to Etosha. There are also many guest farms south of the border near the Andersson gate to Etosha, and in the west around Kaross and Otjovasandu. Most of the few tourists that visit Owambo pass through on their way to other more popular destinations in the Kunene Region. Indeed, there is a stark contrast between the absence of tourism in Owambo and its concentration in Etosha, lying just to the south and part of three of the political regions.



A giraffe drinking at one of the many waterholes in Etosha

About two-thirds of all foreign tourists to Namibia include Etosha as part of their visit. Together with Namibian tourists, these amounted to about 98,100 day and overnight visitors spending 268,000 days and nights in the park in 1997. On average, each day visitor who goes into the park does so for about three visits, whereas people who sleep in Etosha spend an average of four days in the park. Over the past years, about 54% of overnight visitors have been from outside southern Africa, with the rest being from South Africa (23%) or from Namibia (24%). Most tourists visit Etosha during the winter months of July and August, followed by September, October and April as the most popular months (see the adjacent graph). These are cooler months and correspond with holiday periods in the northern hemisphere, as well as some school holidays in South Africa and Namibia.

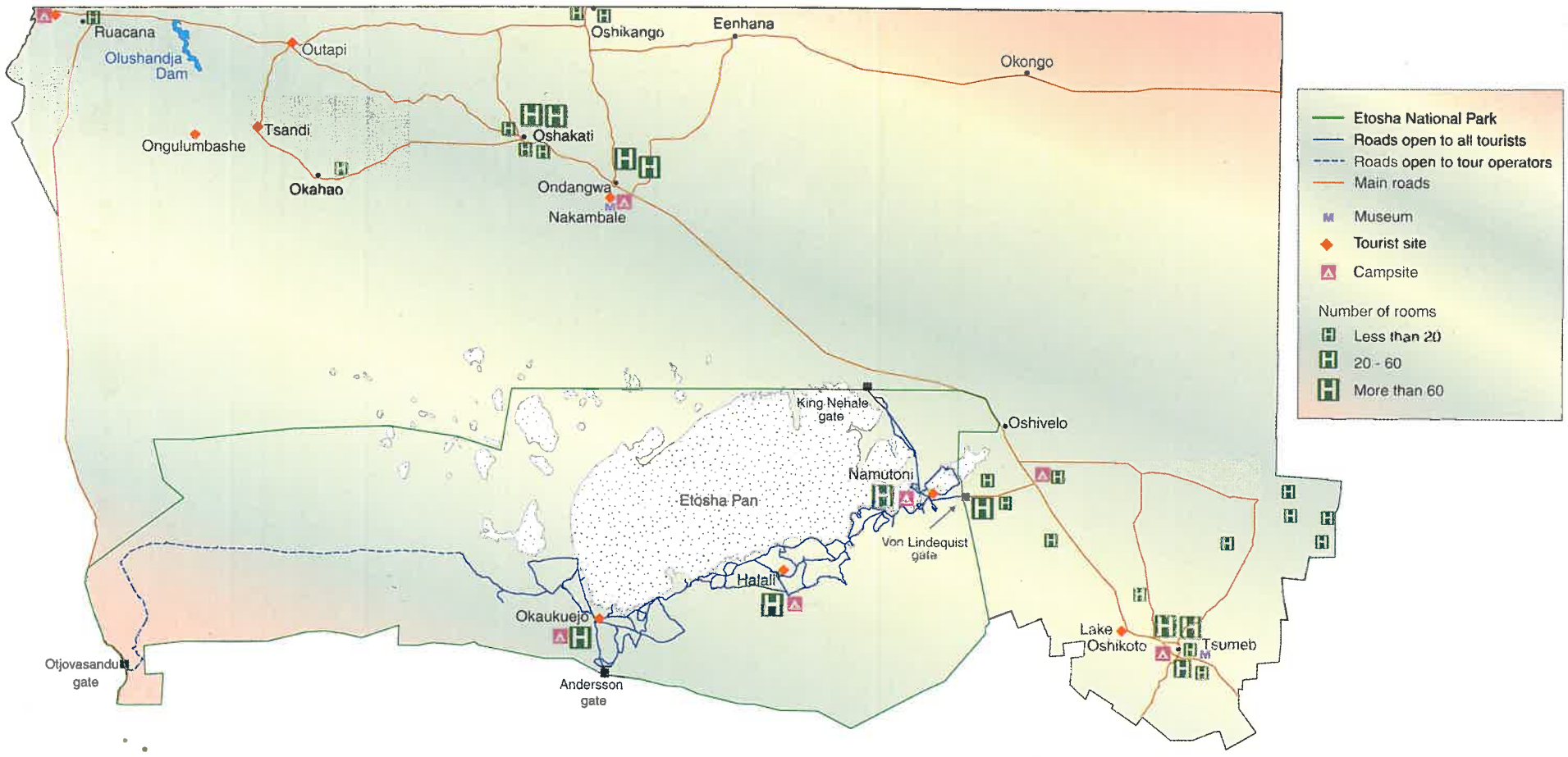
Of the 268,000 days and nights spent by tourists in Etosha in 1997, about 95,000 were spent by Namibian tourists and 173,000 by foreigners.[9] The amount of money spent by tourists varies a good deal, but ranges between estimates of N$151 and N$328 per day. If we assume that Namibian tourists spend the lower amount of N$151 and foreign visitors spend the higher amount, the total sum spent by tourists during visits to Etosha in 1997 adds up to about N$71 million. However, the value of tourism to Etosha lies not only in these millions. More importantly, it lies in the fact that Etosha adds value in making Namibia a worthwhile destination. Put in another way: without Etosha, far fewer people would know about Namibia, or be inclined to visit the country as tourists.

Over the years tourism to Namibia has increased dramatically, as has the number of visitors to Etosha (see the graph below). From just 6,210 visitors in 1955, numbers rose to a total of 193,000 nights spent by visitors in 1998. Since 1990, the number of people staying in the park has increased at a rate of 10% per year on average. Facilities are already often fully booked and, at projected increases of these rates, accommodation in Etosha will be completely inadequate by the year 2004.

The greatest increase has been in the number of day visitors, from 12,500 in 1989 to 81,200 in 1997, but then down to 41,600 in 1998. These are people coming into the park but not staying in one of the three camps. Most spend the night outside Etosha at one of the nearby lodges, and the presence of three such lodges near the eastern Von Lindequist gate probably provides a measure of competition for one of Etosha's own accommodation facilities, namely Namutoni.

Spotted hyena is a relatively common predator Etosha

Etosha provides one of the few sanctuaries for endangered black rhino

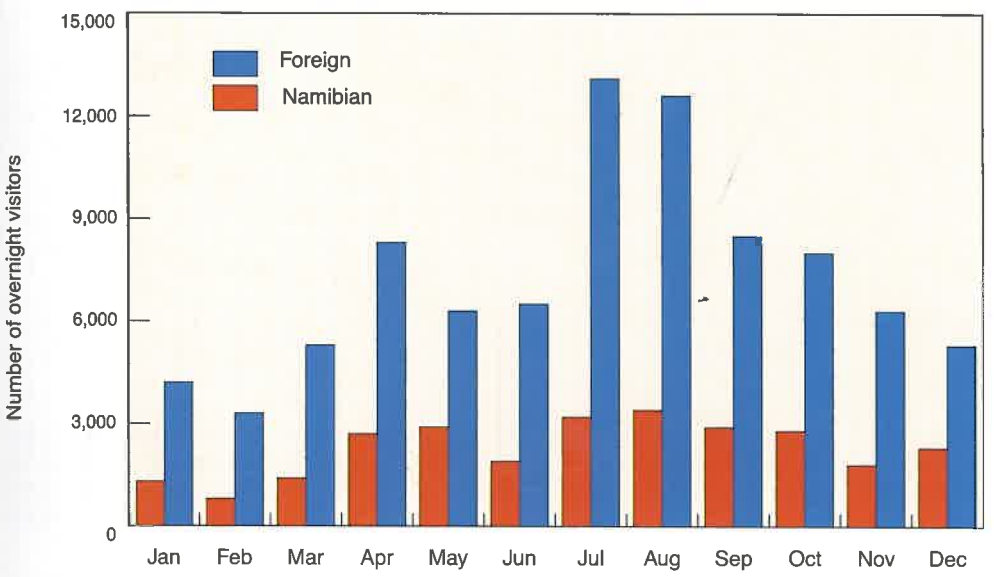


▲ ***Tourist sites and accommodation in the region***

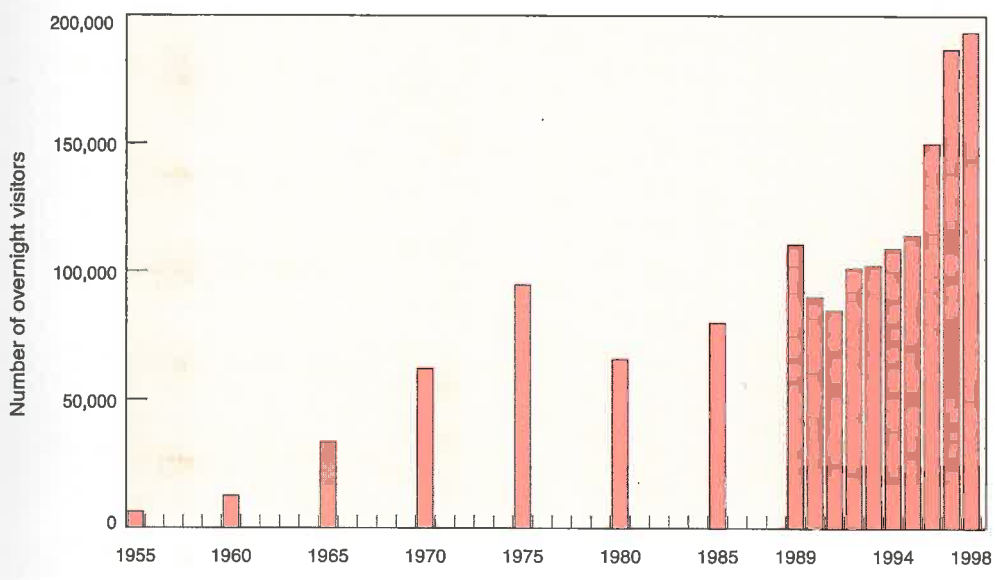
These three guest lodges and others to the south of the park are generally profitable, and some of their profits are made as a result of their close proximity to the park. These ventures are in contrast to conditions within the park, where little effort is made to generate more tourism income for Namibia. Some of that income could also be allocated to improve the maintenance and management of the park. There are a number of ways in which income could be increased. Some options include placing more of the operations of the park in the care of one or more private concessionaires, additional sales of surplus wildlife, and ensuring that entry fees are collected properly. It is estimated that N$15 million could be collected annually from entry fees alone, far more than the N$12 million annual budget for the park. In addition, the park is difficult to manage within the constraints of the civil service. Many staff members with good skills have been lost in recent years, and the ministry has been unable to replace that experience and competence. Bureaucratic problems add additional obstacles to the efficient running of the park.

Much more of the park could be opened for access to tourists. Although there are now about 800 kilometres of roads available for tourists to use, most roads are concentrated in one section of Etosha. At most, a fifth of the 22,900 square kilometres that make up the park can be said to be open to tourism. Some tourists travelling with registered tour companies are allowed to visit the western park, passing through the gate at Otjovasandu. However, the numbers of those tourists are small: some 530 vehicles carrying about 3300 people visited western Etosha in 1999.

A final big question concerns the possibility of seeing how the benefits of tourism can cross the fence into Owambo. Many thoughts are being given and initiatives started to increase the numbers of tourists that visit Owambo, primarily by publishing information on attractive venues, persuading tour operators to include Owambo in some of their packages, and by mobilising groups to set aside conservancies and community campsites. Proposals to open the new King Nehale gate near Okashana are well-advanced. Among sites that hold promise as attractions are Ongulumbashe (where the liberation war started), the Olukonda Museum at Nakambale near Ondangwa, the magnificent baobabs at Tsandi and Outapi, and the Olushandja Dam. As laudable as these efforts are, several difficulties stand in the way of their successful implementation. The first is that there are relatively few features in Owambo that will capture the imagination of many tourists. While the Cuvelai and oshanas can be attractive once it has rained well, for the remaining and greater part of the year the landscape can be very bleak indeed. There are a number of important and interesting historical sites, but most are small, and lack interpretive displays or competent guides. Finding your way to some sites may also be difficult. Communally-operated tourism ventures will be hard to run because of the diverse economic interests of people in those communities, making it difficult for people to agree on how things should be run for the common good. The best chances of success will be for organised tour groups to be guided around the region, but they will have to be guided by competent tour leaders who can provide a really interesting story about the people and their natural environment. Lastly, tourism is extremely sensitive to political instability, safety considerations and outbreaks of infectious diseases. The best intentions to stimulate tourism can be laid to waste by any event that jeopardises the potential pleasure of a holiday to Namibia.

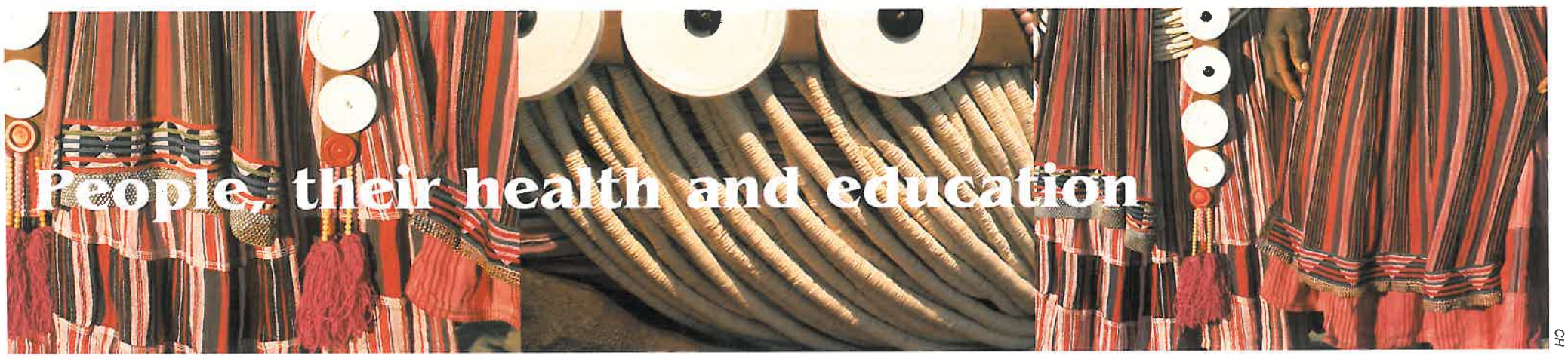


▲ ***Number of local and foreign overnight visitors to Etosha in 1997[10]***
Etosha is busiest during the months of July and August, which is when the foreign tourist season is at its peak. April, September and October are also very busy.



▲ ***Total number of overnight visitors to Etosha since 1955[10]***

The cheetah wearing the collar is the subject of a research project – the collar carries a radio transmitter enabling the animal's movements to be tracked



People, their health and education

CH

There are very few international borders, other than those that follow coastlines or major rivers, that can be seen clearly on satellite photographs. But the border between Angola and north-central Namibia is an exception, especially where the Cuvelai crosses it. The photograph, taken from a space shuttle, on the back cover shows how the pale, bare area south of the border stands in stark contrast to the darker, more wooded area on the Angolan side. This remarkable difference in vegetation cover is due to the very large numbers of people settled in the Cuvelai area of Namibia. Although it makes up only about 10% of the surface area of Namibia, the north-central region is now home to an estimated 786,500 people, about 46% of the total population of the country.[1] Many of these people are packed into relatively small areas, making the demographics of the north-central region both important and interesting.

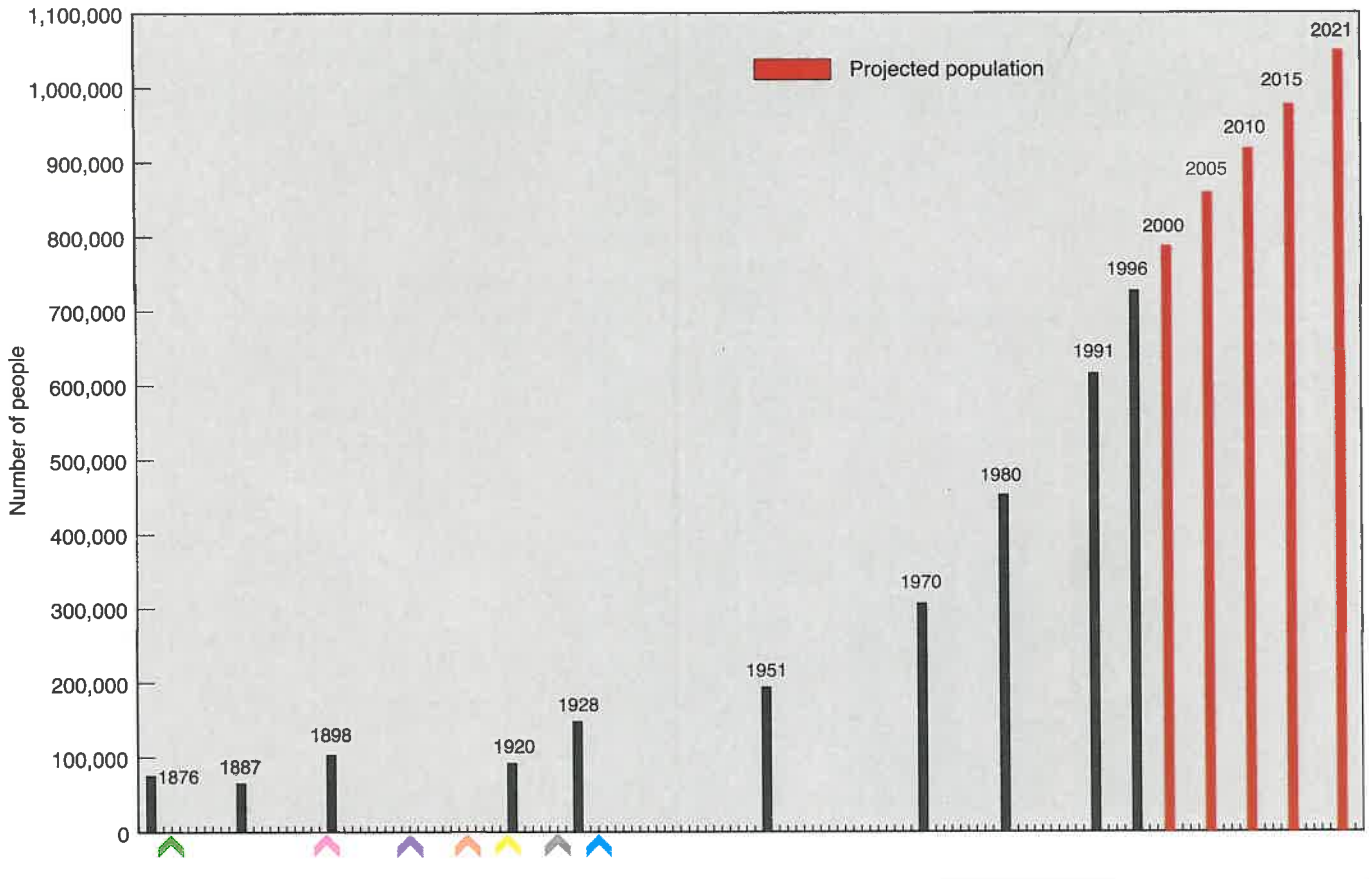
A number of recent estimates suggest that there are about 85,000 rural households in the region. There are no recent statistics for urban areas, but estimates from the 1991 Population Census that take into account rates of urbanisation, suggest that there might be at least 15,000 urban households. Most of these are in Oshakati (5000–6000), Ongwediva (1500–2000), Ondangwa (2000–2500) and Tsumeb (5000). Other smaller urban areas make up the rest of the urban population in places such as Okahao, Outapi and Oshikuku.

Changes in numbers of people

Populations in the region have changed in a variety of different and interesting ways. For a start, there have been rapid increases in total numbers, especially over the past 50 years. The estimated population of about 786,500 people in the year 2000 had grown at a rate of about 2.8% per year from 615,000 in 1991 and 452,000 in 1980, respectively. Dramatic changes to both the size and structure of the population are to be expected in the years ahead. Average annual growth rates are expected to drop to 2% due to changes in the rates of fertility and migration, and the effects of HIV in shortening life expectancies significantly.

The estimated number of people in each of the four political regions in 2000[2]

	Number of people	Percentage
Ohangwena	203,700	25.9
Omusati	240,900	30.6
Oshana	190,000	24.2
Oshikoto	151,900	19.3
Total	786,500	100.0



◀ ***Changes in population size since 1876, predicted population sizes up to 2021,[3] and a list of major famines and other events causing changes in population numbers***

1820s	Known as drought years
1877 - 79	Recorded as famine years
1896 - 98	Famine as a result of a rinderpest epidemic and massive locust attacks on crops
1907 - 08	Harvest destroyed by severe locust attacks, followed by a major drought during which an estimated 20,000 people died
1915	An army worm plague followed by drought caused a famine which reportedly killed over 20,000 people
1920	Reported as a famine year
1926	40,000 people fled from Angola to Owambo to escape Portuguese direct rule
1929 - 31	'Famine of the Dams', when people built dams during the first food-for-work programme. Large numbers of Kwanyama people moved to Angola during this drought

Children lined up to receive food during the 1929–31 Famine of the Dams

NAN

The current population has increased from less than 100,000 people in the last decades of the 19th century and the first few decades of the 20th century. Even though the earlier figures were perhaps rather rough estimates, the population declined at times in the early 1900s as a result of major famines. For example, over 20,000 people were reported to have died in 1907–08 and in 1915, amounting to a loss of perhaps about 40% of the total population over that period. Greater numbers of people than normal probably died during famines in other years, and the region also lost large numbers of Kwanyama people who moved to Angola during the 1929–31 drought.

However, large numbers of people have also moved into the region at times. An estimated 40,000 people fled the effects of direct rule by the Portuguese in Angola in 1926, and others moved in from Angola between the 1920s and 1950s to benefit from labour opportunities in Namibia. Good estimates of the number of people that went into exile during the liberation war are not available, but roughly 36,000 people are thought to have returned to the region before independence. About 13,000 people are reported to have been killed during that war, but then many children were also born in exile and returned to Namibia with their parents.

Projected changes, based on current estimates of fertility, migration and mortality and on assumptions about how these rates will change, take the region's population to just over one million people in the year 2021 – an average annual growth rate of some 2%. This rate can be expected to differ from region to region, and we can expect growth rates in Oshana (as a result of urban migration, page 41) and Oshikoto (as a result of new settlements, see below) to be greater than in Omusati and Ohangwena.

Changes in settlement patterns

The perspective on the distribution and density of people in 1998 provided by the map and on pages 38 and 39 is very different from that given by a map drawn in 1937 (see pages 78 and 79). Most people then lived in concentrated zones where fresh water was available in shallow wells, around what are now the well-known centres of Ondangwa, Oshikuku, Okahao, Tsandi and Onesi. Surrounding areas were mostly used for seasonal grazing, and there were just a few isolated villages scattered here and there. To gain a more detailed idea of how the occupation of different areas has changed in recent years, households were mapped and counted on aerial photographs taken in various years. This was done for five different areas selected to represent different kinds of landscapes and land uses. Cleared and fenced land was also mapped off the same photographs for four of these areas, and show the pattern of expansion of farmland (see maps on page 50).

There were few households in the Okalongo area in 1943 when much of that area was evidently used for seasonal cattle grazing. Rates of settlement then increased dramatically, with new households being established at an average rate of about 7% each year between 1943 and 1964. As the area became more and more settled, less space was available for new homes to be established and rates of increase dropped. The same was true for the area between Oshakati and Ondangwa, which has been well-settled for many decades, and where annual rates of increase dropped from about 5% between 1964 and 1970 to less than 2% between 1970 and 1996.

Both the Okalongo and Oshakati–Ondangwa areas are in the Cuvelai, where places to settle and plant crops are limited to the higher ground above the oshanas. The Tsandi area also saw high rates of expansion in the 1960s, with slower rates thereafter. Settlements are also limited to higher ground in the east of that area, whereas the western area consists of drier Kalahari sands where the little water available is often very salty. Again, suitable areas were occupied rapidly, leaving poorer patches uninhabited.

In the Okongo area, large areas of Kalahari sands also limit the distribution of settlements to old pans that have soils suitable for crop cultivation. The higher rates of settlement of 6–7% per year between 1964 and 1972 were followed by lower rates (about 3%), as suitable areas in which to settle were already inhabited. All the larger old pans are now occupied, so any new households have to be established on their edges or on small, isolated old pans where soils may be poorer and where there is less access to water and services.

The fifth area, around Onankali, continues to experience the kind of rapid increase that was seen in earlier years in the other four areas. Between 1964 and 1972 and between 1972 and 1996, the rate at which new homes were established has been at about 7% per year. The pattern of expansion has been dramatic as new homes and fields have spread out eastwards. Similar patterns hold elsewhere in the Oshikoto Region, where there is a front of new settlements expanding eastwards, perhaps now 50–80 kilometres wide to the east and parallel to the main Oshivelo–Ondangwa road. This area in Owambo is the one most likely to show the most rapid increases in population in the years to come.

Population density

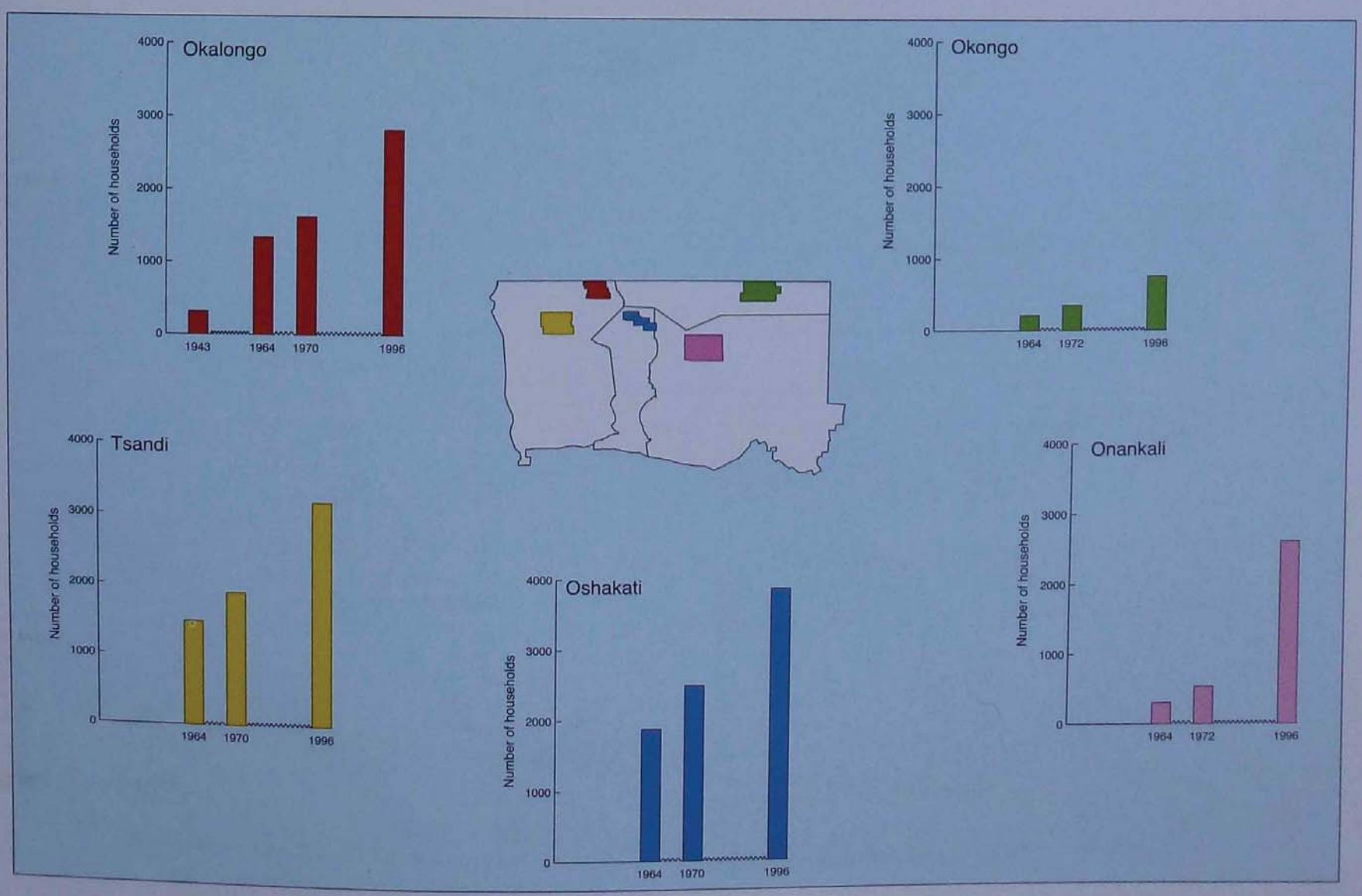
The map on pages 38 and 39 provides detailed information on the density of people in the region in 1998. Apart from the very high population densities in formal towns, three distinct patterns of settlement and density are evident.

The first consists of the sprawling and densely populated Cuvelai, where densities average about 40 people per square kilometre. This area is also characterised by the relatively even spacing between households. Outside the larger settlements and towns, the highest concentrations of people in the Cuvelai reach densities of 100–300 people per square kilometre. Such densities are found in western Ohangwena and eastwards towards Ondobe. There are other, smaller zones of extremely high densities along the road between Ondangwa and Oshakati, north-east of Outapi, and south-east of Tsandi.

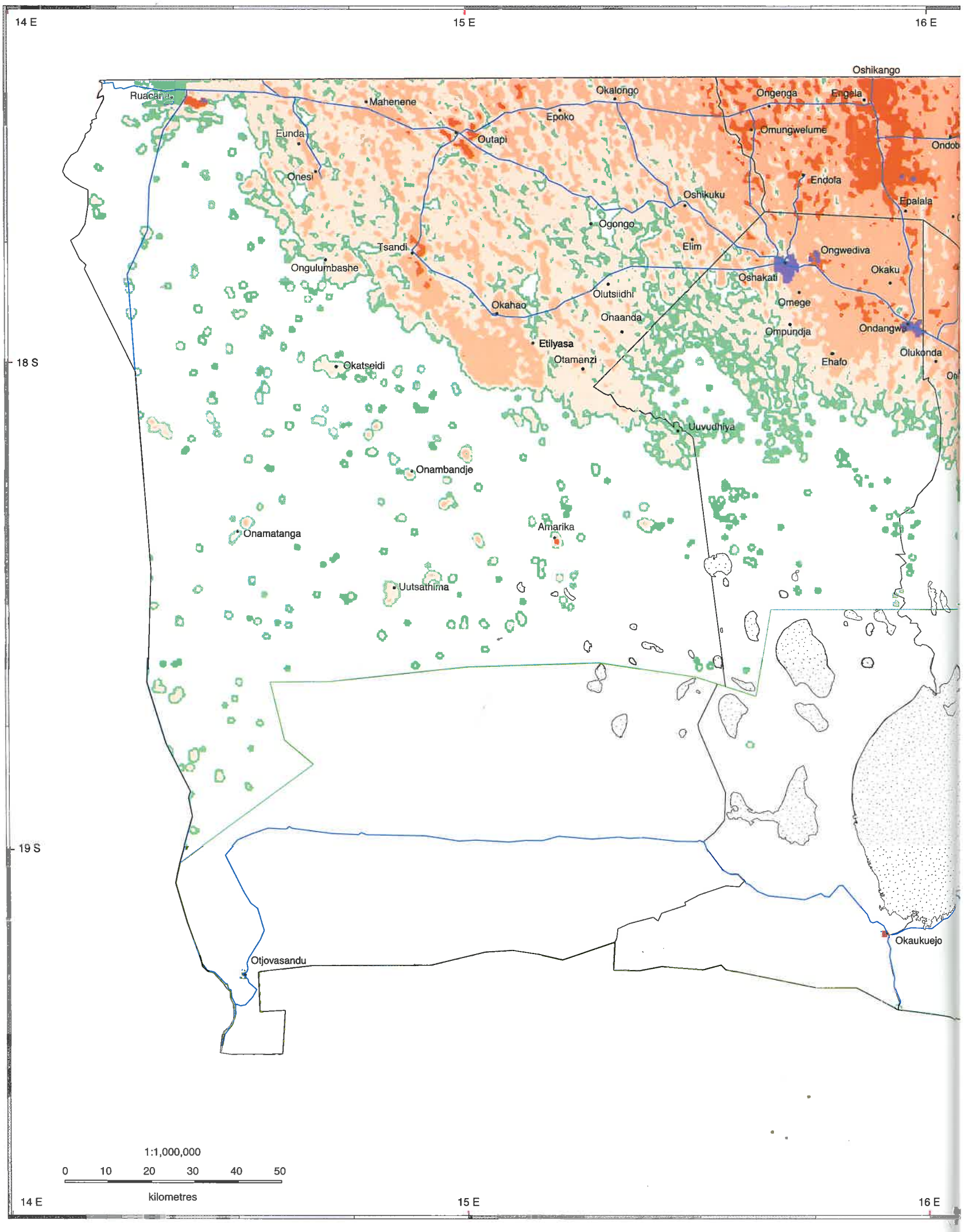
Concentrations of 40–100 people per square kilometre are found in and around a large area stretching from Onayena and Onethindi in the south-east, west to Oshakati and Elim, north to Omungwelume and then east to Ondobe and Oshandi. Other areas with such significant concentrations are found around Onankali, Omuthiya, Okahao, and on the upper oshanas along the northern border of the Cuvelai from Omungwelume in the east to Mahenene in the west.

Average percentage increases in the number of households each year in five areas over the last few decades[4]

Time interval	Percentage increase in household numbers					
	Okalongo	Tsandi	Oshakati	Okongo	Onankali	All areas
1943–64	7.1					
1964–70/72	3.2	4.2	4.8	6.5	7.3	3.5
1970/72–96	2.1	2.0	1.7	3.2	6.8	3.2



▲ ***Changes in population distribution and the number of households in five different areas in Owambo over the years[4]***

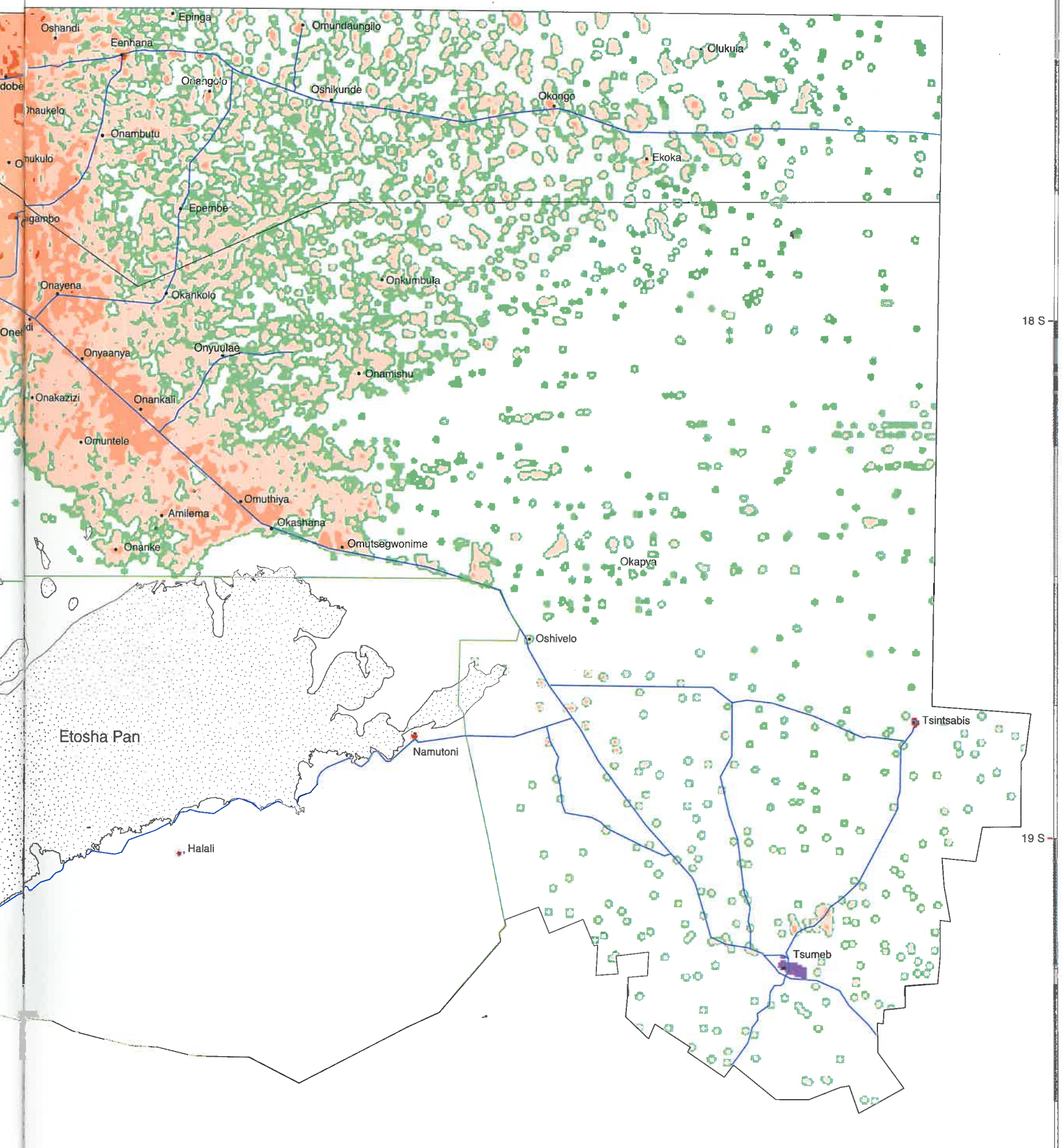


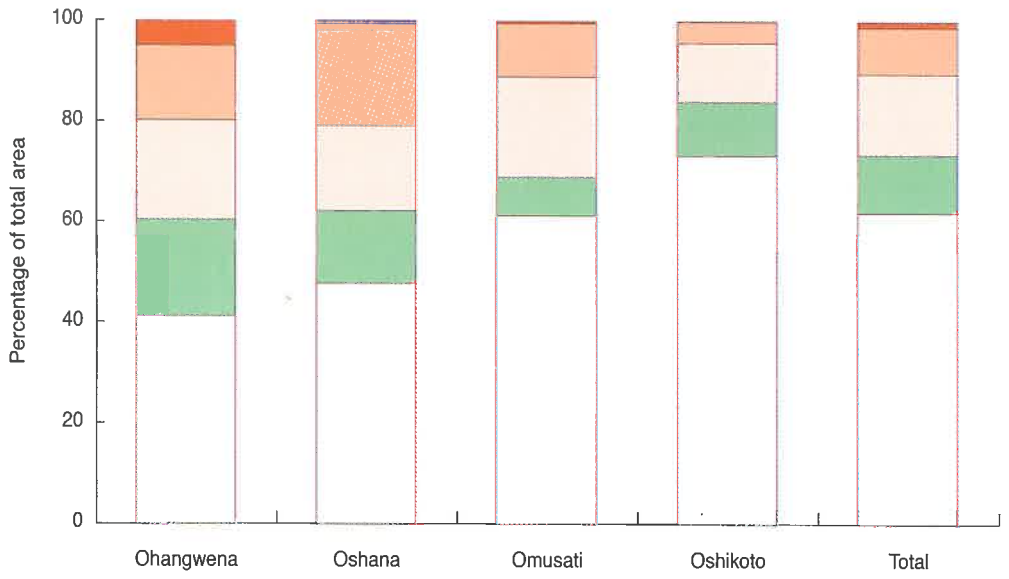
▲ *The distribution and density of people in 1998*[5]

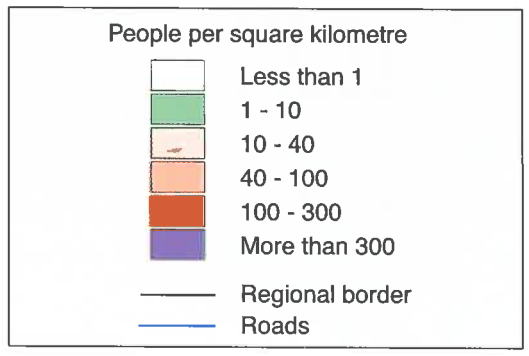
As one moves away from these densely populated areas, the density in much of the Cuvelai drops to 10–40 people per square kilometre. This, too, is the density found over much of the area where the second density pattern holds. This pattern is more patchy. Small concentrations of people form distinct villages in central Ohangwena and north-eastern Oshikoto to the east of the Cuvelai. The average population density over this area is about six people per square kilometre. The households are concentrated in small areas, giving these settlements distinct limits or boundaries. The villages are at the sites of old pans, where water can be obtained from hand-dug wells and where crops can be grown on soils that are more clayey than the surrounding Kalahari sands. In Ohangwena the villages tend to be larger, both in the area they cover and number of people they support, because the pans around which they have formed are larger. Further south in Oshikoto, many tiny villages have been built on much smaller pans, most of which support a mere handful of families.

The third pattern of population density is made up of the large, very sparsely populated areas remaining. Except for a few larger villages in south-western Omusati, the settlements are tiny. These are separated by huge open spaces where no one lives. A large proportion of the settlements in Owambo are cattle posts in grazing areas and on the fenced-off farms in southern Omusati and eastern Oshikoto. The isolated settlements on the Tsumeb farms are either farmsteads or cattle posts. The camps for tourists and management staff at various places in Etosha are also visible as small concentrations of people. In a sense, most of these remote settlements are artificial because they have developed to serve the needs of farmers or visitors that have their permanent homes elsewhere.

Densities change gradually from points of high to low concentration in many areas, for example along the road from Engela to Ondobe and on to Eenhana. In others, however, there are sharp changes in density over short distances. Perhaps the most striking of these is the sharp edge running south-east from the Onesi area to Tsandi, Okahao and Otamanzi. The area to the east of the line has densities of 10–100 people per square kilometre, while that to the west, because there is little fresh water in that area, has just a few small, scattered households. Another spectacular contrast is between the dense settlements around Omuthiya and Okashana and the unpopulated Andoni grasslands north of the Etosha fence. Crops cannot be grown on these grasslands because the soils are salty and contain hard layers of clay (see pages 18 and 19).







▲ ***Proportions of each of the political regions (outside Etosha) that are populated at different densities***
Each of the political regions has some areas with very high densities and other areas where no one lives. Average population densities outside Etosha are 25 people per square kilometre in Oshana, 21 in Ohangwena, 12 in Omusati and 6 in Oshikoto. Again, outside Etosha, more than 40% of all four regions have densities of less than one person per square kilometre. Ohangwena, Omusati and Oshana also have more than 30% of their areas occupied by more than ten people per square kilometre, while Oshikoto has just 16% of its area populated at those densities.

Population structure

The combined effects of births, deaths and migration determine the size as well as the structure of any population. Generally, populations around the world have roughly equal numbers of men and women, and the numbers of people in different age groups decreases from the youngest members of the population to the oldest, giving the typical pyramid shape. Age pyramids for the north-central region, however, differ radically from this standard shape, reflecting some of the features peculiar to the population there.

There are more women than there are men, so the female side of the pyramid is broader, especially for women between the ages of 20 and 60. This is because more men than women move away to work elsewhere. Overall, 45.2% of the total population in the region are men and 54.8% are women.

The broad bases of the regional age pyramids reflect the massive populations of young people. These large populations of children are followed by a sharp decline in the number of young adults once they reach employment age. This is especially true for Ohangwena, Oshikoto and Omusati. The higher numbers of elderly people in Ohangwena and Omusati reflect the return of many people to retire in their rural homes.

The age structure of urban populations is very different from that of the rural population, towns being completely dominated by people aged 15–35, especially women of those ages. The main urban areas of Oshakati, Ongwediva and Ondangwa are all in Oshana, giving that political region a far higher percentage of urban dwellers and an age structure that appears more 'normal' than in the other political regions. This is because many young adults move to these large towns in the Oshana Region in search of work.

Fertility rates

Fertility rates are a measure of the expected number of children a woman is likely to produce on average during her life. These rates decreased markedly between 1991 and 1996, by about 10–15% in Ohangwena, Oshana and Omusati, and by an amazing 30% in Oshikoto. Several reasons might explain the reduction: an increase in levels of education with more educated people having fewer children, the effects of family planning programmes, and the movement of people from a subsistence to a cash-based employment economy. There is also the possibility that fertility levels were unusually high in 1991, following, as it did, the year of independence and that period of excitement. The decline in fertility rate from 1991 to 1996 is reflected in the lower numbers of infants to four-year-olds compared with the numbers of five- to nine-year-olds in the regional age pyramids. This trend is seen throughout Namibia; fertility rates for the country as a whole dropped from 6.1 children in 1991 to 4.7 in 1996, and are expected to fall to 3.0 children by the year 2021. For the four north-central regions, fertility rates are expected to fall to 4.0 by 2021.

Fertility rates in 1991 and 1996

	Fertility rates	
	1991	1996
Ohangwena	7.7	6.9
Omusati	5.7	4.9
Oshana	5.6	4.8
Oshikoto	6.7	4.7

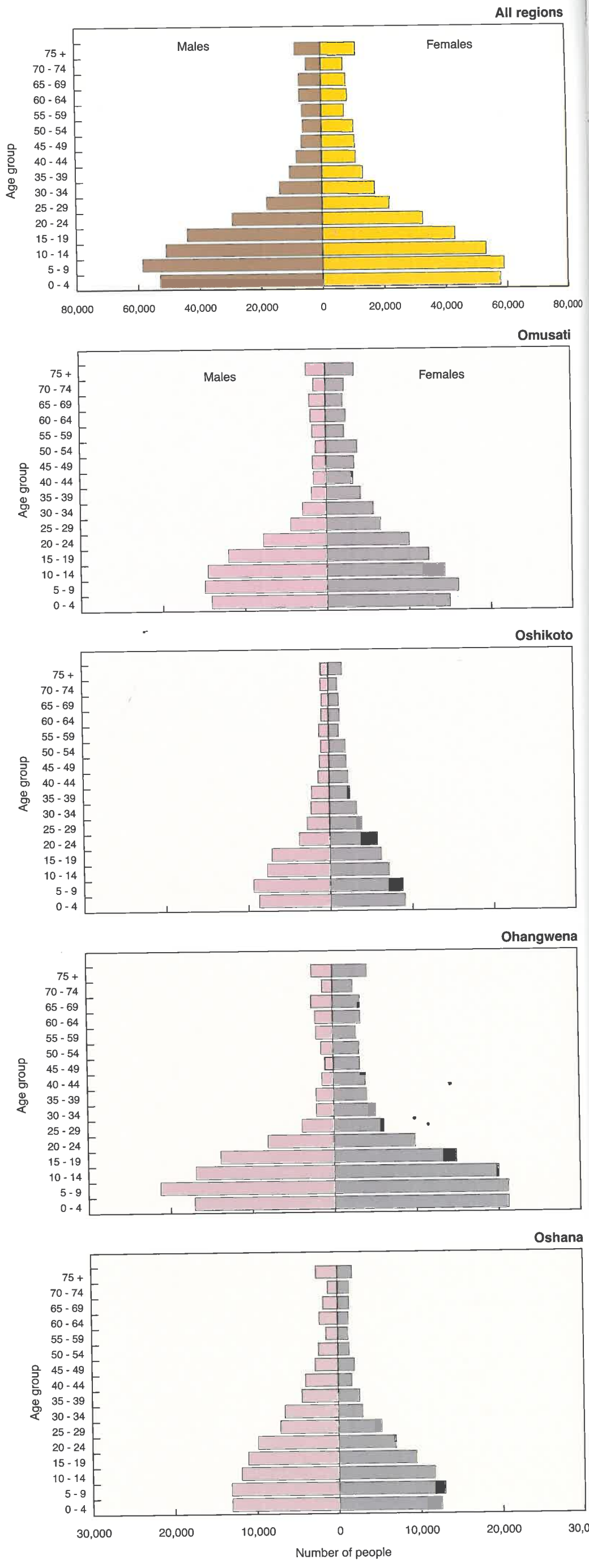
Migration

Migration patterns have had a major impact on the size and structure of the population in Owambo. On the one hand, many people have immigrated to the region, mainly large numbers of Angolan-born settlers. In 1991, there were 42,500 Angolan-born people living in Owambo, making up about 7% of the population there at that time. That may be a considerable underestimate if people were reluctant to declare that they were born outside Namibia. Of those that are Angolan-born, about 4300 were living in towns. In Oshakati, they made up over 10% of the town's population.

