

BY MILES ROBERTS  
AND  
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# OKAVANGO:

## THE RIVER THAT NEVER FINDS THE SEA

PHOTOGRAPHS BY  
KATHERINE BALDWIN



ZEBRAS (*EQUUS BURCHELLI*) GRAZE DRIED GRASSES AT A FOREST/GRASSLAND "EDGE" HABITAT ON PERMANENT HIGH-GROUND. EDGES ARE THE MOST PRODUCTIVE HABITATS IN THE DELTA AND PROVIDE ABUNDANT FOOD AND COVER FOR PREY AND PREDATORS ALIKE.



s our ten-seat turboprop hummed along in the shimmering heat, a bataleur eagle floated silently skyward on an invisible column of air, the gray sands of the Middle Kalahari receding slowly beneath its eagle-eye. Two thousand feet below, an inhospitable wasteland scrolled by, dried and worn to its core by the elements; an expanse of vast dry pans, cracked and crusted white with alkali; an endless wilderness of sandy flats dotted with stubborn thorn trees and leafless baobabs. No rivers flowed here, no lakes or mountains or valleys broke the flat monotony of the parched landscape for hundreds of miles around. Just sand and scrub and heat and wind.

the rivers ceased to flow, lakes receded and dried to crusty pans, and the fertile soils, weathered by water and dry Kalahari winds, devolved to sand. "How can there be animals here?" we wondered. "There's not a drop of water to be seen."

In the local Tswana language, "Kalahari" means "the big thirst," an apt sobriquet for a land dominated by dust, sand dunes, searing heat, and meager rains. But in a remote corner lies a strange and mysterious place where rivers still flow and permanent water supports an abundance of life. A magical air pervades this unlikely oasis, emanating a palpable sense that the gods are still at work, tinkering with the landscape. It is a place where rivers change course without apparent reason and extinct lakes suddenly fill, then, like a dream, evaporate, unremembered. Here, vast undulating sandscapes float atop an underground sea, sand dunes and verdant rivers flow side-by-



ISLAND HABITATS LIKE THE ONE IN THE BACKGROUND ARE OFTEN INITIATED BY TERMITES MOUNDS (FOREGROUND).

BELOW: WARTHOGS (*PHACOCHOERUS AETHIOPICUS*) ARE PERMANENT, NON-MIGRATING RESIDENTS IN THE DELTA AND THE FAVORED PREY OF LEOPARDS.

RIGHT: PERIPATETIC BABOONS (*PAPIO SP.*) AND ELEPHANTS (*LOXODONTA AFRICANA*) ARE THE DELTA'S MAJOR DISPERSERS OF THE SEEDS OF PALMS AND OTHER LARGE TREES.



SCHEMATIC DIAGRAM OF THE SOUTHERN CONTINENTS AS THEY MAY HAVE LOOKED 170 MILLION YEARS AGO, SHORTLY AFTER THE BREAKUP OF THE GONDWANALAND SUPERCONTINENT.

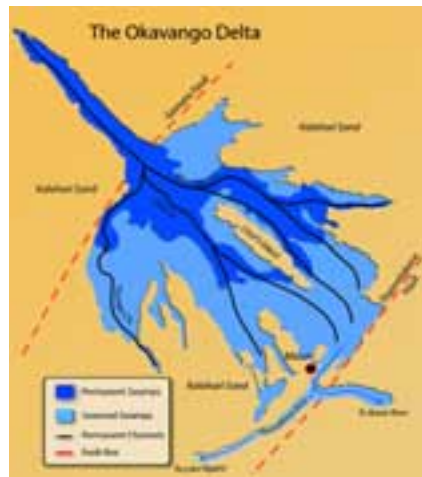
The dry savanna and desert that sprawled endlessly below us, known as the Kalahari, was born some 170 million years ago when Africa separated from the supercontinent Gondwanaland. A ring of escarpments marks where it calved from the adjoining landmass. At its center is an elevated plateau that subsided to form a huge interior basin that accumulated sediments, which would ultimately become the Kalahari sands. For a million centuries, tumultuous geological processes twisted the landscape while a thousand climatic cycles of dry and wet, hot and hotter scoured its face. We could see the weathered scars of wetter times, when rivers flowed into the central basin carrying water and fertile sediments to vast inland lakes. We could also see where, with progressively drying conditions,



OKAVANGO



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FROM TOP: THE OKAVANGO DELTA IS ONE OF THREE INLAND DELTAS ON THE AFRICAN CONTINENT AND IS SOUTHERN AFRICA'S LARGEST WETLAND.

