WATER FOR ELEPHANTS – Towards natural population management

Could a return to natural water availability be changing the face of conservation and management of one of our most beloved species? Article by Petro Kotzé.

The challenges faced by conservation management to safeguard biodiversity placed under their protection are, by and large, not new. However, the solutions are undergoing a major paradigm shift, and include new thinking on artificial water supplementation for game. In South Africa, environmental management has agrarian roots, ran by people who fought a constant battle against the elements and outside threats – they created waterholes in times of drought, erected fences when hunters devastated populations and, in some cases, controlled species' numbers if they were perceived to become too many to be supported by the available habitat.

The world-renowned Kruger National Park (KNP) is an example. Proclaimed a Government Wildlife Park by Paul Kruger in 1898 (and later expanded into the KNP in 1926) the initial goal was to control hunting and protect a diminishing number of animals. To further curb the spread of disease, facilitate border patrolling and stop animals from moving into areas where poaching was problematic, the park was fenced. By 1960, the southern boundaries along the Crocodile River, western and northern boundaries were fenced, followed by the eastern boundary with Mozambique in 1976.

From 1911 waterholes were also increased to ensure reliable water in an environment that was perceived to be 'drying out', reaching a peak of about of about 300 by the 1990s. Water provision also included catchment dams in seasonal streams. Many animals flourished under the enhanced protection, including the African elephant. Indeed, about 17 000 elephants were culled over a period of 27 years until a moratorium was placed on culling in 1995. The reasoning behind the culling operations rested on knowledge of nutritional requirements and a concern about the effect of a growing number of elephants on the environment (including the appearance and ecological functioning of the landscape and the potential impacts on other plants and animals).

Conservation management today is looking towards scientific research to inform management policies and actions, and a tolerance of nature as an environment in constant flux is being advocated. Among others, this entails a return to more natural water availability and elephant roaming areas, both of which are having consequences for much of the fauna and flora within many conservation areas, including the KNP.

Census information suggests that, since 2003, following the closure of more than two thirds of the KNP's boreholes and the creation of Africa's super wildlife park, the 35 000 km² Greater Limpopo Transfrontier

Rudi van Aarde

The Olifants River in the Kruger National Park. Research shows that elephant densities increase along large rivers during dry seasons.

Park (GLTP), the annual population growth rate of the African elephant is declining. Furthermore, research elsewhere indicates that elephant distribution can potentially be altered by the manipulation of water availability.

CHANGING TIMES, CHANGING WATER DISTRIBUTION

In a partially fenced system like the GLTP, management agrees that the provision of water still has a role to play. However, regardless of its good intentions, the previous even distribution of water across the landscape over the years seems to have had a number of negative side-effects. Many of these were facilitated by the fact that throughout the park, permanent sources of water were within walking distances for animals throughout the year. As a result management had to deal with over-grazing, veld degradation and erosion during droughts. Furthermore, catchment dams silted up, while an excess of hippo dung facilitated outbreaks of cyanobacteria, poisoning animals that drank there.

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, synthetic 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.

While not the only species affected, the African elephant has received a lot of public attention. The elephant 'issue' is complex and, says Danie Pienaar, SANParks head of Scientific Services, few other species have been the topic of more studies. One of a number of institutions that have studied the species in partnership with SANParks is the University of Pretoria's Conservation Ecology Research Unit (CERU), under the leadership of Prof Rudi van Aarde. This collaborative research effort aims to develop novel solutions to manage southern Africa's elephant populations through the implementation of ecological principals. Evaluation of the role of water distribution plays one key role in this effort.

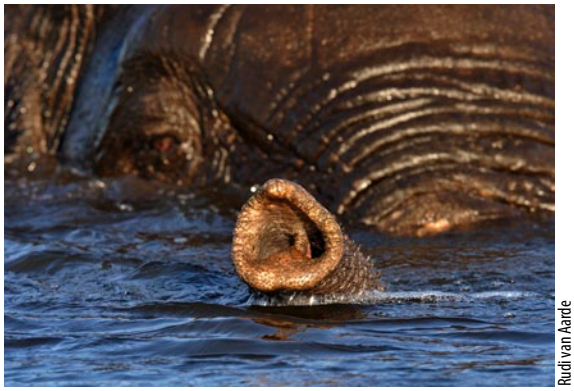
In theory, population growth is determined by death and birth rates as well as immigration and emigration between areas, explains Prof van Aarde. These elements were explored to try and explain why the GLTP elephant population's numbers seems to be stabilising. He says that census counts across neighbouring areas

could not put the blame on dispersal, thus pointing towards a change in the birth and death rates as possible answers.