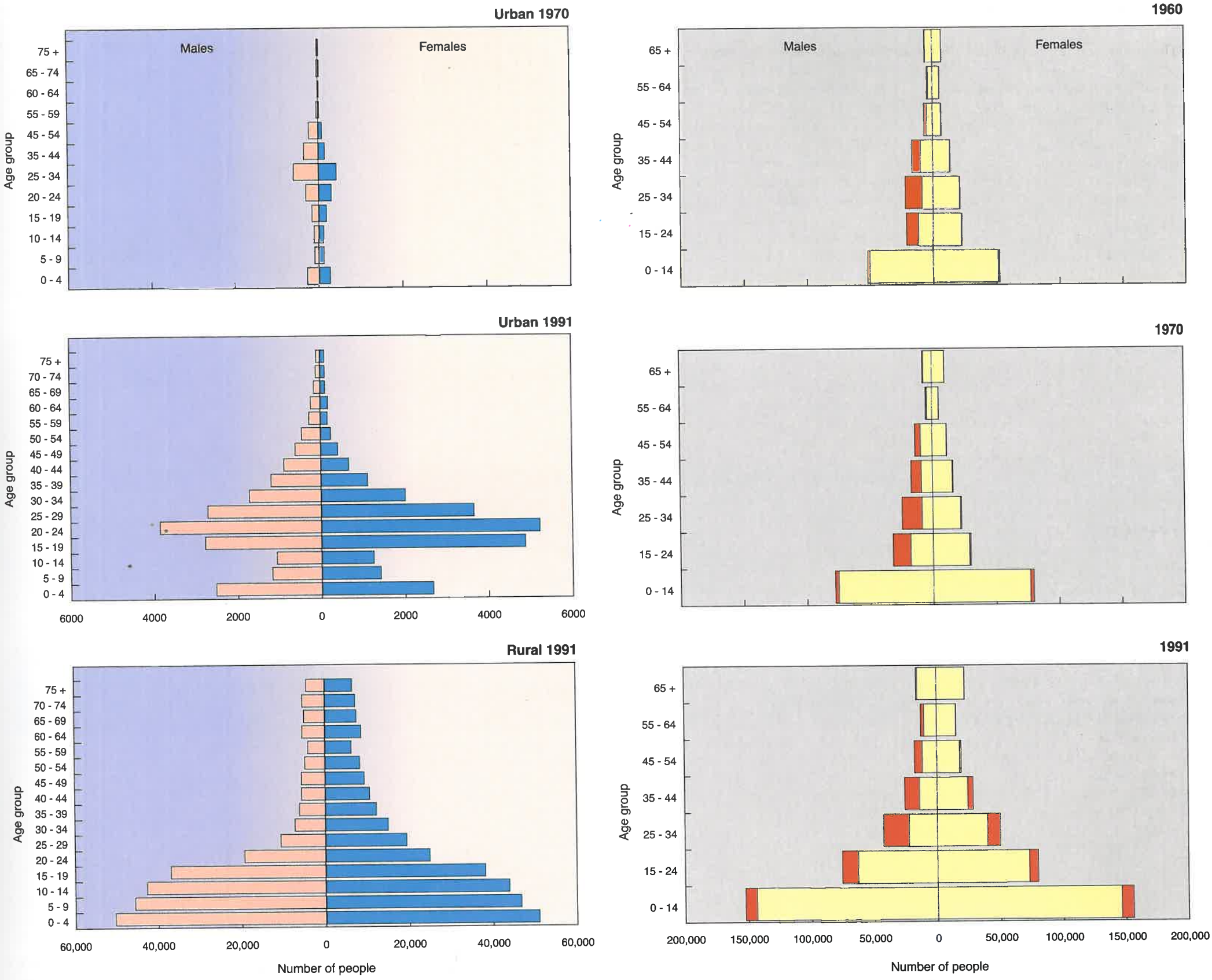
On the other hand, migration out of the region has also happened, and that on a very large scale indeed. As reported in the 1991 census, about 86,500 Owambo-born people had left the region, amounting to over 13% of the total Oshiwambo-speaking population. Of those, some 34,600 were living in Windhoek, especially in Katutura. Other major destinations were Grootfontein (6500 people), Lüderitz (2500), Okahandja (4600), Oranjemund (3500), Swakopmund (6200), Tsumeb (5600) and Walvis Bay (4000).

It is clear that most people leaving the region do so to gain employment, either in the formal sector or as informal businessmen and -women. As a result, most migrants are younger people, especially men between the ages of 25 and 44. These patterns are seen in the age pyramids on the next page, where over 45% of men and 15% of women aged 25–44 were living elsewhere. Because many men later return to Owambo to retire, percentages of men living elsewhere drop from over 45% in the 25–44 age group to about 35% of those aged 45–54 and 21% of 55–64-year-olds. The greatest impact of these high rates of migration is that there are relatively few younger adults available in the region to provide productive labour.

Patterns of labour migration have obviously changed a good deal since the earliest labour migrations to plantations in Angola more than a hundred years



▲ ***Age pyramids showing numbers of people in each five-year age category, in the north-central region as a whole, as well as in each of the four political regions, 1996[6]***



▲ *Age pyramids showing numbers of people in different age categories in urban (1970 and 1991) and rural (1991) areas*[6]

▲ *Age pyramids showing numbers of Oshiwambo-speaking people in different age categories living in Owambo (yellow bars) and in other areas of Namibia (red bars) in 1960, 1970 and 1991*[6]

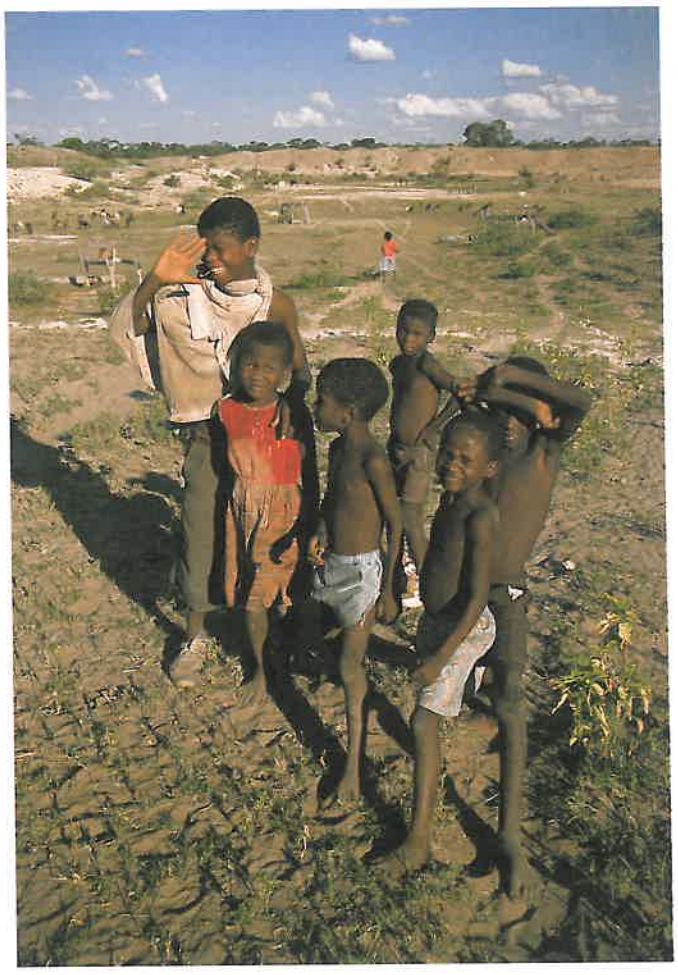
ago (see the map on page 62). Unfortunately, we know little about just how many people were involved in those early migrations, who they were and what impact their absence had on the structure and economy of the population. There is evidence, however, to show that migration patterns have changed in several interesting ways in recent years. Perhaps the most notable of these changes is that women have only recently started to migrate in large numbers, as seen clearly in age pyramids for populations in 1960, 1970 and 1991. In 1960, less than 2% of all Oshiwambo-speaking women in Namibia lived outside the north-central region. That percentage increased to 3% in 1970 and to nearly 9% in 1991. By contrast, proportions of men living and working elsewhere declined from about 26% in 1960 and 1970, to about 18% in 1991. In 1960 and 1970, over 60% of all men aged 20–35 were outside Owambo, and that percentage dropped to below 50% by 1991. Unfortunately, figures on the age and gender of the region's population are not available from the 1981 census results, so we cannot be more precise about when those changes occurred. We should also note that the figures for 1960 and 1970 were collected before the large-scale exodus of people into exile had begun.

Urban-rural migration

Apart from movements out of the region, there is also a very substantial degree of migration from rural to urban areas within the region, in particular to the towns of Oshakati, Ondangwa and Ongwediva. Ongwediva did not exist as a town until 1971, and by 1991 had a population of about 6200 people. Oshakati's population grew from about 3700 people in 1981 to 21,600 in 1991, while the population of Ondangwa increased from 1000 people in 1981 to 7900 in 1991. As can be imagined, the area covered by these towns has increased dramatically (see page 46).

Not only have more women been moving out of the region in recent years, but more women have also been moving to the urban areas of Oshakati and Ondangwa. In 1970, the majority of people in towns were men, but that dominance was reversed in 1991 when the majority of urban residents were women. The higher numbers of women seeking jobs elsewhere is probably due to the fact that large proportions of women now complete their schooling (see page 44), better equipping them to enter the labour market. For men, the increasing level of economic activity in the region perhaps provides them with better business opportunities that they can exploit, encouraging them to stay.

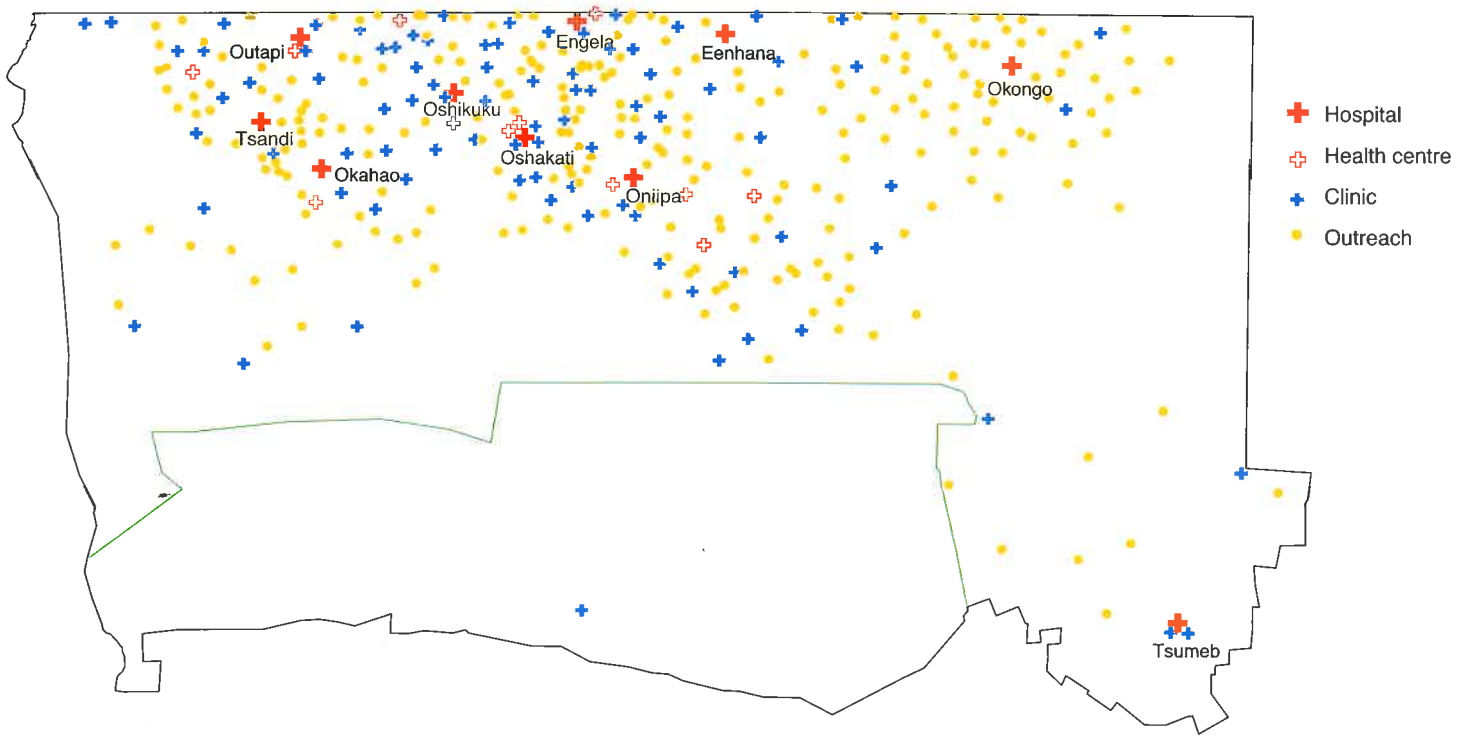
In 1991 the percentages of women and men in urban and rural areas were the same as those for the overall population: 54.8% women and 45.2% men. However, unlike rural areas, where there were more female-headed households (55%) than male-headed households (45%), men headed more households (56%) in urban areas. That reverse in pattern is due to the fact that more men in urban households are resident as businessmen and employees. By contrast, most rural men that are engaged in similar economic activities are absent from those rural homes.



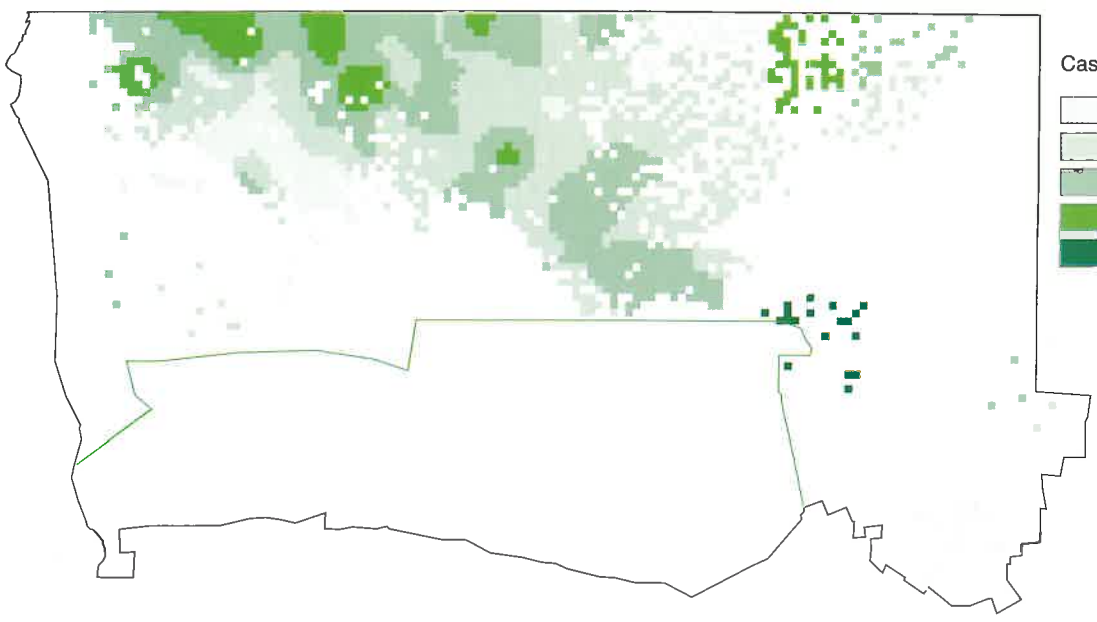
Even though large numbers of children are a feature of a population that has been growing rapidly, fertility rates have fallen in recent years

Health

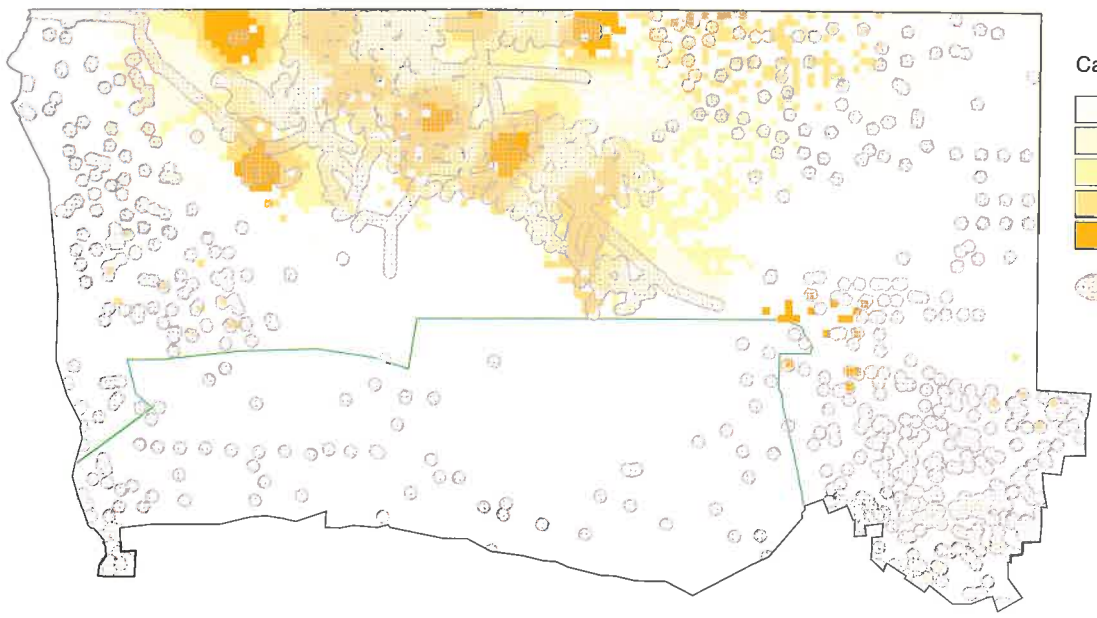
Medical and other social services for much of the region have been limited and remain inadequate in many respects, despite the government's efforts to improve these in recent years. A host of health problems are found in the region. Infection by HIV, which develops into AIDS, is on the increase and is expected to have dramatic effects on the size and structure of the population in the coming years. Tuberculosis and malaria, which is prevalent during the warm, wet summer months, are also responsible for many deaths. Diarrhoea is widespread despite advances made in the supply of safe water to a large proportion of the population (see pages 16 and 17). In addition, bilharzia is a local problem around the Olushandja Dam, where over half the children are infected with the parasite.



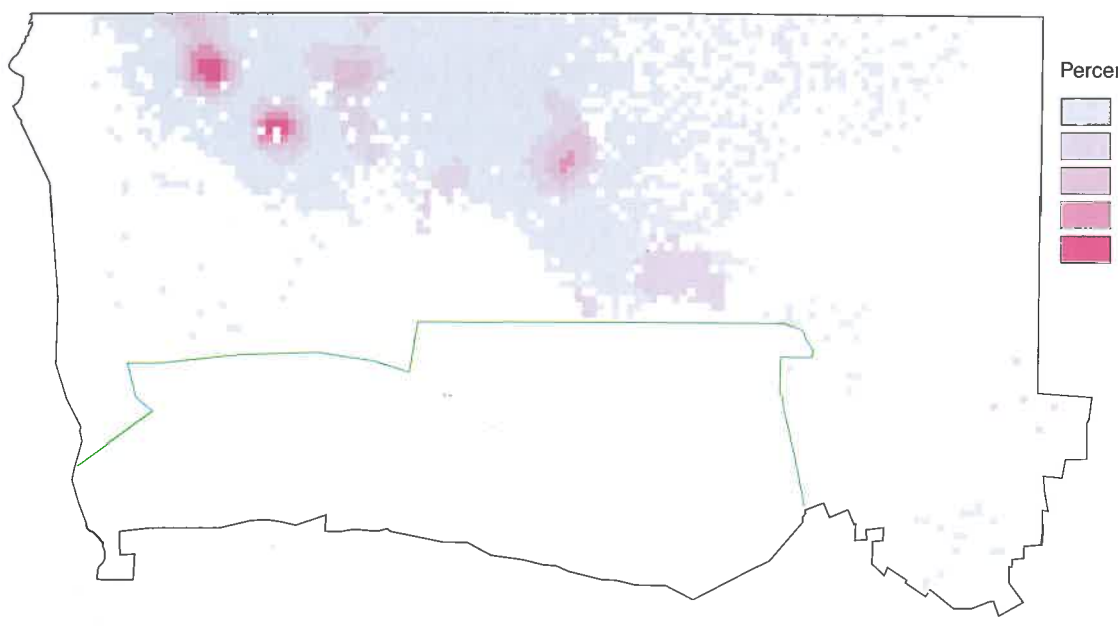
▲ ***Distribution of health facilities***[7]
Health facilities in the region now comprise 10 hospitals, 12 health centres and 86 clinics. In addition, staff at clinics travel out to over 260 outreach centres to provide medical services to people in remote villages. Only hospitals and health centres have beds where patients can be accommodated.



◀ ***Incidence of malaria, 1998***[8]
Malaria ranks as the third most important cause of death in Namibia, following AIDS and tuberculosis. While the majority of people infected by malaria do not die, they are weak and sick during the days that it takes to recover. Malaria occurs throughout the region but is less of a problem in areas such as Etosha and the Tsumeb farms, where population densities are lower. The disease is most prevalent during the warmer, wetter summer months when there is more standing water for mosquitoes to breed. Rates of malaria infection vary from year to year, with the highest rates being seen in years with the highest rainfall.

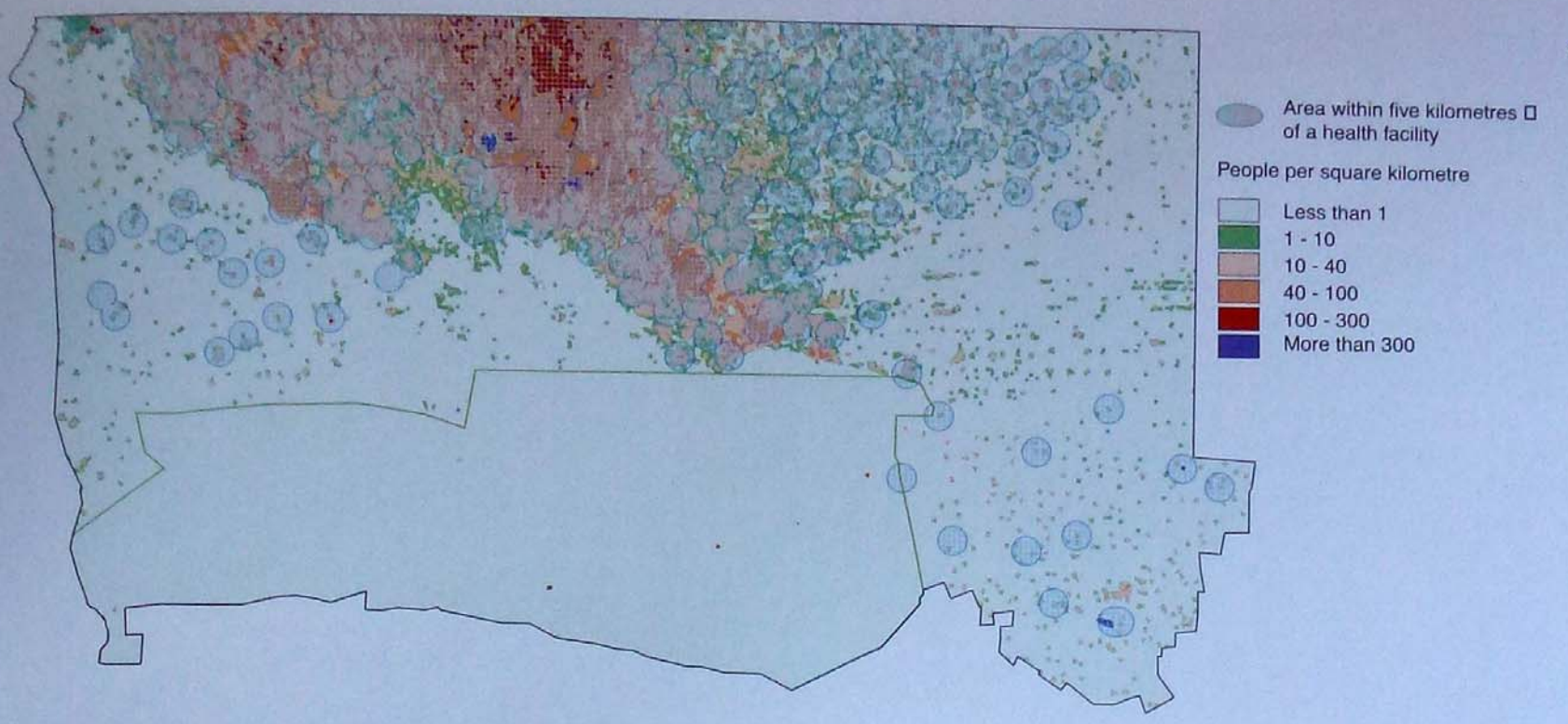


◀ ***Incidence of diarrhoea in relation to the availability of safe water, 1998***[8]
One aim of piped water supply systems and the pumping of groundwater from deep boreholes is for people to have access to 'safe' water, free of infectious diseases. Ideally, safe water should be available within two-and-a-half kilometres of people's homes, and the map shows the area within that distance from existing pipelines and boreholes. Diarrhoea is often the result of drinking contaminated water, but the map indicates that it is about as common near sources of safe water as it is in areas where clean water is not provided. The supply of safe water is, therefore, not in itself sufficient to prevent the high rates of diarrhoea in the region.



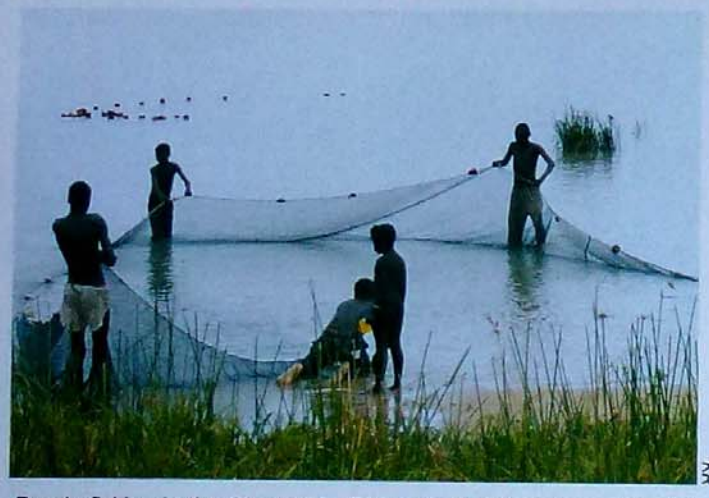
◀ ***Distribution of underweight children under the age of five, 1998***[8]
Malnutrition is not as prevalent as in some other rural communities in Namibia, but it is clear that a significant number of children do not have enough to eat. In one study, about 13% of babies born were reported to be underweight, and high incidences of acute respiratory infections and goitre are associated with inadequate diets. Routine measurements taken at health facilities in 1998 indicated that about 2–3% of all children under the age of five were underweight.

Comparing the proportions of underweight children with population densities suggests that the highest rates of malnutrition are found in areas where there is also a high density of people rather than in the most remote villages. That relationship may be the result of poor homes having less access to farm products as populations increase and wealthy households use more natural resources. Most poor families also lack the means to move to places where pressures are lower and better natural resources are more freely available. A notably high rate of malnutrition appears to be present amongst children at Tsintsabis, where most of the population consists of resettled San people.



Access to health facilities[7]

A theoretical catchment area to estimate the number of people within reach of medical facilities encloses areas within a radius of five kilometres from any health facility. Overlaying those zones on maps of households indicates that about 618,000 people (82% of the population in 1998) live within five kilometres of a health facility. The majority of the remaining 18% not readily served by medical services are in densely populated areas in Oshana and Omusati. Also not served are many people in central Oshikoto, where populations are expanding rapidly.

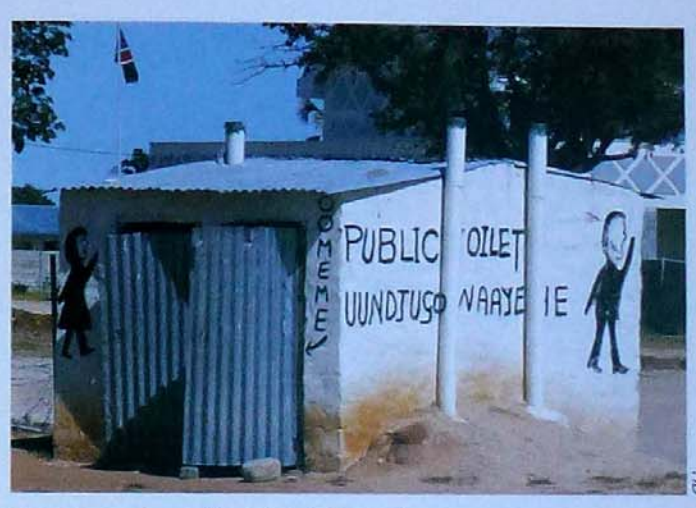


People fishing in the Olushandja Dam are at risk of being infected by bilharzia parasites

KR

Even though clean, piped water is nearby, people often use untreated water from open water sources

EPP



One of very few public toilets in the region

HD

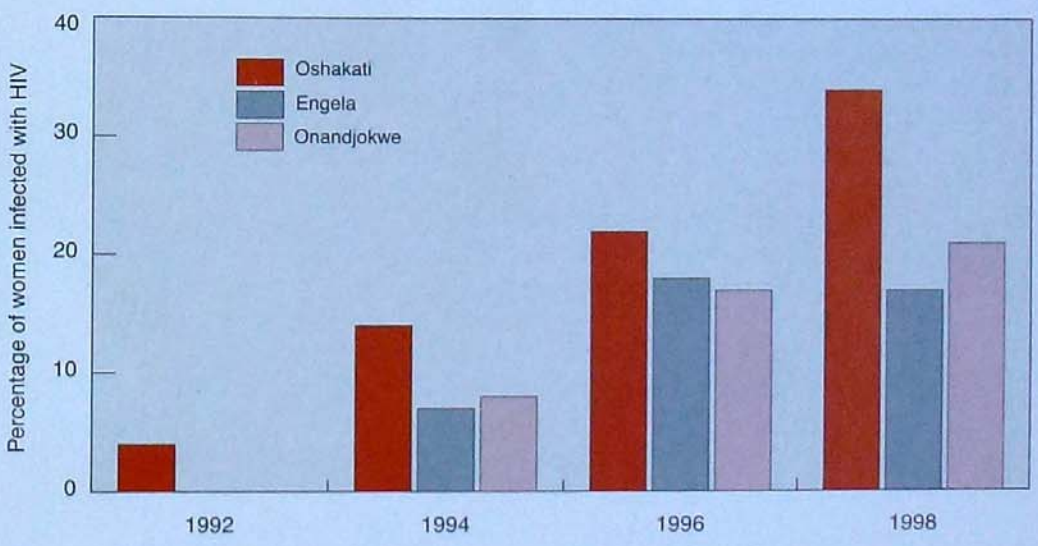
HIV and AIDS

The most recent estimates, obtained in 1998, suggest that slightly more than 24% of all people in the region were infected with HIV, equivalent to one out of every four people. In the absence of any noteworthy changes in sexual behaviour or availability of medical cures, such an infection rate is likely to have a dramatic effect on the growth of the population. Of further concern is the possibility that the rate of infection will increase, continuing the rapid growth in rates of infection in recent years. Most HIV infections in Namibia occur during heterosexual encounters, and rates of infection are closely related to the prevalence of other sexually transmitted diseases, such as syphilis and gonorrhoea.

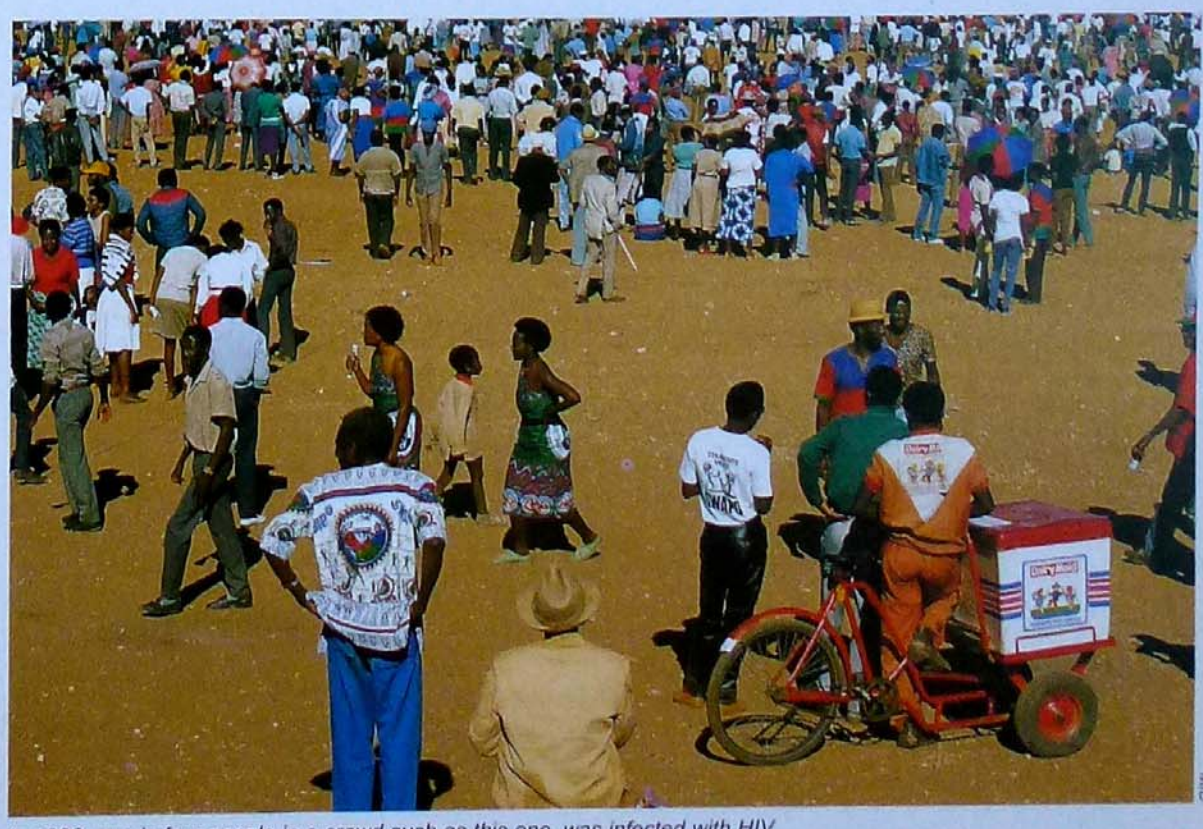
The growing effects of AIDS are evident from the increasing rates of infection among pregnant women and the number of deaths caused by the disease. In 1996, 551 people died of AIDS in the region, 814 in 1997 and 1147 in 1998. The 1998 figure was double that of 1996. If the number of deaths continues to rise at that rate, over 140,000 people in the region will have died from AIDS by the year 2010.

As a result of AIDS, life expectancy has started to drop significantly and current predictions suggest that life expectancies will drop dramatically until 2011 and then increase as a result of changing sexual behaviour. From an expected lifespan of about 60 for men and 65 for women in 1996 for the north-central region, by 2011 the average man will only live for 38 years and the average woman 40 years. Average lifespans will, thus, be about one-third shorter than they are now. By 2021, life expectancies are hoped to have increased to approximately 48 years for men and 50 for women.

The future effect of HIV/AIDS on the population provides one of the biggest challenges facing the region. For a start, the disease will have a major impact on the growth and age structure of the population, as a result of the decline not only in life expectancy, but also in fertility. There will also be many tens of thousands of orphans, and just who will take care of all these children remains to be seen. The costs of medical care will increase dramatically, and much greater demands will be placed on existing medical facilities. One of the greatest losses will be in economic productivity, both as a result of deaths and the weakness that people suffer once the effects of the disease take hold. This loss will be especially severe because the disease is most prevalent amongst younger, educated and economically active people – exactly those who give the region such a dynamic economy.



▲ ***Increasing rates of HIV/AIDS infection among pregnant women at Oshakati, Engela and Onandjokwe hospitals from 1992 to 1998***



In 1998, one in four people in a crowd such as this one, was infected with HIV

MB

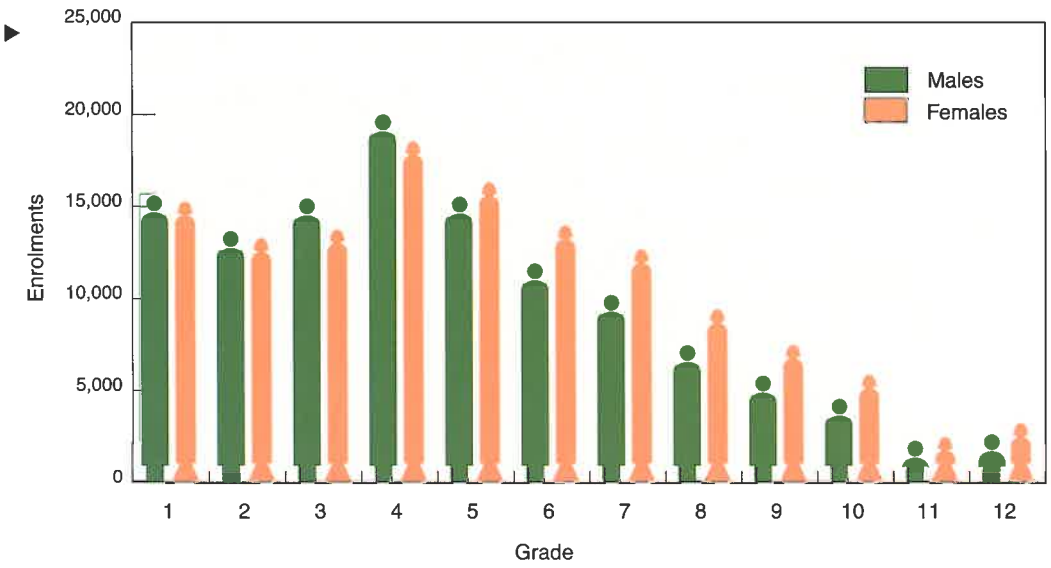
Education

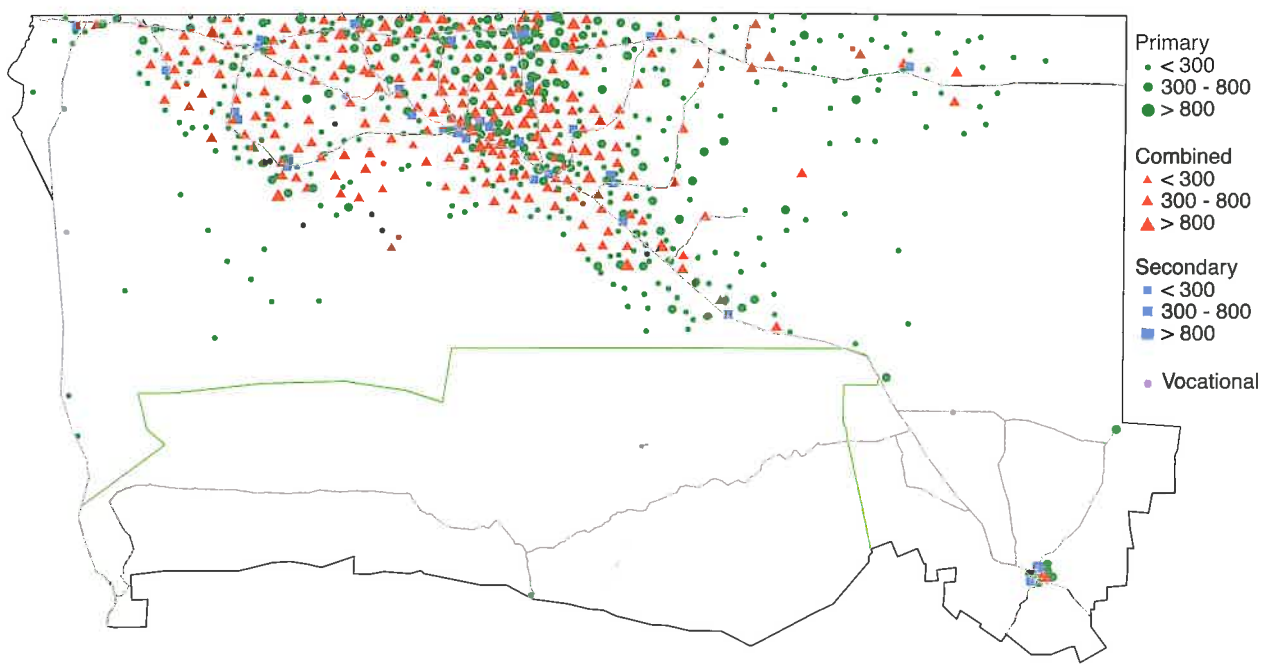
There is a high demand for education in the region, a deeply-rooted demand that goes back to the turn of the 19th century when the first mission schools were established. Parents have started almost all rural schools as privately run, community-based initiatives, and these schools now make up about 95% of the total in the region. Most schools were later registered with government, and provided with teachers, furniture, books and stationery. As they grew, many schools were transformed from traditional structures of poles and thatch into brick classroom buildings. High demands for education are also reflected by the very high school attendance rates in the region, with enrolment rates of 7- to 16-year-olds being about 95% for both girls and boys. The Namibian Constitution declares that all children should be at primary school until they reach the end of Grade 7 or the age of 16, whichever comes first. That goal has thus almost been met.

In 1999 about 269,000 pupils were enrolled at the 709 schools in the region. These comprise 446 primary schools, 229 combined schools (those that offer both primary and secondary education), and 34 secondary schools, but only some offer the full range of either primary or secondary grades. There are also two vocational colleges: the Valombola Technical Institute at Ongwediva and the Ogongo Agricultural College. The University of Namibia has a satellite campus at Oshakati.

While most children attend school, many do not progress through the grades as they should. Children are held back several times during their careers and, therefore, take many years to complete their schooling. Most grades thus have many children that are much older than they should be, and many more places, teachers, classrooms, books, etc., have to be provided than should be necessary. Attempts have been made to reduce this over-enrolment by making promotion from one grade to the next automatic in most cases. Despite this, schools remain heavily over-enrolled, especially in Grades 3, 4 and 5.

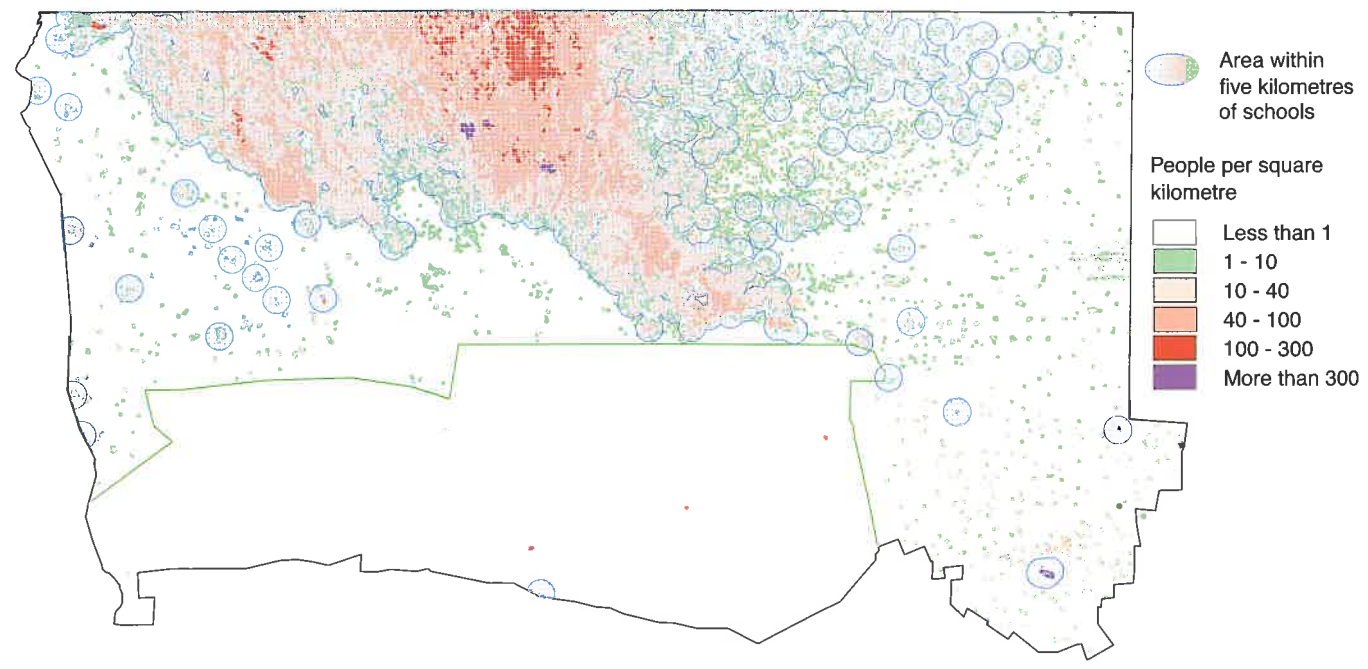
Number of male and female pupils enrolled in Grades 1 to 12, 1998[9] ▶
Although many children drop out of school before reaching Grade 12, relatively high proportions enter the junior and senior secondary grades. There are also many more girls than boys in the secondary grades because so many young men drop out and go off in search of jobs. Large numbers of teenage girls fall pregnant and also drop out.

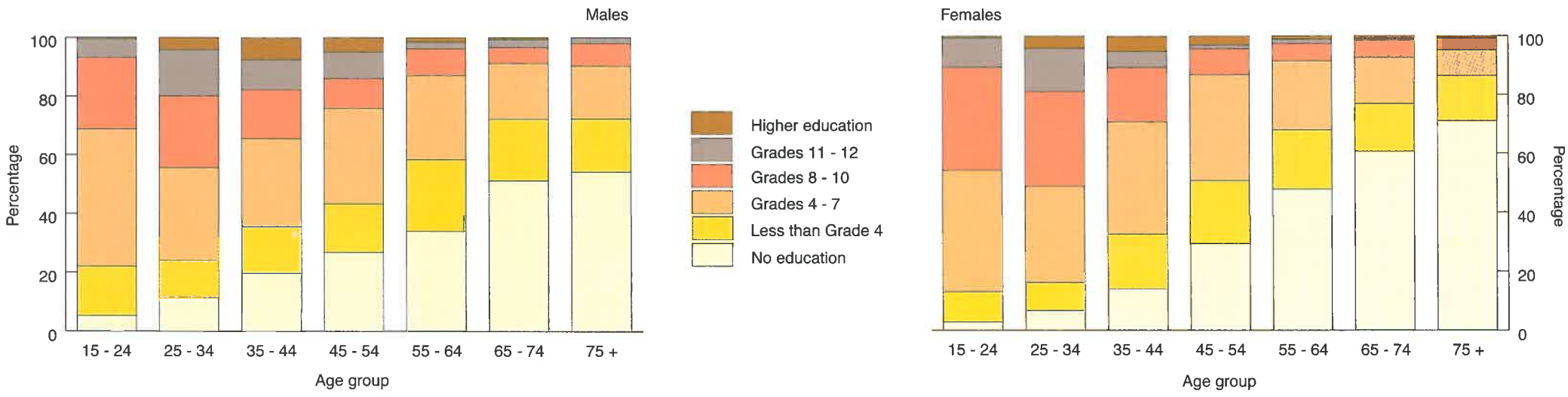




▲ ***Numbers of pupils per school***[9]
Of the 709 schools in the region, those in remote places tend to be much smaller than those in densely populated areas.