AFTER ENCOUNTERING THE GOMARE FAULT, THE OKAVANGO RIVER DIFFUSES ACROSS KALAHARI SANDS AS AN ALLUVIAL FAN FLOWING SOUTHEAST TOWARD MAUN.

side into a seemingly lifeless desert, and a river, born in distant highlands near the sea, snakes a thousand miles inland to create this oasis before evaporating into the vast African sky. This was our destination: Botswana's Okavango Delta, the place "where the river never finds the sea."

Our group of six from Washington, D.C., had come here for three weeks to experience one of the last great wildlife spectacles in Africa. For a year, we read as much as we could, but we didn't really know what to expect. Only one of us had been here, years before; two others had been to Africa, but never this far south, and the other three were completely new to Africa. Rumbling along in anticipation, we were thrilled when the first glistening ribbon of Okavango Delta water came into view.



MEANDERING CHANNELS OF THE LOWER DELTA STRETCH TOWARD THE HORIZON IN THE PRE-FLOOD SEASON.

The Okavango is southern Africa's largest wetland, spreading some 5,800 square miles across the heart of the Central Kalahari Basin. It is one of three large inland deltas in Africa, the Sudd, straddling the Nile in southern Somalia, and the Niger Inland Delta along the Niger River in Mali being the others. Technically called alluvial fans, all occur in arid areas where rivers encounter depressed fault-line structures that cause their flow to spread laterally in a fan-like pattern, creating a mosaic of dry land, marsh, and swamp habitats. They all support large assemblages of plants

and animals that seem out of place in the harsh, arid environments.

The Okavango's water originates a thousand miles away in the Angolan Highlands. Spring rains there, peaking in December, send a pulse of water on a long, slow journey south and east. The river enters Botswana near the village of Mohembo in a somewhat restless state, its meanderings creating new channels, oxbow lakes, and lagoons each year. About 60 miles into Botswana, the river divides into three channels that progress at much reduced rates and in

**DURING ITS LONG JOURNEY, THE WATER IS SLOWED AND DIVERTED BY VEGETATION AND TOPOGRAPHIC IRREGULARITIES. IN ITS 155-MILE JOURNEY, ABOUT 98 PERCENT OF THE SURFACE WATER IS LOST THROUGH EVAPORATION AND PLANT TRANSPIRATION.**

different directions. In the delta's upper reaches, water is contained in these major channels and flows between permanent strips of land called sandveld tongues. This perennial wetland is river-like and only during the annual floods does water leak from the channels into surrounding plains to form seasonal marshes.

**AFRICA'S DELTA WILDERNESS**

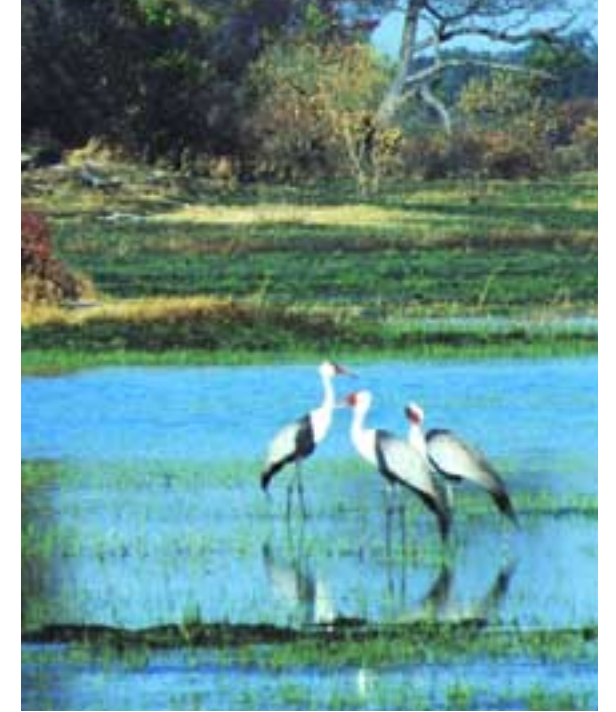
A sudden change in the engines' tune signaled the approach to our first destination. We quickly spiraled down to an airstrip very much in the middle of nowhere. The engines revved impatiently as the crew offloaded us and our meager possessions, then the plane wheeled off, its dusty wake coating us with a fine layer of dust that would be our second skin for the next 21 days.