WATER AND ELEPHANT POPULATION STABILISATION

By measuring their back length, says Prof van Aarde, researchers could determine an elephant's age which, in turn, enabled them to determine age specific breeding and survival rates for elephants living across a range of environmental conditions in southern Africa. Data was then compared to areas' rainfall variability. Through these methods researchers found that 22 of the 36 populations across southern and East Africa have stabilised in numbers (i.e. when annual population growth rates centre on zero even though populations are fluctuating from year to year) and, among these, found a direct relationship between elephant number stabilisation and rainfall, says Prof van Aarde. The higher the rainfall, the higher the level at which a population stabilised. The greater the variability in rainfall, the lower the level at which the population stabilised. This knowledge enabled them to predict the level at which a given population would stabilise compared to rainfall variability.

Combined with details on yearly rainfall and reproductive and survival rates for the 22 elephant populations across southern Africa, explains Prof van Aarde, researchers could now predict the numbers where elephant populations should theoretically stabilise but, there were disparities between the actual and predicted numbers. The answer seemed to lie with the resources (like waterholes) the populations were using. Researchers found that the larger the difference between observed and expected elephant numbers, the larger the resource availability, and *vice versa*. In other words, where significant resources, like surface water, were available over long periods of time, elephant numbers would stabilise at much higher numbers.



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Researchers have found a direct correlation between elephant numbers and rainfall.

This knowledge enabled assessment of whether decreased water resource availability would, in turn, induce declines in reproductive output and survival. Preliminary analyses show that of the 16 unmanaged populations from across southern Africa, elephant numbers appear to be limited through resource availability as it affects breeding and survival rates (especially those of newly weaned calves aged four to eight years).

"We know from our intensive satellite tracking studies that breeding herds in these populations walk longer distances when resources become scarce and when elephant numbers are high," explains Prof van Aarde. "These increased distances also explain an increase of death rates of weaned calves." Notably, this pattern of self-regulation did not seem to occur in managed populations, where water was provided and roaming is inhibited by fences.

Research has also investigated the link between water distribution and elephant movement, although, according to the summary for policy makers of the *Elephant Assessment*, to which more than 60 experts contributed, any possible conclusions are yet to be proven in practice. The *Elephant Assessment* postulated that water manipulation as an elephant management tool would possibly only be feasible in very large reserves with sparse natural distribution of water.

In fenced parks where water is supplemented by water holes and drinking troughs the overlap of wet season and dry season elephant roaming areas is greater than in open parks with natural water availability, notes Prof van Aarde. Such management interventions thus have major consequences, he adds. For instance, in Khaudum Game Reserve in northern Namibia where management installed 12 waterholes over an area of some 3 000 km^2, elephants roam close to the waterholes during both wet and dry seasons. Their numbers also increased from 80

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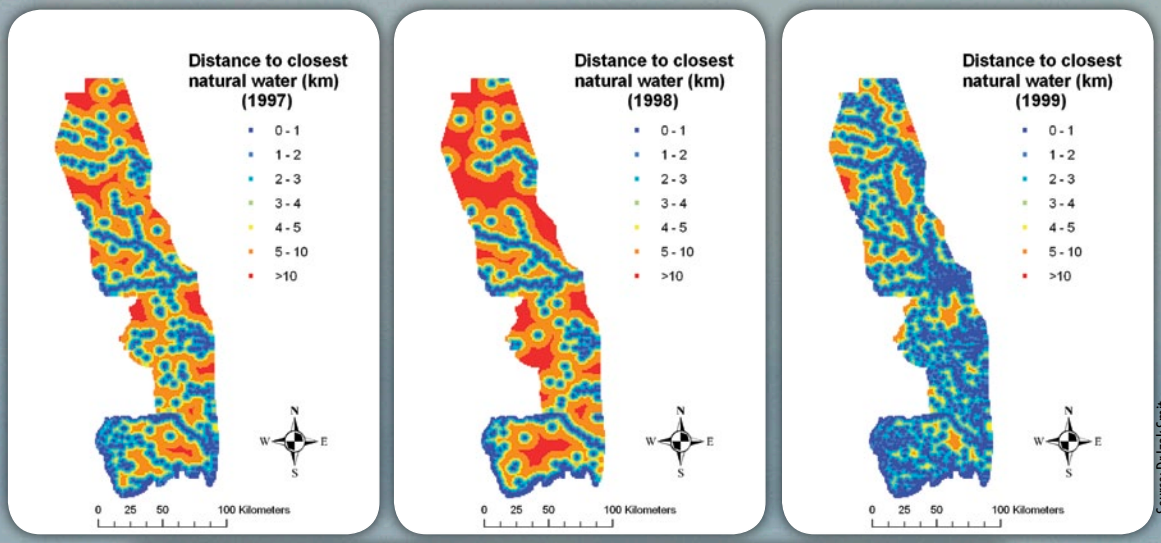
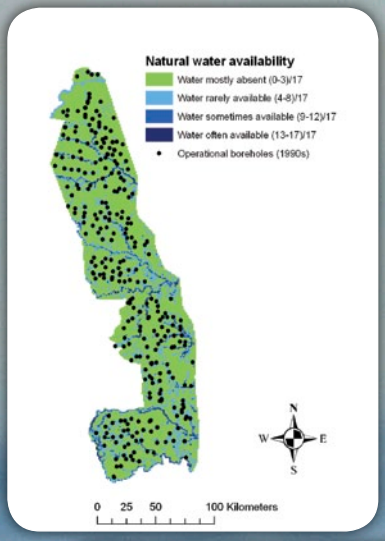
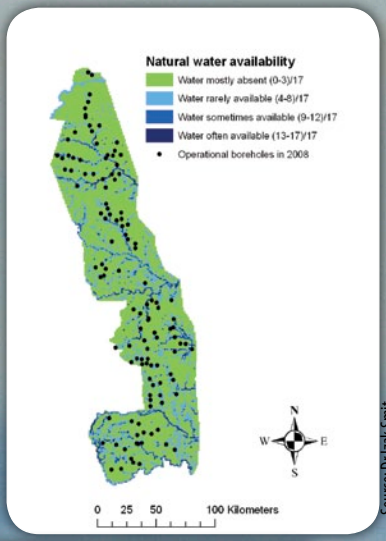