Access to schooling
This map shows areas within five kilometres of any school. The major concentrations of people that might not have ready access to schools are in central Oshikoto, where there is a rapid expansion of settlements towards the east. Many of the other small, isolated settlements outside the catchment area have few, if any, children living in them because they are cattle posts or isolated farms.





▲ ***Proportions of adult females and males having completed various levels of education in 1996***[9]
Young women generally have higher levels of education than young men because more girls go to school and remain at school longer than boys. Thus, amongst 15- to 24-year-olds, 30% of men and 45% of women have eight or more years of education. Nine percent of young men aged 15–44 years have never been to school, compared with six percent of women of that age. While girls now enjoy an advantage in schooling, this was not always the case. Older men generally have higher levels of education than older women, indicating that more boys went to school when educational opportunities first became available. There is also a clear relationship between age and levels of education. Thus, the older the person, the greater the chance that he or she did not go to school, and, if they did attend school, the lower the level of education achieved.

Land and governance

MB

Land is much more important than any other natural resource. People cannot grow crops, they cannot collect wood to build their homes and cook their food, and they will not have pastures on which their livestock can graze if they have no access to land. Over and above those tangible values, land also provides people with a sense of permanence, a feeling of security that comes with having rights over land. Secure rights are particularly important in rural Owambo where people were, and remain, unable to legally own land. The rights of single women to land in Owambo have also been extremely fragile, although recent legislation has sought to give them the same rights to land as men.

The high value attached to land also means that there are strong demands for land, due mostly to the growing population, with more and more people needing places to live and farm. Other demands are the result of people wanting larger pieces of land – giving them more options and greater security. There is also a demand for land that is more ideological in nature: it is often said that the liberation struggle was as much a war over access to land as it was over other issues.

Other than Etosha, the region can be broadly divided into so-called commercial farms in the Tsumeb area and the communal area in Owambo. *Commercial* is a label referring to a production system while *communal* describes an ownership system. The most important assumption guiding state ownership of communal ground is the intention for those lands to be available as a safety-net for the poorest people, those who could not afford to buy land if a system of titled ownership was in place. It is also assumed that poorer people will have ready access to common-property resources. As this chapter will show, however, those kinds of assumptions barely hold in the north-central region, where areas that remain truly communal in terms of common-property resources are dwindling very rapidly.

EPP

Little open space is left between fenced farms in many areas

	Constituency	Area (square kilometres)	Number of people
1	Anamulenge	350	15,000
2	Eenhana	1,282	23,100
3	Elim	608	16,200
4	Endola	488	43,600
5	Engela	289	22,300
6	Engodi	7,795	14,700
7	Epembe	1,790	13,400
8	Etayi	640	34,400
9	Guinas	10,206	8,100
10	Ogongo	806	19,500
11	Ohangwena	181	20,700
12	Okahao	13,972	29,100
13	Okaku	242	16,700
14	Okalongo	645	24,500
15	Okankolo	3,573	13,300
16	Okatana	424	12,900
17	Okatjali	552	2,600
18	Okongo	4,689	16,100
19	Olukonda	257	7,700
20	Ompundja	449	4,600
21	Omundaungilo	619	5,200
22	Omuntele	1,730	22,000
23	Omuthiyagwiipundi	13,384	25,000
24	Onayena	498	18,500
25	Ondangwa	208	23,200
26	Ondobe	737	34,700
27	Onesi	600	11,900
28	Ongenga	318	25,300
29	Ongwediva	204	15,800
30	Oniipa	368	22,600
31	Onyaanya	540	14,000
32	Oshakati East	190	19,800
33	Oshakati West	238	13,800
34	Oshikango	292	26,100
35	Oshikuku	281	6,300
36	Outapi	972	34,500
37	Ruacana	5,348	8,100
38	Tsandi	2,384	32,100
39	Tsumeb	314	23,400
40	Uukwiyu	299	10,300
41	Uuvudhiya	5,872	4,800

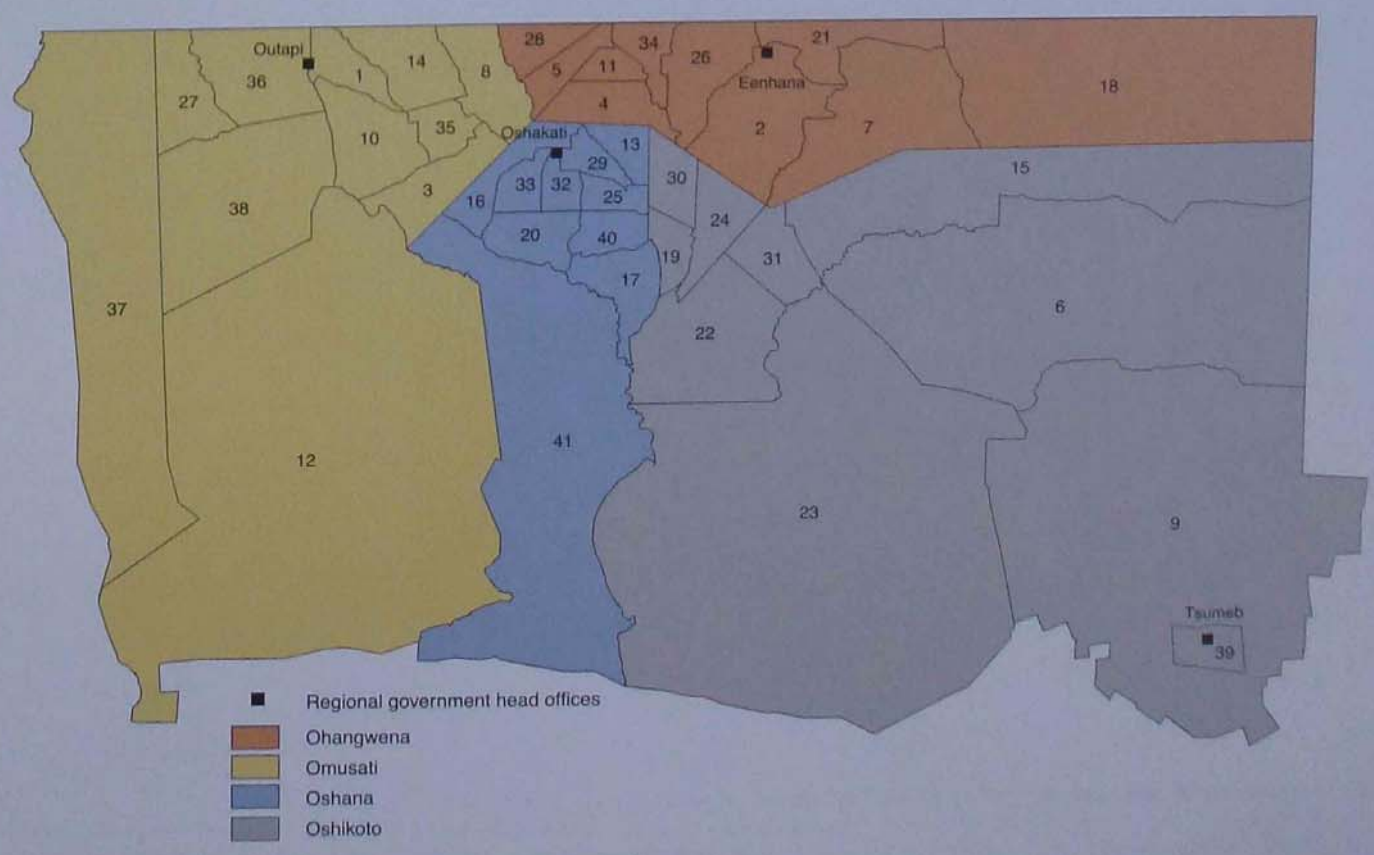
Governance

Regional government

The four political regions are each governed by a governor together with a number of councillors, each representing a constituency. In addition, a chief executive officer and staff administer each region from a regional head office: Omusati from Outapi, Oshana from Oshakati, Ohangwena from Eenhana and Oshikoto from Tsumeb (far from where the majority of people in Oshikoto live). The 41 constituencies in the region vary in size and the number of people represented, as shown in the adjacent table.

The system of regional government was introduced in 1993, and in 1998 the boundaries of three of the political regions (Omusati, Oshana and Oshikoto) and some constituencies were changed. There is currently a good deal of confusion about the limits of each constituency and about which councillor represents which area. This is because, as the map of constituencies shows, many of the borders are straight lines running from one set of arbitrary co-ordinates to another. In addition, the legal descriptions of the borders are not widely published and are often difficult to interpret. That confusion also holds for some of the boundaries between the political regions, particularly those formed by straight lines or where signboards marking boundary positions have been put in the wrong places.

The government's policy is to have regional governments manage many of its services, but little has been done to equip each region with a budget and staff to render those services. Moreover, in many cases, legislation to enable the regional governments to render these services has not been passed, thus adding to the overall weaknesses of the regional government system.



▲ ***Boundaries of the 41 constituencies in 1998[1]***
The names, areas and estimated number of people in each constituency are given in the adjacent table. Regional government offices are in the four towns of Oshakati, Tsumeb, Eenhana and Outapi.

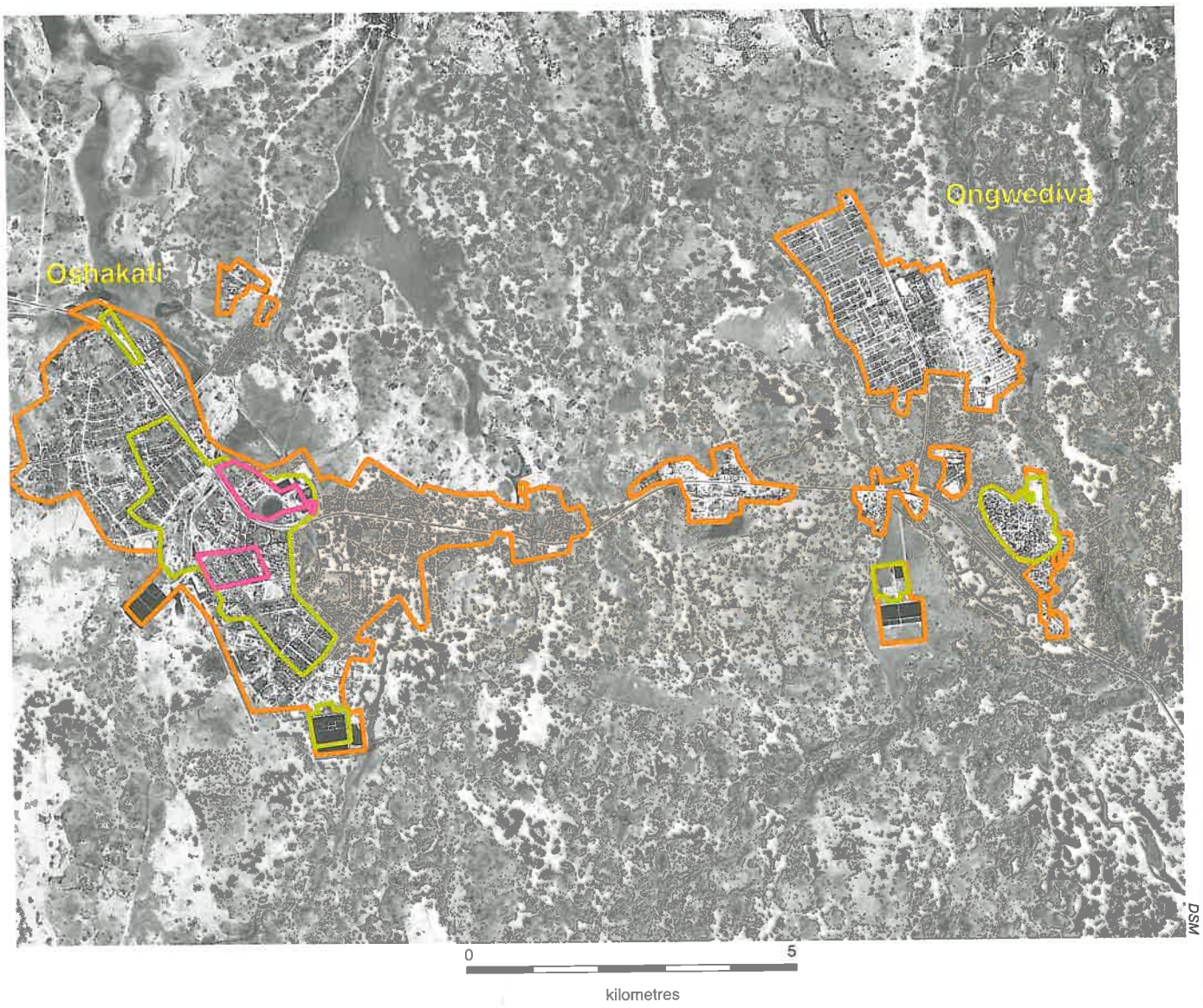
Local governments

At a lower level than the regional governments are the local governments, which are responsible for the affairs of towns and larger villages. There are two categories of local authority in the region: municipalities, which are self-funding bodies, and towns, which may receive financial assistance from the central or regional government. A third category of settlement areas consists of communities that are earmarked for development into towns in the future.

The only municipality in the north-central region is at Tsumeb, while Ondangwa, Oshakati, Ongwediva, Outapi and Eenhana have been designated as towns.[2] Settlement areas have been declared at Endola, Engela, Okahao, Okalongo, Oshikango, Oshikuku and Tsandi, while others are proposed for Ogongo, Okatope, Okongo, Omungwelume, Omuthiya, Onawa, Ondobe, Onesi, Onethindi, Ongenga, Ongha, Oniipa, Onuno, Onyaanya, Oshigambo, Oshivelo and Ruacana–Oshifo.

There appears to be a threshold above which the growth of an urban centre really takes off and attracts business enterprises, rather than just being a place with a concentrated population and a number of government services. The only places that have reached that threshold seem to be Eenhana, Okahao, Ondangwa, Ongwediva, Oshakati, Oshikango, Oshikuku, Outapi and Tsumeb. Information is not available on the growth rates of other towns, but Oshakati, Ondangwa and Ongwediva have been growing at a very great rate, largely as a result of migration from the surrounding rural areas. Ongwediva was only established in 1971, and by 1991 had a population of about 6200 people, while the populations of both Oshakati and Ondangwa grew at about 20% each year between 1981 and 1991. The area covered by these three towns has, thus, expanded greatly, as is shown by the changing outlines of Oshakati and Ongwediva in 1964, 1972 and 1996.

The previous chapter on population (see page 41) describes some of the features of the populations in urban areas. Compared with other growing towns in communal areas, those in Owambo have the interesting distinction that people living in them maintain close links with their rural homes. Many urbanites have fields and livestock at their rural homes, and their urban incomes are thus supplemented by the benefits of farming activities.



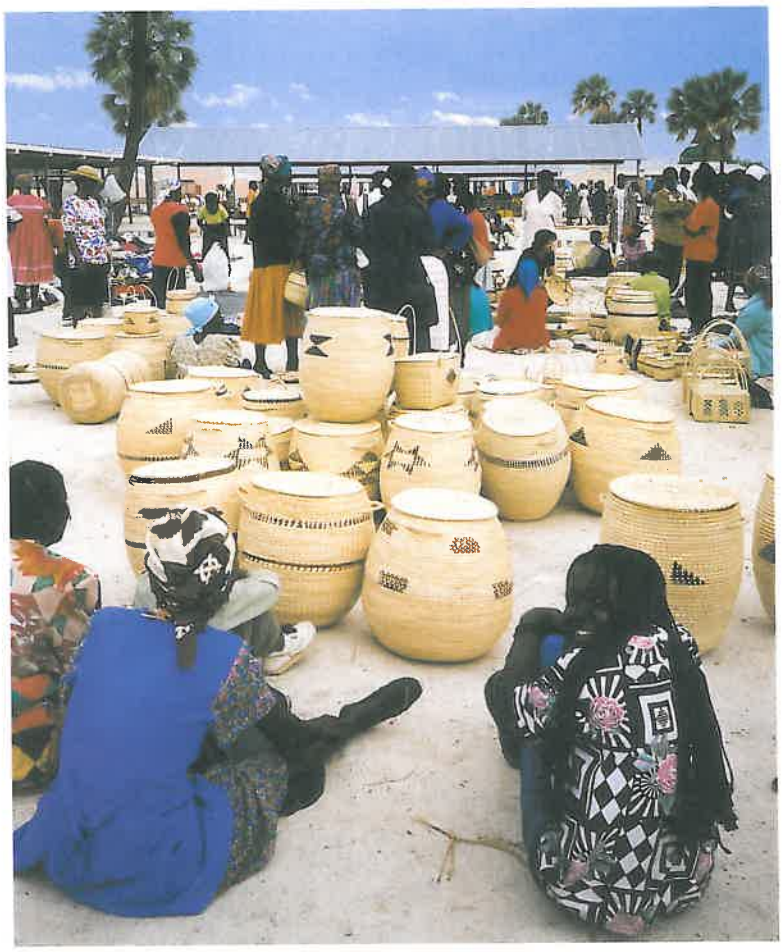
Aerial photograph of Oshakati and Ongwediva taken in 1996, showing the positions of the outlines of the towns in 1960 (pink lines), 1970 (green) and 1996 (orange)

Tribal authorities

Most people recognise the existence of seven Owambo tribes or tribal authorities: Kolonkadhi, Kwaluudhi, Kwambi, Kwanyama, Mbalantu, Ndonga and Ngandjera, while an eighth, Mbandja, is less well known. Each authority has jurisdiction over a particular area and each has its own political structure. Councils of senior headmen administer four of the tribes (Kolonkadhi, Kwambi, Mbalantu and Mbandja), while kings rule the other four tribal groups (Kwaluudhi, Kwanyama, Ndonga and Ngandjera) in conjunction with councils of senior headmen. Each senior headman is in charge of a district within the tribal area, and each district is divided into wards with a headman in charge of each ward. The size of the districts and wards and the numbers of people in them vary a great deal. A detailed survey in 1994 identified over 2000 individual headmen in Owambo, each with jurisdiction over an average of 48 households and about 400 people.[3]

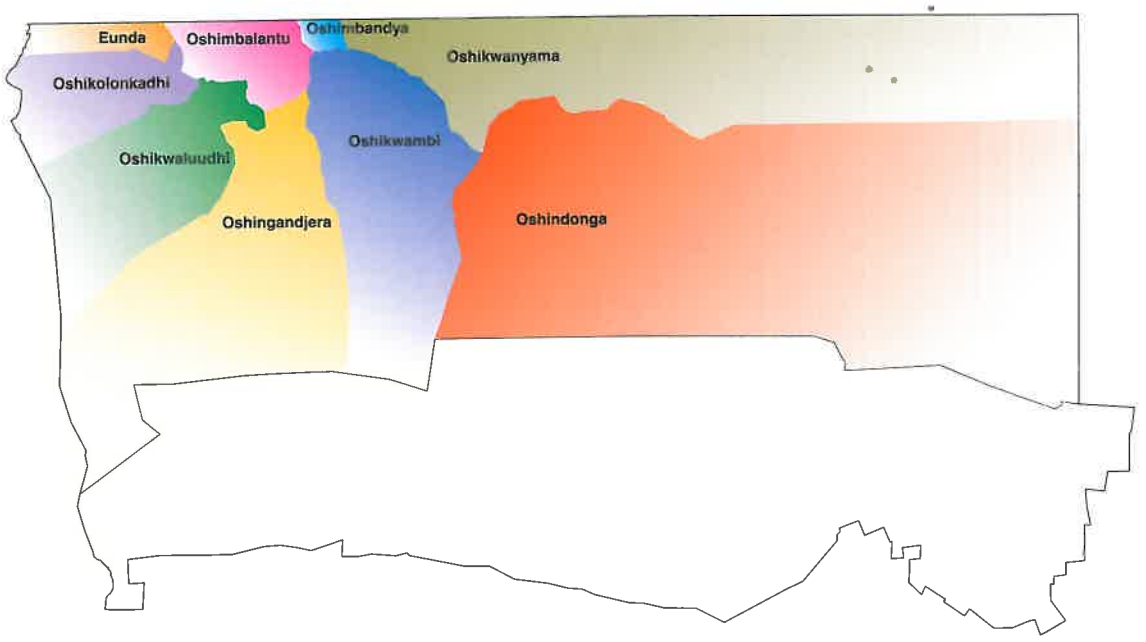
The most important functions of kings and tribal councils are in the overall administration of tribal affairs, the resolution of major conflicts and the allocation of grazing rights. Senior headmen allocate wards to headmen, solve conflicts, and may have delegated authority to allocate grazing rights. Headmen are responsible for allocating land on which people may establish homes and farms. Tribal authorities now have less influence than before, however. Increasing numbers of wealthy and influential people (and others who see them as role models) sometimes disregard tribal authority. In addition, the growing influence of government control has directly and indirectly undermined some traditional authority.

Outside Owambo, the only other traditional rights are those sometimes asserted by Hei//om people to land in Etosha. Those rights are seldom taken seriously by anyone else, however. Most of the Hei//om people that used to occupy land in the park now work as labourers on nearby farms, while about 250 of them are accommodated in Okaukuejo, Halali and Namutoni.



Apart from baskets, relatively few crafts are produced for sale

SK



▲ ***Approximate boundaries of predominant languages and tribal authorities***
The borders of the tribal groups approximate those of the different dialects or languages predominantly spoken. The borders were drawn from an analysis of 1991 Population and Housing Census information. Those in the most densely populated areas are most accurate, whereas the borderlines shown in the sparsely populated areas are somewhat arbitrary. Eunda is not well-known as a language, and people living in that area are usually considered as part of the Kolonkadhi tribal area. However, the language was reported in the 1991 census as used by people living along the Angola border near Ruacana. The 1991 census results show the predominant languages in the Tsumeb area to be as follows: Oshiwambo (36%), Khoekhoegowab (24%), Heiǁom (17%), Afrikaans (12%) and Otjiherero (4%).

Land

Issues of who owns, controls and uses land are often difficult ones. Some land is both directly owned and controlled by the same person or body. Etosha is a good example – it is owned and managed by the government through the Ministry of Environment and Tourism. Other examples are the private landowners who have title to farms around Tsumeb. Then there is land owned by one body but controlled by one or more other people. Much of the so-called communal land falls in that group, creating a complex and often confusing situation. The land is owned by government, supposedly controlled by traditional authorities and regional governments, and both controlled and used by individual farmers. Moreover, since the status of traditional leaders has changed over the years, some of their decisions on land allocations made years ago are now being questioned.

Control of land

Taking the region as a whole, four categories of control are shown in the accompanying map and table. The first consists of small-scale farmers in Owambo who control about a third of the region. The second is made up of the Tsumeb farmers and farmers that have fenced off big farms in Owambo. Each of these groups of large-scale farmers control about a tenth of the region. Altogether, small- and large-scale farmers thus control about half of the region. The third category of land control consists of areas that are essentially open, and used primarily as grazing areas (see page 57) where there are few settlements. These are considered to be under the control of traditional leaders, and make up roughly 20% of the region. Because they are not directly controlled by any single person or body, control over these areas is perhaps weaker than for the other categories. The largest areas of grazing lands are in the south-west, where shortages of useable water and low rainfall make it difficult for people to settle permanently.

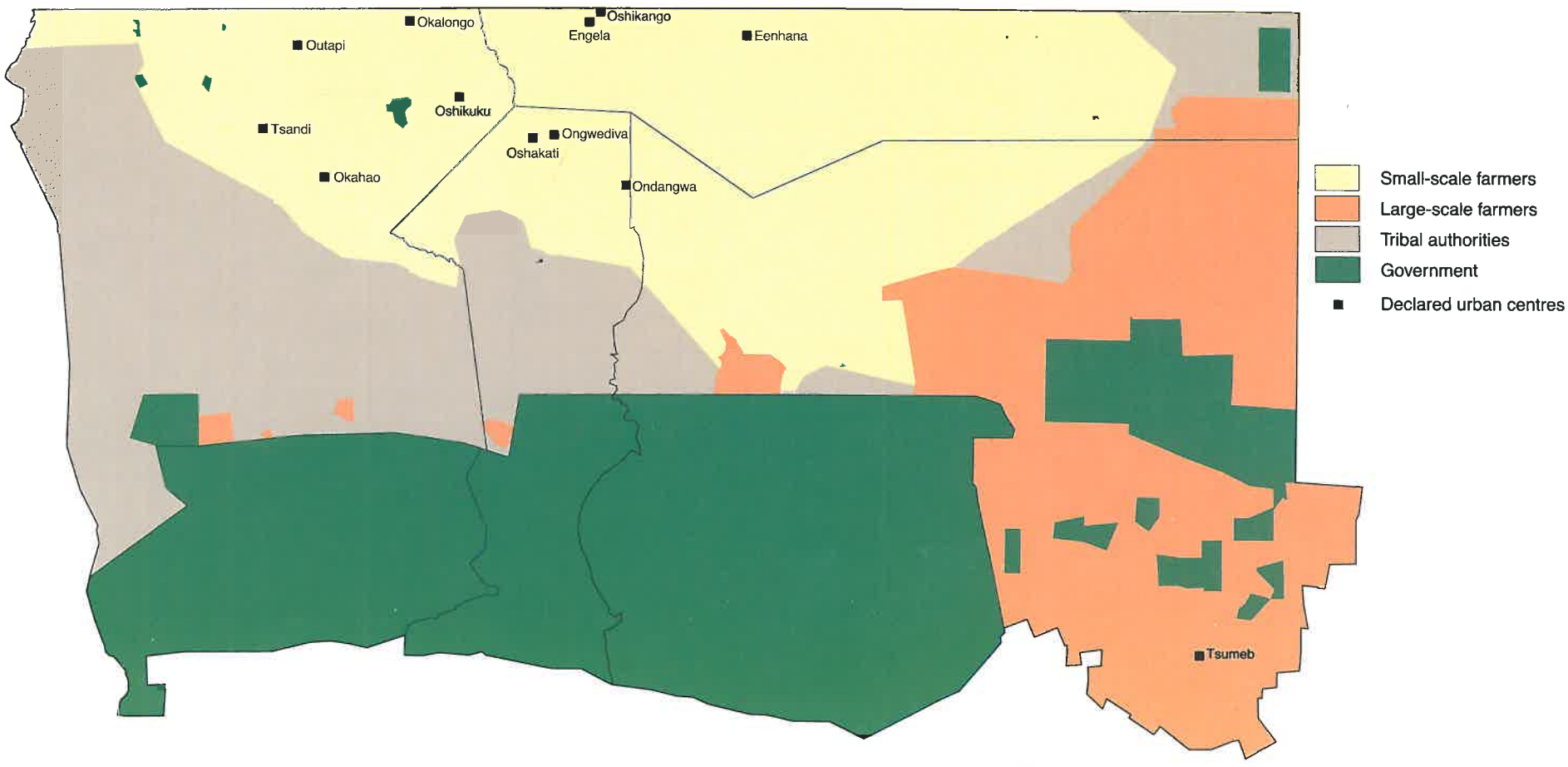
The fourth category is for land over which the government has direct control. This accounts for about a third of the region. Etosha makes up most of that, while the rest consists of the Mangetti farms and farms used for quarantining animals, resettling people and for agricultural projects. Local government bodies control a tiny proportion of the region in towns and municipalities.

Oshikango on the Angola border – a growing business and export centre

EPP

Size of area and percentage of the region under the control of different individuals or bodies

Controller		Area (square kilometres)	Percentage
Small-scale farmers		25,470	30.1
Large-scale farmers			
	Tsumeb farms	7,430	8.8
	Large fenced farms	7,900	9.3
Tribal authorities		17,000	20.1
Government			
	Etosha	22,900	27.1
	Mangetti farms	1,370	1.6
	Various farms	2,300	2.7
	Local government area	230	0.3



▲ ***Distribution of land under the control of different authorities or people[4]***

EPP EPP EPP EPP CH

Some of the many kinds of fences surrounding fields and farms in Owambo helping farmers protect their resources

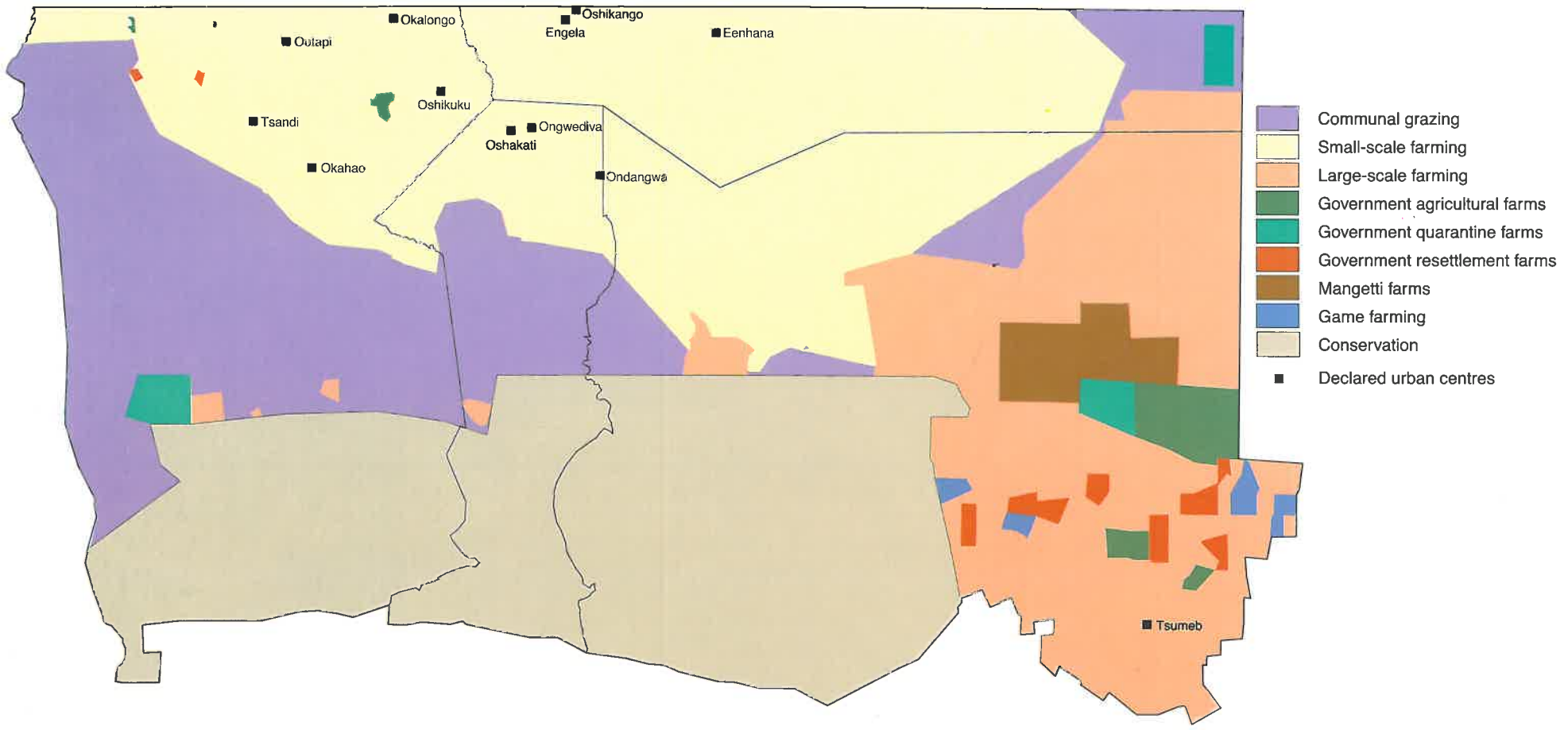
Uses of land

If we now turn to the uses of land in the region, the map and table show that over a quarter (27%) of the region is used for conservation, all of it in Etosha. Another 0.4% is now used for game farming, and some cattle farms in the Tsumeb area also benefit from wildlife in the form of tourism, trophy hunting and selling meat. About 500 square kilometres (0.6% of the region) has so far been allocated by government as resettlement farms. Most of the allocations consist of large farms purchased in the Tsumeb area, but there are also five small resettlement areas in Ohangwena and Omusati. Very few families have been settled on most of these farms, however.

The remaining large chunk of the region – some 70% – is used for farming purposes of one kind of another. Small areas on various farms are used for a number of agricultural projects run by the government for purposes of research, training and correctional services. The biggest of these is the AMCOM farm near Tsintsabis, situated next to one of the three quarantine farms that cover about 1% of the region. The really large areas in the region comprise small-scale farms in Owambo-(30% of the entire region), the Mangetti farms (1.6%), other large farming enterprises (18%) and communal grazing (20%). These large farming areas are the subject of the next section.

Size of areas and percentages of the region used for different purposes

Use	Area (square kilometres)	Percentage
Agriculture		
Communal grazing	17,000	20.1
Small-scale farming	25,470	30.1
Large-scale farming	15,000	17.7
Mangetti farms	1,370	1.6
Government agricultural farms	1,000	1.2
Government quarantine farms	790	0.9
Government resettlement farms	500	0.6
Game farming	330	0.4
Conservation	22,900	27.1
Declared urban centres	230	0.3



▲ ***Distribution of different land uses***[4]

EPP

One of the Mangetti farms

Large-scale farms

Because the nature of land ownership in Owambo and the Tsumeb area differs, it is often convenient to talk of communal farms in Owambo and commercial ones in Tsumeb. In terms of these categories, most farm produce is used for domestic consumption in Owambo in contrast to the marketed production of beef and other products on Tsumeb farms. There are also other key differences between the two groups of farms. Land used for farming in Owambo cannot be owned by the farmers, while the Tsumeb farms are privately owned; farms in Owambo are generally very much smaller than the large Tsumeb ranches; and, until 1979, only whites could own farms in the Tsumeb area.

Some of these distinctions are now disappearing: large farms have been claimed in Owambo, small-scale farmers have been resettled on some Tsumeb farms, and more black farmers have bought land in the Tsumeb area. Of 120 sales made during the past ten years, at least 13% have been to black buyers, but the proportion of black farm-owners in the Tsumeb area is probably a good deal higher than that percentage. Large farms used for beef and game ranching in the Tsumeb area have generally been sold at prices of between N$20 and N$200 per hectare over the past five years. Smaller farms of several hundred hectares, used primarily for irrigated agriculture, fetch much higher prices of between N$6000 and N$9000 per hectare.

In addition to the majority of smallholdings in Owambo, there are also a number of larger farms there, namely, those leased in the Mangetti block, and the large fenced farms. The Mangetti farms, consisting

of a block of 106 individually fenced farms to the east of Oshivelo and just north of the Omuramba Owambo, were established during the 1970s and leased to farmers on a long-term basis. Most of the farms are between 1100 to 1300 hectares in size. Some people lease more than one farm, and about 11% of all the farms are allocated to someone who leases at least one other farm. Rental payments amount to fifty cents per head of cattle per month. Farmers are, thus, required to declare the number of cattle they have on their farms when making these payments. The maximum number of cattle per Mangetti farm is supposed to be 120, so each farm is leased from the government for a maximum of N$60 per month or N$720 per year. The Ministry of Agriculture, Water and Rural Development maintains the boreholes and pumps that provide water at no cost to the farmer.

The Mangetti farms represent an attempt at establishing a formal farming sector in Owambo, with the expectation that farmers would market their animals on a commercial basis. However, a very small proportion of cattle are sold, and the farms have now become more of an exclusive preserve for those farmers who were lucky enough to have been given leases long ago. Moreover, there are often many more than the maximum of 120 cattle on these farms, and grazing pressures on the farms are extremely high (see page 59).

The fenced and exclusive Mangetti farms almost certainly provided the stimulus that led to the widespread, and unchecked, fencing of large tracts of open, communal land. That stimulus was provided in two ways. Firstly, many people saw that the privileges of having a Mangetti farm could be extended into the large, open areas around those farms. All that was required was to fence off a piece of open land for themselves. One estimate suggests that about a third of people leasing Mangetti farms also have large, fenced farms nearby. It is, thus, hardly surprising that people with spare cash to purchase fencing and pay cattle herders seized the opportunity of acquiring their own fenced farms nearby. Secondly, most of the people who were allocated Mangetti farms were comparatively wealthy and elevated members of society. They provided role models to others who then also wanted the benefits of having exclusive farms and large herds of cattle.

Some large, fenced farms were established during the 1980s, but it is clear that the majority have been claimed since Namibia's independence in 1990. There are perhaps now 150–250 of these large, fenced farms, most in the order of 1000 hectares or more in size. There are many other relatively big farms ranging from one hundred to several hundred hectares, and there is indeed a continuous spectrum of farms ranging from the very smallest ones to the biggest of 10,000 hectares or more. That spectrum reflects a variation of wealth on the one hand, but also the trend for people to enlarge their farms as they become richer.

The term *illegal* is often used to describe these big farms but there is no legislation now in place to give them that status. Possibly half of the farms were registered with the Ndonga Tribal Authority, and that registration might give them more formal status than some people would acknowledge. The status of other farms, not registered with any kind of local authority, would then be more dubious. Perhaps the only illegitimate aspect is that all these farms infringe on the customary rights of people in communal areas, rights giving them and their cattle access to traditional grazing areas and water sources. These are water sources in natural pans and boreholes installed at government expense, many of them drilled to provide water during the 1992–93 drought. It remains to be seen how the issue of the farms will be handled in terms of the Communal Lands Bill, which provides for fenced areas to be formally accepted as long as they do not infringe on the rights of other people. However, almost all the owners of the fenced farms enjoy a high degree of influence as wealthy businessmen, senior civil servants or prominent political leaders. There is, thus, little chance of these grazing areas and water sources being made available for communal use again.

Efforts made to map the borders of these farms indicate that about 7,900 square kilometres have so far been fenced off in Owambo. It is also clear that new farms are being established all the time, with the result that land available for communal grazing is rapidly diminishing. This is especially the case in Oshikoto, where a huge block of land in the east of the region has been fenced off. A few corridors within that block remain open, but access to communal pastures for grazing has essentially been closed off. At present there are still relatively few farms in Omusati and Oshana, largely because most open areas lack permanent supplies of water for livestock. However, new farms will in all likelihood be established once wealthy people have their own boreholes drilled.

New, large farms are being established along the western margin of the block of fenced farms in Oshikoto, and it is easy to see how that block is expanding westwards into the few remaining areas of open grazing land. However, large numbers of new settlements and smallholdings are being established to the east of the Oshivelo–Ondangwa road, in virtually the only area in the region where water and soils suitable for crops are relatively easily available (see page 37). The small area of open grazing land is, thus, being closed off from both sides. Some kind of confrontation can be expected between owners of large farms, eager to acquire additional farmland, and those hoping to establish a home and small farm for themselves.

MIB

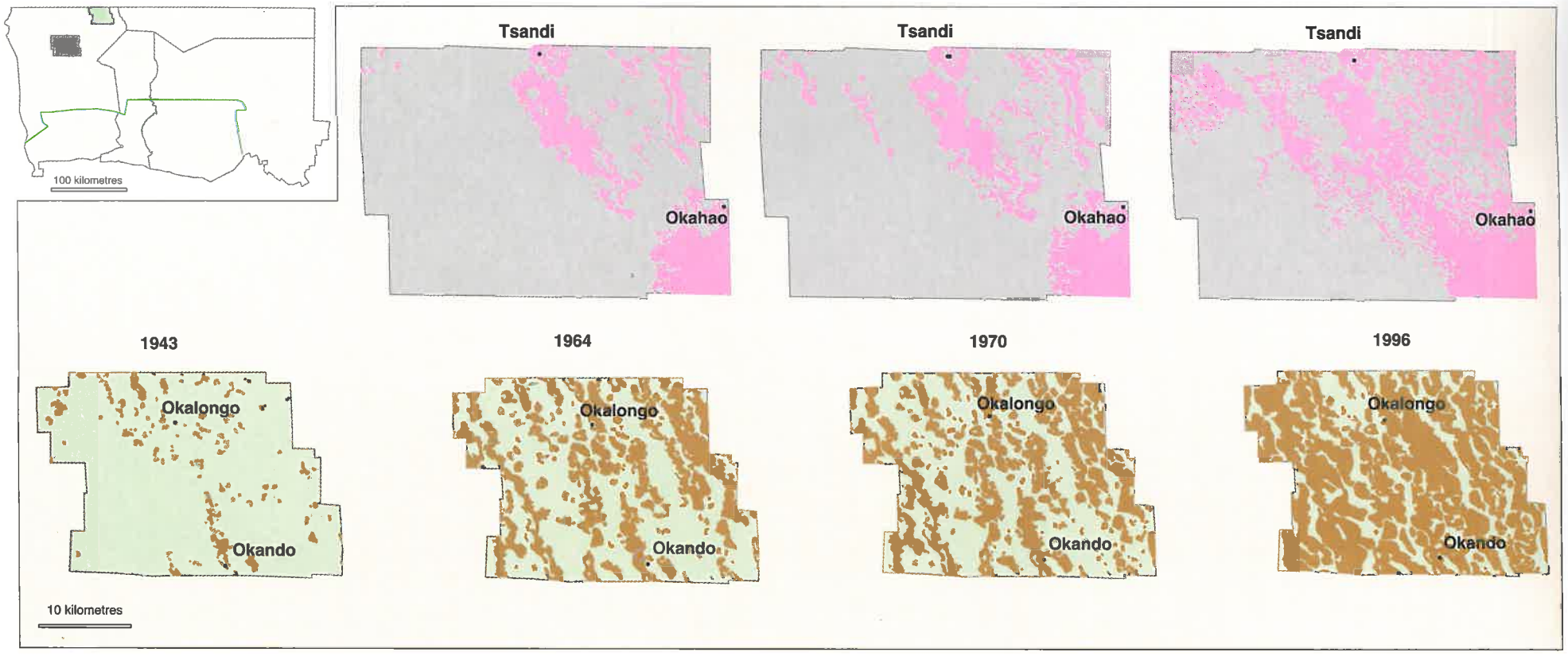
The contrast between a large-scale farm in the Tsumeb area and a small-scale farm in the Cuvelai

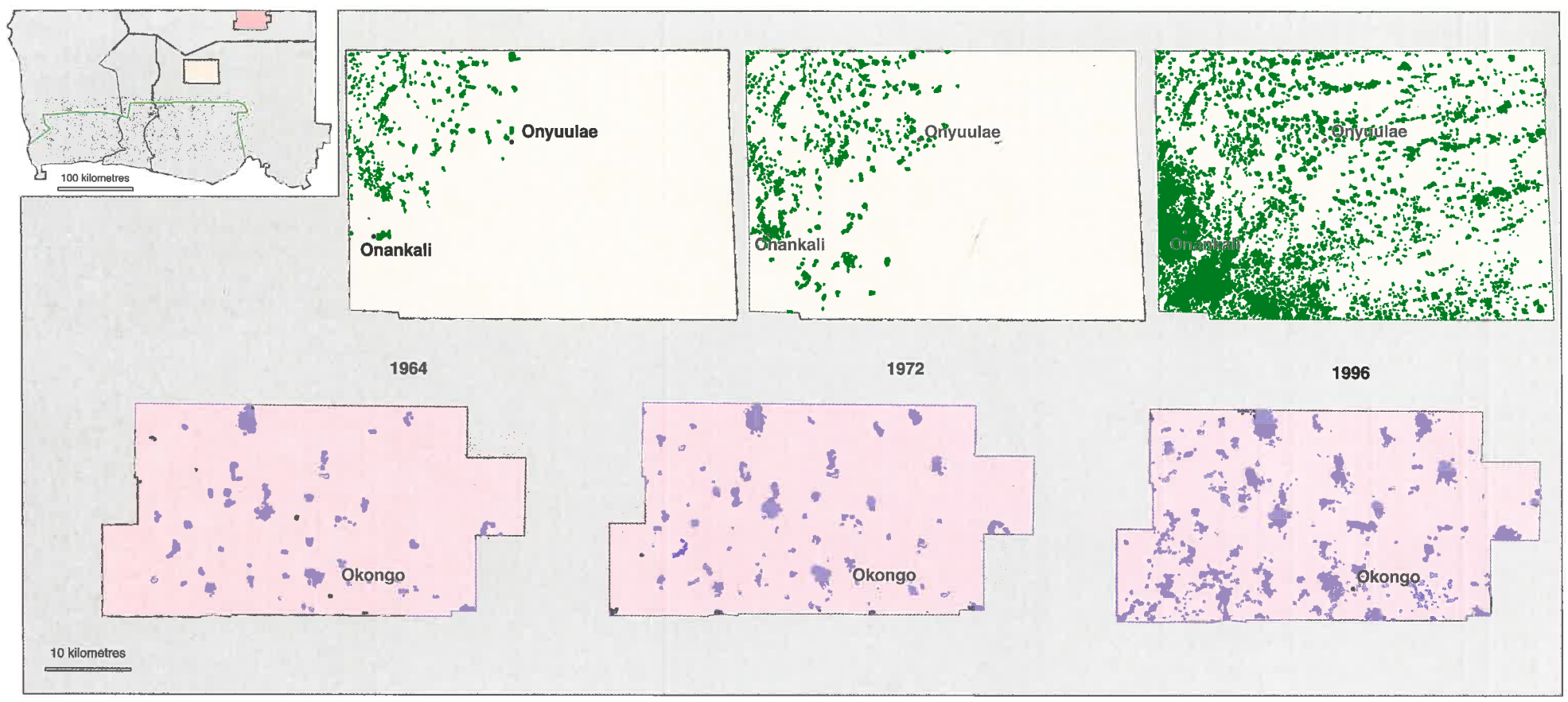
Small-scale farms

Even though many rural households derive their income from a variety of sources (see page 64), almost all the estimated 85,000 rural households in Owambo are surrounded by small fields for farming. The smallholdings are usually divided into two areas: one for the cultivated fields and a separate area of pasture or woodland, locally known as *uuyanda*. Most trees useful for building and fencing are cleared from the *uuyanda*.

The overall size of a farm is largely determined by four factors. Firstly, the availability of land has an important impact on size, in that farms are smaller in densely populated areas (see page 54) where most of the suitable farming land has been occupied for many years. Farms established more recently are, thus, forced into small, unoccupied pockets. Secondly, the local traditional authority plays a direct role in determining the area of land allocated to each farmer, and the amount paid to the headman is related to the size of the farm. The wealth of the farmer is a third factor: poorer farmers cannot afford to fence off large areas, they have less labour available to clear land and cultivate fields, and they have less money to pay traditional leaders for occupation rights. All these conditions are quite the opposite for wealthier farmers, who not only establish large farms, but may also expand them when opportunities arise. Old, broken fences near the home mark the first perimeter of the farm, while newer fences further away mark newer boundaries as the farm expanded. Finally, almost every farmer has a deep-seated desire to have more land, thus increasing his or her assets and options.