As the plane taxied to the strip, we looked around hoping to get our bearings, but the sun was at high noon and the landscape disconcertingly featureless. The turboprop roared by, sending up a flock of birds and another cloud of dust before soaring into the blue and leaving us alone and in silence. We were really in the African wilderness now.

This first stop was at the tip of a permanent sandveld tongue within a few miles of the delta's apex. Here, the main channels begin to divide into progressively smaller streams that feed the lower reaches of the delta. The lower streams have porous walls that allow water to leak out across the terrain in wide swaths. Mixed with overflows

from adjacent small channels, they form the large marshes with small high mounds that become the characteristic islands of the middle and lower delta.

Floodwater arrives at the southern end of the delta in July and August, a full five months after peaking at Mohembo. During its long journey,



THREE ENDANGERED WATTLED CRANES (*BUGERANUS CARUNCULATUS*) FORAGE FOR AQUATIC INSECTS ON AN OXBOW LAKE NEAR VUMBURA IN THE NORTHEAST DELTA. THE OKAVANGO DELTA IS AN IMPORTANT STOPOVER AND DESTINATION FOR MANY MIGRATORY BIRDS.



WILDEBEESTE AT ALERT ON HIGH GROUND NEAR SANTANTADEBE CHANNEL IN THE SOUTHEAST DELTA. WILDEBEEST NUMBERS HAVE DECLINED DRAMATICALLY IN THE DELTA SINCE LIVESTOCK FENCES WERE ERRECTED IN THE MID-1950S.



LECHWE (*KOBUS LECHWE*) CAUTIOUSLY APPROACH A WOODED COPSE. (LEFT) PREDATORS ABOUND IN THE DELTA AND GRASSLAND-FOREST MOSAIC HABITATS SUCH AS THIS ONE ARE THE PERFECT SETTING FOR AN AMBUSH BY WILD DOGS OR LIONS.



the water is slowed and diverted by vegetation and topographic irregularities. In its 155-mile journey, about 98 percent of the surface water is lost through evaporation and plant transpiration.

About three-quarters of the Central Kalahari Basin's water comes from the Angolan Highlands; local rains, falling from November to March, provide the rest. Local rains recharge pools, mud holes, wallows, and even fill two vast nearby pans, or basins. Each year, the water refreshes the landscape and brings food to millions of migrating flamingoes, spoonbills, shorebirds, waterfowl, and their predators. As we drove from the airstrip to our lodgings, we saw one waterhole completely dried out except for a small muddy pool at the center. Scores of trapped catfish were being relentlessly picked off by a mob of maribou storks. "Like fish in a barrel," someone said—in a few days the waterhole would be submerged in floodwater—"timing is everything."

The offset between flood and rain cycles means that water comes to the Okavango Delta from rains between December and March and from the flood between May and August. Rains in the surrounding savanna forests generate a flush of vegetation that is more nutritious than the delta's coarse dry-season grasses. Superior food and abundant rainwater in the small pans and waterholes of the savanna-woodlands draw many large hoofed mammals, or ungulates, away from the delta for much of the dry

## THE OFFSET BETWEEN FLOOD AND RAIN CYCLES MEANS THAT WATER COMES TO THE OKAVANGO DELTA FROM RAINS BETWEEN DECEMBER AND MARCH AND FROM THE FLOOD BETWEEN MAY AND AUGUST.

season, but as savanna forage declines and its surface water evaporates, these same animals drift back toward the permanent waters to await the flood.

We had come to the Okavango to see the ungulates and their predators returning to permanent water. We quickly fell into an easy pattern of rising before first light, throwing on our warmest and cleanest clothes, gulping a cup of coffee, piling into open vehicles, and racing off across the rutted landscape for four or five hours of wildlife tracking. We would return in the late morning to siesta through the midday heat then head out again for another four or five hours, often returning after eight at night and always after watching a spectacular sunset in a smoke-tinged sky.

