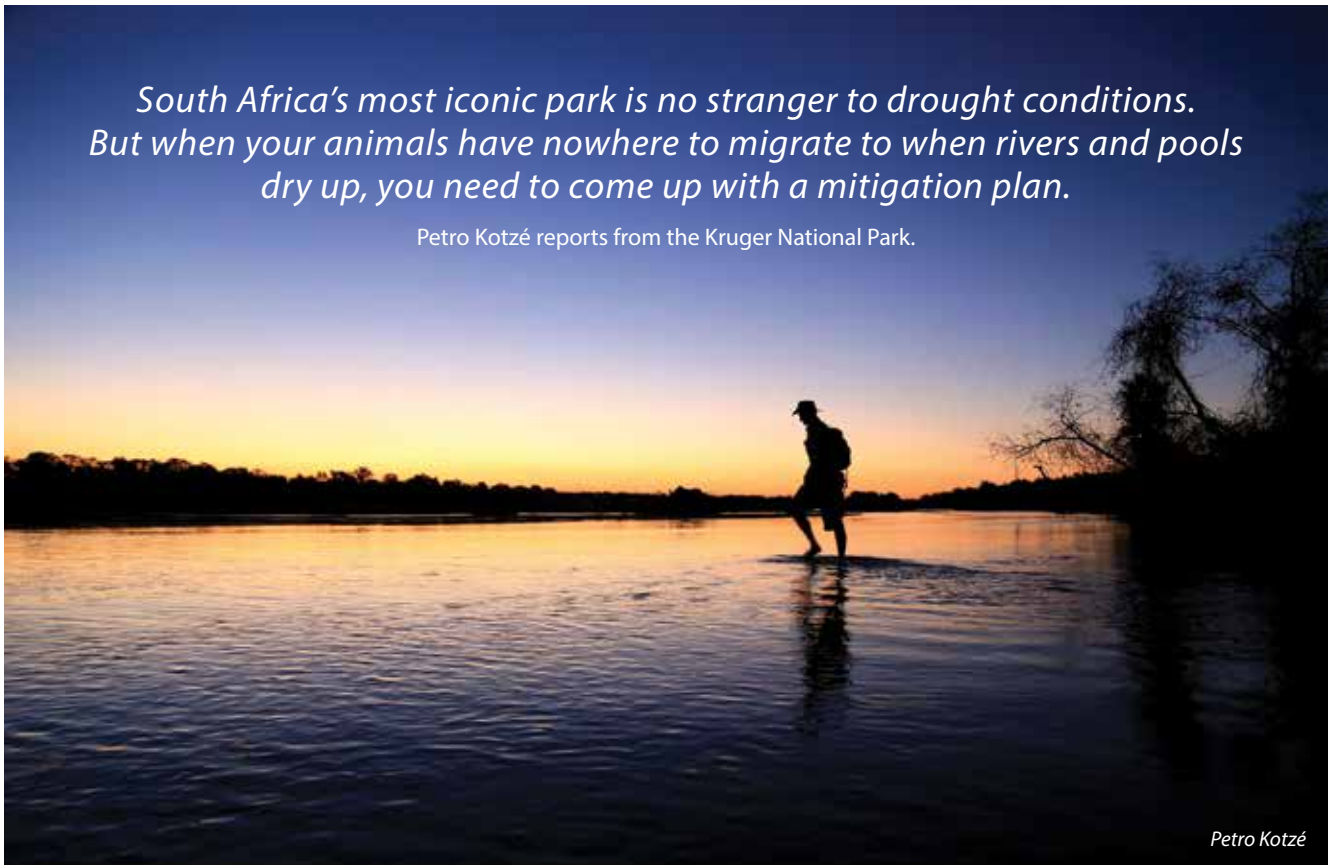


Water and the environment

Kruger getting house in order for severe drought

South Africa's most iconic park is no stranger to drought conditions. But when your animals have nowhere to migrate to when rivers and pools dry up, you need to come up with a mitigation plan.

Petro Kotzé reports from the Kruger National Park.



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Across the central and eastern Pacific, there is a constant interplay between the temperature of the ocean and the atmosphere. It is referred to as the El Niño-Southern Oscillation (ENSO) cycle. Sometimes, the temperature fluctuates higher or lower than the norm, affecting weather and climate across the globe. Simply put, a cold ocean water phase is referred to as La Niña. Currently, we are in a warm phase, better known as El Niño, which typically reaches its peak from December to February.

In one corner of South Africa, conservationists are keeping an interested eye on El Niño. The most recent data from the National Oceanic and Atmospheric Administration (NOAA) in the United States indicates that this phase is likely to continue into our summer rainfall months. Should this be the case, it could hold far-reaching consequences for South Africa's most famous conservation area – the Kruger National Park (KNP). Climatic conditions such as these indicate a strong possibility of severe drought.

Already, the rainfall of the summer of 2014/15 was below normal across large parts of the park and catchment areas of the five perennial rivers that run through it. The Luvuvhu, Letaba, Olifants, Sabie and Crocodile rivers all originate outside the park, flowing from west to east through the protected area, then Mozambique, and eventually drain into the Indian Ocean.