The amount of land used for small-scale farming has increased at varying rates in different areas over the





▲▼ *Changes in the boundaries of cleared areas and fenced farms over several decades for four sample areas near Okahao–Tsandi, Okalongo, Onankali and Okongo*[5]

years. This is clear for four representative zones shown in the maps above. In the Okalongo area, and in probably much of the northern and central Cuvelai system, relatively few areas had been cleared up until the 1940s. There were also relatively few households in that area by then (see page 37). Thereafter, the area cleared for farming increased rapidly, at a rate of over 9% per year from 1943 to 1964. From 1964 to 1970 the rate of expansion was about 2%, and continued at this rate between 1970 and 1996. The area occupied by farms in 1996 covered about 62% of the whole area around Okalongo, and the remaining 38% consists almost exclusively of oshanas, where crops cannot be grown.

Farm areas around Okahao and Tsandi increased at an annual rate of just under 3% from 1964 to 1970 and then at a rate of 2% from 1970 to 1996. Most areas suited to farming around those towns have now also been claimed. Areas to the west remain unoccupied largely because the little water available is generally very salty. Some of those areas have been declared as communal grazing lands by the Kwaluudhi king, but a number of people have settled on those grazing lands regardless. A more concentrated settlement pattern holds for the area around Okongo, where communities and fenced farms are restricted to old pan systems because the soils around those pans are deep Kalahari sands not suited to crop production. Here, areas used for farming expanded at an annual rate of 4.6% from 1964 to 1972 and then slowed to 3.6% from 1972 to 1996.

The area where the number of farms has increased most substantially in recent years is around and to the east of Onankali. Farm areas increased at a rate of 9% per year from 1964 to 1972 and then at 7% from 1972 to 1996. While much of the area to the east of Onankali consists of Kalahari sands, as indeed does the area to the east of the main road running from Omuthiya to Ondangwa, there are nonetheless many small patches of more clayey soils that can be cultivated. Further east, crops are mainly grown in the interdune valleys. That broad area is the only large one in Owambo where significant amounts of unoccupied arable land remain. However, that potential is rapidly diminishing as more and more people move to settle there, and as large farmers fence off large tracts to the east (see previous page).

Most of the increase in areas used for small-scale farming is simply due to population growth because total numbers of households in the same areas increased at a similar rate (see page 37). Taking those counts of households and the total area used for farming gives us a measure of the average area fenced and cleared per household. Combining all four regions, about 11.6 hectares had been cleared or fenced for each household in 1996, a similar figure of 11.5 hectares in the early 1970s and 12.6 hectares in 1964. The average area cleared or fenced per household has, thus, remained rather constant over the years.

The results also mean that farms are seldom divided up. Thus, new households have to find and clear new land rather than being allocated a piece of an existing farm, and total areas used for farming have, therefore, increased as the region's population has grown. However, population growth is not the only factor that has led to an increase in farming land. The other has been the massive increase in numbers of large farms, especially fenced farms in eastern Oshikoto.

EPP

Part of the straight cutline 400 kilometres in length separating Namibia to the left from Angola to the right

As the section on land use has shown, much more of the region is used for agriculture than for any other purpose (see map on page 48). The great majority of people are also either directly involved in agriculture as farmers or they derive benefits from farming. Some of these benefits consist of food eaten at home, while others are less tangible, particularly the security that comes with having large herds of cattle. Farming is, thus, a very large enterprise in the region, and yet, the way in which land is used for farming produces the biggest conflict between people and the natural environment. Land is needed to grow crops and for grazing on the one hand, but on the other, the large areas of land that are heavily grazed and cleared for crops damage the region's natural resources. The loss of those resources occurs at the expense of wild animals and plants, as well as of future generations needing access to those same natural resources.

While not denying that people need food, these concerns force us to ask whether agricultural land is used productively, and whether the kinds of farming practices in the region can continue in their present form. The questions need to be considered in the context of how farming practices have been adapted to a risky environment, and how sources of income for many households have changed in recent years, with fewer and fewer people now relying on farming to provide their daily meals. Finally, it is important to recognise that farming activities vary a great deal from household to household. While almost every rural home grows mahangu, the sizes of their fields vary and not all own herds of goats, and even fewer of them have cattle.

Much of this chapter focuses on small-scale farmers in Owambo, who make up the great majority of farmers in the region. Additional information is given on large-scale farmers in the Tsumeb area, the Mangetti farms and the informally fenced farms in Owambo (see page 49). The chapter starts off with a focus on crop cultivation: the kinds of crops and difficulties in growing them, the inputs that go into, and the stages leading up to, a harvest, and the areas of land used for crop production. The next section on livestock addresses livestock ownership and describes the numbers of cattle, donkeys, goats and other small stock, cattle movements, stocking densities and diseases and their control. Finally, the issue of marketing and the constraints affecting agriculture in the region are examined.

The effects of ownership patterns, household sizes and wealth on the production of crops and livestock are considered in various places in the chapter, and it becomes clear that the size and success of farms are closely related to the size and wealth of households. It is also clear that very few farm products are sold, and that agriculture contributes little to people's cash income. These observations have implications for programmes that aim to improve farming practices, alleviate poverty or conserve natural resources.

Sorghum

Cow-peas

Melon harvest

Bambra nut

Crop cultivation

Crops and difficulties in growing them

Crop farming in Owambo is dominated by one crop: pearl millet, locally known as mahangu. Ninety percent of all cultivated land is used for mahangu production, while sorghum is planted on most of the remaining ten percent.[1] Compared with other cereals, mahangu is the preferred crop because it is relatively drought resistant and takes root again after dry periods, it tolerates high temperatures, and it can grow in sandy soils that are poor in nutrients and do not hold much water. The crop has also been subjected to a long period of improvement, and is now more resistant to drought and heat than the varieties that arrived with the first Oshiwambo-speaking settlers. That development has happened year by year over the centuries as farmers selected the best seeds from their crops to be held over and planted in the next year. There are also 'improved' varieties of mahangu developed in recent years on experimental farms by agricultural researchers, of which the Okashana-1 variety is best known. The improved varieties have largely been developed to produce better yields and to grow more rapidly than traditional mahangu, which requires four to five months of growth before it can be harvested. Okashana-1 can be harvested after about three months, and is therefore often planted during seasons when the first good rains are late. However, traditional mahangu is regarded as having a better flavour and can be stored over longer periods than Okashana-1.



Ears of mahangu (left) and a typical field of mahangu, showing the uneven growth of the plants

Mahangu is generally planted on higher and sandier sections of fields, while sorghum is grown on lower slopes where the soils have a greater clay content. Sorghum requires four to five months of growth. Almost all sorghum is used to make beer. Small crops of cow-peas, beans, pumpkins, bambra nuts, peanuts and melons are planted by 85% of all households, usually by intercropping with mahangu.

A variety of estimates produced by different surveys in recent years suggest that yields of mahangu average about 200–300 kilograms per hectare, while those for sorghum average 250–300 kilograms per hectare. Of more interest than the averages is the fact that yields vary dramatically, some farmers producing 500–600 kilograms while others manage to harvest 100 kilograms at best from each hectare. Yields also vary from year to year, with much better yields being achieved in years with higher and regular falls of effective rain.[2] One analysis of rainfall over the past 23 years indicated that rainfall was inadequate for crop production in 11 of those years. Figures on the numbers of days with rainfalls of more than ten millimetres or more suggest that farmers have probably had lower yields during the 1980s and 1990s than before (see page 10). From information collected during recent agricultural surveys, about 30% of all households produced enough mahangu in the summer of 1996–97 to cater for their food needs in a year with relatively good rains. In 1997–98, when rainfall was lower, that figure dropped to about 16%.[1]

Yields of maize are also often poor as a result of inadequate rain. Overall, only 8% of households plant maize, with higher proportions of households in the eastern Kalahari (12%) planting maize than in the Cuvelai (7%). All crops on small-scale farms in Owambo are so-called dryland crops because they are not irrigated. A few irrigated fields in the Tsumeb area produce maize, cotton, citrus and various other fruits and vegetables for sale. There is also a large irrigation scheme at the government farm of Etunda, where some 300 hectares of various crops are grown.

Crops are planted on higher ground in the Cuvelai, above the oshanas that are regularly flooded and above the soils that are too salty. Farmers have a keen eye for those small patches that are suitable for crops, and patches of soils with different qualities have quite separate names. While the total area above the oshanas is large, most of that area consists of soils that cannot be used for cropping for a number of reasons. Some of these factors place direct constraints on yields, while others make it difficult to man-

Farmers that have access to oxen for ploughing have a great advantage over those that have to plough by hand

Weeding a mahangu field is labour-intensive work that must be done at critical times

age soil fertility, especially through the application of manure and fertilisers. The factors in question are as follows:

- The soils are generally infertile, having low levels of organic matter, phosphorus and nitrogen.
- The generally sandy soils do not retain water well, so much of the little rain that falls drains away rapidly.
- Many soils are too salty and alkaline for good crop growth.
- Some soils have a hard layer of clay below the surface, making the ground difficult to plough and also leading to water-logging after heavier rain.
- Even though there is no clear evidence that soil fertility has declined as a result of intense cropping, that view is widely held and is probably correct.
- Limits on areas suitable for crops mean that farmers cannot rotate or let fields lie fallow to allow their fertility to recover.
- There is a high degree of variation in soil types and qualities, both from place to place in the region, and at a local level within the fields occupied by a single farmer. This variation makes it difficult for farmers or agricultural extension officials to make general recommendations to increase fertility.

Small-scale farmers make very little use of fertilisers, for several possible reasons. The first is that many farmers are perhaps uncertain about just how to use fertilisers, especially nitrogen and phosphorus. Part of that uncertainty may stem from the variation in soil types within one farm, with different soils requiring different fertiliser treatments. Second, in the absence of sufficient organic matter, most fertilisers may be washed down through the sandy soils and, thus, provide little benefit. Third, fertilisers may have detrimental effects on crops in dry years, and given erratic rainfalls, it is hard to make clear recommendations on when fertilisers should be applied. Cost and availability is a fourth reason given. Depending on the type and supplier of fertilisers, it would cost N$150 to N$250 to fertilise an average farm of three hectares, and farmers will be reluctant to spend that kind of money if the benefits of using fertilisers are not clear. Despite all these reasons, the low level of fertiliser use remains surprising since the results of many experiments show that yields could be improved substantially if fertilisers were used to a greater extent.

In contrast to the crops on higher ground in the Cuvelai, those in the eastern and western Kalahari are on lower ground, often in old pan systems, in interdune valleys or along old drainage lines. Compared with the sandy soils on the surrounding higher ground, those in the lower-lying areas are richer in clay and, therefore, hold more water and nutrients. However, areas with soils suitable for cultivation are even more limited in the eastern and western Kalahari than in the Cuvelai.

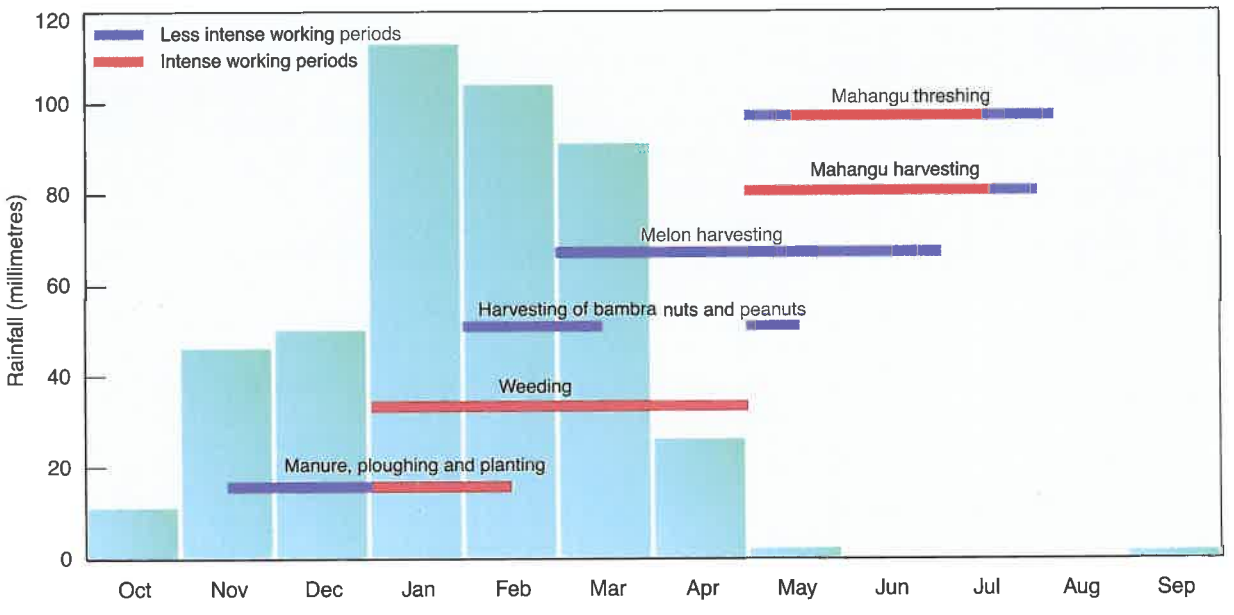
Inputs and stages during crop production

A variety of activities and inputs are required to produce a crop: field preparation and ploughing, sowing, weeding, harvesting, threshing, and the storing of grain. As shown in the graph below, the timing of these activities varies from year to year because there is so much variation in the timing of rainfall.

Some 60–70% of farmers spread cattle and goat manure on their fields before starting to plough; farmers that do not use manure are mainly those that have no cattle and goats. Very few farmers (about 5%) apply chemical fertilisers, and a number of explanations for the low level of use have been offered in the previous section. Fields are only ploughed after good rains have fallen in the Cuvelai because the soils are then easier to work. By contrast, ploughing starts before the rains in the eastern Kalahari woodlands where the soils are sandier than in the Cuvelai, enabling farmers in the Kalahari to plant immediately after the first, good rains. The majority of fields are ploughed using oxen, donkeys or tractors. Only about 17% of all households have both ploughs and oxen, so the remaining homes need to borrow or hire oxen, ploughs or tractors or plough manually. Only poor households plough their fields by hand – a demanding task since those poorer homes have few people to share the work (see page 66). About 15% of all fields are ploughed manually, each hectare taking about 13 days for one person to plough by hand (or, of course, one day if 13 people worked together). By comparison, a hectare can be ploughed in about four days with draught animal power, and in two to three hours using a tractor. The hire of a government tractor costs roughly N$120 to plough an average three-hectare field, and about N$360 if the tractor is hired from a private person. It also costs less to hire a tractor than draught animals for ploughing.

Mahangu is usually planted in several batches to reduce the risk of total crop failure as a result of periods of dry and hot weather. The sowing of a hectare of mahangu takes an average of about eight days of one person's time. Most mahangu is produced from traditional mahangu seeds, as opposed to varieties of improved seed. Some 42% of all households plant only traditional mahangu seed, about 46% use both traditional and improved seed, and 12% plant only improved seed.

Weeding is the most labour-demanding of all the tasks required during crop production, and teams of household members and neighbours work together to rid the fields of weeds. This also has to be done early in the season and as quickly as possible so that the young mahangu plants have little competition from weeds. The cumulative amounts of time spent by groups of people are equivalent to each hectare requiring about 27 days of weeding by one person in a season. Each field is weed-



▲ ***Calendar of events during the production of crops***
The exact timing of events varies from year to year according to when rains suitable for planting fall. The average monthly rainfall over the past 30 years in the central Cuvelai is also shown.

Relationships between household size and the proportions of households using fertilisers, manure and having ploughs[1]

People per household	Percentage of households		
	Using fertilisers	Using manure	Having ploughs
1–2	2	33	26
3–4	5	35	31
5–6	3	52	45
7–8	6	56	50
9–10	7	61	54
>11	7	66	63

Crops must be harvested quickly before pests take their share

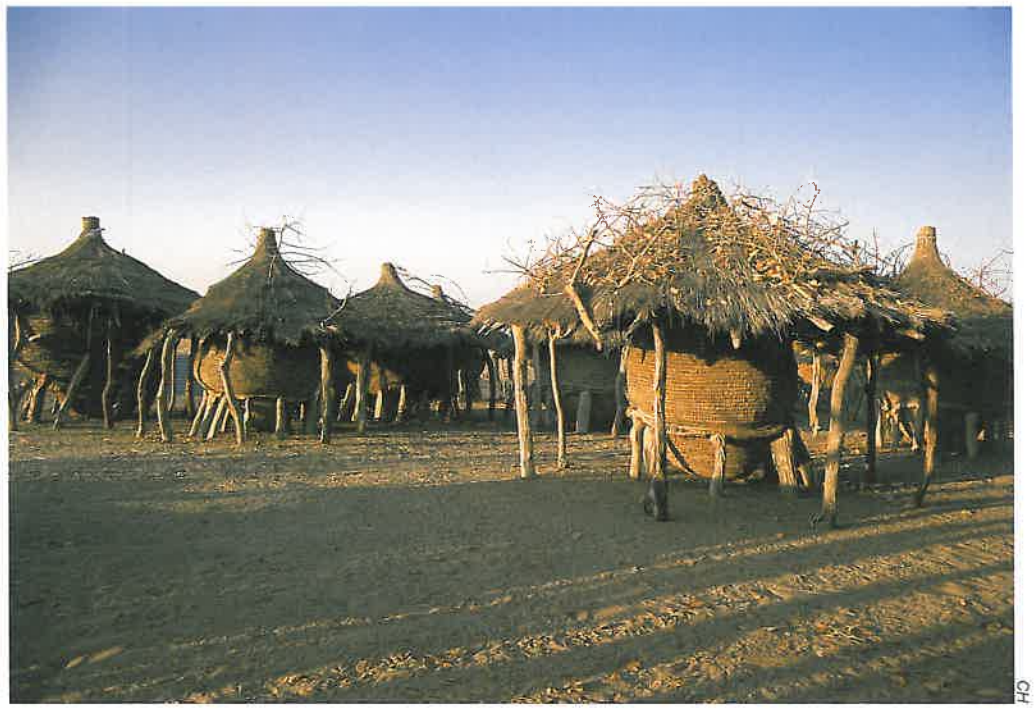
ed two or three times during the season. Young plants are also thinned to about three mahangu plants per hole during weeding sessions.

For the successful production of a crop, fields must be fenced or other measures need to be taken to prevent cattle, goats and donkeys from demolishing fresh crops of mahangu, vegetables or sorghum. Wealthier farmers have both their fields and whole farm area fenced. Their livestock can graze in the uncultivated section of their farms during the mornings until children that have returned from school or other family members can take the animals out into communal pastures. Poorer farmers, however, often cannot afford secure fences around their fields or farms, and they make greater use of their children to tend their animals. In the growing season and in the absence of secure fences, they have to keep their livestock in pens until midday when their children return from school.

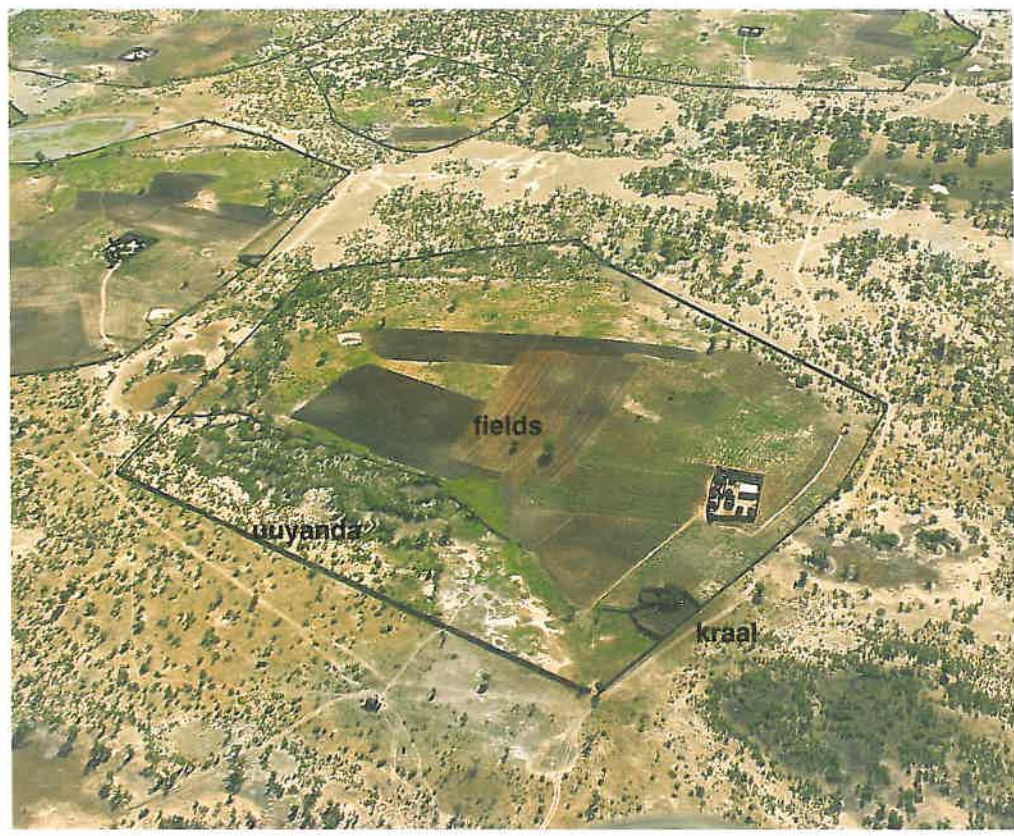
Harvesting occurs between May and July, and has to happen as quickly as possible to reduce the chances of birds eating the grain. The greatest threat is from red-billed queleas. Huge flocks numbering tens, or hundreds, of thousands of these birds can demolish a crop in a day. Threshing of the dried ears follows several days after harvesting. Most farmers prefer to store rather than to sell their mahangu harvests. *Iigandhi* granaries with capacities ranging in size from 0.7 to 2.0 tonnes are used to store grain for up to three years. The need to store surplus mahangu is important because of the high risk of crop failures in an environment which is often dry, where rainfall is unpredictable and where damage caused by pests can be devastating.

Some of the activities and inputs required for the production of crops are costly, and only prosperous households can afford or make good use of them. This is because they have cash resources and because they have more people living in their homes than poor households (see page 66). Thus, richer farmers who have access to incomes from other sources have the cash needed to buy improved seed and fencing materials. Larger, wealthier households make greater use of fertilisers and manure, and are more likely to own ploughs, as the table on page 52 shows. They can also hire ploughing services provided by people who have tractors, oxen or ploughs, and they can recruit labour to help with sowing, weeding and harvesting. Even more importantly, they can obtain these services at the right time during those critical periods when fields require work. It is clear that labour is by far the most important input required for cropping, and this gives large households an advantage in producing crops. The value of labour becomes clear when the labour requirements for each hectare are summarised: 13 days for manual ploughing, or 4 days using draught animal power, or 2–3 hours using a tractor; 8 days for planting; 27 days for weeding; and 7 days for the harvest. Adding these up gives a total maximum working time of 55 days for one person per hectare if ploughing is done manually, and a minimum of 42 days if a tractor is used. For an average household having a field of three hectares, 125–170 days of work would be needed. Poor homes, with perhaps just one or two productive family members, are unable to provide that kind of investment, and can, therefore, only cultivate smaller fields to grow their own food. It is also important to realise that the total number of days of labour are not spread out evenly over the growing period, but rather that there are high demands for labour inputs during critical periods.

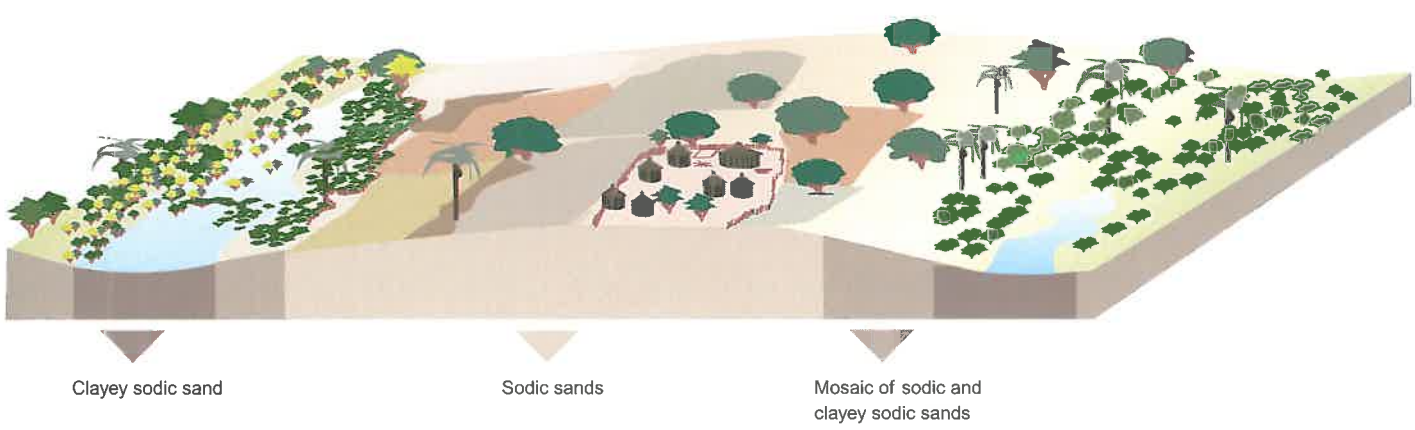
Piles of recently harvested mahangu ready for threshing



Several tonnes of mahangu can be stored in all these iigandhi



A typical small-scale Cuvelai farm showing the uuyanda, fields and kraal



◀ ***Diagram showing the layout of fields on a small farm in the Cuvelai***[3]
Crops are planted in areas that are highest above the surrounding oshanas, and especially those close to the household. Soils in such areas are not as salty as those closer to the oshanas, and they also benefit from organic waste discarded from households. Soils on the higher ground are sodic sands, those in the oshanas are clayey sodic sands and those close to the oshanas are a mix of the two types.

The account given so far focuses largely on small-scale cropping in the Owambo area. As regards other areas, there is very little crop farming on the Mangetti and the large, informally fenced farms, where the predominant activity is cattle farming. For the Tsumeb farms, the predominant crops are maize, cotton, citrus, sunflowers, vegetables and various fruit-trees. In 1997, based on what could be mapped off satellite images, a maximum of about 10,000 hectares was cleared for cultivation on the Tsumeb farms. Cultivation practices are more varied, with various crops being tried on different fields in separate years, using either irrigation or dryland cropping. Changing marketing opportunities, successes or failures depending on rainfall, and the availability of water for irrigation bring about that variation. Many areas have been cleared, crops were planted, and have now been abandoned as bush-encroached thickets of little use to man or beast! In essence, crop production in the Tsumeb area is a variable creature. The most important constraints to crop farming are the long and, therefore, costly distances to markets, high production costs, and the low and erratic nature of rainfall.

Crops grown on the Tsumeb farms are often irrigated

Cultivated areas

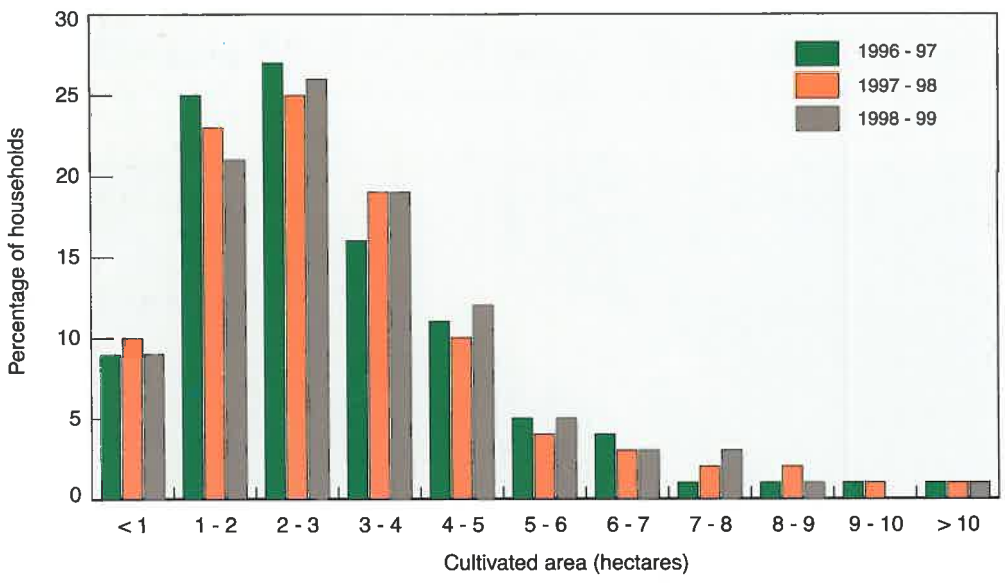
Areas cleared for cultivation consist of those that are planted in any given year, those that could not be planted (because of inadequate rains or shortages of seed), and those that have been abandoned or perhaps cleared but never used. More fields are cleared than end up being cultivated because farmers run into labour shortages, less rain falls than is hoped for, or because tractors cannot be hired. Very few fields (about 2%) are left fallow in any year. This may be surprising, given that poor soils should benefit from rest periods. However, true rotational cropping is not possible because of the limited areas with goods soils available for cropping, and the need to make the best use of them.

Unlike many other rural farming communities, most farmers have only one field. Thus, only 6% of all households are reported as having more than one field (compared with 45% of farmers in Kavango). The average area cultivated is three hectares, with about 2.7 hectares being used for mahangu and the remaining third of a hectare for sorghum.

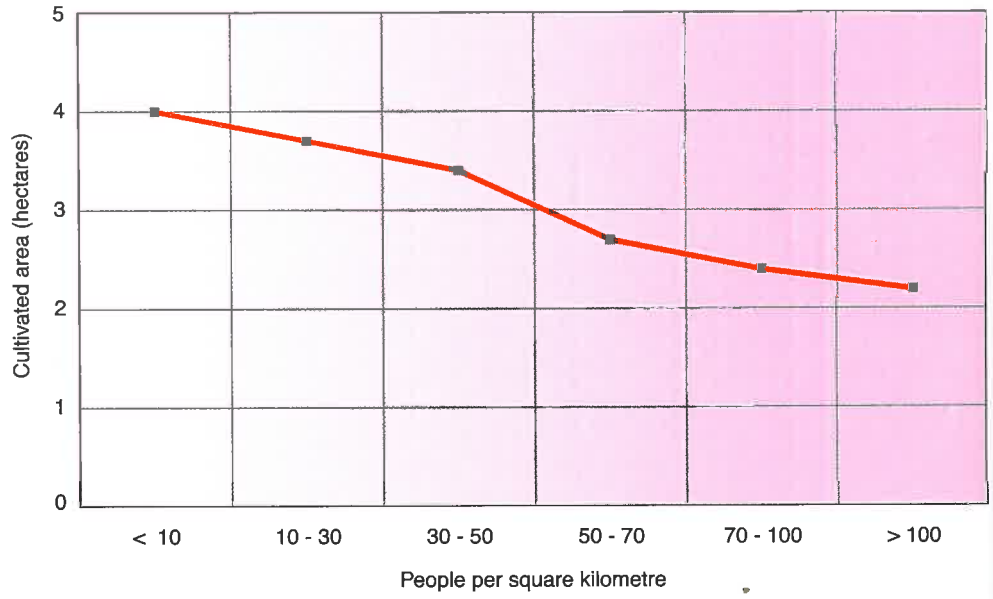
As shown in the graph below, the sizes of fields vary a great deal: roughly 9% are less than a hectare, about 50% are 1–3 hectares, 30% are 3–5 hectares, and about 10% of fields are 5 or more hectares in size. The most important factors determining the size of fields are the availability of land and the size and wealth of a household. The severe limits on areas available for cultivation are best illustrated by the clear relationship between field sizes and population density. Fields in areas that are densely populated (2.2 hectares on average) are nearly half the size of those in more sparsely populated areas (average of 3.8 hectares). The shortage of land is also the major reason why fields in the Cuvelai (2.9 hectares) are smaller than those in the eastern Kalahari (3.8 hectares).

The other major factor affecting the size of area cultivated is the number of people living in a household. Those with between one and three people have fields of less than two hectares on average, while those with 13–15 people have fields averaging over four hectares. Male-headed households are slightly larger than those headed by females, probably explaining why their fields (3.3 hectares) are bigger on average than those of female-headed homes (2.6 hectares).

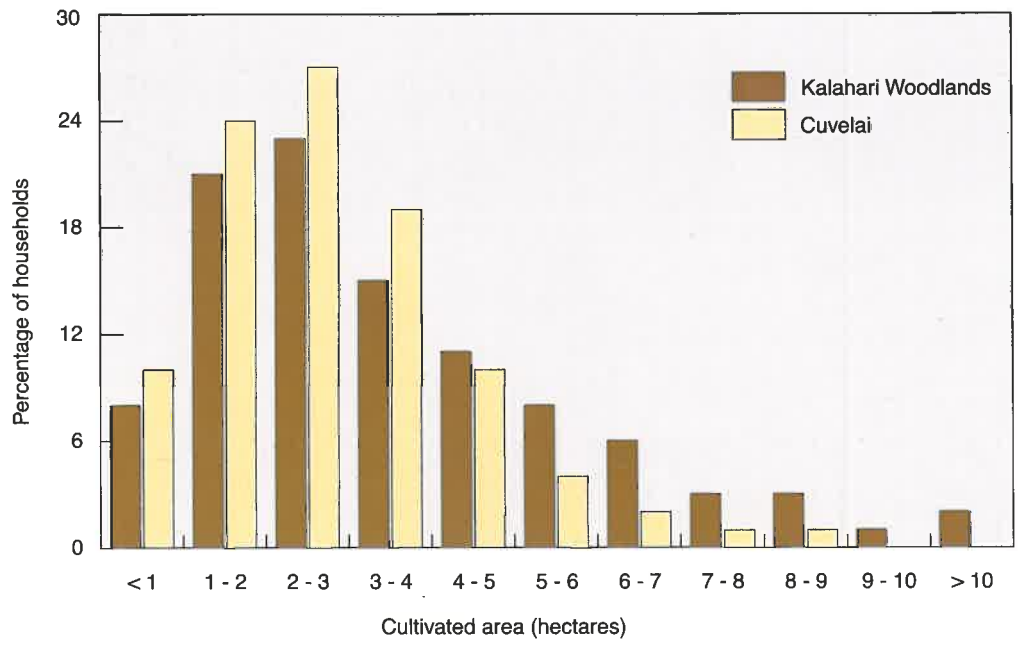
Several recent estimates indicate that the area cultivated in Owambo is expanding at a rate of 2.7% each year, from 231,000 hectares cultivated in 1994–95, to 243,000 hectares in 1996–97, 247,000 hectares in 1997–98, and to 256,500 hectares in the 1998–99 growing season.[1] Much of that expansion (see pages 37 and 50) is due to the increasing population of people.



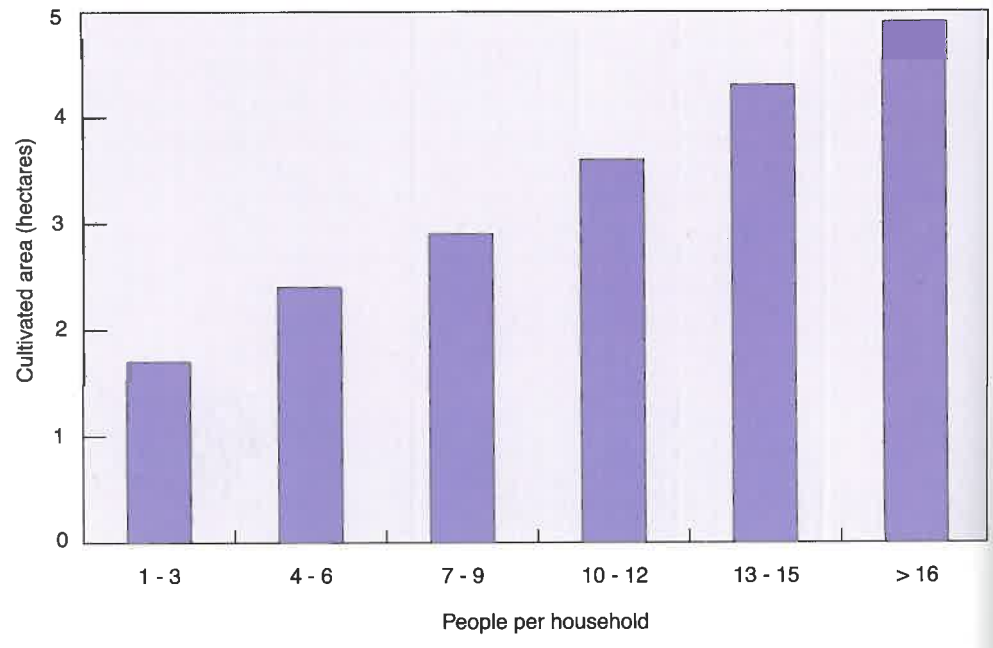
▲ ***The percentages of households having different areas of cultivated land over three years[1]***
Note that while the sizes of fields vary greatly, there is little change in this variation from year to year.



▲ ***The relationship between average field size and population density[4]***
Fields are smaller in densely populated areas and, by contrast, much bigger in areas where there are fewer people.



▲ ***A comparison of the average area cultivated per household in the eastern Kalahari woodlands and Cuvelai[1]***



▲ ***Relationship between the average area cultivated and the number of people in the household[1]***
Households of 16 and more people have fields that are almost three times larger than those of the smallest homes.

Livestock farming

In much the same way as the north-central region has a high proportion of Namibia's large mammals in Etosha, the region is also home to large proportions of livestock. About 25% of the cattle, 43% of the goats and 70% of the donkeys in Namibia are in this region.

Livestock ownership

Historical accounts, from before the time that any surveys were conducted, suggest that most households owned cattle, and quite large numbers of cattle at that. Most recent information suggests that the pattern has changed quite substantially, so that average numbers of cattle per household are lower and cattle ownership is more divided. There is indeed a great deal of variation in the patterns of ownership for all livestock in terms of who keeps animals, the numbers they have, and how these relate to various ecological, economic and social factors. Some of that variation is shown in the figures in the table below. That variation also sets livestock farming quite apart from crop farming, because almost every rural home grows crops but only a selection of households have animals (with the exception of poultry).

Estimated numbers of livestock, and patterns of ownership, in Owambo,1998[5]

	Households owning animals		Number of animals	
	Number	Percentage	Average per household	Estimated total
Cattle	34,000–38,000	40–45	6.0	550,000
Goats	55,000–60,000	65–70	12.0	1,100,000
Donkeys	21,000–25,000	25–30	1.2	107,000
Poultry	76,000–81,000	90–95	10.0	850,000
Pigs	38,000–42,000	45–50	0.8	81,000
Sheep	4,000–8,000	5–10	0.4	37,000

In the Tsumeb farming area there are additional populations of about 31,000 cattle, 23,000 goats, 10,000 poultry, 11,000 sheep and an unknown but not significant number of donkeys.

Cattle are certainly the most important domestic animals, because they make up such a significant biomass and also because they are so highly valued. The average number of cattle per household is about six, yet over half of all households in Owambo do not own cattle. Cattle ownership is thus unequal, and even further so in that about 80% of all cattle are owned by some 20% of all households. The biggest cattle-owners are wealthy people, often with their own private trading business or with formal employment in government or mining companies. There is also a very clear relationship between household size and stock ownership, such that large and, therefore, wealthy households have many more cattle, goats and other livestock than small households, as shown in the next table.

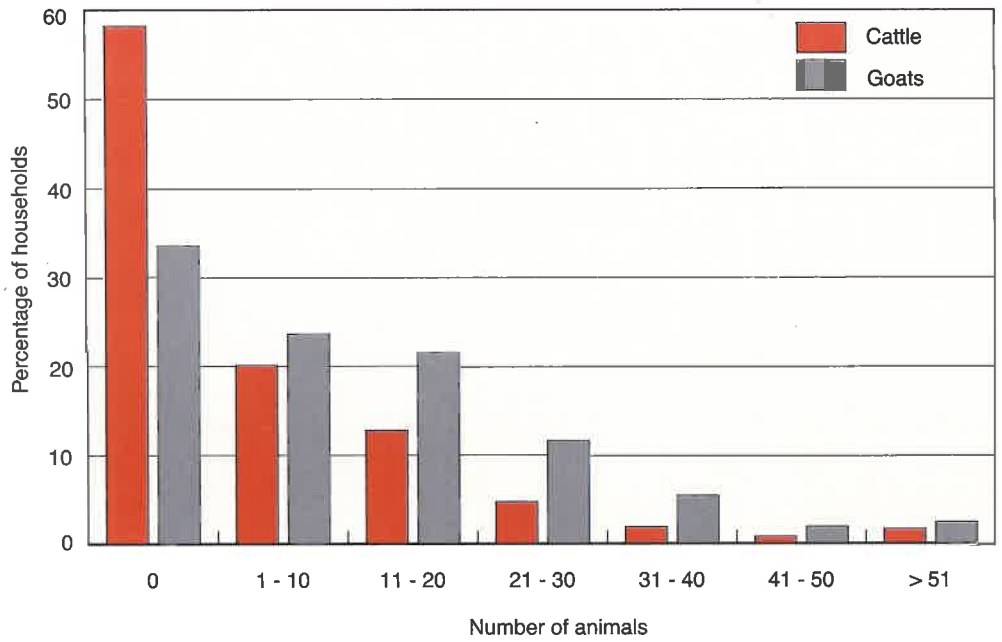
Many more homes have goats than cattle, so the ownership of goats is more even. The average number of goats per household is about 12, even though a third of all homes do not own any goats. As with cattle, large households headed by people that have jobs have bigger herds of goats. Among those households that do own goats, most have 10–30 animals.

One of the biggest differences in livestock ownership is between households headed by women and men; those with female heads have far fewer domestic animals. Male-headed households have an average of about eight head of cattle, four times higher than the average of two for a female-headed home. The disparity for goat ownership is smaller; households headed by women have an average of nine goats, while those headed by men have fourteen. Averages for the ownership of donkeys are 0.5 for female-headed households and 1.4 for male-headed homes.

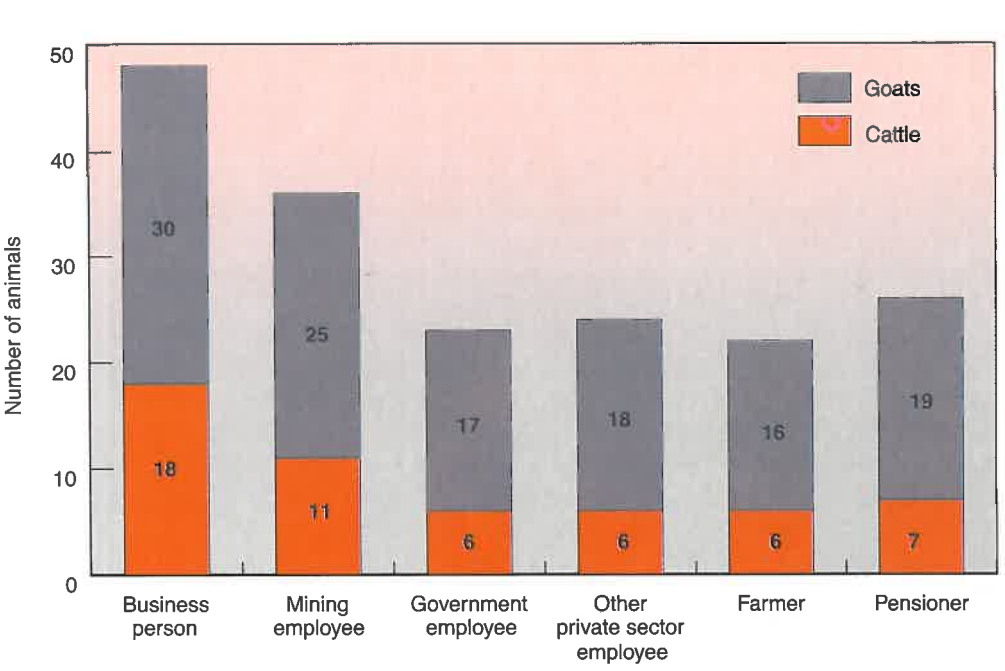
The very high numbers of cattle in densely settled areas are due to the high density of households in those areas, rather than people in those areas owning many cattle. In fact, the average number of cattle per household is actually lowest in the most densely populated areas. Numbers of cattle per household drop from about 10–15 per household in more sparsely populated areas to less than five per household in the most densely populated areas. A shortage of grazing in densely settled areas is almost certainly the reason why households in those areas have so few cattle. The same graph shows that there is a similar relationship between population density and the number of goats owned by each household. Even though there is a great deal of variation, the average household in densely populated areas is thus comparatively poorer in having fewer animals.