We were here at the height of the dry season, a time of fire when about 75 percent of the Okavango Delta's vegetation literally goes up in smoke. Hunters or cane collectors start most of



FEMALE LIONS (*PANTHERA LEO*) ARE ALWAYS ALERT FOR PREY. THIS ONE CAREFULLY SCRUTINIZED A SMALL GROUP OF ZEBRAS FOR SEVERAL MINUTES BEFORE REJOINING HER SLEEPING PRIDE.

the fires, but they are small, localized, and of little threat to wildlife. Occasionally, however, hot, gusting winds fan small blazes into huge conflagrations that leap across channels and wetlands and quickly consume hundreds of acres of vegetation. Aboveground fires travel rapidly and burn out quickly, but ignited peat beds can smolder for months and even years. Although destructive, fires stimulate a flush of new, nutritious vegetation just when ungulates need it most.

### LIVING AT THE EDGE

We moved around the delta by plane, spending three or four days in different habitats. The delta consists of three broad ecological zones based on the amount and persistence of locally available water: permanent swamps, seasonally inundated floodplains, and permanent high ground. The permanent swamps support a few species of wildlife adapted to the year-round aquatic conditions. Crocodiles and hippos, as well as sitatunga and lechwe (water-adapted ungulates) are the most notable permanent residents; savanna elephants and buffalo the most conspicuous transients. Several species of waterfowl, raptors, and songbirds are resident, but few wading and ground-dwelling birds are.

The more complex habitats of the lower delta contain the greatest numbers and highest diversity of wildlife: more than 20 species of ungulates, ranging from the dainty, 11-pound steenbok to the three-ton elephant, and scores of species

of wading, perching, and ground-dwelling birds, and waterfowl. Many of the ungulate species migrate into the area in the middle of the dry season just before the floods, and remain there until the next rainy season lures them away. About half of the more than 400 species of birds recorded from the Okavango Delta are migrants residing there for only part of the year. Surprisingly, reptiles and

amphibians are nowhere abundant, and the fish fauna is equally scarce, perhaps due to the frequent flooding.

During peak flooding, few animals graze on the floodplain except for lechwe and sitatunga, which browse grass stems that break the water's surface. Most herbivores feed on the edges between woodland and grassland, venturing into floodplains only when the water begins to recede. Warthogs, wildebeest, zebras, buffalo, reedbuck,



THE PERMANENT SANTANTADEBE CHANNEL IN THE LOWER DELTA. THE VEGETATION LINING THE CHANNELS CONSISTS OF VAST, TANGLED MATS OF PAPYRUS AND GRASSES.

bushbuck, kudu, impala, giraffes, and steenbok all follow this pattern. Elephants, hippos, and crocodiles, impervious to the trepidations of flooded areas, are ubiquitous. With large numbers of ungulates attracting predators wherever they go, it's easy to spot lions, spotted hyenas, leopards, cheetahs, wild dogs, and jackals stalking the floodplains. Many small carnivores, including servals, caracals, wildcats, several species of mon gooses, civets, and genets, bat-eared foxes, ratels, aardwolves, and brown hyenas, feed on a smorgasbord of animal matter ranging from insects and small vertebrates to carrion.

Our days were anything but routine. Thanks to daily sightings of new species, each night's truncated sleep was bearable. Soon, our daily rhythm was nearly in synch with the world around us,

and we began to feel a part of the interplay between the wildlife and their environment. We were also gaining insight into how close to the edge life here was. Every creature was living by the same harsh rule: Find the next meal soon and avoid being somebody else's. Our own increasing preoccupation with mealtimes reinforced the concept that what was happening around us was

**THE MORE COMPLEX HABITATS OF THE LOWER DELTA CONTAIN THE GREATEST NUMBERS AND HIGHEST DIVERSITY OF WILDLIFE: MORE THAN 20 SPECIES OF UNGULATES, RANGING FROM THE DAINTY, 11-POUND STEENBOK TO THE THREE-TON ELEPHANT....**

largely about nutrient flow.

The Kalahari's ancient soils are extremely low in nutrients, and we pondered how so many large vertebrates could persist here. The explanation, it turns out, lies in the shifting migrations, the seasonal influx of nutrients via water and air, and in the way these nutrients are stored and released

in the delta. Water entering the Okavango Delta system each year brings tons of suspended matter with it, and winds from the Kalahari bring tons of dust, blown in every year from the surrounding desert sands. Most of this becomes suspended in the water and moves with the floods. As the waters move ever more slowly through the fan, solids settle out as nutrient-bearing sediments. Particularly heavy sedimentation in the slow-moving channels of the middle and lower reaches creates habitats for papyrus, which forms dense, floating mats where sedges, grasses, and small plants can grow.