The impact, should this happen, is unknown. The previous time that the park experienced severe drought was during the 1991/92 cycle, and the consequences still ripple through policy and management plans more than 20 years later. And, should a severe drought take place, it would be in an environment where conservation principles have changed considerably.

The consequences this time around will only be clear in retrospect. In preparation, South African National Parks (SANParks) and KNP management are bracing themselves for the worst while keeping a window of opportunity wide open for the knowledge they are expecting to gain from the event.

Times of plenty, times of need

The mean annual rainfall (MAR) in the KNP varies from approximately 740 mm at Pretoriuskop in the south to about 440 mm at Pafuri in the north, but during droughts or floods rainfall can vary from 50% below or 50% above the long-term average respectively.

Naturally, there are cycles of high and low rainfall, seen as drivers to healthy ecosystem functioning such as weaker animals dying off, leaving a genetically stronger population. However, Large Infrequent Disturbance Events (LIDE) such as extreme droughts or floods, are different altogether. It could cause severe or longer term ecosystem changes, especially since the ecosystem of a conservation area like the KNP is curbed by fences, and the rivers that run through it are heavily utilised before they enter the park. Therefore, should a LIDE be on the cards, management steps in and a number of provisions are already being made in the park.

Park management have had a number of severe droughts in the park's existence to learn from; in the 1960s and early 1970s and then again predominant droughts from about 1982 to 1997.

According to Dr Eddie Riddell, the park's manager for freshwater resources, "the most recent and well documented drought in the Kruger National Park is that of 1991-1992 when the park received only 44% of the long-term average rainfall from a 100-year record."

The El Niño-related droughts of 1982/83 and 1991/92 were the most severe droughts on record in the KNP and large parts of the rest of southern Africa. Both these events were characterised by below normal rainfall for two consecutive years – a situation predicted for this year, says Dr Freek Venter, Kruger National Park conservation general manager.

A severe drought such as that experienced in 1991/92 holds many consequences – near inconceivable to those that have not experienced it before. In March 1992, the Sabie River, generally regarded as the most biodiverse in South Africa, was near to losing its status as a perennial river for the first time in recorded history.

Major water users in the catchment came together, eventually forming the Sabie River Working Group (SRWG), consisting of irrigation farmers and forestry and State departments. Farmers voluntarily restricted irrigation up to 60% and forestry ring-barked hundreds of stray trees along the banks of the river, preventing the Sabie from drying up.

Inside the park, the 30 000 strong buffalo population shrank by about 60% to 14 000 and many other herbivore population numbers declined, including hippo, warthog, common reedbuck, kudu and giraffe. Rare antelope such as roan, sable, eland and tsessebe also declined significantly. According to Dr Venter, many of these animal populations rebounded in the wet years that followed, though rare antelope numbers remain low.

Catering for the park's people

The management of the Kruger National Park have got another aspect to keep in mind when the water levels get low: people. In particular, those that call the park home and the thousands of tourists who enters through its gates every year.

To offset the potentially detrimental effects of drought, the KNP has a number of water efficient policies in place. These include the introduction of a hydro-zoning programme in its tourist camps so that their gardens are water-wise, and a water use restrictions policy of its own which is applied to staff and tourist areas. It hosts the national Working for Water programme, through which beneficiaries tirelessly remove often water guzzling alien invasive plant species from the landscape. In addition, some camps have had additional boreholes drilled for low level emergency water provision should the need arise to use groundwater to augment supplies.

If the drought continues then there will be additional cost in terms of the time the park personnel have to allocate to drought management, for instance servicing water supply infrastructure and liaising with upstream stakeholders and water management institutions to ensure that water uses are equitably restricted and commensurate with legislation to ensure that the ecological reserve flows are maintained.



Additionally, the droughts were characterised by significant human migrant movement from neighbouring countries through the park, and many accidental veld fires flared up as a result. Tourists also encountered migrants on the road from time to time.

Looking back, moving forward

Since then, a number of changes have taken place in the park. The 1991/92 drought was one of the most researched and documented, says Dr Riddell. "We know that these dry periods change the balance in favour of the plains game such as zebra and blue wildebeest who utilise the shorter grasses, while not favouring those long grass feeders such as buffalo and the rare roan, tsessebe and reedbuck." This, in turn, leads to a switch in the grass species composition of the veld due to the resulting grazing pressure dynamics, he says.

"We also know that the larger predators, such as lion, leopard and hyenas, did well during these times, at the expense of the smaller predators, including wild dog, cheetah and jackal by out-competing them for resources." Furthermore, the surviving buffalo were the strongest and most resilient, and thus only the 'best' re-populated the park.

Significantly, management started looking differently at the water provision strategy in the park.

In the past, waterholes were steadily increased from 1911 until the 1990s to provide reliable water in an environment that was perceived to be 'drying out'. They reached a peak of about of 300 and included catchment dams in seasonal streams.