Average numbers of livestock owned by households of different sizes[1]

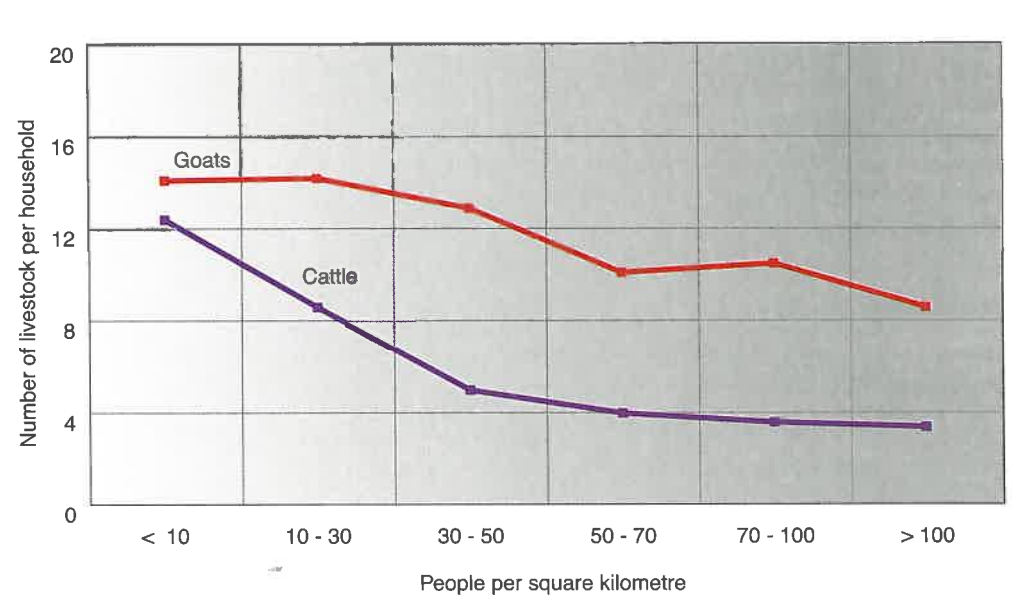
People per household	Average number of livestock				
	Cattle	Goats	Donkeys	Sheep	Pigs
1–3	1.3	5.0	0.5	0.1	0.3
4–6	2.3	10.3	1.0	0.3	0.7
7–9	4.8	18.0	1.6	0.5	1.2
10–12	8.3	23.3	2.1	0.8	1.6
13–15	10.9	28.1	2.5	0.9	2.0
16–18	16.7	30.7	2.5	1.2	2.7
19–21	15.6	29.8	2.6	1.0	2.6
>21	32.4	38.5	2.5	1.8	3.7



▲ ***The proportions of households owning different numbers of cattle and goats[1]***



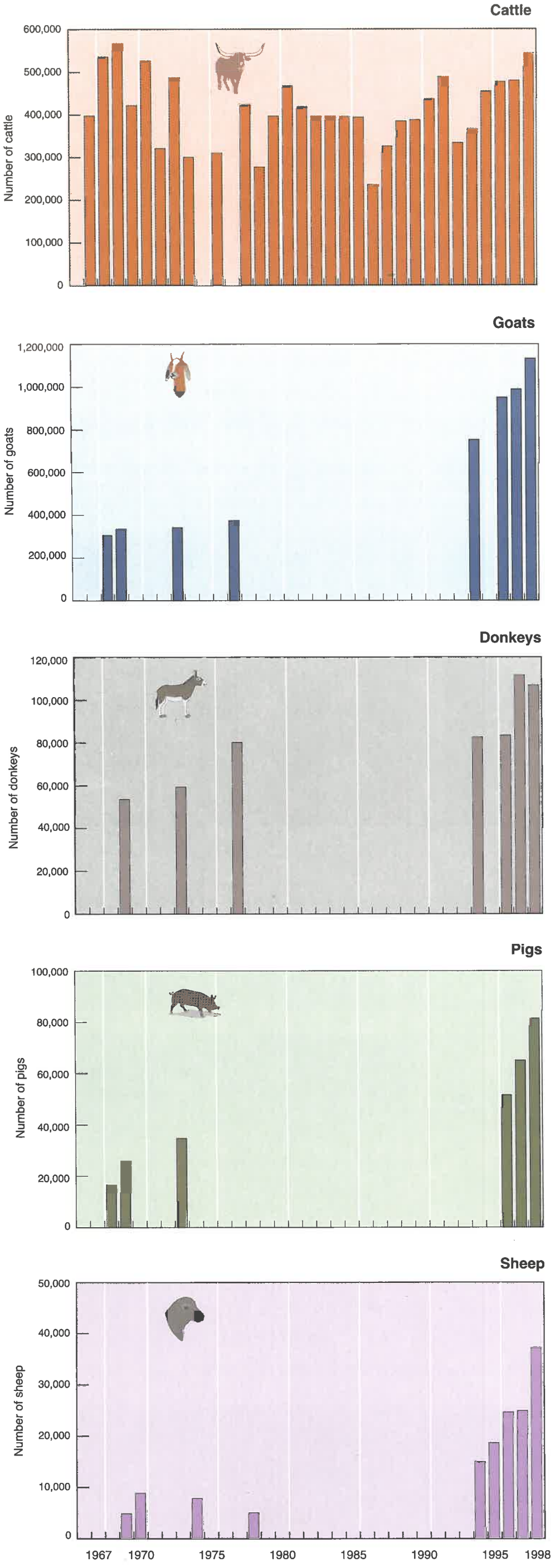
▲ ***Average numbers of cattle and goats in relation to the occupation of the household head[6]***



▲ ***Average numbers of cattle and goats owned by households in relation to population density[4]***

A typical scene in the Cuvelai, where livestock belonging to nearby homes graze communally

HD



▲ *Number of cattle, goats, donkeys, pigs and sheep in Owambo over the past three decades*[8]

Cattle around Oshakati and Ondwangwa now regularly feed on cardboard

HD

Livestock populations

There were enough cattle in Owambo at the end of the 19th century for surpluses to be traded into and through Angola and south into southern Namibia, Botswana and South Africa (see page 63). No estimates of the numbers of cattle are available for that period, but a total of 150,000 cattle were estimated to have been in Owambo in 1935. Numbers then probably increased quite rapidly until the 1960s, after which estimates could be made based on Directorate of Veterinary Services' vaccination campaigns and stock censuses. Some estimates may have been quite inaccurate because information was hard to collect during the liberation war. However, two conclusions seem clear. The first is that total numbers reached something of a plateau during the 1960s and early 1970s, perhaps at a total number of between 400,000 and 600,000 head of cattle. These numbers seem to have been more or less maintained since then. The second is that during these past 40–50 years numbers have fluctuated, often quite widely, between about 300,000 and 550,000. Some changes may be due to errors in estimating the size of the cattle population, but others have been due to severe droughts when large numbers of cattle died. For example, the most recent drought in 1992–93 resulted in the loss of about a quarter of all cattle.

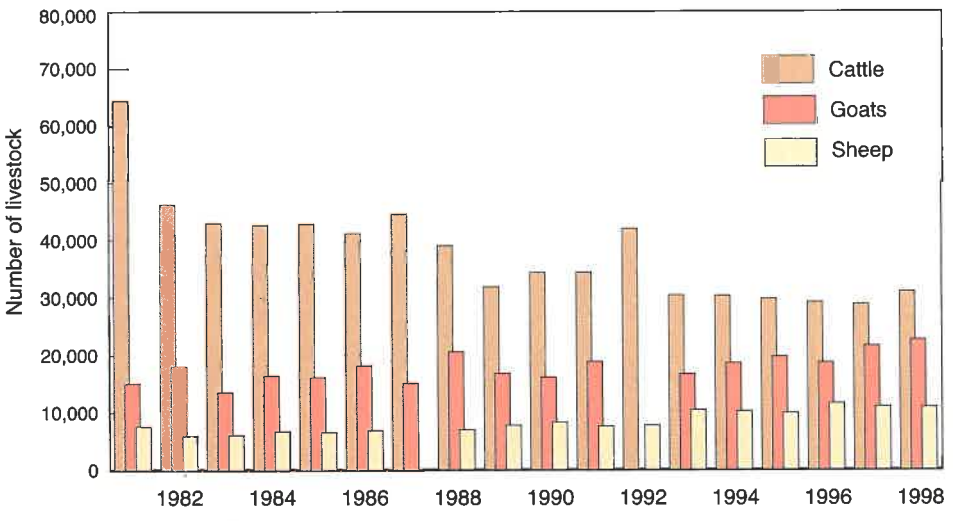
Estimated populations of cattle, 1998[7]

Region	Number of cattle
Omusati	218,000
Oshana	39,000
Ohangwena	130,000
Oshikoto*	193,000
Total	580,000

** The total for Oshikoto includes an estimated 31,000 head of cattle on the Tsumeb farms*

Agricultural censuses done over the past three years in Owambo put the total population of goats at about 1.1 million, having increased fourfold over the past thirty years, and donkeys at 107,000. There are relatively few sheep and pigs – about 37,000 and 81,000, respectively. Not all the figures from previous years and decades may be terribly reliable but it seems that, unlike cattle, numbers of goats, donkeys, sheep and pigs have increased along with the increase in human population.

In 1998, there were an estimated 31,000 cattle, 23,000 goats, 10,000 poultry, 11,000 sheep and small numbers of donkeys in the Tsumeb area. There has been a dramatic decrease – by more than 50% – in cattle numbers on these farms since the early 1980s. Three reasons probably account for this drop. The first is that rainfall in the area has been substantially lower than before the 1980s (see page 10), so the farms have had less grazing than before and could not support as many cattle. The second reason is that beef prices paid to farmers have remained rather constant in recent years. Prices have, thus, not increased at the same rate as inflation, so it now costs farmers relatively more to produce beef. The third reason is that carrying capacities have dropped as a result of increasing bush encroachment (see page 29). It is difficult to judge the relative importance of these different factors, and some apply more clearly on certain farms than on others. Along with the decline in cattle numbers, farming goats and sheep has become more popular in the Tsumeb area. Numbers of goats and sheep have, thus, increased since the early 1980s.



▲ *Number of cattle, goats and sheep in the Tsumeb area over the past two decades*[7]

Cattle movements

Large numbers of cattle are moved to take advantage of better pastures and water supplies, similar to the movements that are commonly made by cattle herders in semi-arid areas throughout the world. Early travellers to Owambo in the late 19th century reported how cattle were brought home after the annual harvest, suggesting that the movement of cattle has been going on for many, many decades. Most movements would have been for two reasons in those early years: to conserve water supplies once they started to dwindle near the homestead so that enough water remained in hand-dug wells for the use of people, and to exploit better grazing opportunities. These days, however, piped water is available in many areas and, thus, most movements are made to give cattle better grazing. Cattle are now also moved to pastures further away than before, when they could be grazed in unoccupied areas within the Cuvelai.

There are two major movements each year. The first is towards the end of summer, usually between March and May, when cattle are brought home to densely populated areas where families live permanently. Cattle can then enjoy new pastures that have grown during the summer rains and also feed on mahangu stubble after the harvest. The second movement, back to the cattle posts, occurs once all the grazing has been depleted between August and October.

The direction of movement and relative proportion of cattle moving between different areas are shown in the map below. The region is divided into the settled areas (densely populated, where most families live permanently), grazing areas (where access to pastures is unrestricted), mixed areas (where significant numbers of permanent settlements are surrounded by open, grazing areas), and areas that are fenced and unavailable (see page 48). Most movement is between the settled and grazing areas, although some more localised movements take place within grazing areas to better pastures or new water points. The movements are also largely within the boundaries of traditional tribal authorities. For example, most Kwanyama cattle move from the populated, settled areas to grazing areas further east, and most Kwambi cattle move south towards Etosha. Moving cattle outside these borders is perhaps difficult, special authority being needed from the relevant tribal leaders before cattle can be grazed in areas under their control.

Regular movements of cattle into and out of Angola are widely reported, especially by cattle-owners living close to the northern border. Just how far cattle move out of Namibia appears not to be well known. As areas available for communal grazing become more and more limited, especially by the fencing off of open grazing pastures and water points (see the map on page 47), cattle-owners will be forced to rely more and more on open grazing areas in Angola.

EPP

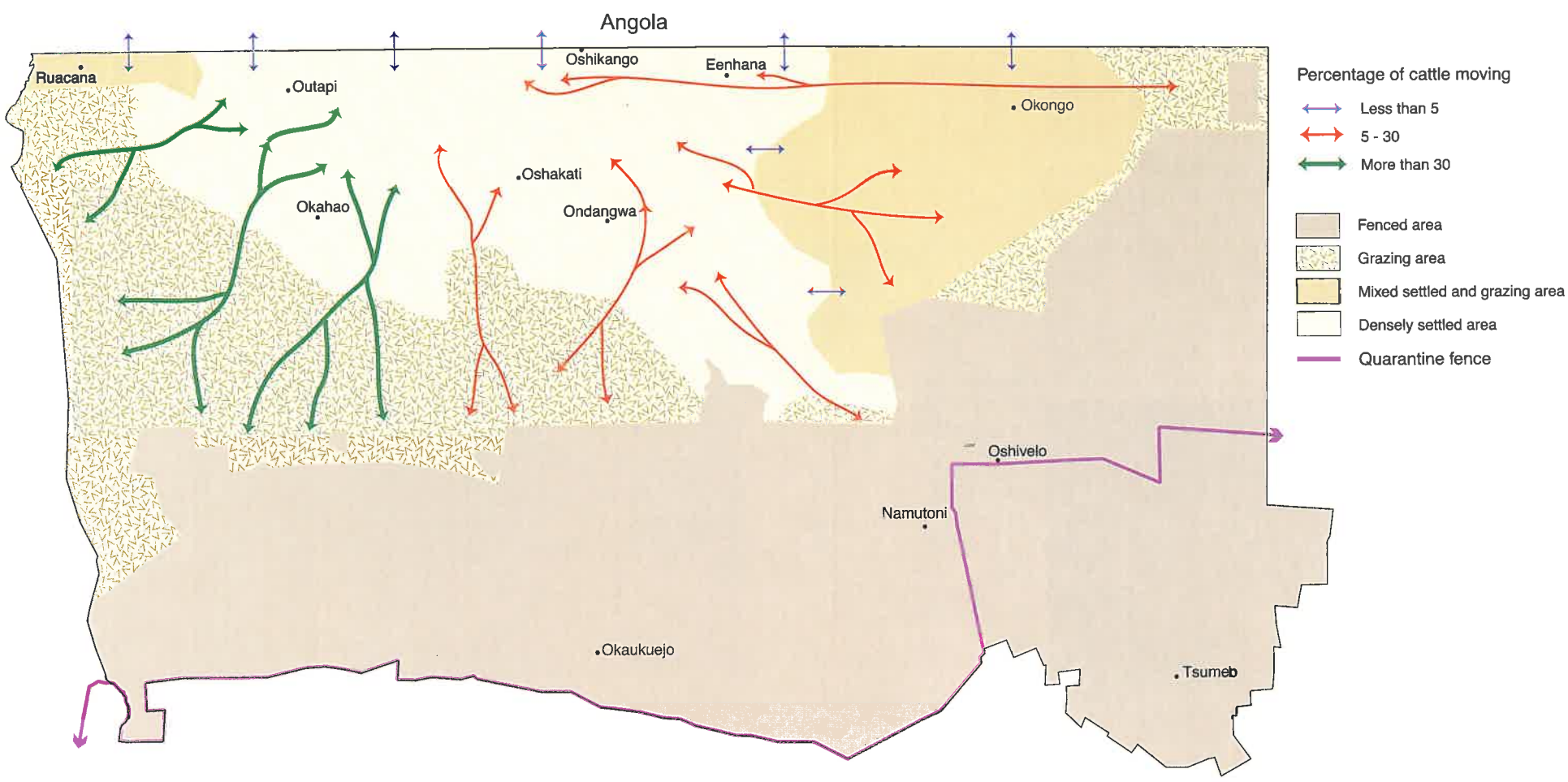
Cattle on the move to greener pastures

Most of the cattle that are moved belong to households that are at least moderately wealthy – those with herds of around 10–30 animals. These households have enough people to look after animals at the cattle posts. Poorer households, with smaller herds of perhaps less than ten head, often do not have enough labour of their own to move cattle to distant grazing areas. Some of these cattle-owners keep their animals at home permanently, while others pool their resources with other people so that a larger herd is formed and labour to look after it is shared. Most very large herds belonging to the very wealthiest cattle-owners are too big to benefit from the limited grazing available in settled areas. Their animals are thus permanently at cattle posts, many of which are on large, fenced farms.

A few head of cattle are kept at most homes throughout the year, but for the rest it is hard to get good information on the overall proportions moved between grazing and settled areas. Claims of 70–90% of all cattle being moved are exaggerated, and an overall estimate of about 30% is probably more correct. That figure is based on a survey of some 13,000 households in the Outapi and Endola areas.[6] Only about 15% of all cattle appear to move seasonally in areas around Engela, Endola, Ongenga and Okalongo, while between 40% and 60% of cattle are moved to and from households in the Outapi and Tsandi areas. Comparatively greater proportions of the herd may be moved from areas which are more stocked than those with less cattle, probably because the densely stocked areas are so overgrazed. Few movements take place in the 'mixed' areas in eastern Ohangwena and Oshikoto, where settlements are scattered between old pan systems with large areas of Kalahari woodlands (and pastures) between them. Grazing resources are adequate throughout the year in these areas, so cattle-owners only move their stock elsewhere during the driest years.

An interesting change appears to have occurred in and around the towns of Oshakati, Ongwediva and Ondangwa recently. Owners of small herds of cattle near these towns now apparently keep their animals there permanently because the cattle can feed on cardboard and other paper refuse when all other grazing has been exhausted. Some cattle-owners even visit large warehouses to fetch cardboard boxes which are taken home to their animals.

Cattle on the Tsumeb farms are also moved during particularly dry years. The farmers can move their animals anywhere within Namibia south of the quarantine fence, depending on where they can hire grazing. These movements may be over hundreds of kilometres, and the herds can remain on distant farms for long periods until it rains and pastures on the Tsumeb farms recover.



▲ ***The approximate directions and relative sizes of cattle movements at the end of summer and then again at the end of winter***
The position of the quarantine fence that prevents the movement of animals out of Owambo is also shown.

Livestock densities

Densities of cattle largely mirror the distribution of rural people, with the highest densities in the densely populated Cuvelai. The two maps on the right provide estimates of cattle densities during the winter and summer months. These are based on counts of cattle at crush-pens during the winter, and assumptions about the proportions moving between settled and grazing areas, and into Angola, as discussed in the previous section on cattle movements. During the winter months, there are very high densities in a belt running south-eastwards between Onesi, Okahao and Onaanda, in another zone stretching south-eastwards between Ondangwa and Omuthiya, and in a broad area along the northern border between Okalongo, Endola and Ondobe. In all these areas densities are greater than 20 cattle per square kilometre, equivalent to less than five hectares per head. There are between 5 and 20 cattle per square kilometre in most of the remaining densely populated area. The highest densities of cattle in the grazing areas during the winter months are in south-western Omusati, around settlements such as Onamatanga, Uutsathima and Amarika, and in areas in and around the Mangetti farms.

Numbers in the settled areas drop during the summer months and densities in the grazing areas increase correspondingly, especially in eastern Ohangwena and southern Omusati, and east of Onyuulae in Oshikoto.

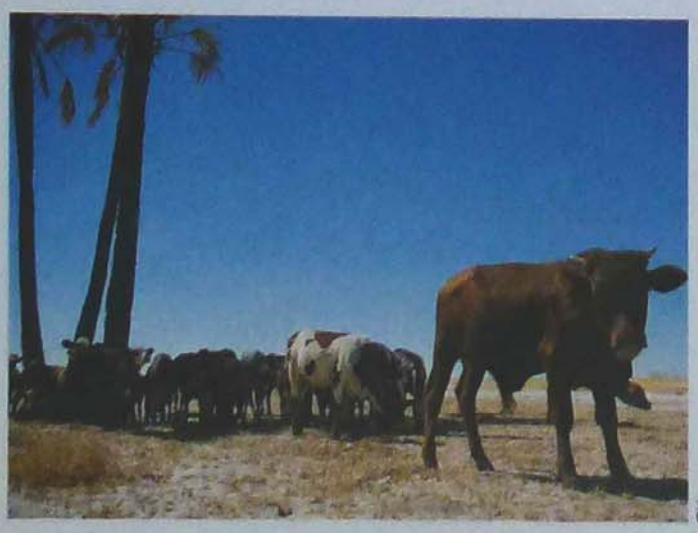
A number of areas have low cattle densities both in summer and winter. Two of these – in eastern Oshikoto and the south-western corner of Omusati – almost certainly have slightly higher densities than shown in the two maps. This is because there are few crush-pens in those areas at which cattle are counted. A third area, in central and western Oshana, also has few crush-pens, but large numbers of cattle are known to move onto the grasslands between Onaanda and Ompundja during the summer months. By contrast, there are indeed few cattle in southern Oshana just north of Etosha because of the lack of fresh water in that area.

DD

Huge numbers of donkeys characteristically graze in the broad, open oshanas in the western Cuvelai

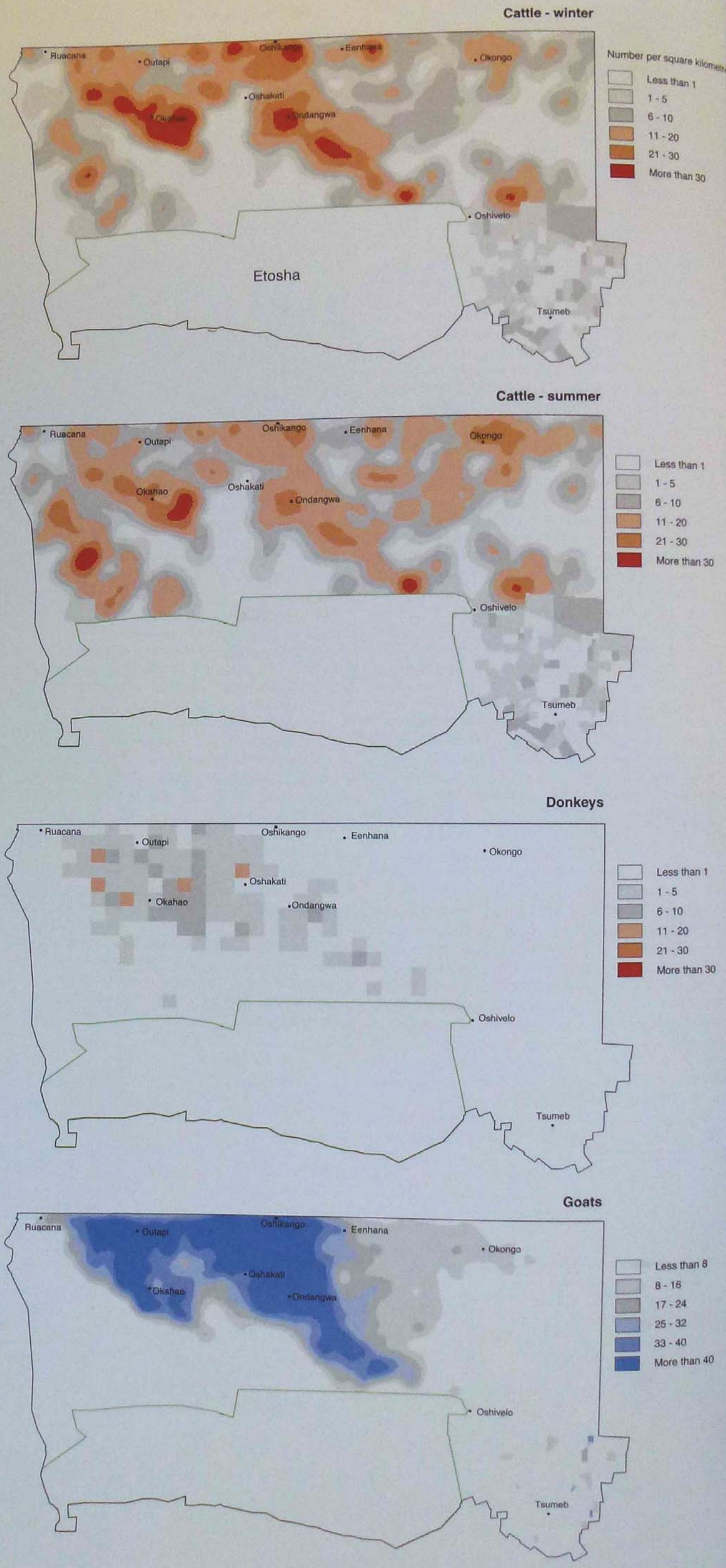
The majority of donkeys are concentrated in the Cuvelai, especially west of Oshakati, where they are so conspicuous in the broad, open oshanas. There are very few donkeys in the Tsumeb area. The map showing the density of goats indicates that there are more than 30 goats per square kilometre over much of the settled area of Owambo. In the most densely populated areas this figure rises to over 50 goats per square kilometre, equivalent to less than two hectares per goat.

Putting the densities of cattle, goats and donkeys together provides estimates of total stock densities, giv-

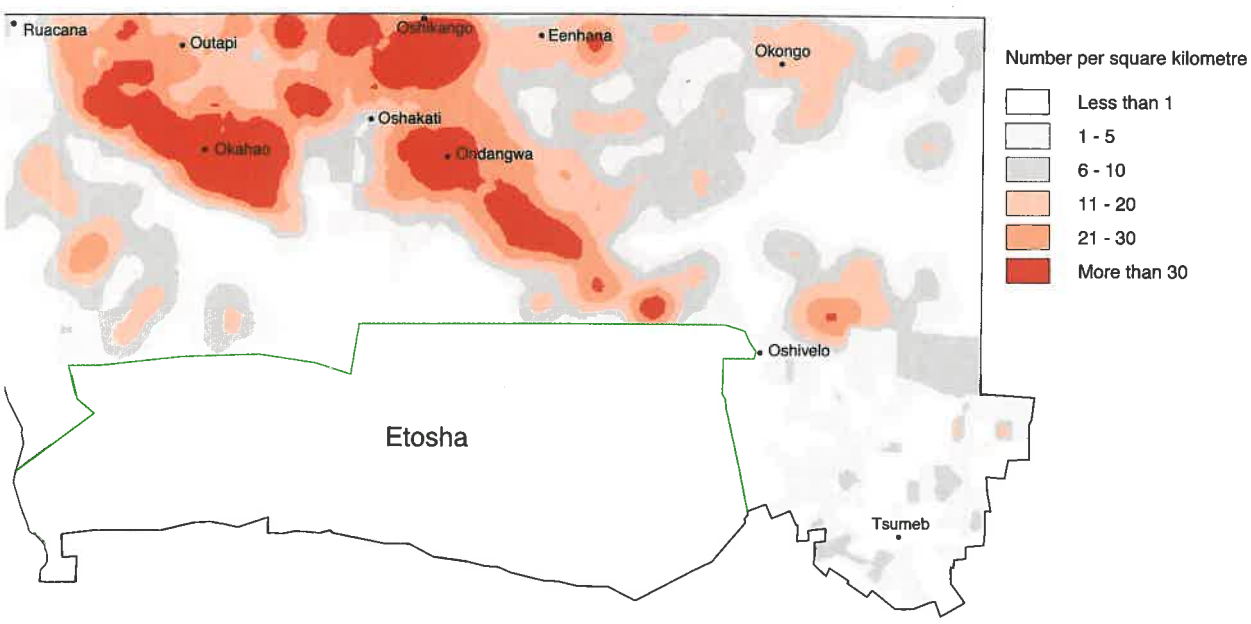


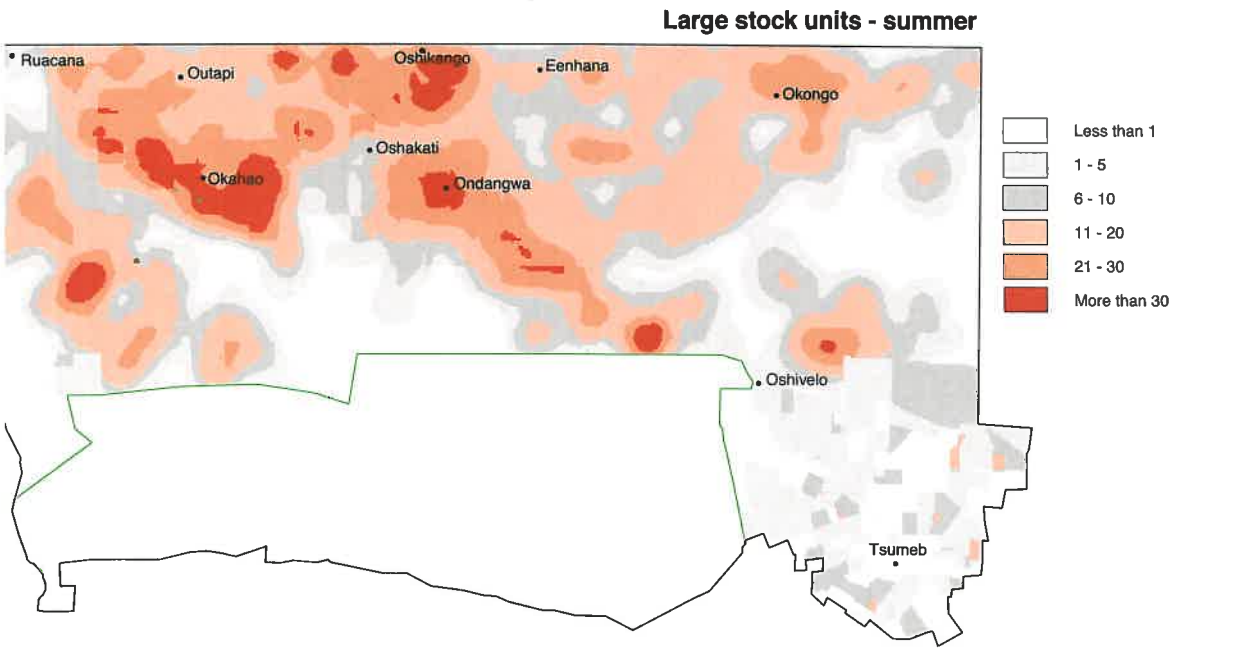
HD

Palm trees provide a tiny bit of shade for some of these animals, part of a population of some 580,000 cattle in 1998



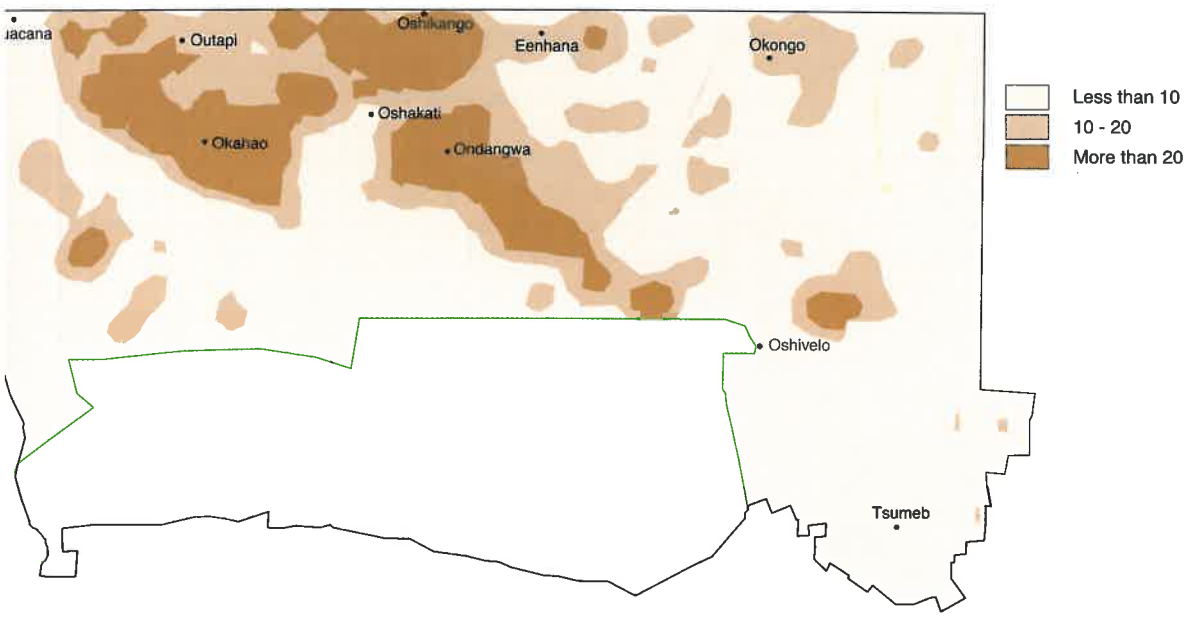
▲ ***Densities of cattle in winter and summer, and goats and donkeys[9]***
Note that the legend and scale of categories for cattle and donkeys is the same, while that for goats is given in groups of eight because eight goats are more or less equivalent to one head of cattle or one donkey.





ensities of large stock units in summer and winter[11]

ne large stock unit is equivalent to one head of cattle, one donkey or eight goats, and the maps therefore rep-sent a compilation of densities of cattle in summer and winter, donkeys and goats, as shown on the opposite ige.



reas where there are more than 10 or 20 large stock units per square kilometre throughout the year[11]

EPD

y bit of greenery is food to the population of over a million goats

ing the number of large stock units per square kilometre. A 'large stock unit' is equivalent to one head of cattle, one donkey or eight goats. The maps of winter and summer densities of large stock units, respectively, use the winter and summer estimates of cattle numbers described earlier. Both maps are approximations, but they provide realistic indications of the kinds of stocking rates in the region. They are also useful in making judgements about which areas are overstocked, and which areas might be used to support greater numbers of livestock. These judgements are made in relation to estimated carrying capacities – the numbers of large stock units that can be supported in an area such that the animals can graze or browse the vegetation in a sustainable manner. For the kinds of vegetation that occur in the region, a figure of ten animals per square kilometre, or ten hectares to support one large stock unit would be reasonable and desirable.[10]

EPD

Water is widely available to livestock after good summer rain showers, but animals often walk far to drink during the dry winter months

The table below shows the number of square kilometres stocked at different densities, as well as the percentages of the area available for livestock farming that these densities amount to. A number of conclusions can be drawn from the maps and the table. First, it is clear that large areas of the region are very densely stocked, and stocking rates are several times higher than is desirable in the most densely populated areas. Second, the overall pattern of stocking does not change dramatically between summer and winter, indicating that the extent of cattle movements is not as great as is usually supposed. Large areas in the Cuvelai remain stocked at rates that are several times higher than ten hectares per large stock unit. About 8500 square kilometres carry more than 20 large stock units per hectare during winter and summer, and about 19,000 square kilometres have more than 10 large stock units throughout the year. It is very likely that these kinds of high stocking rates have had damaging effects on pastures (see page 27), but the exact nature of these effects has not been studied. Likewise, animals living in such densely stocked areas are likely to be in poor condition, thus, not growing as fast as they might, not reproducing as often as they could, and being more susceptible to disease.

A third conclusion is that stocking rates on the Tsumeb farms are much lower than in most areas of Owambo. There is, however, considerable variation from farm to farm, and some farms have no cattle or other livestock because they are not used for cattle ranching (see page 48).

Total areas with different stock densities in winter and summer, and the percentages these areas make up of the whole region (excluding Etosha)[10]

Large stock units per square kilometre	Winter area Square kilometres	%	Summer area Square kilometres	%
<1	15,780	26	12,510	20
2–5	13,860	22	11,700	19
6–10	12,260	20	11,380	18
11–15	5,270	9	9,050	15
16–20	3,400	6	6,860	11
21–30	5,970	10	7,980	13
31–40	3,760	6	1,890	3
>40	1,380	2	310	1

Livestock diseases and their control

Diseases in the region have two quite different effects on livestock. The first and obvious one is on the health of the animals, especially by reducing their growth and reproductive rates, and by causing death. The second is produced by the restrictions placed on the movements of livestock and the ability of people to market livestock products outside the region. These limits are largely enforced through the quarantine system: the veterinary cordon fence or infamous 'red line' and the quarantine farms. The veterinary cordon or quarantine fence prevents the movement of any livestock, and diseases that they might carry, from Owambo south into the so-called commercial farming area. The fence also maintains a division that has long had political implications in separating land allocated to white farmers from the homelands to the north. Foot-and-mouth disease and lung sickness have to be kept out of the commercial area since Namibia's ability to export beef relies on the animals being 'clean'. The fence also restricts the movements of any other large mammals, a limit that is necessary because any cloven-hoofed animal can transmit foot-and-mouth disease. The red line does not affect livestock on the Tsumeb farms, although there is a buffer or surveillance zone two farms wide south of the fence.

Three quarantine farms have been created in Owambo (see the map of land uses on page 48). Cattle sold to Meatco (the organisation responsible for marketing beef for farmers in Owambo and other areas north of the red line) must spend three weeks on those farms before being slaughtered and before the meat can be exported. This might seem like a reasonable solution, but transporting animals to and from the quarantine farms incurs costs that cattle-owners must bear. Naturally, many cattle-owners complain about these costs and resultant lower profits. However, the nature of cattle farming in the region means that it is unlikely that sales would increase substantially if these costs or, in fact, the red line were removed altogether (see the following section). Perhaps the most valid complaint is that the red line reduces marketing opportunities for the minority of farmers that may indeed want to market their animals further south.

In addition to the quarantine measures, the Directorate of Veterinary Services conducts annual vaccination campaigns during which cattle are vaccinated against foot-and-mouth disease, anthrax and lung sickness. All cattle in Owambo are vaccinated against lung sickness, while anthrax vaccinations are only provided in areas where the disease is most prevalent. Because foot-and-mouth is suspected to come from Angola and there have been no outbreaks in recent years, only cattle in a strip along the northern border are vaccinated. Major outbreaks of this disease in Owambo occurred in 1946, 1958, 1962, 1967, 1969 and 1970.

To sell or not to sell?

Many agricultural development projects aim to improve the productivity of farming in the region, and their efforts are based on a number of assumptions. Perhaps the most prevalent are those that assume the majority of people rely on home-grown food as their sole source of nutrition, and that many farmers are eager to earn cash incomes from their crops and livestock. The first assumption is incorrect because only a minority of households rely on farm produce to provide all their food needs. Cereal production is often inadequate and, as the chapter on household economies will show, most households buy additional food.

The second assumption is also incorrect, because the evidence that follows shows that the majority of farmers are not eager to sell their produce. This also implies that much of the agricultural land does not generate any cash income. What evidence is there for these claims? For a start, it is clear that few farmers sell mahangu, as demonstrated by the small percentages reported in the next table.

Percentage of farmers that sell mahangu, goats and cattle regularly, seldom or never[12]

Frequency of sales	Percentage of farmers that sell their produce		
	Mahangu	Goats	Cattle
Regularly	3	6	0
Seldom	15	24	27
Never	82	70	73

Farmers also expect very high prices, setting prices higher than that of maize meal, and sometimes at about double the price. Many people are obviously reluctant to pay so much, and Angolan farmers who sell mahangu at lower prices at informal markets fill part of the gap that Namibian farmers seem unwilling to occupy. It is also often said that demands for milled mahangu are high, especially in places such as Windhoek, Oranjemund and Walvis Bay, but most of the many enterprises established in recent years to market mahangu have not been successful.

The most popular reason given to explain the reluctance to sell mahangu is that farmers do not produce enough surplus of the crop. That must often be true, especially among farmers with small fields and during years with poor or even average rainfalls. Farmers also prefer to keep surpluses because mahangu is highly valued as a traditional food. There are also good reasons to keep a reserve in case the next harvest fails.

For commercial enterprises, there are technical difficulties that make the milling process expensive. It is also difficult to produce milled flour that has an acceptable taste. In spite of all these reasons, it is clear that there are opportunities for farmers to make money if they were to increase production. These are the same opportunities that Angolan farmers seem to exploit in selling mahangu at markets in Owambo.

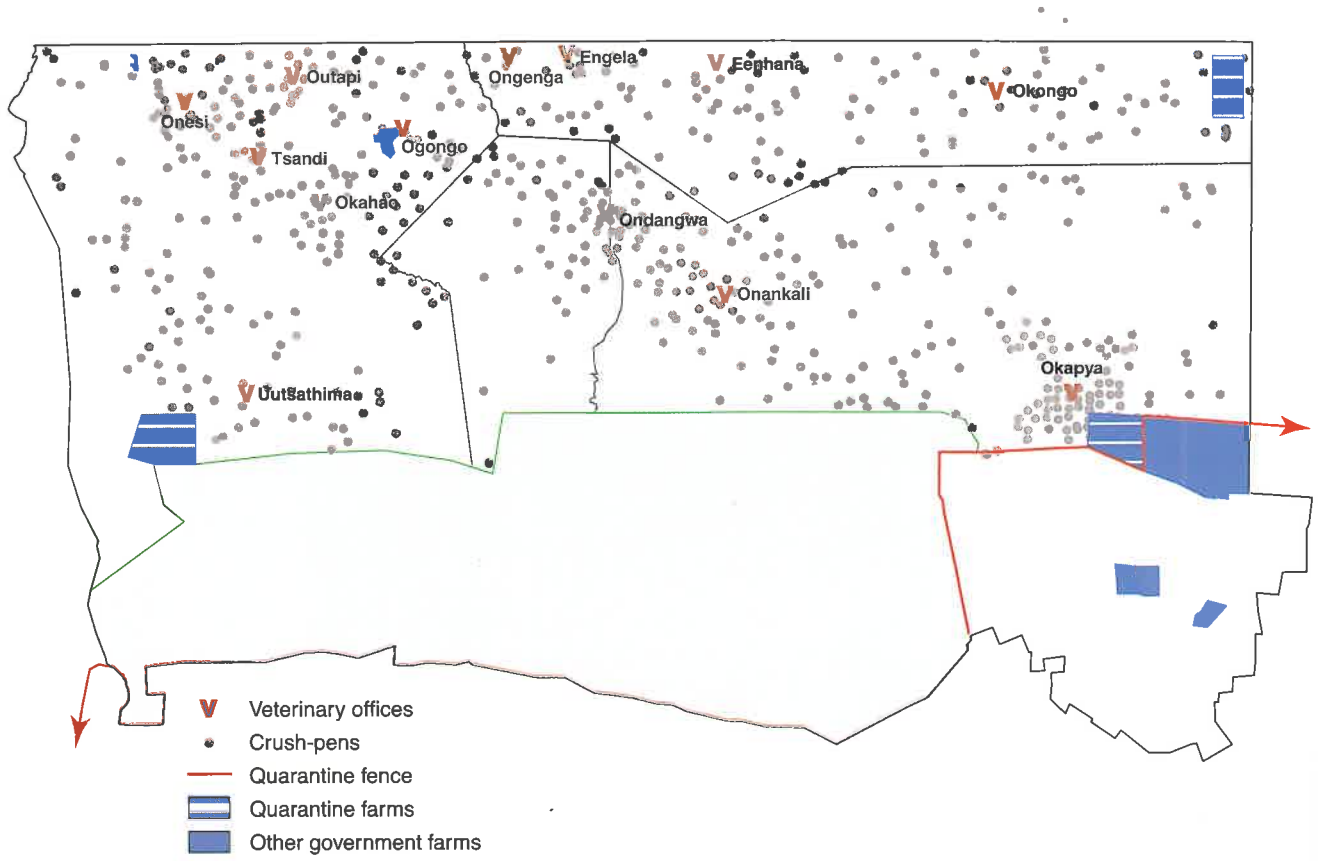
Livestock are also sold with reluctance, with only about one in twenty farmers in Ohangwena regularly selling goats, and none selling cattle (see adjacent ? table). Of all the goats in the region, about 18% are estimated as being slaughtered each year, but the great majority of those are consumed at home. For cattle, only 7% are estimated as being slaughtered each year, with about 5.5% being used for domestic consumption and the remaining tiny proportion of 1.5% being sold. Very few cattle are sold to Meatco, the only formal marketing scheme. The 1200 to 1300 cattle sold to Meatco in 1997 and 1998, respectively, amount to less than 0.3% of the total number of cattle in Owambo. There is a larger informal market but, again, the numbers of cattle sold are small. The biggest informal market is at Outapi, which then also supplies cattle to the large markets in Oshakati and Ondangwa. Recent estimates indicate that 70% and more of the cattle and goats sold in Outapi come from Angola.[13] Another 5% come from Kunene. Marketing cattle has traditionally been controlled by men but, interestingly, a group of women have now entered the business by buying cattle from farmers and selling them to informal markets.

Most of the 1.5% of cattle in Owambo that do find their way to the market are sold by farmers that own relatively few animals. Thus, farmers with small herds sell a higher proportion of their herds each year, compared with those with much bigger stocks of cattle. The people that we might expect to be farming their cattle commercially, selling perhaps 15–30% of their total stock each year, thus sell very few cattle.

If the value of most cattle does not lie in productive agriculture, why are cattle such an important resource, and why are there so many in Owambo? The same question holds for goats, and for mahangu. There appear to be two explanations. The first is based on the value of livestock and mahangu as a food resource to be used in the event of food shortages. The collective experience of terrible famines (see page 36), as passed down the generations in oral history, must have had a marked effect on farming strategies. One of those strategies is to provide for the future, but to do so effectively also requires that investments be made to develop a farm that will indeed provide food resources for the future. Even though cattle are hardy, they have low calving and growth rates, and natural mortality rates may be high as a result of disease or drought. Building up a large herd takes a long time, and cattle-owners focus more on the potential future value of their herds than on obtaining short-term profits by selling their animals.

A goat on its way to market! Most goats and cattle sold in Owambo come from Angola

DD



▲ ***Veterinary services and government farms used for research, training and production***

A cattle post in southern Omusati, consisting of the huts for the herders, several kraals or stockades, and a cluster of wells

EPP

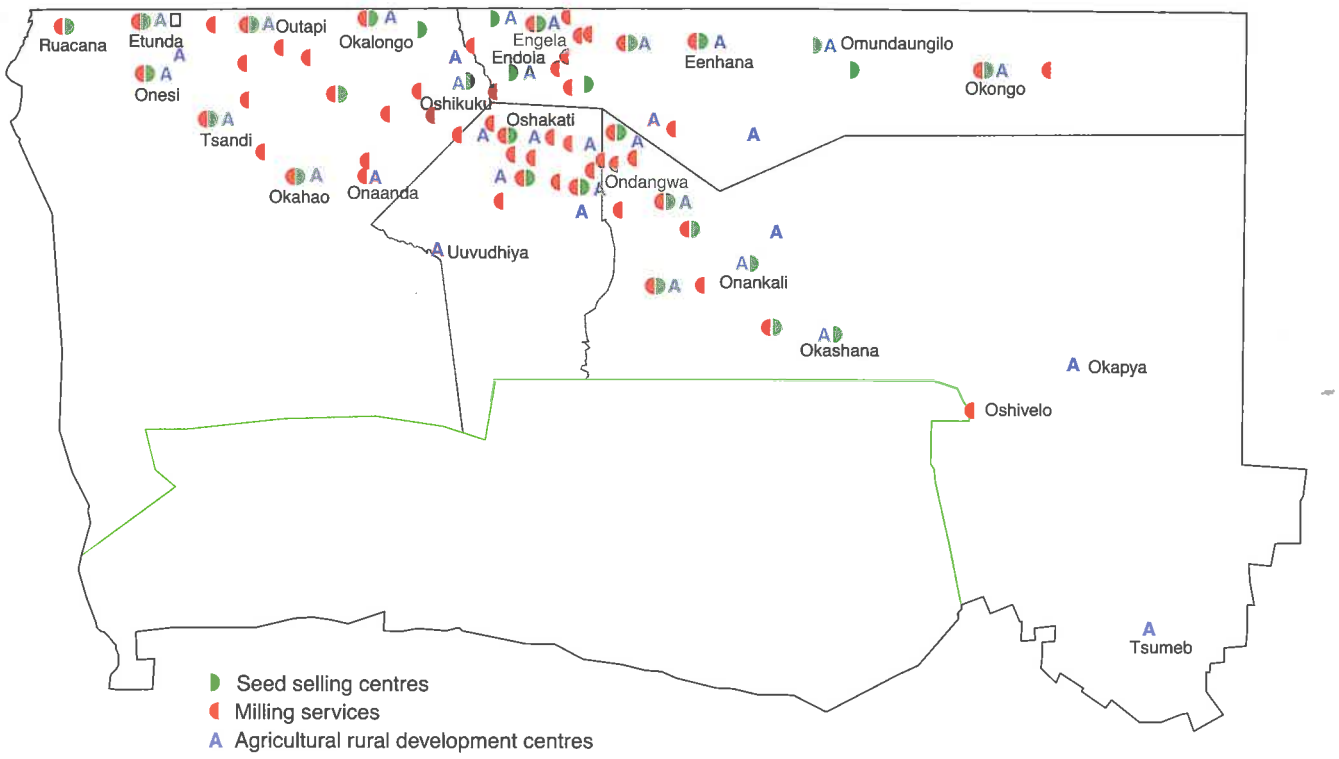
The second explanation, which also helps explain the low levels of sales of both livestock and mahangu, is that there are easier ways for most households to obtain cash incomes. One study estimated that less than 6% of the cash incomes of households in Owambo come from farm produce,[14] while a different study found that crop sales provide about 3% and livestock sales about 7% of annual cash incomes.[12] These very small percentages simply mean that households have much bigger sources of cash incomes. They also mean that, given the large cash economy in the region (see page 68), it is easier for the majority of households to earn money by having household members enter the job market or by running businesses. For that majority, there are few incentives to sell surplus mahangu, goats or cattle. These households will also have little interest in attempting to grow other crops that might yield cash incomes.

Farming in a risky environment

A number of factors influence the size of a harvest: rainfall, soil quality, the availability of land, and the inputs invested in crops. Likewise, several factors determine the size of a livestock herd: the availability of grazing, the health of the animals and their reproductive rate, and inputs from the household to look after those animals. Both for crops and livestock, many of the inputs are determined by the size and wealth of the household. Thus, richer households have much bigger fields, (which are also better fenced), better access to draught animal power for ploughing, and more cash to pay for ploughing services, improved mahangu seeds and fertilisers. Wealthy homes also have bigger herds of goats and cattle. And because they are large, prosperous homes have more labour to help with all the tasks involved in producing a crop, and for looking after their animals at home and at distant cattle posts (see page 66).

Opposite conditions hold for poor households. For example, their fields must often be ploughed manually. But the burden of that activity coupled with other labour needed in the fields is disproportionately greater because poor homes have few people living in them. They also have few livestock and are thus unable to apply as much manure to their fields to improve yields.

In summary, large, wealthy homes can invest considerably in large fields and herds, while poor households cannot provide the same inputs into their small fields and herds. Those differences seem perfectly logical, due to the simple and unfortunate fact that some people are better off than others. However, the difference has more serious implications if we consider that it is the poor households that are really dependent on farm produce to feed themselves. In other words, those that invest the least and have the smallest fields and herds, rely to the greatest degree on natural resources to give them food.



