Drought management

Drought – Nature's lessons in overdrive in Kruger National Park

While South Africa's beleaguered farmers have their eyes on the sky, eagerly awaiting the onset of summer rainfall, the researchers of the Kruger National Park have their ears on the ground, closely monitoring drought conditions that have unfolded in sections of the country's largest nature reserve.

Lani van Vuuren visited the park.

Since hippos are not able to move to far away from deep water resources in search of food, they are particularly vulnerable to drought.

All photographs by Lani van Vuuren

"Besides a scarcity of rain, high temperatures have resulted in a lack of fodder for the animals in the Kruger National Park. Both artificial dams and natural and man-made pans have been reduced to mud, while large-scale deaths occurred among animals, such as buffalo and baboons."While this scene sounds eerily familiar, it is actually a (loosely translated from Afrikaans) exert from the Kruger National Park's Annual Report of 1991/92.

Drought has always been a natural part of the Kruger National Park and runs like a golden thread throughout its 90-year history. While the park's climate can be described as semi-arid (average annual rainfall for the park is only around 550 mm) this can vary considerably from year to year, and multi-year oscillations have been observed that vary from above average rainfall years (with increased likelihood of floods) to below average rainfall years (with increased likelihood of droughts).

Every 20 years or so a really severe drought comes along, and these were experienced in the Kruger National Park in the thirties, sixties, early eighties and again in 1991/92. So it came as little surprise to park management when the latest super El Niño made its appearance in 2015 and brought with it hot and dry conditions. During the 2015/16 rainy season areas such as Skukuza only received 190 mm, compared to an annual average of 550 mm. The lack of water has been compounded by some of the warmest days on record being experienced in December, January and March.

The park has a good working relationship with its upstream neighbours, which means that even during dry times, water is being let through to serve the Kruger National Park at the bottom end of the river catchments.

Each mega-drought has brought increased knowledge about this natural phenomenon in the Kruger National Park, and how best to manage it. "Due to the infrequent nature of such intense droughts, we still have many knowledge gaps," notes Dr Izak Smit, Kruger National Park Science Manager: Systems Ecology, GIS and Remote Sensing. "Now is the time for us to gain as much knowledge as we can so as to prepare better for the future."

As a result research efforts have been intensified in the Kruger National Park to gather as much data as possible during this drought period. For the park's younger researchers especially, many of whom were in primary school during the previous drought, this is an opportunity to contribute significantly to the knowledge pool.

Each drought has been managed differently, depending on the information park management had at the time. During the earliest drought, in the thirties, animal populations were relatively low compared to today, and the park was unfenced, so animals were free to migrate out of the park to water and better grazing. During the early years the drought was largely left to take its course with only a few boreholes being drilled to provide mainly the tourist camps with water.

When fencing of the borders of the Kruger National Park started in earnest in 1957 this left managers with a conundrum. The park's main water resources, the Sabie, Olifants, Luvuvhu, Letaba and Crocodile rivers were starting to show the effects of development and industry upstream. As a result managers implemented an artificial water programme, aimed at boosting water supply in the park through dams, windmills and enlargement of natural pans.

While this seemed to temporarily relieve the situation it also had detrimental effects – since game could now move freely across the breadth of the park (since they had water points all along the way) the grazing disappeared faster. Large herds of animals such as zebra, also pushed out rarer species such as roan antelope. Once grazing is gone animals die of starvation rather than thirst.

Following intensive studies in the eighties and nineties to better understand the natural systems within the Kruger National Park the artificial water policy was adapted. A new management policy, based on strategic adaptive management principles, was adopted whereby nature has been allowed to return to its natural variability.

About half of the artificial water points (mostly away from tourist roads) have since been closed. What this means in the current drought, explains Danie Pienaar, Kruger National Park Head: Scientific Services, is that pockets of grazing have been left in between points where water is available. Stronger animals, which can trek between these grazing areas, will survive, while weaker, diseased animals will perish. It is an unfortunate law of nature – that only the strongest will survive, and a sight that is not always a 'nice to see' for tourists visiting the country's most popular national park. However, game viewing currently is excellent due to the lack of vegetation and daily sightings of the Big Five are a regular occurrence.

Unfortunately, nature has a habit of sometimes throwing curve balls at humans' plans. Late rains experienced in some sections of the Kruger National Park during March may have fed water sources and provided access to some of these grazing sanctuaries too early. So Pienaar and his team are monitoring the situation closely. Conditions are expected to worsen until the onset of the rainy season in November. Due to existing water supply infrastructure potable water supplies to camps and staff quarters have not been affected by drought conditions.

Animal populations are the highest they have ever been in park history. Densities of rhino, elephant, hippo and buffalo, for example, are much higher than they were during the previous drought. Mortalities of hippo and buffalo have already started to occur (rhino and elephant tend to withstand drought conditions longer). Smaller grass-eating species, such as impala, have also been affected. Of course, while some animals are negatively affected by the drought, others are thriving, such as lions, leopards and vultures, which now have an abundance of food. The drought is also not occurring at the same intensity across the park, with the central section being worse off than the far north and south-west.