Source: Dr Izak Smit

The distance to the closest surface water source during the early dry seasons of different years (1997, 1998 and 1999) differ tremendously. The impact of the current SANParks management plan (limiting artificial water provision) will be clearer following the next severe drought.





Source: Dr Izak Smit

Since 1911 borehole-fed water points were installed in the KNP totalling some 300 by the 1990s. By 2008, more than two thirds were closed, mimicking a more natural water distribution system.

Rudi van Aarde

The African elephant is not the only species affected by artificial water provision but it has received the most public attention, particularly in the Kruger National Park.

in 1976 to 3 500, as the water also attracted elephants from neighbouring Angola.

Some studies also indicate a difference in the roaming patterns of breeding herds and bulls. As breeding herds need to drink every day, they seldom move more than 16 km from surface water. Bulls, on the other hand, drink less frequently and roam further. In theory, if a large enough area could be rendered free of surface water for large parts of the year, they would be only lightly and seasonally used by elephants.

It is, however, not easy for these theories to be tested in practice as this depends on availability of sufficient space and time for ecosystem processes and functions to play out over increased scales.

MEGAPARKS AND METAPOPULATIONS

In theory, the interplay between increasing and decreasing elephant populations could induce regional stability, despite local elephant population fluctuations. In this picture, elephant populations act as sub-units that together form a metapopulation. Environmental conditions differ from one sub-population to the next, but there is interaction and movement, and a dynamic interplay between different birth and death rates. Some would have a positive growth, while others a negative, but as a whole, the metapopulation numbers remain stable.

So-called 'megaparks' could provide space for ecosystem processes and functions to play out over increased scales. Furthermore, this could provide for seasonal changes in elephant impacts across space and aid in the maintenance of biological diversity, possibly contributing to the stabilisation of elephant populations at these large scales. At regional and smaller scales, cautions Dr Stefanie Freitag (General Manager of the Savanna & Arid Research Unit of SANParks), it is also important to know how the elephant impacts are distributed across space and time and how these impacts affect other values and objectives (eg. biodiversity, livelihoods).

But how big a megapark is big enough? And would the GLTP, for example, fit the bill?

According to Prof van Aarde, recent assessments in the GLTP suggests that the demographic profiles and predicted growth rates for elephants differ greatly between areas. For instance, population growth rates in the south seem to be negative while those in the north, positive. Paradoxically though, the south has more permanent water than the north of the GLTP. These differences may be due to differences in resource availability, but when combined, the overall predicted trend from present breeding and survival rates, at this stage, equates to zero – indicating the size of the population across the park is stabilising. However, cautions Dr Freitag, in a complex system, change, even dramatic change, should always be anticipated.

Does the correct plan for biodiversity management then entail letting fences around our protected areas rot, and not supplementing water provision? Currently, SANParks is embracing a holistic view to ecosystem management in large parks such as the GLTP, with an increased landscape approach to conservation management. "We believe, however, that any management action should also be seen as an experiment in order to learn," says Pienaar. Furthermore, he adds, the KNP currently hosts about 14 000 elephants, the Limpopo National Park about 1 500 and Gonarhezou about 9 000 elephants. Private and provincial parks around the GLTP have another 3 000, totalling about 27 500 elephants for the whole Greater Limpopo Transfrontier Conservation Area. "Management objectives and conservation values differ in these areas and the KNP elephant management policy has to take cognisance of this bigger picture."

"Science," concludes Dr Freitag, "is not value-free and does not have 'the answer'. " It is, she says, "a complex, value-based endeavour in its own right, much like the complex KNP ecosystem." An integral question is rather how to make sense of apparently conflicting findings and arguments. Even more so, the effect of a different management paradigm, as with the first, when even water distribution across the landscape was advocated, will only be evident in retrospect. ❑

SOURCES

- www.theelephant-assessment.co.za (Summary for policy makers)
- *Biodiversity – Conservation in times of change* (published by SANParks)