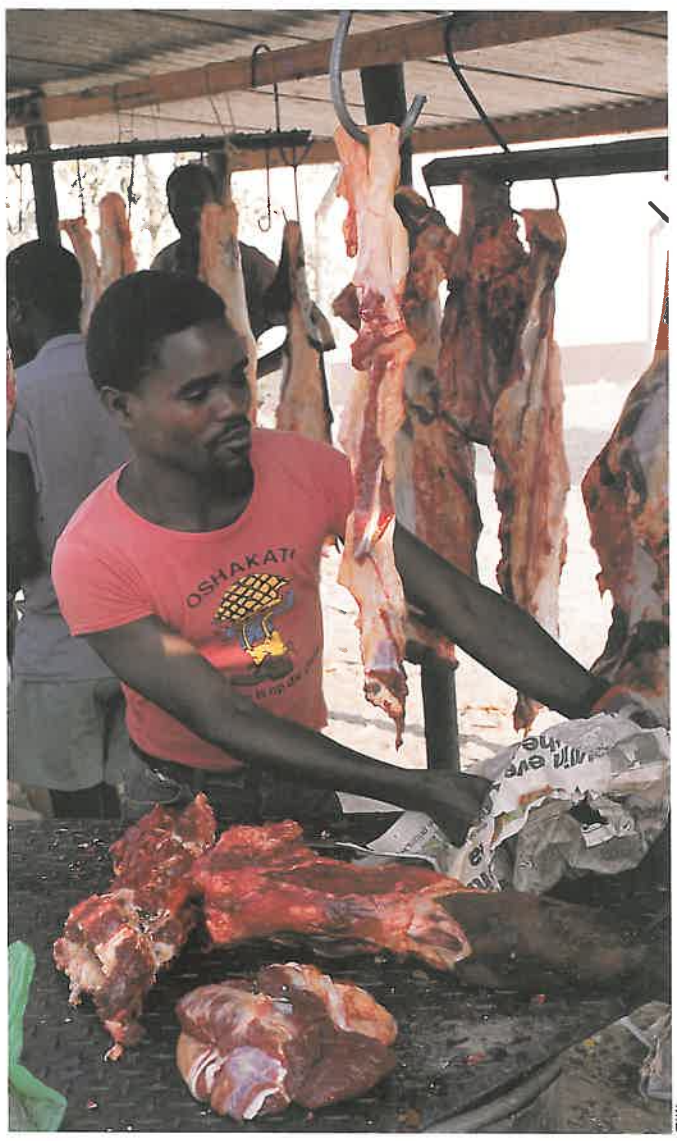
▲ *The distribution of services that support crop farmers*

The effects of bad yields, when rains fail or crops are damaged by pests, are disproportionately more severe on these poor homes because they lack other sources of food. They do not have the larger numbers of people with cash incomes from jobs and businesses that are to be seen in wealthy households. By contrast and whether it rains or not, rich homes do not rely on their large fields and herds because they have many other sources of income.

Another way of looking at this is to say that poor farmers are severely constrained in producing enough food to provide for their families. Prosperous farmers, on the other hand, invest resources into farming which they do not really need for purposes of day-to-day living. Most of their food needs are met by buying food and they make no money by selling farm produce. The use of natural resources – pastures for grazing, water and those limited areas with good soils – by wealthy homes is, thus, much greater than the use made of the same resources by poor homes.

How, then, does one assess the high rate at which land has been cleared for crop production, and the high stocking densities of livestock? For those households that depend on farming to live it is easy to argue that their use of the land is entirely justified. For those that make little use of agriculture to meet their subsistence needs, however, and who increase the sizes of their fields and herds as they become wealthier, there is less justification. Many would argue that it is the traditional right of people to farm and to expand their farming operations. But is that legitimate if large areas of natural habitats are lost, and it becomes increasingly difficult for poor subsistence farmers to have access to the remaining natural resources?

These are issues that should force us to consider whether farming practices in the region are fair, and how wisely natural resources are being used. A range of agricultural development projects and support services are provided with the aim of increasing crop yields and harvests, and also the number and health of livestock. It can be argued that many of these projects and services largely promote the interests and activities of wealthy farmers, for example by inoculating their animals, and providing fertilisers and mahangu seeds at subsidised costs. One solution would be to reduce this assistance, allowing their places to be taken by commercial enterprises that provide the same services in much the same way as many entrepreneurs now have mills for the milling of mahangu. Another option is to redirect the public funds spent on these services to activities that specifically benefit poorer farmers.



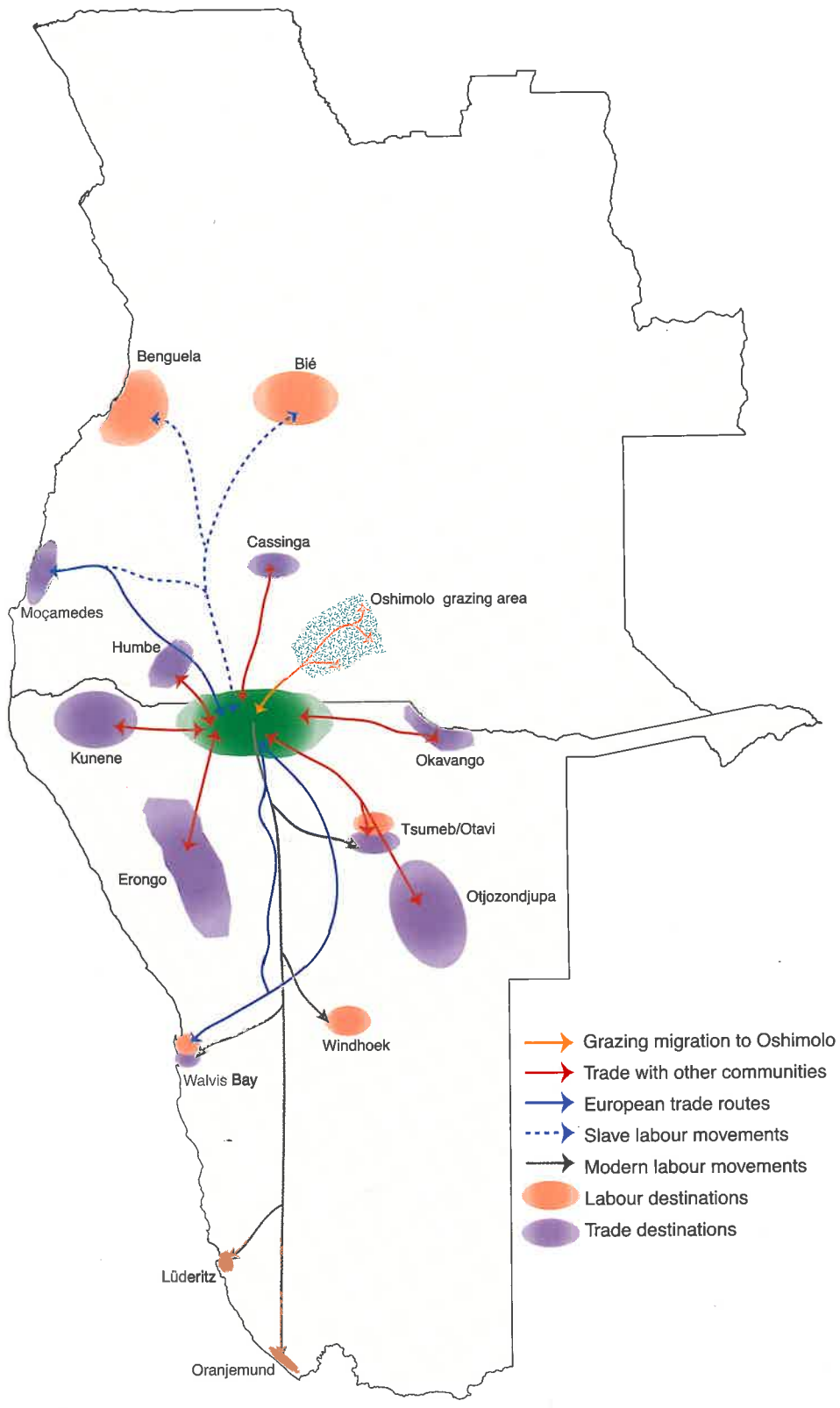
MIB

Most meat is sold in informal markets

Household economies

Two attributes best describe the region's economy: diversity and vigour. These are qualities that have evolved from a long history of trade, hardship, migratory labour and entrepreneurship, and the results of that development are to be seen today in the variety of economic activities in which families are engaged. Incomes from subsistence, employment and diverse business activities contribute to most homes, and different people make their livings in an assortment of ways. The idea that the region has a single subsistence economy is thus wrong. It also misleads in suggesting a view of the great majority of people clustered together on the lower rungs of the ladder we call 'socio-economic development'.

Much of the chapter focuses on the household as the economic unit of greatest importance. It is the household unit that controls natural resources, and different features of households have major effects on the use of those resources. Large disparities in wealth between household units raise questions about equitable access to natural resources, and the availability of natural resources to sustain people in poorer homes. These are issues that need to be addressed if levels of poverty are to be reduced, and if natural resources are to be sustained for the use of future generations.



▲ ***Major trade routes and centres of migrant labour***
People from Owambo have a long history of travelling out of the region to trade, to acquire basic resources and to work. Different kingdoms developed their own special spheres of trading activity. For example, the Kwanyama were specialist traders in iron from mines in the Cassinga area, while the Ndonga specialised in trading copper items and salt extracted from pans near Etosha. Most of these commodities were traded in exchange for cattle. From the middle of the 19th century, European traders started to trade with kings and other leaders in Owambo, bringing in arms, ammunition, beads, cloth, horses and tobacco in exchange for ivory and ostrich feathers.

Origins of livelihoods

A key question everyone must ask about Owambo is simply this: Why does the region have such a vibrant and diverse economy? The answer lies in how people have adapted to a highly variable environment over the past few hundred years. Environmental variability provides people with opportunities to do new things during good years when food is abundant, but it also forces people to develop survival strategies when conditions are harsh. In short, that variation produces an overall diversification of economic activities, and it forces people to be innovative.

Let us start at the beginning and then sketch events over the past few hundred years.[1] Exactly when it was that the Oshiwambo-speaking people first arrived in the region remains a debatable issue, especially in the light of southern African politics with its many claims and counter-claims of who got here first! However, most people agree that the first Oshiwambo-speakers settled in the region sometime during the 16th or 17th century, four to five hundred years ago. The predecessors of the Hei//om people, living as hunter-gatherers and pastoralists, occupied the region before that, perhaps for the past 100,000 years.

The earliest settlements of Oshiwambo-speakers were established in the Cuvelai for the main reason that water was available here throughout the year, either as standing water or from shallow wells. The soils in the Cuvelai were also comparatively well-suited to the cultivation of mahangu, unlike the Kalahari sands or salty soils elsewhere. Fish were also available in the oshanas, and fruit could be harvested from marula, berchemia and other fruit-trees.

Surpluses of food in good years were pivotal in stimulating the emergence of groups of specialist artisans, such as metal- and wood-workers, salt-gatherers and potters. Societies around the world have only developed such specialists if food production has been sufficiently high for some members to spend their time on things other than the direct pursuit of food production. The same is true for the emergence of leadership systems. Classes of leaders, such as chiefs, kings and clan leaders, were only established if there was enough food to support them through a system of taxes that could be exacted from their subjects. Good seasons and harvests in Owambo provided those conditions, which led to the leadership systems remaining as the kingdoms of today (see page 46). As in other societies, these kingdoms provided some organisational benefits to people, but they also created immense hardships, as we shall see.

Inasmuch as there were good years, there were also bad years when harvests failed as a result of lower rainfall or attacks by pests. Those lean years played other roles in stimulating the development of strategies to survive shortages of food and reduce risks. The first of these strategies was the development of methods to store food over long periods, mainly by using large baskets to store mahangu. The spectacular *iigandhi* represent centuries of innovation and development to store large quantities of grain for as long as possible. Another way of guaranteeing food security was to build up large herds of cattle and goats that could provide food when all else failed.

The second major strategy to reduce the risk of food shortages was to seek resources elsewhere, notably by using areas outside the Cuvelai as grazing pastures and hunting grounds, and by trading with other people. This was also an important way of diversifying resources available to people. Since fish were less abundant in dry years,

King Mandume ya Ndemufayo with his soldiers carrying arms obtained from traders The firearms gave the kings muscle during tribal conflicts, but were also used, in turn, to obtain ivory and ostrich feathers to be traded for more firearms. All of this had a major impact on wildlife populations and led to a great deal of social upheaval.

hunting in areas away from the Cuvelai provided alternative sources of protein. Another factor which allowed the use of grazing and hunting areas was the seasonal nature of mahangu cultivation. The labour-intensive nature of mahangu cultivation demanded all household members at settlements in the Cuvelai to be most active from December to June. Thereafter, people could use their time to exploit food resources, and hunting and various other opportunities elsewhere.

Obtaining resources by trading was probably first developed between people within Owambo, as some households and local areas would have been better off than others. Historical narratives provide good accounts of how mahangu, salt, fish, sorghum, livestock, tobacco and crafts were bartered within the region. Trade relationships also developed with Hei//om people who provided meat and, later on, copper from the Tsumeb area. (The distinct identity of the Hei//om may have developed as a result of their close and long contact with Oshiwambo-speaking people.) Other active and impressive trade connections developed over much wider areas as well, of which the most important and best documented are summarised in the map on the previous page.

One of the earliest forms of trade over long distances was with Otjiherero-speaking people, from whom about 800 head of cattle were traded each year. Classes of specialist traders emerged and trade outside the region came to be under the tight control of kings and other leaders. Owambo had been isolated from European trading until the 1860s when the Portuguese came in search of ivory, cattle and labour to work on new plantations in Angola. In exchange, the Portuguese provided alcohol, glass beads, tobacco and later firearms. Traders from Walvis Bay also reached Owambo in the 1860s, bringing in firearms, horses, clothes, ox-wagons and other goods. These were exchanged for ivory and ostrich feathers, and heavy demands on these products led to a decline in the populations of ostriches and elephants. The Ndonga leader, King Shikongo, is reported to have collected about 2000 kilograms of ivory each year during the late 1860s. Two-thirds of the ivory shipped out of Walvis Bay during the 1880s came from the Etosha area. Cattle from Owambo were also traded as far afield Kimberley and the Transvaal in South Africa.

There was one other big commodity to be exported: labour! Kings and other elite members of society controlled trade with the Europeans, and they soon developed into merchant capitalists, readily selling slaves to work on the Angolan plantations. They also started to extract much higher taxes, especially in the form of cattle, from their people to pay for firearms. Demands for firearms were indeed great, especially for purposes of defence and hunting. Raids into southern Owambo by Jan Jonker Afrikaner had forcefully demonstrated the value of the arms. Tension between communities intensified with the increase of raids to capture slaves and cattle from neighbouring groups. By the end of the 1880s, kings were selling members of their own communities to Angolan traders.

EPP

A great deal of work goes into making an oshigandhi *basket, a valuable asset used to store mahangu over many years*

Along with the severe stresses imposed by higher taxes and the selling of slaves, several other upheavals were to come upon the people during the last few decades of the 19th century. Substantial social changes were caused by the expansion of Christianity. There were repeated years of drought, locust attacks on crops and, as the final straw, the rinderpest epidemic in 1896–98 when up to an estimated 90% of all cattle in the region died. Further ills were to befall the region in the early decades of the 20th century, when repeated crop failures and famines killed tens of thousands of people (see page 36). The introduction of direct rule and taxation by the Portuguese in southern Angola led to an exodus of some 40,000 refugees from there into Owambo, adding considerable demands on the resources available for crop and livestock production.

By the end of the 1800s, the production system in Owambo had essentially collapsed, and people grabbed the opportunity of adding a new source of income to their diminished resources: salaries from contract labour. Slave labour was outlawed in 1875, and replaced by paid jobs on Angolan plantations late in the 19th century. Demands for labour also emerged on Namibian mines and farms in the first few years of the 1900s. For the first time, households could add cash wages and remittances to their incomes. The benefits of these new incomes came, of course, with all the social costs associated with the migrant labour system.

The large-scale migration of people to work elsewhere that we see today thus owes its origins to the contract labour system that emerged 100 and more years ago. Almost all labour leaving the region for the first 60–70 years consisted of men, but increasing numbers of women started to seek jobs elsewhere after the 1970s (see pages 40 and 41). The whole idea of working elsewhere has indeed become firmly entrenched, and there is considerable social pressure on young people to leave their homes to find a job. What is important is that the migration system is a strategy to provide incomes to households within Owambo; it is not the usual kind of migration where people go off to set up independent homes elsewhere.

In summary, the region has provided surpluses which allowed for the emergence of kings, artisans, traders and their modern descendants: the many successful businessmen and -women. However, the nature of the environment also meant that there were shortages of food. Those shortages led to mechanisms to reduce risks by storing food effectively and exploiting resources elsewhere: in seasonal grazing and hunting areas first, then by trading over wide areas, and lastly through the migrant labour system. Along with the surpluses and shortages, several other factors would have promoted the development of economic activity. Competition between the kingdoms stimulated innovation, the relatively large population of people provided greater chances for specialists to emerge, and the widespread movement of traders meant that new ideas were brought into the region. Bringing all of these things together over the past few hundred years, we now have a diverse economic system, one with many different sources of income derived from many different places.

NAN

Manual work has provided tens of thousands of migrant labourers with incomes over the past 100 years, and …

NAN

… many young men continue to come to Windhoek – ever hopeful for a job

Household incomes and consumption

Many rural African communities obtain almost all their resources from land around their homes, for example through subsistence farming, the collecting of firewood and the use of water from local sources. Most urban households, on the other hand, depend upon resources that are produced elsewhere, and they usually use wages and other cash incomes to pay for those resources. The contrast between these two kinds of household economies is clear, yet in the case of north-central Namibia there is a huge and dynamic mix between the two.

The mix is between households, with some living largely off the land while other homes use cash incomes to buy the resources they need. There is a mix within households as well, so most households have several incomes. One person may have a paid job, another obtains a pension, and yet another is given a remittance by a relative working elsewhere. Others in the family are engaged in farming activities to produce consumable goods in the form of mahangu, milk, and meat from slaughtered livestock and poultry. In addition to the combination of incomes acquired by different family members, there are also individuals in a household who themselves have varied incomes. A typical example would be a government employee who earns the salary and benefits of a civil servant, owns one or more cuca shops and also harvests various types of consumables from his or her own farm.

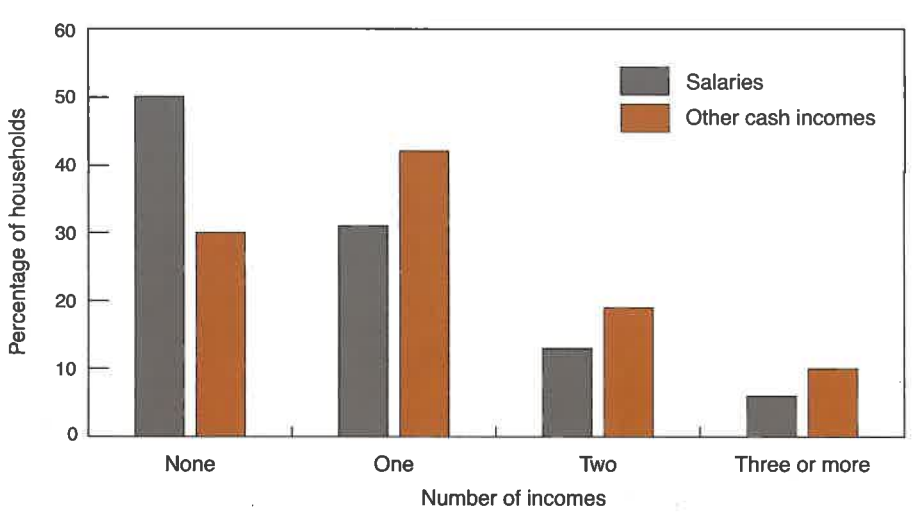
The following table shows the proportions of people acquiring different kinds of incomes in 1996. A total of 31% of the people were paid some kind of wage and 15% obtained a pension or a remittance. The remaining 53% reported that they had no cash income and would have obtained most of their income in the form of their own farm produce. It might be assumed that many of these people actually obtain some cash income from agricultural activities, given the common assumption that farming provides important sources of cash income. However, it is clear that farm products are not sold frequently in Owambo, and that few farmers are willing to sell livestock or surplus mahangu (see page 60).

Percentage of people aged 15 and older (excluding students) with different kinds of income, 1996[2]

Source of income	% of people
Do not receive any income	53
Pension recipients	14
Recipients of remittances	1
Recipients of wages	32
Paid employer	*1*
Paid by own business	*5*
Paid government employee	*9*
Paid private employee	*17*

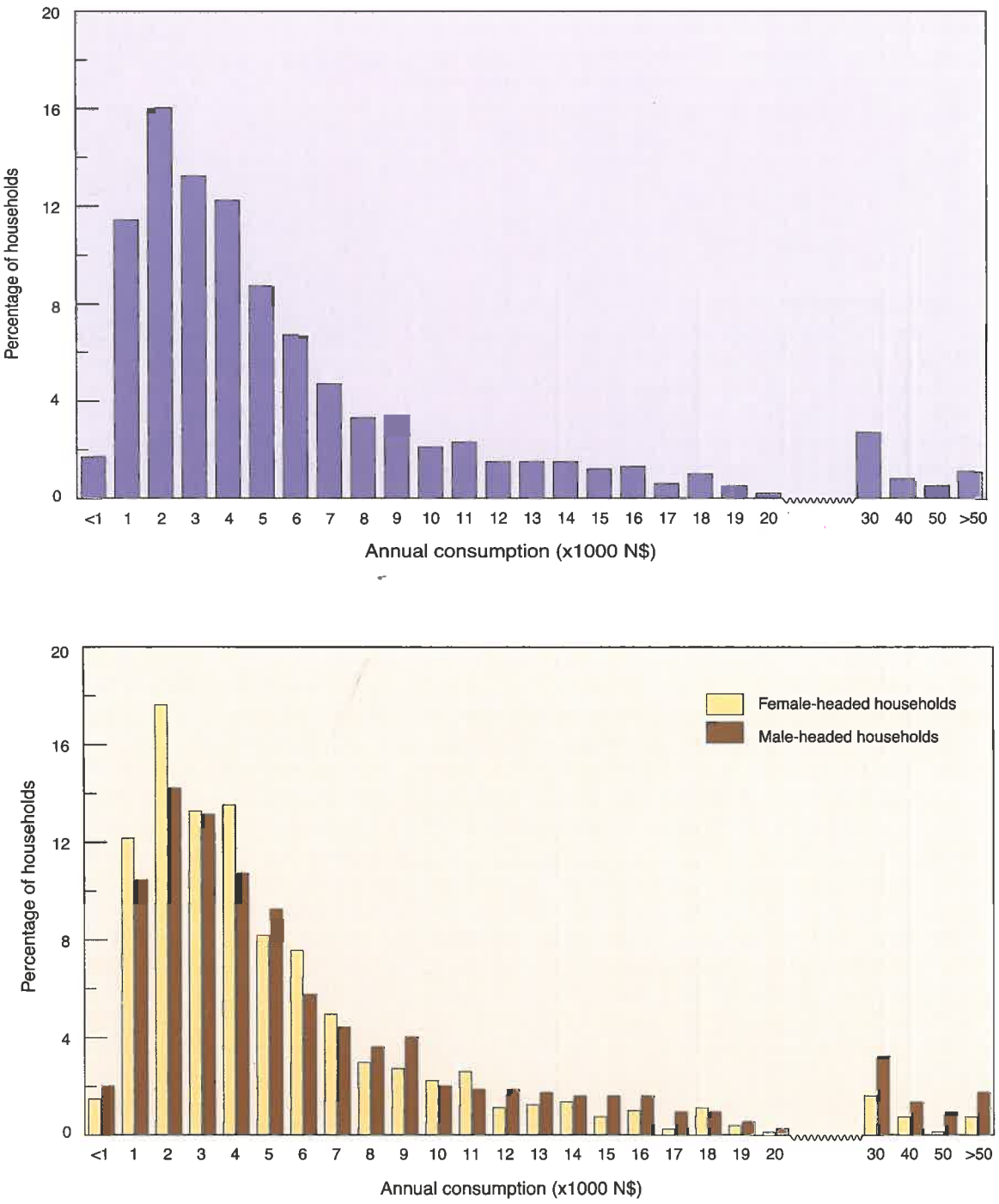
The last four rows provide details for the 31% of people that were paid wages

Looking now at the proportions of homes with different sources of income provides a perspective on how the numbers of incomes vary between households. In 1996, about 50% of all households did not have a member of the family earning a wage or salary, while 31% of households had one wage earner, 13% had two wage earners, and 6% had three or more such sources of income. Adding family members who obtain pensions or remittances from relatives elsewhere provides an indication of the proportions of households that have any type of cash income. Thus, 30% of households had no cash income, 42% had one source of cash, 19% had two people receiving cash and 10% had three or more people with cash incomes.



▲ ***Percentage of households having various cash incomes from wages or other sources, including pensions and remittances[2]***

Other information on how households vary in wealth comes from the 1994 Income and Expenditure Survey, a collection of detailed information on what households consume. That consumption was both in terms of commodities bought using cash and those that they obtained through non-cash benefits, for example by harvesting farm products and living in houses that they had built. The total amounts consumed in a year provide a good measure of incomes because it can be fairly assumed that few families save much money. Most households in 1994 had total consumptions – and, therefore, incomes – of less than N$5000 per year. Thirteen percent of all homes consumed less than N$2000 per year, and 41% consumed between N$2000 and N$5000. However, there were also many households that had much higher incomes, with about 27% having consumption totals of between N$5000 and N$10,000, and 19% with more than N$10,000. It may be argued that these figures are somewhat deflated, but it is hard to know to what degree that might be true. What is important, however, is the very skewed nature of income distributions to be seen in the long tail of higher consumers in the graphs below. All of the figures in the graphs are in 1994 N$ values. Adjusting for inflation of about 10% per year means that the top group of 19% of households will spend nearly N$18,000 or more per year in the year 2000.



▲ ***Proportion of households having different annual consumptions, 1994[3]***
The top graph shows the proportion of all households having different total annual consumptions in 1994. The lower one shows that although annual consumptions in homes headed by women are lower than those headed by men, the differences are not very marked. The last four categories show consumptions from N$20,000 to N$30,000, N$30,000 to N$40,000, etc.

A great variety of goods are offered at the many markets in the region

Results from the 1994 Income and Expenditure Survey showed that 60% of all consumption was obtained through cash purchases, with the remaining 40% coming from self-generated, non-cash benefits. The table below compares amounts spent on different commodities by an 'average' household having a total annual consumption of N$5000.

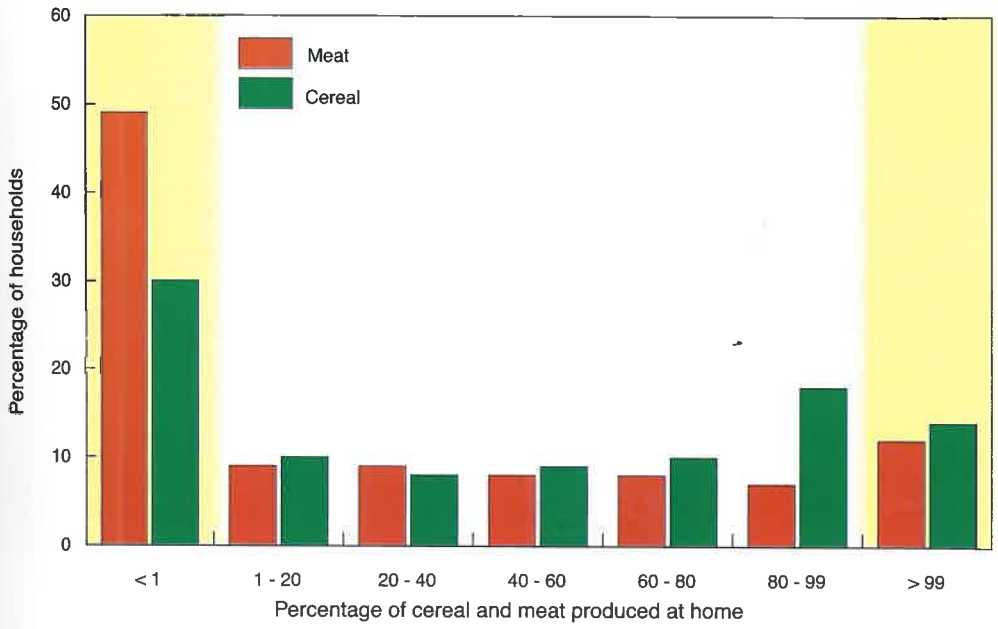
Cash and non-cash (self-generated) amounts consumed for different commodities in an average household having a total consumption of N$5000 in 1994[3]

Commodity	Consumption (N$)	
	Cash	Non-cash
Clothing	390	100
Housing	360	740
Transport	600	0
Other	240	40
Total for food	1410	1120
Cereals	*465*	*650*
Meat	*240*	*134*
Fish	*85*	*22*
Dairy products	*42*	*22*
Fats	*71*	*11*
Fruit and vegetables	*99*	*146*
Sugar	*113*	*11*
Beverages	*212*	*101*
Others	*85*	*22*
TOTAL	3000	2000

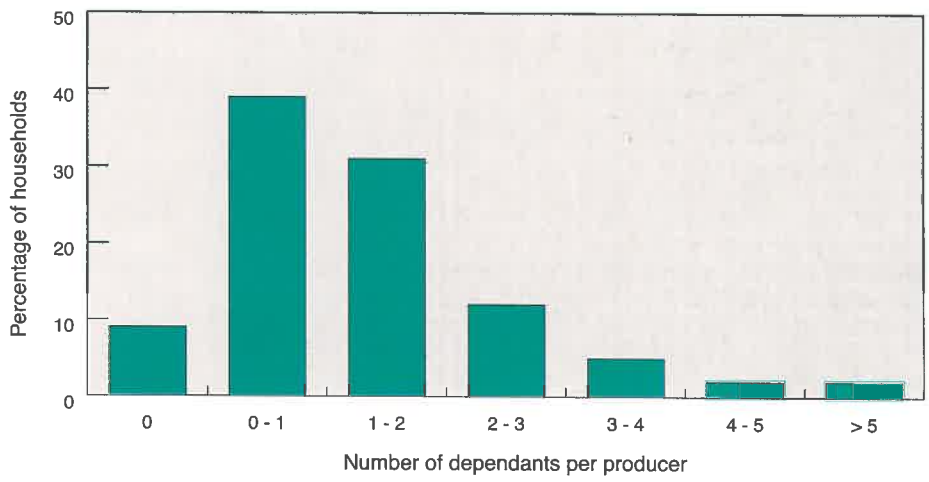
In addition to cash remittances, many other benefits come back to the region from people working elsewhere, in this case all manner of goods piled on the roofs of these north-bound taxis at Oshivelo gate passing through the quarantine fence.

These averages, of course, mask some of the substantial variation between households. Thus, people in rural homes would have paid nothing in cash for housing because they built their homes themselves. The extent of some of the variation is shown in the graph below where the percentages of households that obtain their cereal and meat requirements from self-generated produce are given. The cereals would have consisted almost entirely of mahangu. For both kinds of food, 15% of households produce all their cereal needs and 14% produce all their own meat. By contrast, many other homes have little or no dependence on home-grown food or subsistence agriculture because they buy all their cereals and meat: 29% of households for cereals and 49% in the case of meat. Between these groups that are either heavily dependent or independent of home produce are about 56% of households that both buy and produce cereals, and 37% that buy and produce meat for their own consumption.

Most households in urban areas throughout the world lead quite independent existences from rural ones, even from those rural homes that belong to relatives of town dwellers. However, urban homes in Ondangwa, Oshakati and other towns maintain close connections with family members remaining in rural households. That connection allows urban people access to resources and security offered by their rural relatives, for example in the use of land, the ownership of livestock, and portions of the mahangu and sorghum harvest. Urban dwellers also often leave their children in the care of grandparents and other relatives living in rural homes, and this is one reason why the age structure of the urban population has such a bulge of young to middle-aged adults (see page 41). On a reciprocal basis, relatives living in rural homes obtain remittances and material gifts bought with cash in towns. Both the rural and urban members of the family, therefore, benefit from these connections. Apart from the direct benefits obtained through access to resources, the household also gains access to a much more diverse range of incomes and resources.



▲ ***Percentages of households that produce different proportions of the cereal and meat that they consume[3]***
Those producing all their cereal and meat needs are in the category 'more than 99', while those that consume no home produce are in the category 'less than 1'. Percentages in between these categories represent homes that consume both bought and home-produced cereals and meat.



▲ ***Proportions of homes with different numbers of dependants per producer[4]***
For purposes of understanding what labour a home has and what numbers of people have to be supported, it is useful to separate people into dependants (children aged less than 15 and people above the age of 64) and producers (those aged 15 to 64). In the region as a whole, about 54% of people are dependants and 46% are producers, so there is roughly one person dependent on each producer. But this graph shows that there is a good deal of variation between households, with about half of all households having one or no dependants per producer. Producers in another quarter of all homes carry much greater loads in having to support two or more dependants.

Cash purchases of packaged goods – especially drinks – generate vast quantities of rubbish, a small proportion of which is collected at recycling points

Wealth and household size

The size of a household is closely related to its overall wealth: the richer it is, the larger the household. Some aspects of that relationship are obvious in the various photographs of households on page 71. Large households with many individual huts to accommodate many people also often have one or more modern buildings, a sure sign that the owner has enough money to buy construction materials. Before exploring that relationship in more detail, however, let us consider some of the variation in household size. The average household size for the region as a whole is about eight people, these being people living in the same house or group of buildings and that share the same kitchen or eating place. Of course, there is a great deal of variation around that average, with about 17% of households having less than 5 members, and 19% having 13 or more. Urban households, with an average of five people, are much smaller than rural ones, which have an average of eight to nine people living in them. Homes headed by women are slightly smaller, with an average of eight people, than those headed by men, having an average of nine people.

Evidence for a relationship between household size and wealth comes from a comparison of sizes and the sources of incomes of the heads of those households in the next table, with businessmen having about 50% more people living in their homes than farmers.[5]

Average number of people per household in relation to different occupations held by the head of the household[6]

Main occupation	Household members
Business	11.5
Mine employee	10.5
Civil servant	8.6
Private sector employee	8.4
Farmer	7.6

Large households also have far more livestock and bigger fields, and can invest more in crop cultivation than smaller ones. These aspects are considered in more detail in the chapter on farming (see pages 54 and 55), where larger households are also shown to use fertilisers and manure and own agricultural implements more often. The table below provides information for four categories of households, grouped on the basis of an index of wealth. Numbers of cattle and goats and field sizes increase from group to group, with the poorest group having the smallest household size of six people, compared with 11 people in the most prosperous group. About 35% of all households fall in the poorest group, 24% in the next group, followed by 21% and then 20% in the wealthier categories. Group A can be separated into another, even poorer, category, which makes up 12% of all households. These have no cattle or goats, and have field sizes of less than 1.5 hectares. Similarly, a subcategory of the richest group make up 6% of all households, and have an average of 32 goats, 50 cattle and 5 hectares of fields per home.

As shown in the graph below (left), the numbers of cattle, goats and field areas per person vary between the different wealth groups. Field sizes per person vary to a much lower degree than livestock ownership, such that about 0.3 hectares per household member is available in the poorest category compared with just over 0.4 hectares in the wealthiest homes. Cattle numbers increase from 0 in the poorest group to over 2 per household member in Group D, while numbers of goats per person range from 0.2 in Group A to 2.5 per person in the richest homes.

The overall trend, therefore, is for larger households to be wealthier in having more livestock and bigger cultivated areas. The important consequence of this is that wealthy homes, with the biggest herds and fields, control and use far more natural resources than smaller, poorer homes. Competition between households for natural resources is greatest in the most densely populated areas where the majority of land suited to crop growing has already been cleared (see page 50). Stock densities are also very high (see page 59) and pastures are heavily grazed in those areas. Livestock belonging to all households will suffer under those conditions. However, the costs of having livestock in bad condition are more severe for poor homes because they depend more heavily on their few animals to provide milk and protein. Wealthy households, on the other hand, will have cash incomes to buy what food they need.

The disadvantages faced by poorer households are even more severe because the great majority of such homes are in the most densely populated parts of the Cuvelai. The map on page 67 of a densely populated area near Engela gives an idea of the spacing and mixing between different households, and shows how the herds of households headed by wealthy wage earners compete for grazing with the few animals owned by subsistence farmers nearby.

Several features are related to the size and wealth of households. Other than the direct assets that are more abundant in wealthy, large homes, these households enjoy a number of qualities that are largely absent in smaller, poorer homes. Perhaps the most significant of these qualities is that large, rich homes have a diversity of incomes, assets and opportunities available to them. They have different kinds of incomes and economic interests, and that variation, in turn, provides them with further opportunities of diversifying their sources of income. As wealthy people they can also call upon social connections that have been developed as a result of their diverse interests and greater status in society.

The different kinds of income available to wealthy households also provide a larger safety net in the event of droughts or other calamities. Should their harvests of mahangu fail, or if a family member employed, say, as a teacher dies, they can either sell some livestock, draw more heavily upon income from business interests, or call upon more remittances from a relative working somewhere else in Namibia. By contrast, these kinds of options are not available to a small, poor household that has no livestock, no one working elsewhere, and no business interests. Homes headed by women may obtain remittances from their husbands working elsewhere, but those that do not have husbands or other working relatives would be in dire straits in the event of a drought.

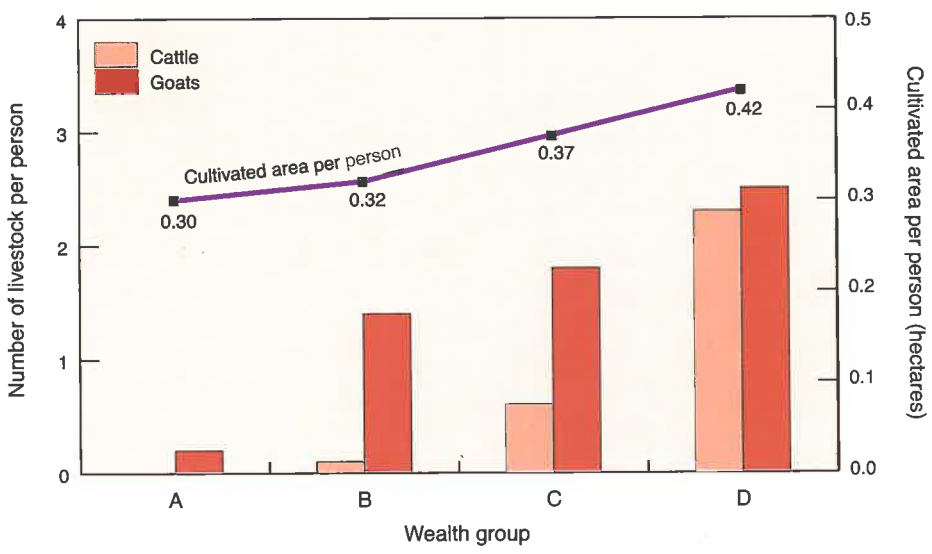
Households that obtain most of their income from wages might be expected to reduce their use of farming land. However, exactly the opposite is true: the more wealth that comes into a home from jobs performed elsewhere, the more natural resources that are used for crop production and for grazing livestock. The acquisition of large herds, fields and other assets can be considered to be the result of a simple desire to accumulate wealth. Another way of looking at that process is to recognise it as a way of developing strategies to cope with shortages of resources which may result from drought, attacks on crops by pests, or the loss of livestock due to diseases. These kinds of disasters have befallen people in Owambo frequently in the past and it is logical that households have evolved methods of overcoming them. It is for this reason that the economies of households embrace such a mix of incomes, and that surpluses from those incomes are invested in the acquisition of more land and more livestock.

Wealth groups, based on an index of the combined value of cattle, goats and field sizes, range from A (the poorest) to D (the richest)[7]

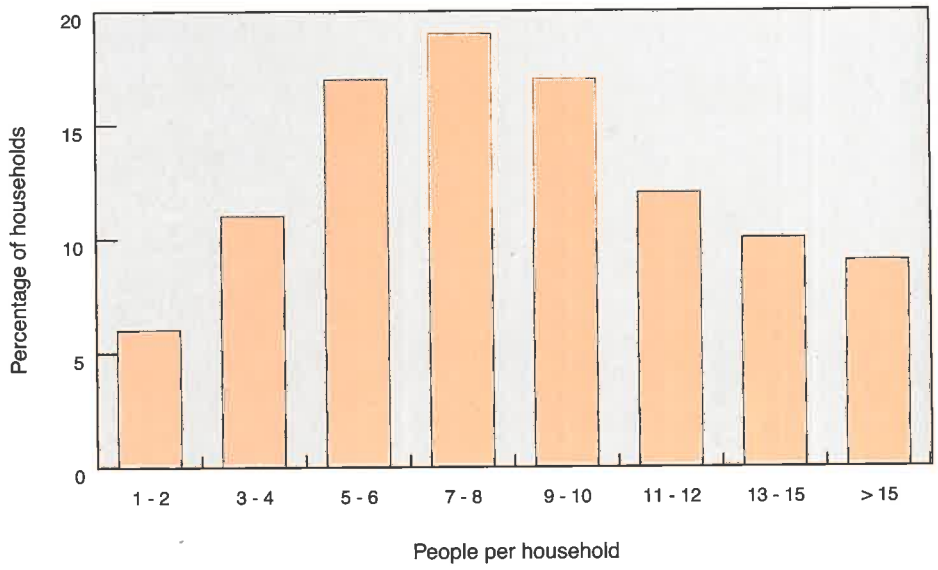
Wealth group	Number of cattle	Number of goats	Field size (hectares)	Household size	% of all households
A	0	1	1.9	6	35
B	1	13	2.9	9	24
C	6	18	3.7	10	21
D	25	27	4.6	11	20

Major differences between large, wealthy households and those that are small and poor

Large household	Small household
Head is wealthy	Head is poor
Head is often a man	Head is often a woman
Household has several cash incomes	Household has little, or no, cash income
Household has various business interests	No business interests
Ready access to cash	Little access to cash
Own many head of cattle, goats and other livestock	Own few, if any, livestock
Large field	Small field
Access to a range of sources of labour	Little access to labour
Big safety net in the event of disaster	Highly vulnerable in the event of disaster
Greater chances to diversify income	Few chances to diversify income
Wide and useful social connections	Few connections and little social status



▲ ***Average number of goats and cattle and areas of cultivated land per person in the four wealth groups[7]***



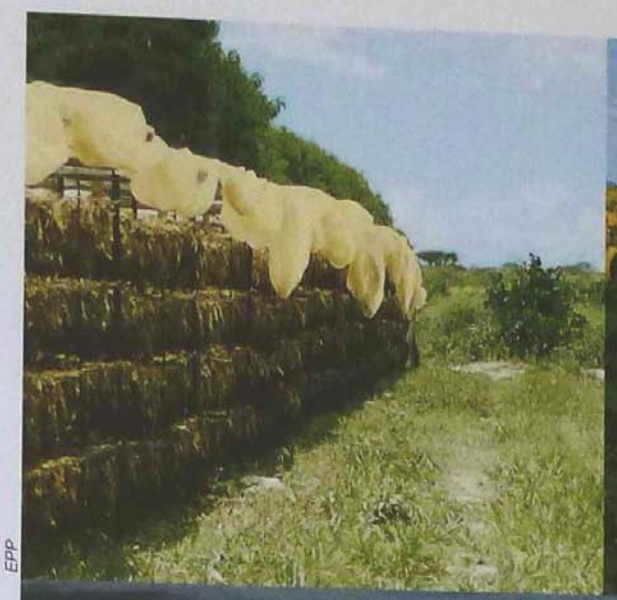
▲ ***Variation in the number of people per household[6]***

Tsumeb farmers

The account of households has thus far focused entirely on homes in Owambo. However, households in the Tsumeb area, especially farming ones, have also developed ways of coping with losses in production, lower profits and other risks. Losses have occurred due to the lower rainfall in recent years, the lower prices paid for beef over the past few years, and lost pastures as a result of bush encroachment. The main change implemented by Tsumeb farmers has been to diversify their sources of income. Previously, most farmers concentrated on the production of beef, but today, some family members (mainly wives) are employed in paid jobs in Tsumeb, and some farmers have supplemented their activities with tourism and hunting ventures, and the selling of game meat. Many farmers have also added goats to their stock (see page 56), while others have attempted to grow crops, especially maize and cotton.

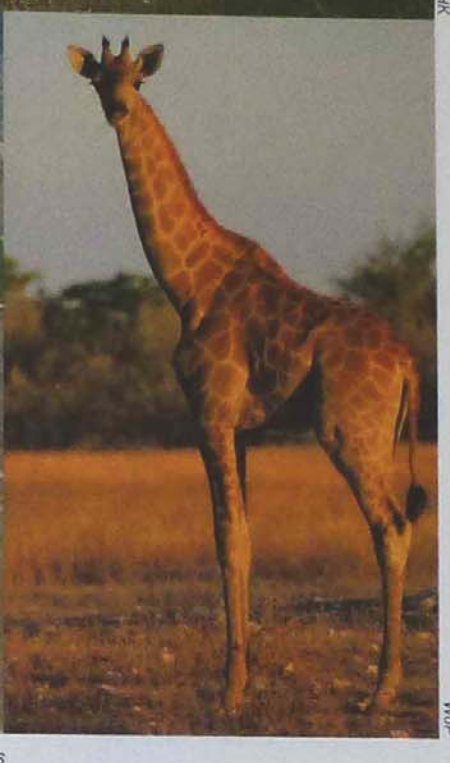
Another change in farming practices in the Tsumeb area has been to buy up young animals in good years, fatten and then sell them when they reach marketable weights. This means that stock numbers can be adjusted more readily to the availability of pastures, rather than the previous approach whereby farmers built up and maintained large herds regardless of the availability of grazing.

Some farmers have also sold off parts of their farms as a simple way of generating a single large sum of money. Finally, quite a number of people have simply given up farming, and have sold their farms. Much of the land bought by the government as resettlement farms was sold by farmers who were battling to make a living and saw the opportunity of realising a good price for their land.