The Okavango's terrestrial systems are also in perpetual flux, and new land areas emerge constantly. Earth movements continue to bend and twist the terrain, creating major features, such as the permanent sandveld tongues of the upper

A DAY-BLOOMING WATER LILY ON THE WATERS OF THE OKAVANGO OASIS.

delta. But most of the smaller land features are created by the actions of plants and animals. Among these, the lowly termite ranks among the major architects of change.

Termites eat woody matter and live in colonies of millions of individuals that industriously create large conical mounds, or termitaria, from sand, dirt, dust, and a gluey mortar of saliva. We saw many huge termitaria in our travels, marvelling at what takes years to grow from a few tiny parent cells on a fallen twig or branch into conical concretions several yards high, complete with galleries, nurseries, and cooling air shafts. Their exteriors accumulate wind-blown sediments in which plants germinate, grow, and collect even more sediments until gradually an island begins to form.

A few close encounters with submerged hippopotami revealed that they, too, reshape the habitat by dredging new channels along frequently used paths and creating clearings on islands where they forage and sunbathe. Elephants also contribute to new channel formation as they crush their way through floating mats of vegetation while foraging. Both species, along with the plentiful and peripatetic baboons, are also important long-distance seed dispersers. Hippos and crocodiles, once superabundant throughout the Okavango, were hunted on a massive scale for their meat and hides in the mid-1900s. While fully protected now, their numbers are much lower than before, and their impact on channel formation is undoubtedly much reduced.

**HUMAN IMPACT**

Not surprisingly, the water and other resources of the Okavango Delta have attracted humans as well as wildlife. Small bands of Bushmen have probably lived in and around the delta for many centuries, but the Bayei, Batawana, and Hambukushu people, who dominate the region today, began colonizing various parts of the delta from surrounding areas in the mid-1700s. Nomadic hunter-gatherers, the Bushmen live mainly in the desert and occasionally on the edges of the delta and its islands. In the past, the Bayei hunted and fished from dugout canoes and pa-





DESPITE THEIR GREAT DISPARITY IN SIZE, ELEPHANTS AND TERMITES ARE THE TWO MOST IMPORTANT AGENTS OF LANDSCAPE CHANGE IN THE DELTA.

pyrus boats, while the Batawana and Hambukushu raised crops and livestock. Today, education and the mixing of different populations in multicultural communities have made the distinctions between these groups much less clear. All tend to practice mixed subsistence strategies of cultivation, fishing, hunting, collecting wild-plant foods, and cattle and goat herding.

Westerners were late arrivals. David Livingstone, the first European to visit the Okavango, was drawn there by stories of a great lake in the middle of the desert. He reached Lake Ngami and the edge of the Okavango in 1849, then left believing that he had discovered a string of lakes fed by snowmelt from distant, unseen mountains. In 1853, Western hunter Charles Anderson penetrated the Okavango and sensed its true extent and nature. "On every side, as far as the eye could reach, lay stretched a sea of fresh-water," he wrote, "in many places concealed from sight by a covering of reeds and rushes of every shade and hue."

In the following years, many Europeans traveled to the region, mostly to extract its treasures. In 1867, hunters killed an estimated 20,000 elephants for their tusks and thousands of crocodiles for their hides and meat. Local people benefited little from this trade, but they did acquire firearms, which they used with alacrity to slaughter big game in unprecedented numbers. Within a few years of the musket's introduction, black and white rhinos had all but disappeared and buffalo and elephant numbers had plummeted.

In the 1920s and 1930s, administrators of the Ngamiland Protectorate, as this part of the Kalahari was then known, began eyeing the delta's water as both a commodity and a means of transportation. The first goal was clearing a permanent waterway through papyrus-clogged swamps to form a commercial-boat route between the panhandle and the growing commercial center of Maun. In 1930, a contractor succeeded in opening up about 60 miles of channel, but failed in the larger mission of creating an open waterway because channels changed courses and closed behind him almost as quickly as he could open them up.