Current guidelines include that water should not be provided in areas that are naturally dry, or be provided too evenly across the landscape. Water provision is still condoned in certain areas to cater for tourist expectations and because of remaining fences (inhibiting a complete return to natural water availability). However, for the most part, artificial water points are being closed down, certain dams breached and rehabilitated and in a few relevant cases water points opened up again. In effect, vegetation and animal distribution patterns are allowed to recover so that seasonal variation between times of water availability and drought can fulfil their natural function.

A common misconception is that animals die of thirst during prolonged droughts when, in fact, most starve to death after grazing has been depleted, explains Dr Riddell. Some animal



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During the previous drought experienced in the Kruger National Park the 30 000 strong buffalo population shrank by about 60% to 14 000.



The Sabie River Working Group, which prevented the river from drying up during the 1991-92 by applying voluntary water restrictions.

(Photograph courtesy KNP)

Another sight during the previous drought: The Black Heron Dam in Letaba River ran dry and filled with slime. Since then, the dam wall has been removed and reverted to a measuring weir.

(Photograph courtesy KNP)



and plant species flourish when plenty of water is provided, while others do not. It is therefore important to provide water in a way that creates conditions suitable for sustaining a wide range of biodiversity, and not only for those species that do better in close proximity to water (like zebra and blue wildebeest).

Thus those species that prefer to occupy drier areas further from water where there are fewer predators, less competition for food and less trampling (like sable and roan antelope) also need to be catered for. The KNP's new water provision policy creates refuge areas for grass further away from permanent water.

The aim is for seasonal variation in water availability and drought episodes to again fulfill their natural function in the system. Research already suggests some recovery of the vegetation and animal distribution patterns since waterpoint closures.

KNP will have a number of other weapons in its arsenal to offset potentially catastrophic effects of a severe drought, this time around. Following the 1991/92 drought, the SRWG successfully lobbied the then-Minister of Water Affairs, Kader Asmal, for additional storage capacity in the catchment, which led to the construction of the Inyaka Dam on the Marite river tributary of the Sabie. "The Inyaka Dam is currently almost full and it will be interesting to see how it maintains its level if another dry summer occurs," notes Dr Venter.

He adds that this process created an outstanding relationship with and awareness amongst water users in the Sabie River catchment that lasted for more than a decade. "From these droughts also flowed the 12-year long WRC-funded KNP Rivers Research Programme, involving many scientists from several universities, that was designed to inform minimum in-stream flows and water quality for KNP rivers. Knowledge gained from this programme eventually cascaded into the Environmental Reserve clause of the National Water Act."

This does not mean that substantial challenges do not remain.

“There have been some challenges of late to meet the ecological Reserve in the catchments of the Letaba, Crocodile and Sabie rivers,” says Dr Riddell. These issues have been resolved through collaboration with upstream institutions particularly Catchment Management Agencies and Water User Associations as well as the Department of Water and Sanitation. As a result, the ecological reserve could be met due to water releases from dams (the Tzaneen, Kwena and Inyaka dams respectively).

“Should a severe drought take place, it would be in an environment where conservation principles have changed considerably.”

However, he adds that if the dry period continues for another year or two, reconciling the rivers’ ecological reserve requirements with those of upstream users will become more challenging.

Dr Venter adds that census numbers of large herbivores in the KNP indicate that the biomass of these animals has more than doubled during the past decade. This increased animal biomass (most of it due to an increasing elephant population) may have compounding effects on the influence of the next major drought.

Still more questions than answers

While ENSO can be forecast with good skill up to nine months ahead, it is critical to keep in mind that an El Niño/La Niña forecast is not a rainfall forecast. Though most El Niño years have been associated with below-normal rainfall, this impact is often reduced by sufficient groundwater and soil moisture content that have remained in the system from previous season.



Dry periods favour game such as zebra and blue wildebeest.



The Luvuvhu River with normal winter flow (1986) and during the drought of 1992. (Photographs courtesy KNP)

It is complicated further by the fact that the numerous rainfall regions in southern Africa correlate differently with ENSO. It cannot be accepted as a rule that the southern part of Africa will receive below-normal rainfall during El Niño years and above-normal rainfall during La Niña. For example, according to Weather SA, "The 1997-98 El Niño was the strongest on record, but not all of South Africa received below-normal rainfall. Some regions had an abundance of rain because of moist air that was imported from the Indian Ocean."

For KNP management, this implies that they will have to wait for the rain or the lack thereof, to make any concrete conclusions.

If severe drought does occur, says Dr Venter, it will allow them to answer a number of pertinent questions: Will the perennial rivers flowing through the KNP dry up or will the changed strategy to build larger dams in the upper catchments rather

than in the KNP itself bear fruit? Will water quality problems currently experienced in some rivers be compounded? Will the more natural distribution of water lessen the drought impact on the vegetation some distance away from permanent water? Will the more natural water distribution pattern (due to the closure of many man-made waterholes) favour roan antelope so that they survive better, or will they decline further or disappear from the KNP ecosystem? What will happen to other rare antelope such as sable, tsessebe, eland and reedbuck? Will the KNP's elephant population continue to increase, will it stabilise or will it decline? Will a serious drought present the park with opportunities to work closer with its neighbouring communities, or assist to provide them with lifesaving natural resources?

For any answers, we will have to wait for something as fickle as the weather.