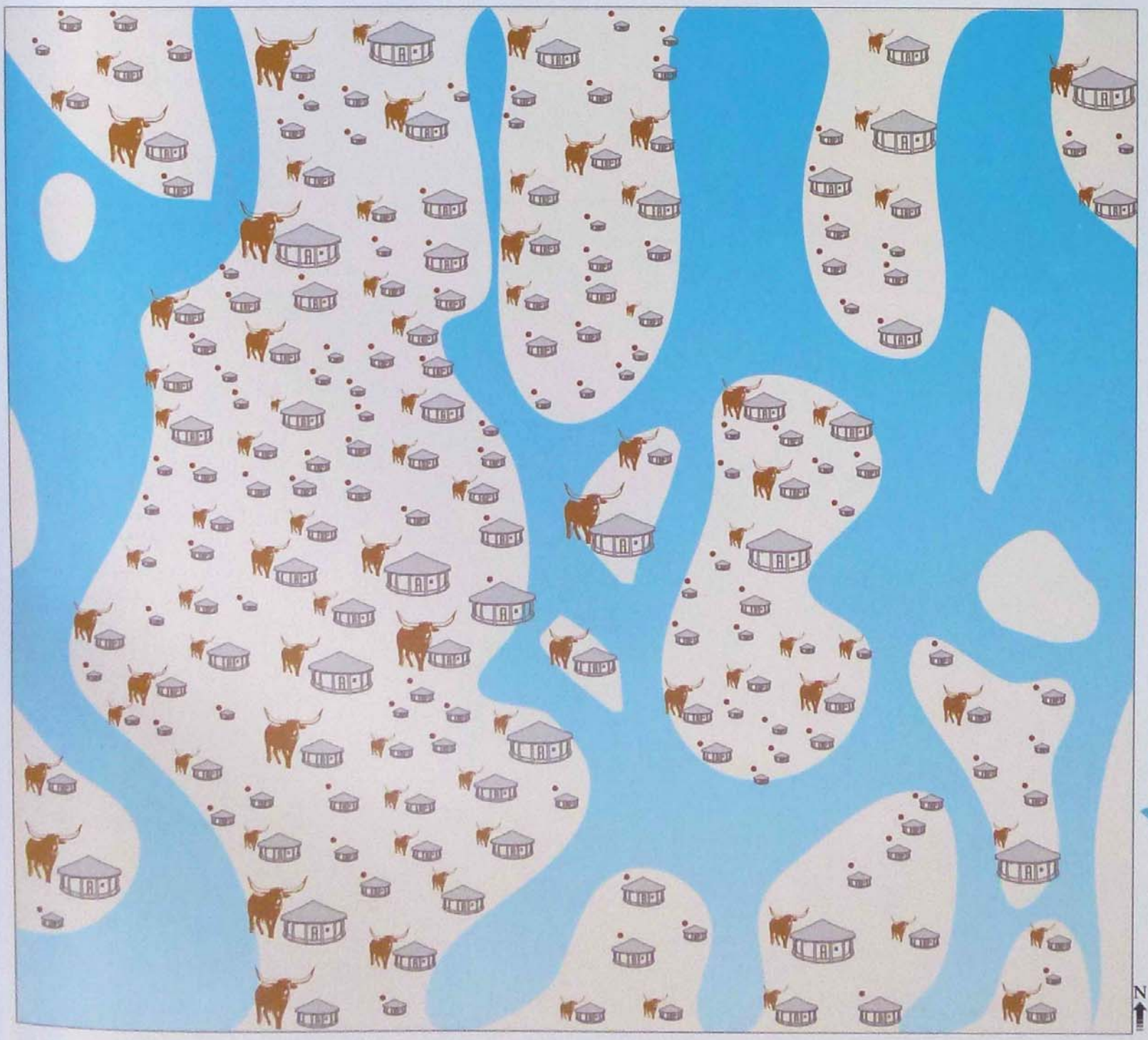

EPP


HK


EPP


WRP

In addition to cattle ranching and game farming, a wide range of crops are grown on the Tsumeb farms



◀ ***An area near Engela, showing the positions of individual homes***
Larger homes tend to have more cattle, and it is clear that households of different sizes and different numbers of livestock are close together. Livestock from different homes therefore compete for pastures.

MB

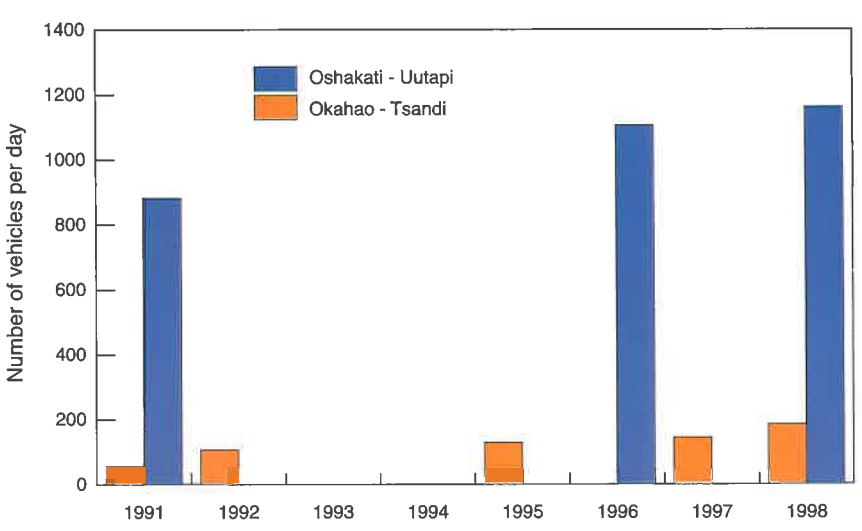
EPP

MB

DD

DD

Trading activities vary from the small scale, with various foods, clothes and many other items on offer in markets and along town streets, to massive retail and wholesale stores



▲ ***The number of vehicles travelling along the Okahao–Tsandi and the Oshakati–Outapi roads during the 1990s[9]***

HD

EPP

EPP

DD

A selection of the colours and imaginative names given to the 7000, and more, cuca shops

Cash trade and businesses

The level of retail activity in the region as a whole is impressive, as any visit to a market or town such as Oshakati, Outapi or Ondangwa will demonstrate. Many large southern African companies have outlets here, and there are also several big retail and wholesale businesses owned by people based in Owambo. Unfortunately, there is no comprehensive information available to measure the level of retail activity. However, one approximation is available from results of a detailed survey of households and businesses in the Outapi and Engela–Endola area during 1998. About 115,000 people were living in the homes surveyed and a total of about 1200 cuca shops and bottle stores were counted and mapped in the same area. While these shops largely sell liquor and other beverages, many of them also sell a variety of household goods and packaged foods.

Given a total of 1200 cuca shops means that there was roughly one shop for every 100 people in the area. From information on age distributions, we can say that 53% of all people in the area were older than 15, so it would be more correct to say that each shop served about 53 adult customers. The survey also revealed that each shop served an average of 24 customers per day. That would mean that each adult in the area would visit a cuca shop about every second day on average.

Taking the ratio of one shop per 53 adults and extrapolating that to the total population in the region would mean that there are roughly 7000 cuca shops in Owambo. Let us assume that each customer spends N$5 and that the shop owner takes a profit margin of 15% on that amount. If each shop serves 24 people per day, about 168,000 people would visit the shops each day, generating a turnover of roughly N$307 million and a profit of about N$46 million per year. These figures are impressive, and provide an idea of the amount of disposable income available in the region. They are even more striking if one remembers that few of these profits are taxed.

Another survey conducted in Owambo in 1998 found there to be about 14,600 small businesses.[8] Of these, 28% were involved in brewing beer or other liquor, 22% were cuca shops, 15% were bottle stores, 14% were general dealers, 4.6% sold food, and 4.3% were hawkers. Other businesses counted in significant numbers included: basket-making (210 enterprises), clothing retail (197), taxis (175), informal butcheries (149), and builders (109). Of all businesses, 60% were involved in trading, 36% in manufacturing, and 4% in the provision of services.

In the same way that the level of economic activity is impressive, so, too, is the rate at which that activity is increasing. One measure to reflect these changes is the volume of road traffic. Cars and other vehicles counted at intervals along the roads from Okahao to Tsandi and from Oshakati to Outapi indicate growth rates of traffic of between five and ten percent per year. At that rate of increase, very high levels of traffic can be expected in the years ahead. The Oshakati–Ondangwa road is already said to be the busiest in Namibia.

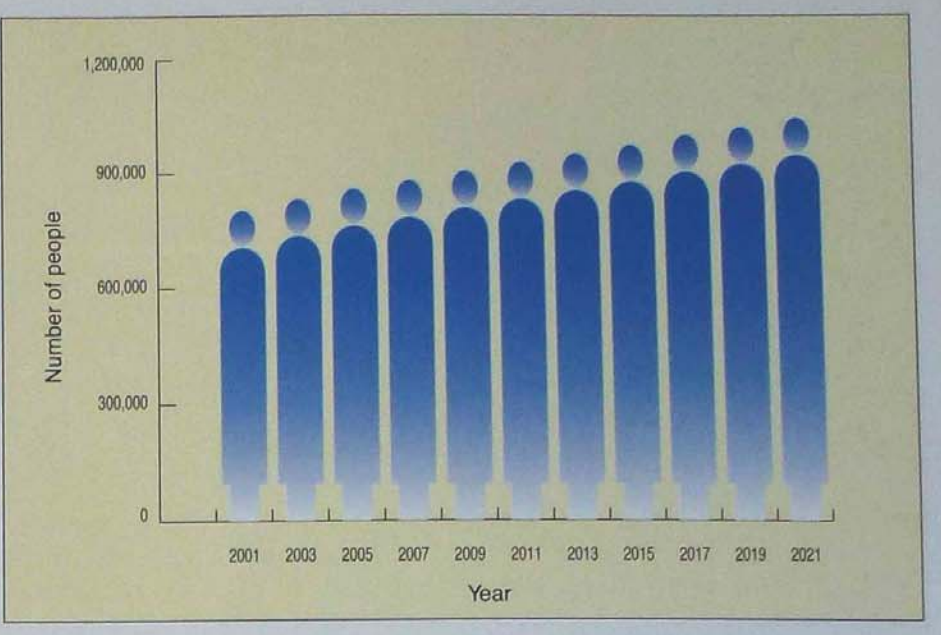
In addition to the large-scale trade between people in the region, there is also a significant export component to Angola. Once again, good information is lacking, but it is certain that massive volumes of goods are exported from the region to Angola. Many Angolans also visit Owambo to buy goods from local shops. Much of that trade is in the bigger centres, with Angolans driving across the border to load up their cars with a variety of goods. There is also a good deal of less formal trade, often consisting of people on foot or by bicycle, visiting shops immediately along the border. Angolans visiting Namibia on short shopping trips are registered as tourists, and more Angolan 'tourists' are registered as such each year than people from any other country. In 1996, 145,000 Angolans visited Namibia. That number grew to 158,000 in 1997 and 177,000 in 1998. The majority of those visitors came through the Oshikango border post.

There is also a large volume of cargo transported through the region in big trucks, often originating in South Africa or at Walvis Bay. Although most trucks pass through the region, they do provide various benefits to local businesses. For example, some of the load carried is sold locally, so the costs of importing that produce are reduced because the trucks also travel to Angola. Large wholesalers based in the export-processing zone at Oshikango handle other exports, selling goods to retailers and other traders from Angola who come to Oshikango to purchase the goods they need.

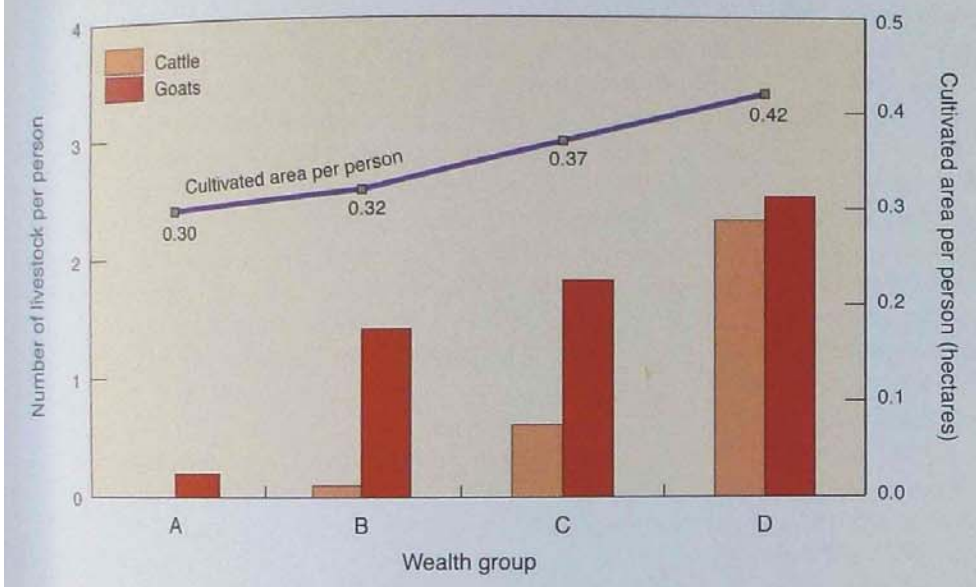
Looking to the future, from the past and present

North-central Namibia has come a long way: its ancient geological history has given it the Cuvelai drainage system, peculiar underground water resources, a mixture of soils and some minerals – all resources that mould the way in which land is used today. Likewise, its people have been shaped by a long history of environmental variation that has encouraged them to be entrepreneurial and to diversify their sources of income. These physical and socio-economic conditions have provided options and set constraints that affect the use of land and natural resources today: for example, in the production of crops, grazing practices, farm sizes, and numbers of livestock and wildlife. What happens in the future also depends to a great degree on that foundation of physical and socio-economic conditions, because these parameters will shape the use of land and how people develop economically. There are sure to be strong links between land use and economic development, but not because the natural resources will generate money, as we might expect. Rather the links will go the other way, in that economic development will have major impacts on the quality of natural resources and on the land. Indeed, the great challenge will be to ensure that people develop economically in ways that enhance the quality of the natural environment, rather than exploiting natural resources to their detriment and at the expense of people who remain poor.

Compiling this book took a long time! Reflecting on where it started, two major assumptions or hypotheses guided part of our approach. The first was that increasing numbers of people would lead to greater pressures on natural resources, as has been the case in so many other parts of the world. We studied aerial photographs taken in different years to count numbers of households and areas used for farming as one way of testing that idea. The results of those analyses (see pages 37 and 50) indeed show that numbers of households (and thus people) and farming areas have expanded rapidly where good farming land is available. Once areas became densely populated, rates of expansion dropped and people needing to establish new homes had to find land in suitable areas elsewhere. It is also clear that farming and domestic activities had harmful impacts on natural resources. Little wildlife remains in densely settled areas, most large trees are felled to build houses, other wood is used for fuel and fencing, huge areas are cleared for crops, and large numbers of livestock place great pressures on pastures. In short, the growing numbers of people who make direct use of natural resources have stripped much of the region of its natural vegetation and wildlife.

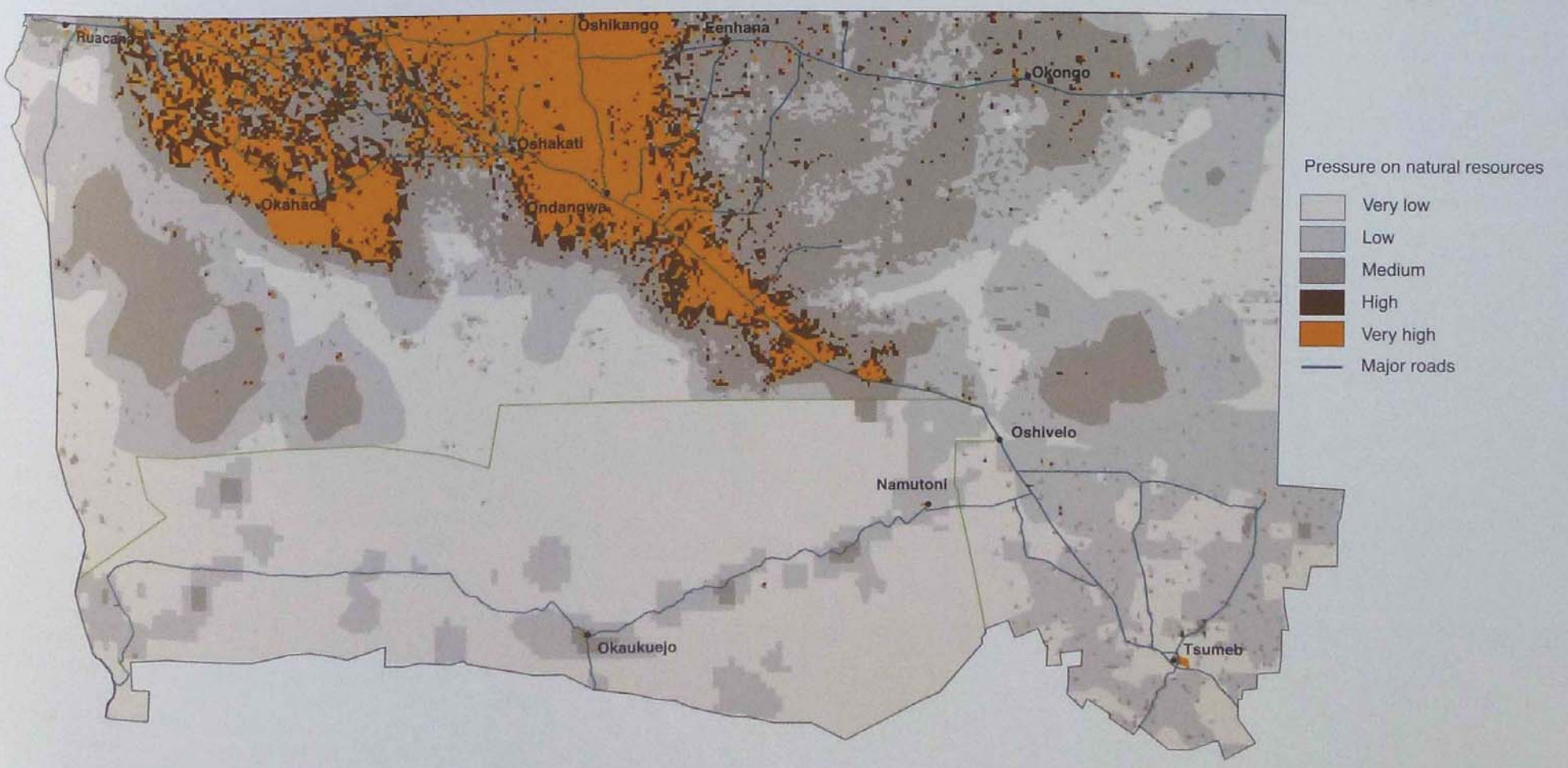


▲ ***Predicted population growth in the region between 2001 and 2021***



▲ ***The number of cattle, goats and area of land under cultivation per person in different wealth categories***
An average wealthy household has more livestock and larger fields for each person in that home than a poorer household. Group A represents the poorest homes, and Group D the most prosperous ones, as described on page 66 in the chapter on household economies.

The second assumption was that people would reduce their use of natural resources, as they became richer from incomes earned from jobs and businesses. They would be expected to 'move off the land', reducing their farming activities and their use of natural resources, giving up their farms and perhaps going to live elsewhere. As wealthier individuals moved off the land, they would also leave behind them greater opportunities for poorer folk, who would then have increased access to land and other natural resources. How wrong all of that thinking was! Instead, we find just the opposite in a pattern made clear by richer farmers with other incomes acquiring larger farms with more cattle and goats, and bigger fields. Wealthier people also make greater use of other resources, such as water and wood for building, fencing and fuel. It is clear, too, that the greater consumption of farming land and other resources by richer people leads to ever-greater disadvantages amongst the poor.



▲ ***Pressures on natural resources in the region***
Five categories of pressure, or demand, on natural resources were derived by adding together the densities of people, large stock units and wildlife. The five categories represent total numbers of people, stock units or wildlife per square kilometre: very low = less than 1; low = 1–10; medium = 10–40; high = 40–80; very high = more than 80.

EPP

Will the quality of life in the years ahead be better or worse than that offered now?

Increasing pressures on natural resources have, thus, been caused both by population growth and increased demands made on the land by wealthy people. A key point is that natural resources in the region have not made people rich. Rather, they have provided opportunities and constraints that have forced people to seek other incomes. Those that were successful in this search have returned to place additional pressures on the land.

The map on page 69 gives a perspective on how different parts of the region are subject to varying levels of pressures brought about by different kinds of 'consumers': people, livestock and wildlife. While the interpretation of the different categories can be debated, it is clear that very considerable demands are placed on natural resources in most parts of the Cuvelai and the eastern Kalahari. Low and medium demands on resources elsewhere are largely as a result of the presence of cattle in communal grazing areas. Cattle in Owambo also graze areas rated as having very low pressures, at least on a seasonal basis. In Etosha, grazing pressures by game animals are not known to have major effects on vegetation, except around waterholes where there are serious losses of plants and soil as a result of trampling and overgrazing.

Pressures on natural resources will increase in the future, as the population is expected to grow to over one million people in the next 20 years, as livestock numbers increase, and as more prosperous people place greater demands on resources. What will be the consequences of these greater demands for the natural and social environment, and what changes can be made to improve matters? These are big questions, demanding huge answers and determined action. The pages ahead explore aspects of these questions and some possible answers.

How much more pressure on the land?

Much more land – roughly 70% of the region – is used for agriculture than for any other purpose, and that land can be divided into three quite separate kinds of farming. The first is that practised by small-scale farmers in Owambo, who make up the great majority of all the farmers. They are often called 'subsistence farmers', a description only appropriate to those households that obtain most of their food and income from their crops and livestock. From information on numbers of households, wealth groups, sources of income and proportions of food consumed that are produced on farms, we might estimate that about 20,000 of all households largely lead a subsistence existence. Most of the remaining 65,000 households have small farms but also have one or more alternative incomes; and the greater their incomes, the larger their farms and numbers of cattle and goats.

The second group of farmers occupies very much larger farms in Owambo, either leased at nominal rates in the Mangetti area or established informally by fencing off large tracts of communal land. The number of individual farmers is small, perhaps a few hundred people. These large farms make up about 11% of the total area of the region, or about one-fifth the area of Owambo. Most of these farmers are wealthy businessmen, civil servants or politicians, and most live far away from their farms.

The third category of farmers are in the Tsumeb area, which makes up about 9% of the region's surface area. These are so-called commercial farms because most of their produce consists of marketed beef and other yields. The Tsumeb farms are privately owned as freehold titles and, until 1979, were owned only by white people. Again, the number of individual farmers is very small.

It is generally assumed that much of the farming in the region is geared towards maximising the volume of produce. That seems a fair assumption, but a secondary assumption holds that farmers aim to produce grain and livestock that can be sold to provide cash incomes. Many development projects and government policies and programmes base their activities on that second assumption by promoting the economic value of farming and, implicitly, that of the land being used for agriculture. While that assumption probably holds for most farmers in the Tsumeb area (where development projects and government assistance are not prominent anyway), it clearly does not hold for small- and large-scale farmers in Owambo. This is because of the simple reality that few farmers actually sell mahangu or livestock. A popular reason given repeatedly is that prices for both products are too low. Other reasons are offered for farmers being reluctant to sell their produce (see page 60), but all these explanations do not satisfactorily answer the larger questions: Why are so few farm products sold, and why does agricultural land generate so little money?

In reality, most farmers have easier and better sources of income. Sales that can be made from farm products are insignificant compared with other sources of cash. Information from two surveys showed that average sales of farm produce amount to just a few percent of the total average income of a household (see page 61). Quite simply, most farmers have little reason to sell their produce. It is more in their interest to keep surplus animals in their herds, giving them greater capital assets, security and status. They also have fewer taxable assets as a result. In the case of mahangu, which can be stored over several years, it is better to keep surpluses in case of shortages in the years ahead. It is also noteworthy that much of the mahangu and most of the cattle and goats sold in Owambo come from Angola where households probably have substantial demands for cash and fewer opportunities of making money from businesses or wages than most farmers in Owambo.

Few farmers in Owambo, thus, seem interested in making money from farming, suggesting that there are few inherent incentives to develop agriculture into sources of cash income. That observation means that farming land in Owambo produces few direct financial benefits to the people, to the region or to the country as a whole. This is not to deny the other benefits of farming, especially in producing food for households that have no other incomes. Having some farm produce also saves households from buying all their food. However, the low monetary value of farmland has implications for government policies and programmes, and for development projects. These programmes are unlikely to improve the financial value of agricultural land if farmers are not disposed towards selling mahangu and livestock. Similar difficulties are likely to hold for projects that aim to introduce other marketable crops, such as cotton, tobacco and rice, because many farmers will prefer to allocate land, time and other resources to mahangu production rather than new cash crops. The benefits of many government services go mainly to more prosperous farmers in the form of vaccinations for livestock, tractors to plough their fields, and extension services. Thus, those benefits go to farmers least in need of assistance and better able to pay for these services than others. They are probably also least likely to sell their farm products.

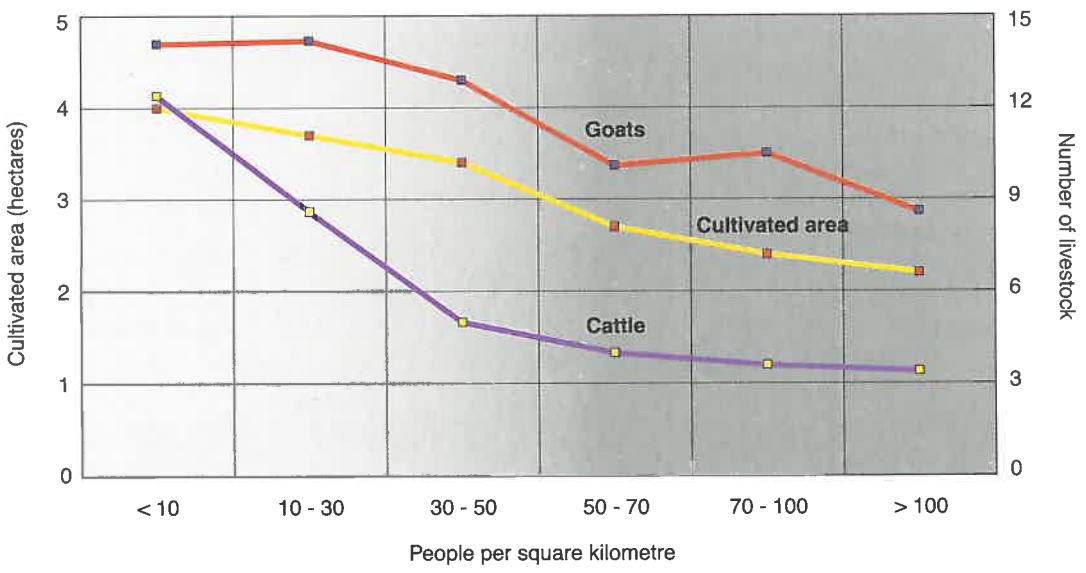
Farming in Owambo is a risky and difficult business: poor and variable rains, low soil fertility, various crop and livestock pests and diseases, limited pastures, and few new areas on which to farm are some of the constraints to be faced. It could be argued that farmers might sell more produce if some of these constraints were reduced. Better yields, as a result of improved technology and farming methods, should provide more surpluses for sale. However, very substantial improvements would have to be made to move present farming incomes from a few percent of total income to levels where they make a real difference to the wealth of a household.

There are other reasons why government or donor-funded programmes that aim to increase livestock numbers should be reconsidered. Firstly, grazing pressures will be increased in areas that are already heavily grazed, leading to further degradation. Secondly, demands on water supplies will be increased. Thirdly, if most benefits of these programmes go to wealthier farmers, increased pressures on limited pastures will harm the small herds belonging to poorer people. This is especially the case in the densely populated Cuvelai, where the majority of poor people live. Recall that cattle ownership is very unequal: 55–60% of all households do not own cattle in Owambo, and about 80% of all cattle are owned by some 20% of all households (see page 55).

Rather than attempting to increase numbers, it is surely time for limits to be imposed on the number of livestock that can be kept in the Cuvelai. Those kinds of limits would reduce grazing pressures and provide opportunities for poor households to improve their herds.

Can the growing disparities be reduced?

Most people outside the region characterise Owambo as having a subsistence economy. The label carries implications of general poverty, a high dependence on natural resources and small-scale farming, and the notion that everyone is at a similar level of deprivation. However, there is a very high level of economic activity in the region, much of it pursued for purposes of increasing cash incomes. Wages, pensions, remittances and business earnings contribute much more to household incomes than farming. Surplus cash is invested in additional land, fields and cattle, all of which adds pressures on natural resources. Many of the country's wealthiest people live in Owambo, and they have made much of their money from retail trade, serving a large population of customers who have cash to buy food, clothes, liquor and other household items. In addition to the high level of busi-



▲ ***The average field size and number of cattle and goats per household in relation to population density***
Households in densely populated areas have fewer goats, less cattle and smaller fields than those where there are fewer people.


EPP

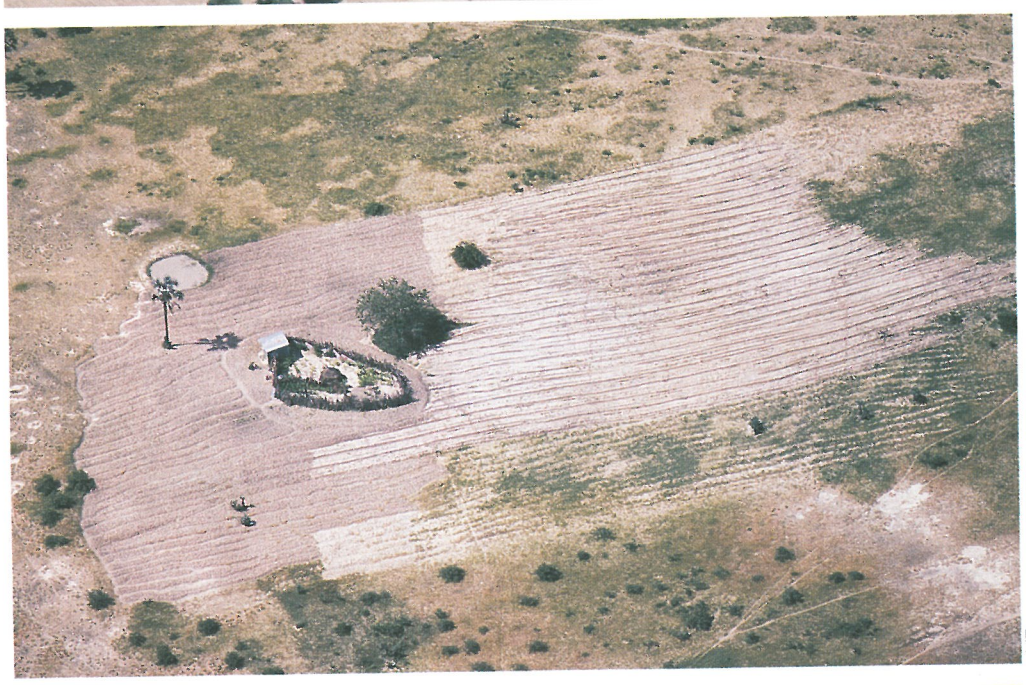

EPP

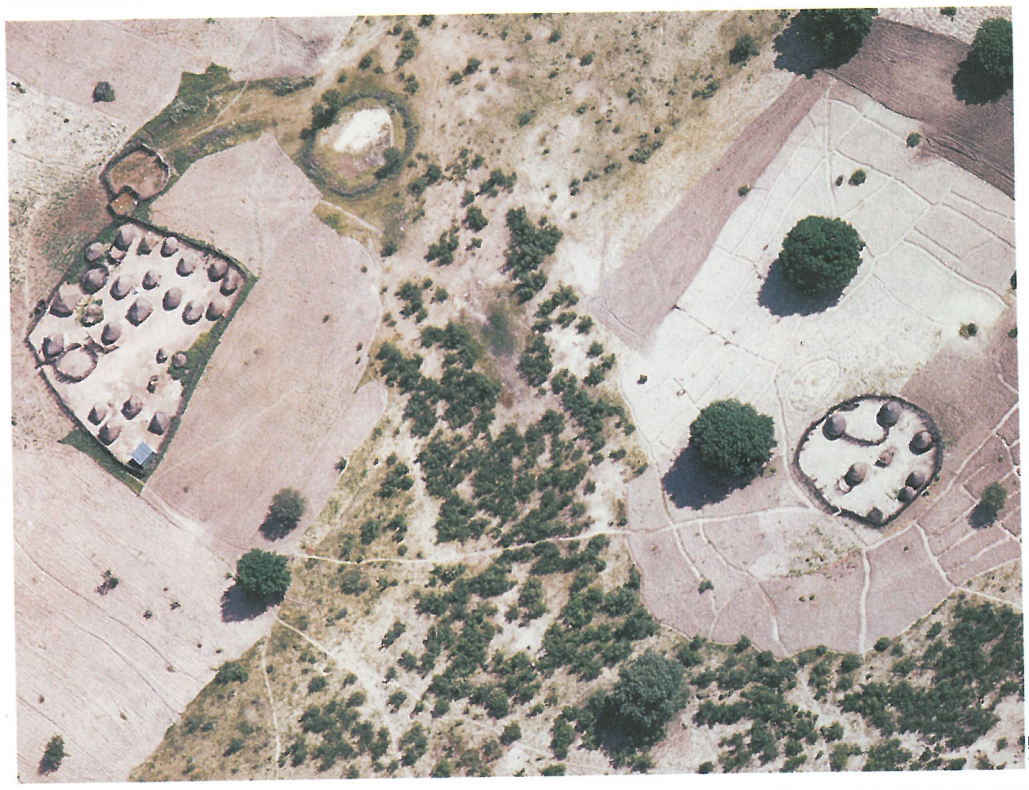
ness, the other impressive feature is the great diversity of economic activity. Most homes have a range of different incomes and many individuals themselves have more than one income. That diversity, along with a willingness to work as migrant labour elsewhere in Namibia, is doubtless a result of the long-standing need to cope with limited and varying natural sources.

Many of the poorest people in Namibia, however, have to scratch out a living in a society and economy that is highly stratified and differentiated. This is especially the case in the most densely populated parts of the Cuvelai where the majority of poor households are to be found. Those poor households are becoming poorer as their access to natural resources becomes ever more limited. Poorer people are thus squeezed, and they have few ways of escaping their plight. Areas of suitable, open land onto which they can move are almost non-existent. Even if there was open land, moving is difficult: one needs the financial and labour resources to do so, one needs the permission of the local headman, and it is risky. Young people may also leave their homes if they are living in poverty – a beneficial move if they get good jobs allowing them to send remittances home, but not if their absence means there will be less labour to cultivate crops and support the home in other ways.

In the same way that the idea of a subsistence economy is generally incorrect, it is also wrong to assume that most natural resources are common property resources. Fences enclose most farms and the natural resources they contain. In addition, growing numbers of people and wealthy households in densely populated areas mean that livestock numbers have increased substantially, leaving smaller open areas between the farms and in the oshanas available for grazing. Those constraints are especially severe for poor homes because they do not have the resources to use remote grazing areas. Poor people also depend upon access to other natural resources, such as wood for building, fencing and fuel. Unlike wealthier people, they cannot afford to buy household furniture, commercially produced beer and other modern substitutes for natural products. Their greater reliance on natural resources, which are so limited in the densely populated areas where they live, thus has a major impact on the quality of their lives.

Furthermore, the region already has a very distorted age and sex structure, with many of its working men and women away from the region. Most of those missing from the region are the young or middle-aged, the educated and the economically active. We can also expect that higher numbers and proportions of these people are likely to be lost in the future for two reasons. The first is that the global and African trends of migration to urban areas will continue to increase. Many people in the region aspire to entering the job market or business world, and there are few incentives for them to continue trying to scratch out a living in a harsh environment. The second reason is that the toll of HIV/AIDS will be concentrated largely on young, educated and economically active people. These are the people that are also most active sexually, and they will die in the greatest numbers. Moreover, the disease will also affect women to a greater degree than men, so fewer educated and economically active women will be left in the region to support its children and elderly folk.


EPP


EPP


EPP


EPP

This selection of photographs of households in the Cuvelai shows the variation in size and wealth of different homes. The biggest, wealthiest homes have many individual buildings, often with modern structures as part of the household complex. All the homes are surrounded by fields, which are usually much bigger if they belong to a large household than those owned by small, poor homes.

Many of the younger, educated and economically active people are forming a middle class in the region. In the absence of these people, we might expect the numbers of poor people to grow in the region because they will lose remittances from income earners in that middle class. The population may, therefore, develop into one with many poor people and a small but powerful group of very wealthy people. To the group of poor people will be added a large population of AIDS orphans.

We believe that there is an urgent need for policies and programmes to address the plight of the poor, especially in the light of diminishing natural resources and the possible effects of AIDS mortality. Those interventions must be focused on the Cuvelai because this is where most poor people live and where natural resources are in shortest supply. Limits on livestock numbers would, for example, improve matters, as would taxation on large herds and land holdings. Traditional and other authorities (perhaps through the land boards envisaged in the proposed Communal Land Reform Bill) should devise ways of ensuring that poorer homes are given better access to natural resources and land. Wealthy people should also be encouraged to place their surplus wealth in investments other than additional livestock and land. And methods should be found to help poor households increase their cash incomes and reduce their dependence on the land.

Development projects, which seek to promote alternative ways for people to generate cash, should, therefore, be directed specifically at poor households. They are most likely to be successful if they fit into existing value systems, timetables and land-use patterns. People are likely to fill gaps, but are unlikely to engage in new activities if they are perceived as replacing existing lifestyles, opportunities or incomes. For example, new cash-generating crops are unlikely to be adopted if, even as poor people, farmers belong to households that have more lucrative sources of cash. In short, farmers have a good sense of what is profitable and what is not, and new sources of income will only be pursued if the returns are worthwhile.

The marula oil project (see page 27) provides some useful lessons. Activities required of the project fit into 'free' time, the main production period being in August when most domestic and farming activities are at a lull. Most of the labour used is also 'free' labour: older women and young girls collect the fruit and remove the kernels. The project fits into a range of cultural activities in which people have been involved for many generations. Even though each woman may earn only N$100 per year, that money comes in at times when other sources of income are seldom available. The whole enterprise may be small, involving only about 1000 women, but for those people it is a useful and profitable activity.

Can the pressure be relieved?

Books of this nature are often expected to provide thorough analyses of options for land uses. A number of hopes and assumptions are implied in that expectation: that there is indeed land, scope for planning and a readiness to change land-use practices, and that recommendations to make better use of resources could be implemented. However, as the chapter on land and governance has shown, there is little scope for making major changes to land uses. Many layers of governance, ownership, control and use all have a strong hold over the land, and it is hard to imagine anyone willing to change matters in any real way. Moreover, the overwhelming support given to the ruling party means that there are few political incentives to change matters, especially if it means changing existing controls and uses. Despite these constraints it is fitting to make some observations and to offer suggestions as to how land might be better used in the future. Those suggestions are offered with three goals in mind:

- To improve the social environment
- To conserve the natural environment both as a resource for people's use in the future and for its intrinsic value, and
- To enhance the economic value of the land.

The first and clear observation has to be made that very little land remains open and available for the expansion of farming activities. Most areas that remain unsettled are not suited to crop farming, either because the soils are infertile, water is lacking, rainfall is inadequate or because they have been claimed for other purposes. Some people can be fitted in here and there, but that will do little to alleviate existing pressures. Settling small numbers of people in different areas is also a costly business. Indeed, the question of what costs – financial, social and those of lost opportunities – will be involved by changing land uses needs to be asked repeatedly.

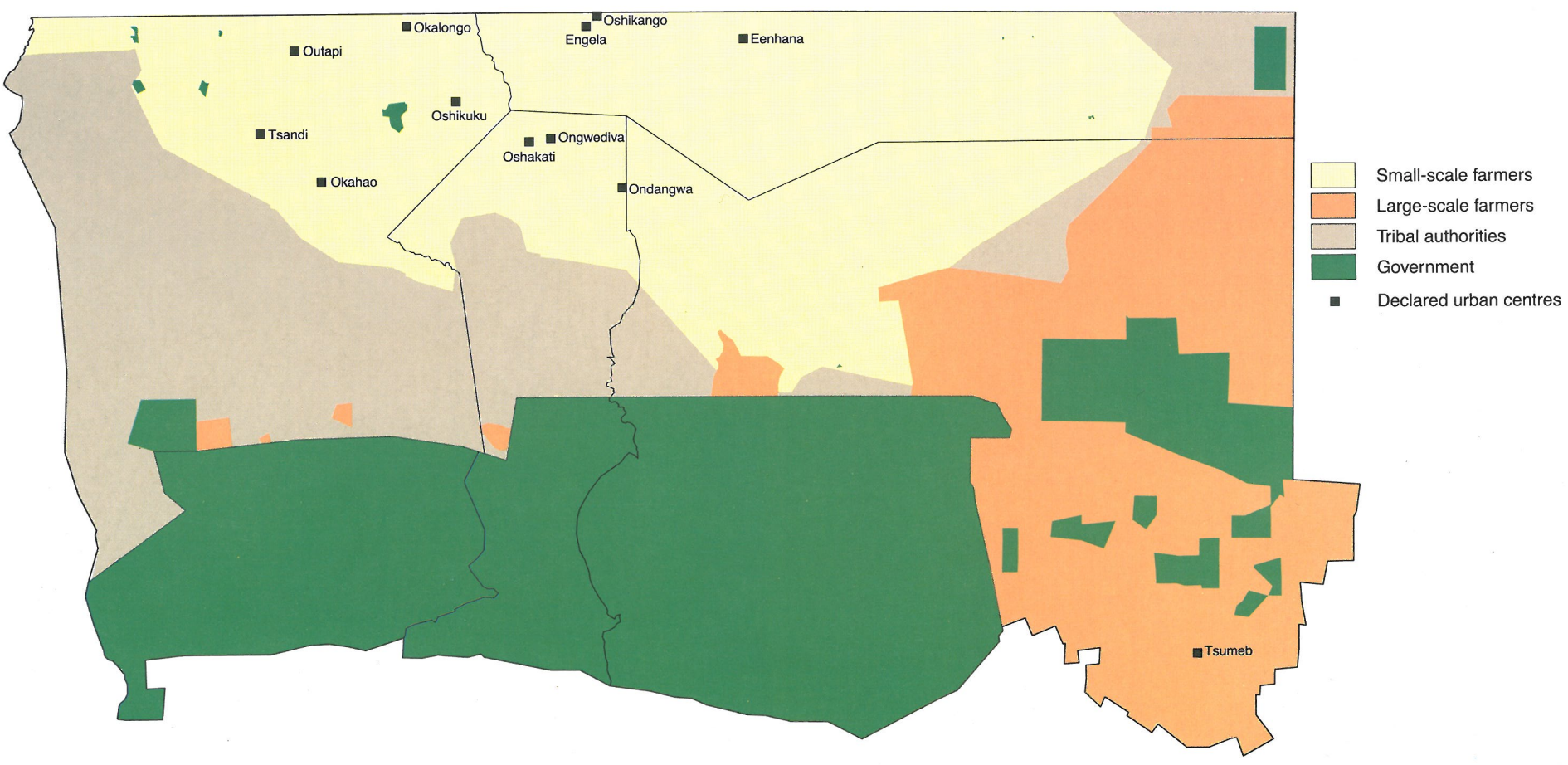
Two other factors add to the problem of new farming land being in short supply. One is the preference for new households to be established in areas that are not occupied, rather than by subdividing existing farms. Not only do farmers battle to find new, suitable land, but the practice leads to more clearing of the little natural vegetation that remains. The other problem is that there are far too many farms in some areas, especially in the Cuvelai, where fields are smaller and the number of goats and cattle owned by households are lower than elsewhere. Farmers, therefore, produce less and the shortage of alternative land means that they have little chance of improving their production. Again, poor farmers suffer most because they have the smallest fields and herds and have little access to other incomes. They also lack the resources to send any cattle they might have to graze elsewhere. Even if they could find the odd patch of land, they lack the resources to pay all the costs in establishing a new farm.

Towns

Areas occupied by towns will grow as a result of urbanisation, a trend to be encouraged so that more people move out of rural areas and reduce pressures on natural resources. The major challenges for towns are organisational and management ones: to ensure that towns are well planned, wastes are properly disposed of, crime is held in check, health hazards are minimised, and that residents can invest in property. Of course, the country as a whole and the region in particular need to see as many jobs created in towns as possible. Towns must also offer secure investments for people to buy property, especially if there is any hope that wealthy people might invest their surplus cash more in urban areas than in land and livestock in rural areas. In the case of Tsumeb, the residues of heavy metals that accumulated there during previous mining operations still need to be cleaned up. The cost of doing so was estimated to be about N$44 million in 1998. Some urban areas in Owambo have huge waste disposal problems which no one has started to address. These problems are likely to lead to water pollution and health hazards.

Small-scale farming areas

The huge numbers of people living in this area means that little can be done to change land uses. However, some change in practices and policies would be worthwhile. Limits on livestock numbers are needed, and these could be enforced by headmen and the water-point management committees that are being established. Special programmes should also be directed at improving the livelihoods of poor households. In particular, agricultural development activities and extension services should be directed at people really in need of help. Poor households also need support to help them diversify their sources of income and become as independent as possible of farm produce. The many prosperous, small-scale farmers should be encouraged to invest in things other than land and livestock. Incentives might be found to persuade those occupying larger farms to move into towns and make that land available for poorer people. The wealthier farmers should also pay for agricultural and other services they now enjoy for free. The planned system of payments being made for the supply of water sets an example of how people using resources can pay for them, especially in the sense that people using greater quantities of water will pay more.



▲ ***The principal authorities or groups of people controlling different areas at the beginning of 2000***

Large farms

Large farms make up about 20% of the region: 9% in the Tsumeb area and the other 11% in the Mangetti and the large, so-called illegally-fenced, farms. A re-evaluation of the effectiveness, uses and allocation of the Mangetti farms is needed. Most of those ranches are not productive, functioning more as places to keep large herds of cattle for the few people fortunate to have been allocated farms. Stocking rates on those farms are also high. It might be desirable to open them up for settlement by small-scale farmers. Soils suited to crop production are present in many places, and fresh water is available from the many boreholes that have been provided. Proposals to reallocate the Mangetti farms to poor farmers would meet fierce resistance because many of the present farmers are influential people.

The same difficulty holds for suggestions on how to deal with the 'problem' of the large, informally established farms. From a social point of view, the existence of those farms is irregular and inequitable, and most of them are also not used productively. Those in eastern Oshikoto enclose old, small pans and interdune valleys on which crops could be grown, providing opportunities for new small-scale farms to be established. These are valid reasons for the large farms to be dismantled. From an environmental point of view, the opening up of these areas to small-scale farming could be desirable by reducing pressures on natural resources in areas that are now densely populated. An opposite view is that natural vegetation on these large ranches is in relatively good condition, but much of it would be cleared, cut and, therefore, lost if the farms were opened up for small-scale farming. Since the 'owners' of these large farms will not give them up, policies and incentives should be considered that aim to turn these farms into productive units. Limits should be imposed on stocking rates to ensure that the land remains in good condition, and borders should be clearly demarcated.

The costs of establishing resettlement farms in the Tsumeb area have been high in relation to the small numbers of people that have been placed there. Government assistance programmes now heavily support most of their farming activities, and it is uncertain how many resettled people will be able to farm without continued assistance. These small-scale farmers are also isolated from other members of their communities. The biggest challenge facing the Tsumeb farms is to improve their productivity by reducing the high levels of bush encroachment, a difficult and expensive task.

EPP

The best intentions to keep urban areas clean are often ignored

EPP

Contrasting pastures inside and outside the fence of Ogongo Agricultural College
This photograph was taken in January after good rains had fallen in the weeks before, and when a good deal of grass should have been available. But the effects of heavy grazing pressures outside the fenced area are already obvious, and very little grass will remain in the months ahead. The preserved grounds of the College give it a high conservation value since it is the only remaining area of the Cuvelai that has not been badly degraded.

Traditional grazing areas

Areas of communal grazing under the control of headmen are perhaps more open to alternative land uses than any others. This is because they have not been fenced and claimed for more formal farming enterprises. However, proposals to use those areas for other purposes would have to take into account two important factors. First, cattle-owners see the pastures in these areas as important resources and they would object to any move to reduce their use of the pastures. Recent proposals to establish a conservancy in the Uukwaluudhi area met with this kind of reaction. Interestingly, cattle-owners are quick to complain about alternative land uses if they are proposed by people from outside the region, but little is heard in protest of the fencing-off of communal pastures by influential people in Oshikoto and elsewhere.

The other point to consider is that any further reduction in the availability of seasonal pastures will force more cattle into Angola. Large numbers are already grazed there on a seasonal basis, and those cross-border movements make it more difficult to control livestock diseases. Any increase in the number of cattle moving in and out of Angola also means that veterinary authorities would be less inclined to move the quarantine fence.