Park management are also keeping a close eye on natural-occurring diseases such as anthrax, which tend to spike during droughts. During the previous drought buffalo numbers dropped from 30 000 to 14 000 when the drought was followed by an outbreak of anthrax. In the meantime, however, their numbers have swelled again to around 48 000, which tells researchers that recovery in game numbers is not only possible but an eventuality.

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Since hippos are not able to move to far away from deep water resources in search of food, they are particularly vulnerable to drought. Current hippo numbers are around 8 000 and may be an artificially high density. "Before the establishment of the Kruger Park humans were part of the ecological system. They stayed near permanent water and hunting hippo especially in dry times would have been easy. The many earthen dams that were built also facilitated an unnatural increase in hippo numbers" notes Pienaar. "Too many concentrated hippo creates water quality problems and disease risks in certain water bodies and we had to selectively reduce hippo numbers at some of these places" he explains further. "

A significant feature of the current drought is that the Kruger National Park's main rivers are still flowing thanks to the implementation of the Ecological Reserve, an element of the National Water Act (Act no 36 of 1998), which determines that water of a certain quantity and quality must be made available by law to sustain the natural ecosystem. This is a far cry from the dry rivers encountered in the Kruger National Park in 1991/92 when hundreds of animals such as crocodiles were left to die in significant numbers due to a lack of water. This despite the fact that the current drought is in some areas of the Park more extreme than previous droughts in terms of the lack of rainfall, record summer temperatures and low humidity experienced.

The fact that the Park's perennial rivers are still flowing is extremely important, as large game, in particular, tend to congregate around these rivers during drought conditions, when semi-permanent water resources dry up. As Dr Eddie Riddell, Manager: Water Resources at the Park points out, the perennial rivers also play a key role in supporting terrestrial ecosystem processes.

"We have been able to keep the rivers flowing, and our initial analysis shows that flows in all our perennial rivers have been in the majority of cases better than in the previous two significant droughts. This is a result of improved cross-sectoral management of water resources, through restrictions and to some extent the reliance on water resources infrastructure such as dams," explains Dr Riddell.

The latter particularly refers to dams such as Inyaka Dam, located in the Marite River, a tributary of the Sabie. "We have come to rely on Inyaka Dam, particularly at the end of the low flow/dry season in most years to augment supply in the Sabie river. Flows in the Sabie are much better than they were during the previous droughts as a result," explains Dr Riddell.

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"When it comes to what we call operational water management we have direct communication with the Catchment Management Agency or Provincial Operations offices of the Department of Water and Sanitation, with their respective river or infrastructure managers," explains Dr Riddell. "Furthermore, this interaction usually includes the Irrigation Boards or Water User

Leaf eaters are less impacted by the drought than grass eating species.

Despite the drought, water is still flowing in the Kruger National Park's main river systems.

Associations (irrigated agriculture) as well as the Water Boards (bulk water supply), as well as our neighbours in Mozambique responsible for water management in the rivers there. Through regular meetings of operational committees tricky decisions in terms of water allocations from dams and restrictions on users have led to a fully transparent and accountable water management process."

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Using what modern technology has to offer, the Kruger National Park's water managers have become quite reliant on social media such as Whatsapp for real-time group communication and decision-making to track flows in the catchments. Moreover, the use of modern technology such as hydrological models links to decision support systems and climate forecasting systems greatly assist in the stakeholder management process of water resources.

It is uncertain when the current drought will be broken. The El Niño started weakening in May, and sometimes (but not always) this climate phenomenon is followed by a La Niña. El Niño and La Niña are opposite phases of atmosphere-ocean interplay over the tropical Pacific, collectively referred to as the El Niño/Southern Oscillation (ENSO). They have opposite effects on weather and climate in different parts of the world. Areas which receive below average rainfall during an El Niño (such as South Africa) tend to receive above average rainfall during a La Niña and vice versa.

Some experts are predicting that the dry El Niño conditions will be replaced by wet La Niña conditions in the third quarter of the year. However, according to the World Meteorological Organisation, such an El Niña is likely to be weak and not expected to match the intensity of the past El Niño which was one of the strongest on record.

"If we do get to a situation of a La Niña, then we can expect significant flooding, and this is the forecast for mid-summer," notes Dr Riddell. "The Kruger National Park recognises that floods are also a natural part of the river system processes, and the ecosystem requires them in order to maintain that natural variability in the system by moving sediment and creating new habitats in the river system, for example. Nevertheless, if the rains are significant over the past two very dry years, we will be expecting significant sediment delivery into the rivers from upstream, as the catchments have been quite denuded. This is something we will be keeping an eye on."

A view from Nkumbe lookout near Skukuza illustrates the lack of grazing currently being experienced in the Kruger National Park.