Undaunted by early failures, and spurred by the demands of growing human populations, administrators subsequently conceived endless schemes to clear, drain, extract, use, and tame the delta. Chronic water shortages around Maun have led to several attempts to dredge lower channels to increase the amount of water flowing through them. Unfortunately, this had the

opposite effect of destabilizing flow and causing floodplains to dry out, rendering them useless for subsistence farming.

Diamond miners once proposed to take vast amounts of water for their operations, but fortunately found abundant groundwater nearby before they started. More recently, the Namibian Water Board has proposed to pipe about one percent of the Okavango River's annual flow to local agriculture and to Windhoek, Namibia's capital. In principle, this plan might qualify as sustainable development because removing this small amount of water wouldn't cause a shortage in Maun. However, extracting the water creates problems. Dams and weirs are likely to impound vast amounts of sediment, resulting in a cascade of negative consequences throughout the delta. Direct pumping may have less impact, but agricultural land adjacent to the river will require heavy applications of fertilizer to supplement the nutrient-poor soils. The high likelihood of large quantities of fertilizers being washed into the river threatens the entire aquatic system.

In recent years, the Okavango's combination of land, water, abundant wildlife, and excellent tourist facilities, together with Botswana's political stability, have made the delta a popular ecotourism destination for people like us looking for the "real and unspoiled" Africa. About 75 percent of the delta is now included in the Moremi Game Reserve and is designated for either tourism development or wilderness. Tourist zones are confined to about 50 concessions leased to operators for five- or fifteen-year periods. Each concession may host no more than 24 clients at a time (many accommodate 12 or fewer), must demonstrate a capacity for local employment and community development, and must have near-zero impact on the environment. These conditions, and the logistics of operating luxury camps in a remote wilderness, make the Okavango wildlife-safari vacation an expensive proposition.

But ultimately, this strategy may have less impact on the ecosystem and its wildlife than the high-volume tourism found elsewhere in Africa and, in so doing, may be more likely to achieve the dual goals of sustainable revenue and conservation.

We were also aware that this was no wildlife utopia. Wildlife outside the delta's protected areas

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faces pressure from hunting and livestock rearing. The prevalence of the tsetse fly, which carries the protozoan that causes sleeping sickness in livestock and people, has until recently kept the cattle industry, Botswana's second highest

earner of foreign exchange, out of the delta. Under pressure from the powerful cattlemen, however, the government is conducting a massive anti-tsetse fly spraying program in an effort to open up some areas to ranching. Conservationists are concerned that the insecticide being used may be toxic to many other insects, fish, and their various predators up the food chain, including humans. Moreover, eliminating the tsetse fly could open the entire delta to the commercial livestock industry and herald the beginning of the end for its wildlife.

There is good reason for this concern. Transmission of disease from wildlife to

domestic animals has long been an issue in Botswana, and, in the 1950s, fences were erected to prevent domestic animals from coming into contact with

wildlife. The fences have reduced disease transmission, but they also have fatally entangled many wild animals and blocked their traditional seasonal migrations to water and food. The government reported in 2000 that wildebeest,

eland, and ostrich populations had declined significantly since the fences were erected, and warned that declining wildlife might adversely affect the tourist industry.

So it is that all-too-familiar conservation debates followed us to the heart of the Kalahari desert. For the moment, the Okavango seems to us reasonably secure, but the tenuous stream of tourist dollars may not be enough to meet the demands and temptations of a developing nation with a burgeoning population and pressing social problems. It occurred to us that we could substitute the word "Everglades" for "Okavango" and tell a surprisingly similar story of discovery, exploration, human population growth, conflicts over water, and disagreements between wildlife and livestock advocates. We wondered whether lessons learned half a world away might help maintain the Okavango as the special place that it is. Z

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SMOKE FROM GRASS FIRES CREATES SPECTACULAR SUNSETS. FIRE IS AS MUCH A PART OF THE DELTA'S ECOSYSTEM AS THE ANNUAL FLOODS AND MIGRATIONS.



HIGH-END TOURISM BRINGS MUCH FOREIGN EXCHANGE TO BOTSWANA AND CONSIDERABLE REVENUE TO LOCAL COMMUNITIES. ITS ENVIRONMENT-FRIENDLY POLICIES HAVE BEEN CALLED A MODEL FOR ECOTOURISM.