There is also little scope for small-scale farmers to settle in traditional grazing areas. The narrow section of land in Oshikoto is likely to be fenced off soon into large, informal farms. A large area of traditional grazing land in eastern Ohangwena has recently been allocated to a quarantine farm, and there are few old pans with soils on which crops can be grown. Several factors prevent further settlement in the large seasonal grazing area in Omusati and Oshana. Water in hand-dug wells is very salty and alternative supplies, in the form of borehole water from deeper aquifers or piped water, would be expensive. Good soils for crop cultivation are present in some areas, but in most the soils are too sandy or saline. Low and variable rainfall is the biggest constraint in Omusati, and it is only during years with exceptional falls that crops can be successfully grown.

The Communal Land Reform Bill will theoretically put a stop to the fencing-off of large farms in the communal grazing areas. If the Bill is not effective, it should be clear that most of those pastures will not remain open for communal use for long. Sooner or later, large, open grazing areas in Omusati will be fenced off informally into large farms. While a lack of water has prevented much of that from happening so far, farms will be established once wealthy people have their own boreholes drilled.

EPP

A large charcoal production unit near Tsumeb
Much bigger markets are needed for charcoal exports before the harvesting of bush for charcoal production will have any noticeable effect on levels of bush encroachment in the region.

Government-controlled land and Etosha

About 30% of the region's land is controlled by the government. Apart from the large block constituting Etosha, there are many government farms both in Owambo and the Tsumeb area used for agricultural research and training, quarantine farms, resettlement farms and as a prison. Significant changes to the uses of these areas seem unlikely to be made, but more effective use could certainly be made of the resettlement, prison and agricultural farms in the Tsumeb area. Every possible effort should be made to protect the Ogongo Agricultural College because it is the only piece of the Cuvelai in Namibia that remains in good condition.

Etosha, as the flagship conservation area in Namibia, is also the most important draw card for tourism to the country. Any proposals to increase its area are unlikely to be taken seriously. Its southern and eastern borders now form part of the veterinary quarantine fence. There are, thus, few opportunities for closer links with adjoining game farms south and east of the park, for example by taking down fences to allow game to move over larger areas. To the north and west, the only possibility is for the park to link with conservancies, but getting any new conservation areas established there will be difficult.

Tourism to Etosha and Namibia has seen tremendous growth over the past ten years, growth that has obviously earned the country increasing income. However, tourism is a fickle industry. Unfortunate events can damage a country's name as an attractive destination and it may take many years to repair that reputation. Nevertheless, it is clear that Etosha is underutilised as a tourist destination (see page 35), and many more areas in the park could be made available to tourists. All of this would generate more tourism income for Namibia, and more income could be allocated for the maintenance and management of the park. In addition, the park is difficult to manage within the constraints of the civil service. Many staff with good skills have been lost in recent years, and it has not been possible to replace much of that experience and competence. Bureaucratic problems add additional obstacles to the efficient running of the park. Even though the management of resorts has been made the responsibility of a parastatal organisation, the quality of service is the subject of numerous complaints by tourists. An attractive solution to these problems would be to divide the whole park into a number of concessions, and to invite bids for each. In addition to offering accommodation and other services for tourists, the concessionaires could be responsible for managing waterholes, and maintaining fences, roads and firebreaks. The ministry's role would then be to provide management guidelines, monitor the running of the park and conduct research appropriate to the good management of Etosha.

IMB

North-central Namibia can present images of striking beauty, but also ...

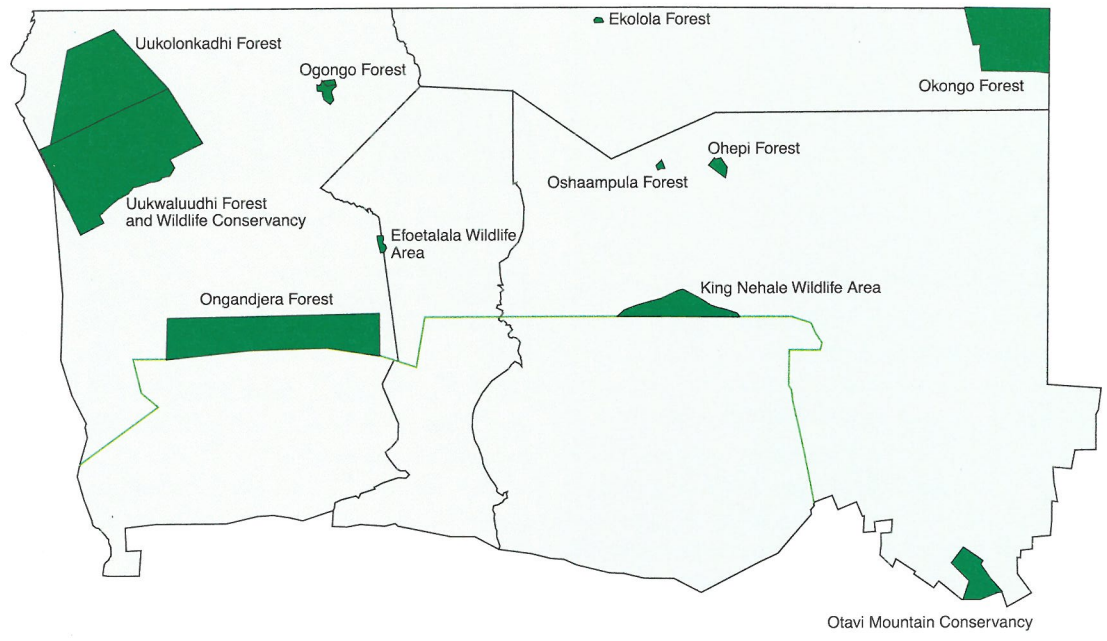
Conservancies

Conservancy programmes to encourage good relationships between conservation and farming are being promoted in many areas elsewhere in Namibia and southern Africa. These are intended to be community-run areas, with benefits from conservancies going to rural people living in them, for example as a result of tourism revenues and the selected harvesting of surplus wildlife. Built into the idea of conservancies is the concept that land be used both by livestock and wildlife.

One declared conservancy exists in the Tsumeb area, and at least eight proposals to establish other conservancies and community forests in Owambo have been made. It would also be useful to think of having one very large conservancy covering the whole area north of Etosha up to the Omadhiya lake complex. At the moment most of that area is used for seasonal grazing, although a number of large farms have been fenced off inside the area. If the existing Etosha fence was removed, zebra, springbok and wildebeest that used to migrate north to graze seasonal pastures could do so again, and their populations may recover to something like their former numbers.

However, none of the proposals for conservancies in Owambo has reached any stage of agreement to formally declare a conservancy, and a number of difficulties stand in their way. The very different economic interests of people in the region makes it hard to reach agreement on how a communal resource could be used for the benefit of everyone. Economic benefits to be derived from conservancies will also have to be substantial if they are to compete with other land practices. Some areas proposed as conservancies are thought to be in open grazing land, and yet a number of informal, fenced farms have been established inside some of those proposed conservancies. There has also been confusion with one section of the Ministry of Environment and Tourism proposing forest conservancies and another proposing wildlife conservancies in the same area.

An alternative to conservancies is to have wildlife parks run by groups on behalf of tribal authorities, regional governments or the Ministry of Environment and Tourism. Both approaches intend to reintroduce wildlife and develop tourism. Even though a range of problems confronts the establishment of conservancies and wildlife parks, the Ministry of Environment and Tourism must make every effort to see these proposals implemented. This is particularly true for areas in north-eastern Ohangwena, south of Ruacana and along the Omuramba Owambo, where valuable woodlands and other natural vegetation remain in good condition. The establishment of new conservation areas will also encourage more tourists to visit Owambo, as will proposals to open one or more gates between Etosha and Owambo to allow people visiting the park better access to attractions in Owambo.



▲ ***Proposed wildlife and forest conservancies and wildlife areas in Owambo, and one established conservancy near Tsumeb***
Forest conservancies have been promoted as a way to conserve woodland resources, while the focus in other areas has largely been on wildlife, especially large mammals.

WdP

Blue wildebeest on the wide-open plains of Etosha – part of the drawcard that makes Etosha Namibia's premier tourist attraction

... scenes of desolation, bareness and squalor

KR

MIB

In conclusion

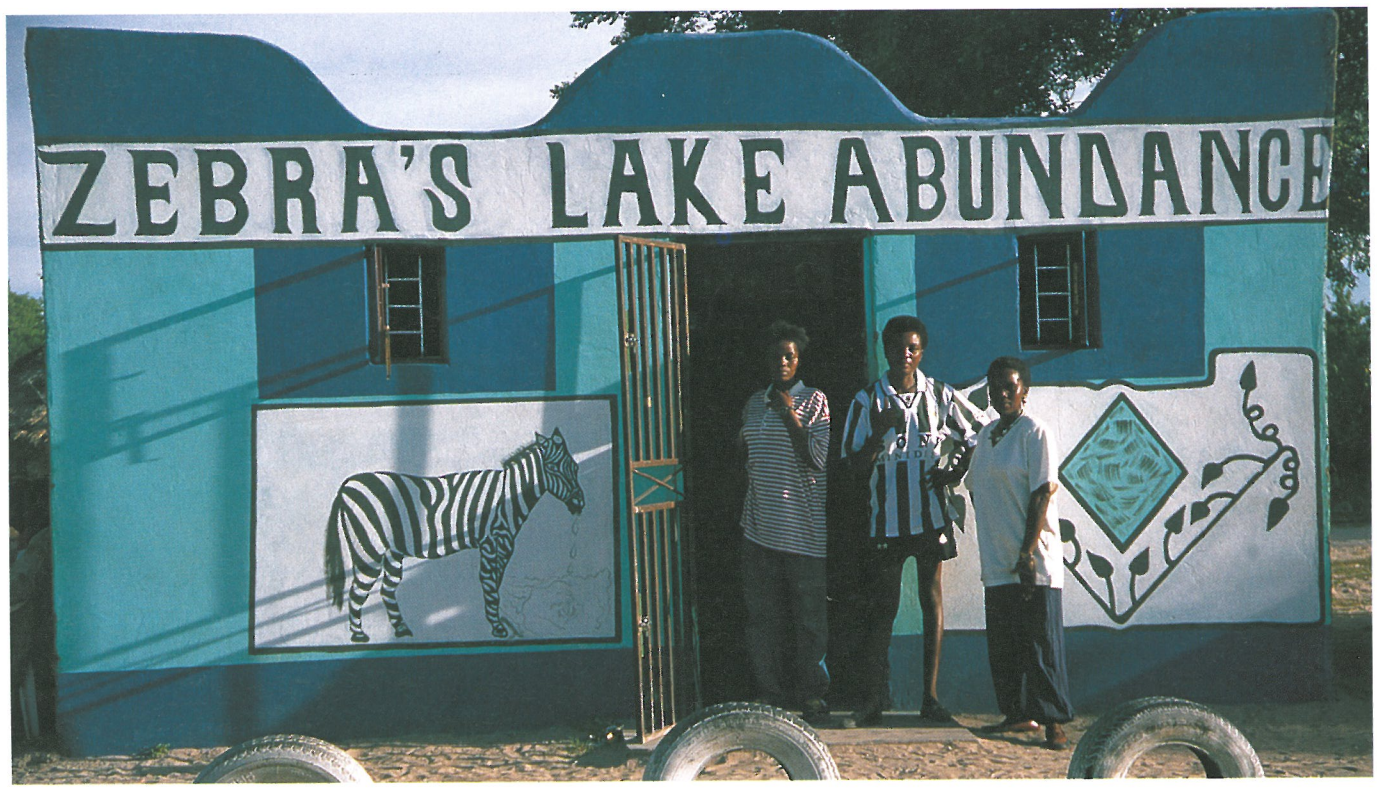
Perhaps two main points should be clear from this chapter. First, there are few options for making changes to the use of land by zoning it for different purposes. The small changes that could be made would not improve social and environmental conditions to any real degree. Most proposals would also meet with resistance from entrenched economic and political interests. This does not mean that the ideas should be abandoned – it is simply a recognition of the problems of scale and implementation. Second, and of much greater importance than the zoning of land for new uses, is the need for changes in policies, practices and attitudes towards land use. In essence, government – at national, regional and traditional levels – must adopt new ways of thinking about agriculture, social issues and land uses.

Ways of supporting agriculture in Owambo need to be reconsidered, particularly as far as cattle ownership is concerned. Agriculture does not make money for most farmers, and it is hard to imagine conditions under which that will change. For the poor, farming continues to provide an important source of food, but for the rich it now serves as an enterprise into which capital investments are made. As more and more people enter higher income brackets, more land and resources will be used by them to invest their savings at the cost of the poor, in particular, and the natural environment in general.

Another aspect to be reconsidered is that concerning land ownership, and for several reasons. First, land settlement and acquisition practices in Owambo run counter to the policy that communal areas provide a safety net for poorer people who cannot afford to buy property. Second, shared ownership and control over natural resources is difficult in a society containing large groups with such diverse economic interests and status. Third, the concept that communal land and ownership is vested in the government is seen as perpetuating control of the kind that previous colonial governments implemented. Fourthly, some land is already being bought and sold on an informal basis, and it is certain that land will be traded commercially on a large scale in the future.

The new land boards proposed in the Communal Land Reform Bill might play a useful role in controlling and improving the use and allocation of land. Another level of authority that could enhance the use and management of resources are the water-point committees now being established. Their primary responsibility is to manage rural water supplies within their small areas of jurisdiction, but it seems worthwhile to consider expanding their role to other natural resources. In this respect, they would also fill some of the gaps that have arisen as a result of the reduced power of traditional authorities.

There is a need to recognise that people who live and farm on a piece of land really control that land and are in effect the owners of the land. That recognition opens up useful possibilities of putting in place incentives for good land uses and disincentives for bad practices, especially when it concerns making use of the land in an economically productive way. Broadly speaking, what we need is for people to be held accountable for the way in which they use land. As difficult as it might be to enforce accountability, holding people responsible for the way in which Namibia's most valuable assets – its natural resources and land – are used, represents our best hope for a better future.



HD

Notes

Introduction

1. Many local Oshiwambo words and expressions aptly describe various features characteristic of the region and have been locally adopted into the English language. As the plural forms of many of these words are different from the singular forms, the English plural is usually used. These colloquialisms are explained in the glossary on pages 78 and 79.

2. Many sets of data were analysed during the compilation of this profile, the most important of which are:
   - Annual Agricultural Surveys of 1996–97, 1997–98 and 1998–99
   - 1991 Population and Housing Census, Central Statistics Office, Windhoek
   - 1996 Intercensal Demographic Survey, Central Statistics Office, Windhoek
   - 1994 Income and Expenditure Survey, Central Statistics Office, Windhoek
   - Survey of about 13,000 households in the Engela–Endola and Outapi areas by Lund Consulting Engineers in 1998 for the Directorate of Water Affairs
   - Aerial census data collected by the Ministry of Environment and Tourism in 1995 and 1998
   - The Environmental Profiles Project assembled data on boreholes and wells from various sources, the most important being the Directorate of Water Affairs' database.

   Hundreds of reports, articles and other publications provide information on the north-central region, but two recent publications cover many aspects for large parts of the region:
   - Marsh, A. and Seely, M. (eds.). 1992. *Oshanas – sustaining people, environment and development in central Owambo, Namibia.* DRFN and SIDA, Windhoek.
   - Lindeque, P.M. and Lindeque, M. (eds.). 1997. Special edition on the Etosha National Park. *Madoqua* 20(1).

3. All maps of the region in the book are projected using an Albers Equal Area projection with 16° East as the central meridian, 19° South as the standard and first parallel, and 18° South as the second parallel.

The shape of the land

1. The account of the region's geological history is based largely on discussions with Roy Miller and his publication:
   - Miller, R. McG. 1997. The Owambo Basin of northern Namibia. In: Selley, R.C. (ed.). *African basins: Sedimentary basins of the world 3.* 237–268. Elsevier, Amsterdam.

2. Map adapted from:
   - Miller, R. McG. 1997. The Owambo Basin of northern Namibia. In: Selley, R.C. (ed.). *African basins: Sedimentary basins of the world 3.* 237–268. Elsevier, Amsterdam.

3. Accounts on mineral deposits in pans are to be found in:
   - Schneider, G.I.C. and Genis, G. 1992. Salt. *The mineral resources of Namibia* 6.21:1–12.
   - Schneider, G.I.C. and Genis, G. 1992. Soda ash and thernadite. *The mineral resources of Namibia* 6.23:1–5.

4. The most recent review on the geology and history of Etosha Pan is:
   - Buch, M.W. 1997. Etosha Pan – the third largest lake in the world? *Madoqua* 20(1): 49–64.

Climate

1. An annual cycle from July of one year to June of the next was used in all analyses of climatic variables. Maps of rainfall were generated using Kriging interpolations for data collected from 1961 onwards at the following stations: Berg Aukas, Choantsas, Ermo, Gaub, Goabforte, Grootfontein, Halali, Hüttenhof, Koukuas, Namutoni, Nkurenkuru, Ogongo, Okahao, Okatana, Okaukuejo, Ombika, Ondangwa, Onguma, Ongwediva, Oniipa, Opuwo, Oshakati, Oshigambo, Oshikuku, Sissekab, Soavis, Toggenburg, Tondoro, Tsandi, Tsintsabis, Tsumeb and Outapi. Data on rainfall were supplied by the Namibian Meteorological Services, the Ministry of Agriculture, Water and Rural Development and by staff of the missions at Oniipa, Okatana and Oshikuku.

2. Data on temperature, wind and evaporation were provided by the Namibian Meteorological Services, and analysed by Peter Hutchinson for the Ministry of Environment and Tourism.

Water

1. Important references on fish are:
   - Van der Waal, B.C.W. 1991. Fish life of the oshana delta in Owambo, and the translocation of Cunene species. *Madoqua* 17: 201–209.
   - Van der Waal, B.C.W. 1999. Fish resource management study of the Omadhiya ephemeral wetland complex. Report for the Northern Namibia Environmental Project, Ongwediva.

2. Information on oshana flow frequencies from:
   - Van der Waal, B.C.W. 1999. Fish resource management study of the Omadhiya ephemeral wetland complex. Report for the Northern Namibia Environmental Project, Ongwediva.

3. Information on groundwater resources was compiled from different reports and advice provided by Arno Bittner and Katharina Dierkes (Bittner Water Consulting, Windhoek).

4. Maps of rest water levels below the ground, positions of groundwater above sea level (i.e. piezometry), groundwater qualities, sulphates and flouride concentrations are all based on an analysis of a database of boreholes compiled by the Environmental Profiles Project from data held by the Directorate of Water Affairs and many Namibian engineering companies. The maps were generated by running Kriging interpolations on data from boreholes, with some manual editing to correct obvious inaccuracies generated by the interpolations.

5. Water obtained from oshanas and open wells is considered to be 'unsafe' because it often contains parasites and chemicals that may be harmful to people. On the other hand, water supplied through pipelines is 'safe water' because it has been treated. Borehole water is also 'safe' because it is pumped from deep under the ground. The map of population density is the same as that shown on pages 38 and 39.

6. Data on pipelines and canals were compiled from various sources by the Northern Namibia Environmental Project.

Vegetation and soils

1. Borders of the nine soil type units coincide with borders of the 35 vegetation units. Each vegetation unit was assigned a soil type, as well as a rating of salinity and potential for crop cultivation. The rating for crop production is an overall approximation based on fertility, soil depth, water retention capacity and salinity. For salinity, ratings were likewise overall approximations. Most soil types were assigned on the basis of the known preferences of different plant species, but the following reference was an important source for the Etosha area:
   - Beugler-Bell, H. and Buch, M.W. 1997. Soils and soil erosion in the Etosha National Park. *Madoqua* 20(1): 91–104.

2. The 35 different vegetation units were mainly distinguished on the basis of differences in the structure of woody plant growth, plant species composition and soil type. This work was based on an interpretation of Thematic Mapper Landsat images taken in 1997, various reports, and fieldwork and experience of Wynand du Plessis (Etosha Ecological Institute, Okaukuejo), Christopher Hines (Environmental Information Services, Windhoek) and John Mendelsohn. The units were restricted to a manageable number, concentrating on those that could be described and recognised most effectively. The map and information provided here is an approximation that can be further developed and refined. It is also important to recognise that all units are mosaics of many smaller components, many of which are also found in other units and are too small to be mapped and described separately for the purposes of this project. That mosaic of features is especially important (and problematical!) in assigning values of resources for pastures, crop cultivation, wood use, etc. These measures are, thus, generalised ones, based on an overall assessment of what is available in each unit.

   Important references on vegetation are:
   - Le Roux, C.J.G. 1980. Vegetation classification and related studies in the Etosha National Park. DSc thesis. University of Pretoria, South Africa.
   - Clarke, N.V. 1998. *Guide to the common plants of the Cuvelai wetlands.* Ministry of Agriculture, Water and Rural Development, Windhoek.

3. The estimated population in each unit was derived by overlaying the boundaries of the units with the population density estimates (see Note 5 for the chapter on population). Estimates for areas under cultivation and the area cleared were obtained by first calculating the number of households in each unit. The number of households was then multiplied by 3.0 (hectares) to obtain an estimate of the area under cultivation. For the estimate of the area cleared and fenced, the number of households was multiplied by 13 hectares for vegetation units in the eastern Kalahari woodlands, by 9.0 hectares for those in the Cuvelai, and by 11.5 hectares for other vegetation units. The number of large stock units (see page 59) was estimated as the average summer and winter numbers for each vegetation unit outside Etosha. The density estimates of large wild animals were calculated as averages from the 1995 and 1998 aerial surveys (as shown in the map on page 31).

4. Marsh, A. 1994. *Trees: threatened lifeline of northern Namibia.* Gamsberg Macmillan, Windhoek.

5. Discussions with Cyril Lombard (CRIAA) on the marula oil development project.

6. Staff at the Etosha Ecological Institute, Okaukuejo, processed NOAA images to detect areas that had been burnt. The scars were detected by comparing images taken on different dates to identify major, rapid losses of vegetation cover.

7. These maps were produced on the basis of information supplied by Wynand du Plessis (Etosha Ecological Institute, Okaukuejo). NOAA images were processed for each day during the rainy season (October to April) to provide normalized differentiation vegetation indices (NDVIs). The indices reflect the green vegetation biomass in each cell (1x1 kilometre in size) for the area covered by the image. Daily images were combined every ten days and the maximum value of every pixel recorded over that period was extracted to produce a ten-day composite image. For each rainy season, all the ten-day maximum value composites were combined and the maximum value of every pixel extracted to produce a maximum biomass value for the whole season. These values thus represent the maximum biomass values over an entire rainy season.

8. Averages of maximum vegetation biomass values over six years were calculated (see Note 7 above), and those with pixel values of 160–180 were classified as having low levels of bush encroachment, those with 180–190 having medium levels, and those having 190 and more as having high levels. All dolomite hills were classified as having low bush encroachment values.

Wildlife and tourism

1. Simmons, R.E. 1996. Population declines, viable breeding areas, and management options for flamingos in southern Africa. *Conservation Biology* 10: 504–514.

2. Berry, H.H. 1997. Historical review of the Etosha region and its subsequent administration as a national park. *Madoqua* 20(1): 3–12.

3. The maps were generated by first estimating densities separately for the 1995 and 1998 aerial survey counts on a 5x5 kilometre grid, and then averaging the two estimates.

4. Lindeque, M. and Lindeque, P.M. 1991. Satellite tracking of elephants in northwestern Namibia. *African Journal of Ecology* 29: 196–206.

5. Information on problem animals was obtained from the Etosha Ecological Institute, and Chris Eyre and Flip Stander of the Ministry of Environment and Tourism.

6. As quoted in Berry, H.H. 1997. Historical review of the Etosha region and its subsequent administration as a national park. *Madoqua* 20(1): 3–12.

7. Gasaway, W.C., Gasaway, K.T. and Berry, H.H. 1996. Persistent low densities of plains ungulates in Etosha National Park, Namibia: Testing the food regulating hypothesis. *Canadian Journal of Zoology* 74: 1556–1572.

8. Information on anthrax in Etosha was obtained from:
   - Ebedes, H. 1976. Anthrax epizootics in Etosha National Park. *Madoqua* 10: 99–118.
   - Lindeque, P.M. and Turnbull, P.C.B. 1994. Ecology and epidemiology of anthrax in the Etosha National Park. *Onderstepoort Journal of Veterinary Research* 61: 73–84.

9. MacGregor, J. 1999. Economic appraisal of the development of the Andoni Gate, Etosha National Park, Namibia. Unpublished report. Directorate of Environmental Affairs, Windhoek.

10. Based on information from the Policy, Planning, Management and Information Unit of the Ministry of Environment and Tourism, and from:
    - Berry, H.H. 1997. Historical review of the Etosha Region and its subsequent administration as a national park. *Madoqua* 20(1): 3–12.

People, their health and education

1. The total population is now estimated to be about 786,500. That figure differs from most published figures, which do not take into account changes made to the regional boundaries in 1998. An estimated 17,000 people in the area around Ruacana and the settlements south to Etosha were added to Omusati when the new delimitations came into force.

2. These figures were estimated from counts of households (see Note 5 below), based largely on aerial photographs taken in 1996. The figures for 1996 were increased by the rate of population increase estimated by the Central Statistics Office, to produce estimates of the total population in 2000.

3. Population projections were produced by the Central Statistics Office based on assumptions and predictions developed in collaboration with the Ministry of Health and Social Services, to incorporate the effects of HIV infection rates.

4. Aerial photographs from 1943 were only available for the Okalongo area. Photographs taken in 1970 were analysed for the Okalongo, Oshakati–Ondangwa and Tsandi areas, while ones taken in 1972 were used for the Okongo and Onankali areas. The Oshakati–Ondangwa counts are those of households between the two towns and do not include households within the urban areas.

5. Information on the distribution of people came from several sources:
   - The Environmental Profiles Project mapped some 53,000 households as points off 1:80,000 aerial photographs taken in 1996; the number of people allocated to each household was eight.
   - The Water Supply and Sanitation Project of the Ministry of Agriculture, Water and Rural Development had mapped another 18,500 households in western Ohangwena off 1:30,000 aerial photographs taken in 1993; the number of people allocated to each household was eight.
   - Lund Consulting Engineers mapped some 13,000 households in the Endola and Outapi areas in 1998 using global positioning systems; they recorded the actual number of people in each house.
   - The Northern Namibia Environmental Project mapped the positions of 64 cattle posts using global positioning systems; they recorded the actual number of people at each cattle post.
   - In the Tsumeb area, 269 households or farmsteads were identified off aerial photographs and each farmstead was then assigned to the enumeration area in which it fell (the enumeration areas were those used in the 1991 Population Census). The number of farmsteads in each enumeration area was counted and divided into the total number of people counted in the area in 1991. That gave an average number of people per farmstead, which was then inflated by two percent each year to produce an estimate for the 1998 population.
   - A Ministry of Environment and Tourism survey in 1996 of all people living and working at each camp provided an estimate of the number of people in Etosha. These counts do not include tourists.
   - The Ministry of Lands, Resettlement and Rehabilitation provided a figure for the number of people living at Tsintsabis.

- Populations in urban areas (Okahao, Ondangwa, Ongwediva, Oniipa, Oshakati, Oshigambo, Oshikuku, Outapi, Ruacana and Tsumeb, as defined in the 1991 census) were increased by four percent each year from the 1991 census totals up to 1998.

All of the estimates of numbers of people per household at camps in Etosha, Tsintsabis, and in urban areas were taken as reflecting numbers in 1998. To derive the map of densities, ArcView's Spatial Analyst density function was used to 'spread' the number of people at each point over a radius of 1000 metres using the kernel method (the cell size was 500x500 metres). To that was added the simple densities (number of people per area) for each urban area to produce the overall map of densities. The value of each cell in that grid file is the estimated density in numbers of people per square kilometre. Adding up all the densities for each cell gives a total estimated population for the region of 775,000 people, compared with 755,000 people estimated in the population projections for 1998.

6. Information used for the age pyramids comes from the 1996 Intercensal Demographic Survey, the 1991 Population and Housing Census, and the 1960 and 1970 population censuses (all of the Central Statistics Office, Windhoek).

7. Information on health facilities was correct at the end of 1999. Numbers of people outside catchment areas of five kilometres were estimated by adding up the number of mapped households outside those areas and applying an estimate of eight people per household.

8. Information for 1998 on underweight children and diseases was obtained for each health facility. For malaria and diarrhoea, theoretical catchment populations were estimated using Thiessen polygons and the assumption that all people reported at a facility lived within 20 kilometres of the facility. The polygons were overlaid with the map of population densities to estimate the 'catchment population'. The number of cases reported at a facility in 1998 was divided by the population to obtain a measure of the prevalence of the disease.

9. Information on schooling and enrolment was obtained from the Ministry of Basic Education and Culture's Education Management Information System, in particular from the reports for the 1998 15th School-day and Annual Education Censuses. Levels of adult education were derived from data collected during the 1996 Intercensal Demographic Survey.

Land and governance

1. Estimated numbers of people per constituency were obtained by overlaying the boundaries of the constituencies on the analysis of population density (see Note 5 for chapter on people, their health and education, above) and calculating the total number of people in each constituency.

2. This information was correct at the end of 1999. More recent information is available from the Ministry of Regional and Local Government and Housing.

3. These data are taken from the results of a survey of headmen by the Ministry of Health and Social Services in 1994. Each headman reported the number of people and households under his jurisdiction.

4. A variety of sources of information were used to demarcate the boundaries on these maps. Boundaries of the Tsumeb and Mangetti farms were taken from digitised, cadastral maps of farms, whereas global positioning systems were used to record the boundaries of some resettlement farms in Owambo, as well as the boundaries of the Okashana farm. Other boundaries of government and resettlement farms were traced off aerial photographs or sketch maps. Boundaries of large, 'informally fenced' farms in Omusati and Oshana were mapped from an aeroplane, using a global positioning system, while the boundary of the large area in Oshikoto was drawn after extensive aerial mapping of the many fenced areas (from an aeroplane and using a global positioning system). Communal grazing areas were demarcated as those outside the most densely populated zones, as shown in the map on pages 38 and 39.

5. Areas that had been visibly cleared or fenced were calculated by tracing their boundaries off aerial photographs. Photographs for 1943 were only available for the Okalongo area. For the Okalongo, Oshakati–Ondangwa and Tsandi areas, photographs taken in 1970 were used, while ones taken in 1972 were used for the Okongo and Onankali areas.

Farming

1. Based on analyses of data collected during the Agricultural Surveys of 1996–97, 1997–98 and 1998–99 by the Central Statistics Office, Windhoek.

2. Important sources of information on crop production are:
   - Keyler, S. 1996. Economics of the Namibian millet subsector. PhD thesis, Michigan State University, USA.
   - Matanyaire, C.M. 1998. Sustainability of pearl millet (*Pennisetum glaucum*) productivity in northern Namibia. *South African Journal of Science* 94: 157–166.
   - Ministry of Agriculture, Water and Rural Development. May 1999. Farm-household Economics Survey of the Ohangwena Region in 1997–98, Analysis Report 1.

3. Personal observations and adapted from:
   - Investigation into soil fertility in the North Central regions. Survey Report 1 (undated), Farming Systems Research and Extension Unit, North Central Division, Ministry of Agriculture, Water and Rural Development, Windhoek.

4. Relationships between population density on the one hand, and field size and livestock numbers on the other were obtained by comparing the density of people (from mapped households) in each of 79 primary sampling units with the average sizes of fields and numbers of cattle, goats and donkeys per household. The primary sampling units and the data on field sizes and livestock numbers were those used and recorded during the Annual Agricultural Surveys in 1996–97 and 1997–98. Population densities are those calculated and reported in the chapter on population. The following equations reflect the relationships between population density and cattle and goat numbers per household:
   - Cattle: $y = -3.8742 \ln(x) + 20.103$
   - Goats: $y = -2.6396 \ln(x) + 21.759$

5. Based on data collected during the Annual Agricultural Surveys of 1996–97 and 1997–98 by the Central Statistics Office and estimates of numbers of households as described in the chapter on population.

6. Analysis of data collected in 1998 by Lund Consulting Engineers for a study on behalf of the Department of Water Affairs. About 13,000 households were covered during the survey.

7. Numbers of cattle are based on the 1998 Directorate of Veterinary Services' vaccination campaign counts, the Ministry of Environment and Tourism's aerial census in 1998, and records from the Directorate of Veterinary Services in Otavi.

8. Based on Agricultural Surveys of 1996–97, 1997–98 and 1998–99, and Directorate of Veterinary Services' reports on vaccination campaigns and stock inspections.

9. Densities of cattle on the Tsumeb farms and the quarantine farms (Omatambo–Maowe and the Mangetti AMCOM farm) were calculated by dividing the area of each farm by the number of cattle reported there. For the Owambo region, cattle densities were estimated from vaccination counts at each crush-pen in August 1998. The number of animals was 'distributed' over a distance of 15 kilometres around each crush-pen, providing a map of 'winter' densities.

   For the 'summer' densities, counts of cattle at crush-pens in fenced areas and on quarantine farms, the Mangetti farms, the fenced farms in eastern Oshikoto were held constant, assuming that no cattle were moved into or out of these areas. It was assumed that 30% were moved out of settled areas in summer, and numbers of cattle at crush-pens in those areas were, thus, reduced by 30% for the summer months. The total of 30% was distributed elsewhere by assuming that 5% went to Angola and the remaining 25% moved to grazing and mixed areas (see map of cattle movements on page 57). The number of cattle represented by the 25% was then divided by the number of crush-pens in the grazing and mixed areas, and the resulting total was added to the number of cattle counted during the winter vaccination campaign. This procedure produced a new set of summer counts per crush-pen, and a density map was again generated by distributing the numbers over a distance of 15 kilometres around each crush-pen.

   Densities of donkeys were based on data collected during the 1998 aerial census conducted by the Ministry of Environment and Tourism. Densities of goats were estimated by applying the regression relationship between human population density and numbers of goats per household (see Note 4 above).

10. The usefulness of guidelines for carrying capacities and stocking rates is widely debated, especially in areas where animals are moved from one pasture to another. However, the results given here show that many areas are indeed heavily stocked throughout the year. Many studies suggest ten hectares per large stock unit as an approximation of a stocking rate that is reasonable and sustainable. There is of course a great deal of small-scale variation between patches of pastures of different qualities.

11. Maps of total stocking rates were generated from the densities of cattle in winter and summer, and densities of donkeys and goats (as described in Note 9 above). Stocking rates were calculated as the number of large stock units per square kilometre:
   - cattle density + donkey density + (0.125 x goat density)

12. Schade, K., Kalili, N. and Simpson, R. 2000. A survey of subsistence farmers in the Ohangwena region. *Namibian Economic Policy Research Unit Research Report* 19. Windhoek.

13. Sources of information on livestock consumption are:
   - Northern Regions Livestock Development Project. 1999. Livestock Marketing Study. NOLIDEP.
   - Liagre, L. 1999. Cattle marketing in northern Namibia: A study through a commodity chain analysis approach. Namibian Economic Policy Research Unit, draft research report. Windhoek.
   - Data on formal sales supplied by Meatco, Oshakati.

14. Pendleton, W. and Frayne, B. 1998. Report of the results from the Namibian Migration Project. Social Science Division, University of Namibia, Windhoek.

Household economies

1. Important sources of information on the history of the region, its kingdoms, trading activity and migrant labour are:
   - Andersson, C.J. 1875. *Notes on travel in South Africa.* London.
   - Clarence-Smith, W.G. and Moorsom, R. 1977. Underdevelopment and class formation in Ovamboland, 1844–1917. In: Palmer, R. and Parsons, N. (Eds.). *The roots of rural poverty in central and southern Africa.* Heinemann, London.
   - Galton, F. 1853. *The narratives of an explorer in tropical South Africa.* J. Murry, London.
   - Hahn, C.H., Vedder, H. and Fourie, L. 1928. *The native tribes of South West Africa.* Frank Cass, London.
   - Hayes, P. 1992. A history of the Ovambo of Namibia, *ca.* 1880–1935. PhD thesis, University of Cambridge, UK.
   - Hishongwa, N. 1992. *The contract labour system and its effects on family and social life in Namibia: a historical perspective.* Gamsberg Macmillan, Windhoek.
   - Kreike, E. 1997. *Vanishing floods, people, land and water resources in Ovamboland 1890–1990.* In: Land, violence and social problems in the history of southern Africa. Princeton University, U.S.A.
   - Loeb, E.M. 1962. In Feudal Africa. Published as an annex to the *International Journal of American Linguistics* 28: 49–50.
   - Siiskonen, H. 1990. Trade and socio-economic change in Ovamboland, 1850–1906. *Studia Historica* 35. Societas Historica Fennica, Helsinki.
   - Williams, F-N. 1991. Precolonial communities of Southwestern Africa, A history of Owambo kingdoms 1600–1920. *Archeia* No. 16. National Archives of Namibia, Windhoek.

2. Analysis of data collected during the 1996 Intercensal Demographic Survey by the Central Statistics Office, Windhoek.

3. Analysis of data collected during the 1994 Income and Expenditure Survey by the Central Statistics Office, Windhoek.

4. Analysis of data collected during the 1991 Population and Housing Census by the Central Statistics Office, Windhoek.

5. Many surveys record the main source of income of the head of the household, and that information is then analysed to see how sources of income relate to various social and other parameters. The results are also used to present a picture of what proportions of households, or the population, have different kinds of income. However, those analyses are often flawed, especially in households where there are many different incomes. For example, the head of the home is often an elderly pensioner who regards his or her monthly cash pension as a main source of income. There may, however, be several working adults in the same household, each earning much more from their respective jobs.

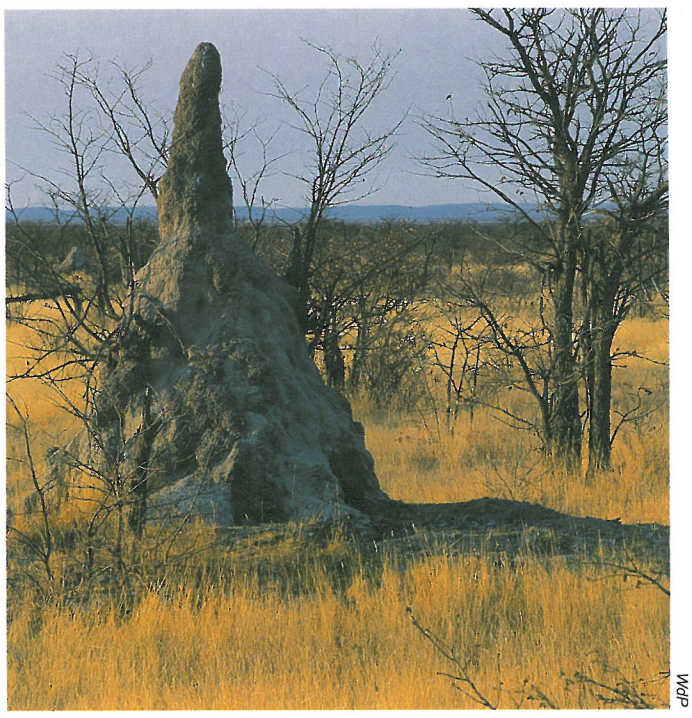
6. Analysis of data collected at about 13,000 households in the Outapi and Endola areas during 1998 by Lund Consulting Engineers for a study on behalf of the Department of Water Affairs, Windhoek.

7. The analysis is based on information collected during the 1996–97 and 1997–98 Agricultural Surveys by the Central Statistics Office, Windhoek. The index was created by summing the value of each household's herds of cattle and goats, and area used for cultivation. Each head of cattle was given a value of N$1000, a goat N$200, a pig N$100, a donkey N$400, a sheep N$300 and each hectare a value of N$250. The values are arbitrary to some degree, but do reflect the relative market values of these assets. Thus, households with the highest numbers of livestock and biggest fields had high index values and are placed in Group D. The poorest ones ended up with much lower values and are in Group A. The four groups were determined by simply dividing the range of indices, from the lowest to the highest, by four.

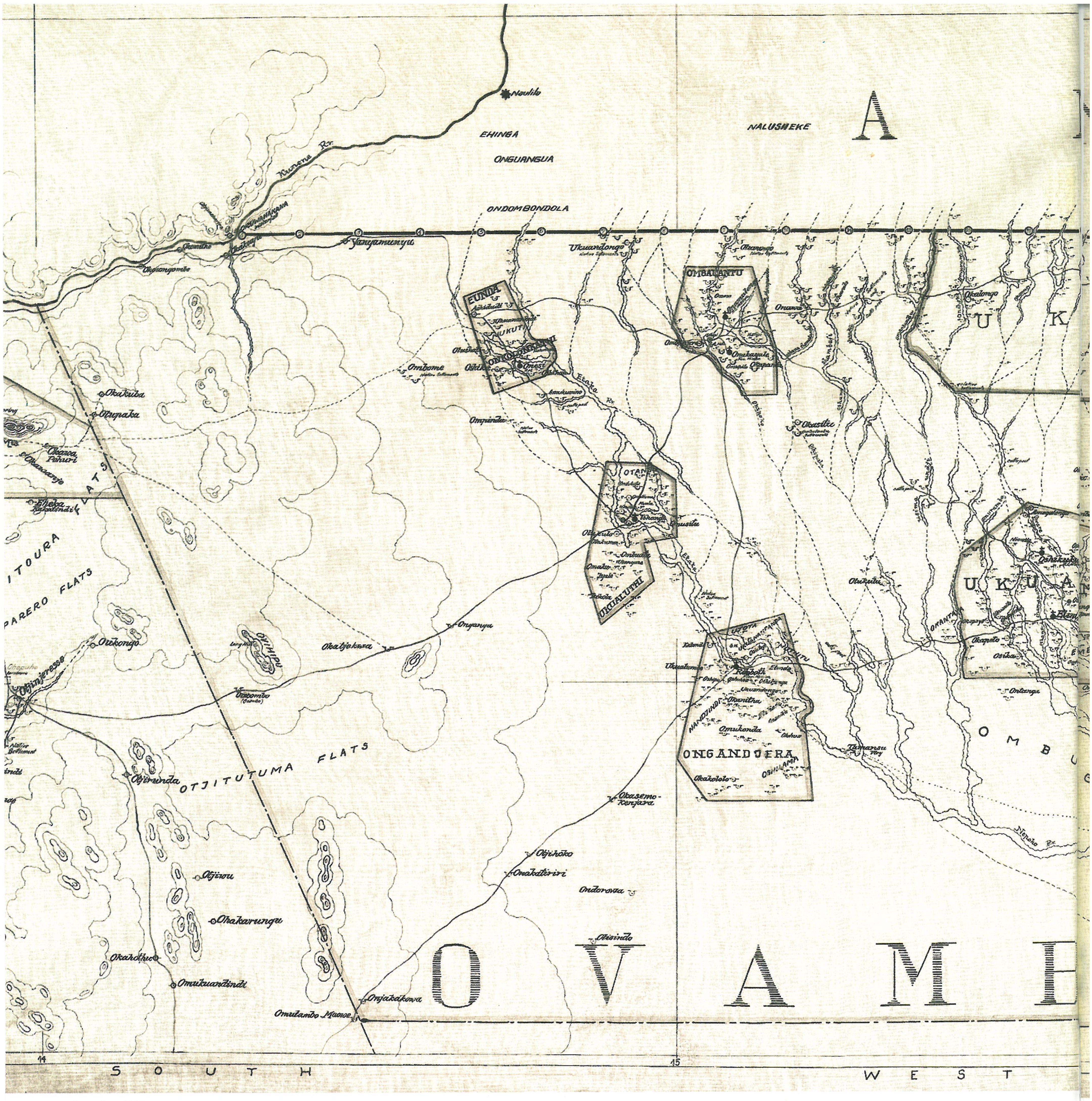
8. Information presented in:
   - Ministry of Trade and Industry. 1998. Small Business Survey. Windhoek.

   The cuca shops (22% of all small businesses), bottle stores (15%) and general dealers (14%) reported in this survey amount to about 7400 of the 14,600 small enterprises. That total is equivalent to the estimated total number of cuca shops, bottle stores and general dealers based on counts in the Engela and Outapi area (see Note 6, above).

9. Information presented in:
   - BICON Namibia. 1999. Roads Master Plan for Oshikoto, Oshana, Omusati and Ohangwena. Report for the Ministry of Works, Transport and Communication.



WWF



▲ *Owambo, 1937*

Glossary

AIDS	acquired immune deficiency syndrome
AMCOM	Amalgamated Commercial Holdings
CRIAA	Centre for Research Information Africa Action
DRFN	Desert Research Foundation of Namibia
HIV	human immunodeficiency virus
N$	Namibia Dollar(s)
NASA	National Aeronautics and Space Administration, USA
NDVI	normalized differentiation vegetation index
NOAA	National Oceanic and Atmospheric Administration, USA
SIDA	Swedish International Development Agency
SWAPO	South West Africa People's Organisation

commercial area	within the north-central region this refers to the *Tsumeb area*
communal area	within the north-central region this refers to the area north of the veterinary quarantine fence, excluding Etosha National Park
cuca shop	term used for a small trading store, often selling, amongst other things, beer; also known locally as *uundingasho* (Oshindonga)
efundja	a large flood of water in the Cuvelai
Etosha	Etosha National Park
Four O's	popular term for the four political regions of Ohangwena, Omusati, Oshana and Oshikoto
mahangu	pearl-millet, from the Oshiwambo *omahangu*
Mangetti farms	a block of government-owned farms, demarcated in the early 1970s, in central Oshikoto that are leased out to private farmers
iigandhi (plural)	*oshigandhi* (singular) (Oshindonga); known also as *omashisha* (plural) or *ashisha* (singular) (Oshikwanyama); large grain-storage baskets
omithima (plural)	*omuthima* (singular) (Oshindonga) shallow, hand-excavated well
omuramba	ephemeral river or watercourse
oondungu (plural)	*ondungu* (singular) (Oshindonga) deep, hand-dug wells

NAN

oshana (singular)	oshanas (plural) adapted by English-speakers from Oshiwambo (*oshana* singular; *oyana* plural) to describe the drainage channels which interconnect with others in the Cuvelai system; Oshana is the political region
Owambo	used to describe the so-called *communal* area within the four political regions of Ohangwena, Omusati, Oshana and Oshikoto, i.e. that area which lies north of the veterinary quarantine fence, excluding Etosha
red line	the veterinary quarantine fence
region	unless otherwise indicated, refers to the north-central region of Namibia which encompasses the four political regions of Ohangwena, Omusati, Oshana and Oshikoto
Tsumeb area/farms	used to describe the so-called *commercial* area in the north-central region; it is the area south of the veterinary quarantine fence in the south-eastern area of the region (and Oshikoto)
uuyanda	(Oshindonga); known also as *ekove* (Oshikwanyama); the land within the homestead that is uncultivated and used to graze livestock

Names of plants frequently used in the text, and their scientific and Oshindonga names

English common	Scientific	Oshindonga
Baobab	*Adansonia digitata*	*omukwa*
Berchemia	*Berchemia discolor*	*omuye*
Burkea	*Burkea africana*	*omutundungu*
Jackal berry	*Diospyros mespiliformis*	*omwandi*
Kiaat	*Pterocarpus angolensis*	*omuguya*
Mangetti	*Schinziophyton rautanenii*	*omunkete*
Marula	*Sclerocarya birrea*	*omugongo*
Mopane	*Colophospermum mopane*	*omusati*
Palm, makalani	*Hyphaene petersiana*	*omulunga*
Teak	*Baikiaea plurijuga*	*omupapa*
Terminalia, purple-pod	*Terminalia prunioides*	*ohama*
Terminalia, silver	*Terminalia sericea*	*omugolo*
Wild fig	*Ficus* species	*omukwiyu*

ISBN 99916-0-215-1

9 789991 602158

Gamsberg
Macmillan