WATER CONSERVATION

Savvy showers helping SA's top nature reserve save water

A project to reduce the water consumption of the Kruger National Park's tourists is paying dividends, writes Petro Kotzé.

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The Kruger National Park is one of South Africa's premier protected areas and provides thousands of people with the opportunity to enjoy the internationally renowned wilderness. A visit to Kruger might be the closest many will get to experiencing untamed lands but, in the process of catering to tourists, a heavy imprint is made on the conservation area.

"Conservation very often involves trade-offs," says SANParks Senior Scientist, Dr Izak Smit. "This is even more so when considering social-ecological systems where both nature and people, and their interaction with each other, are considered." Tourists visiting parks do have some environmental impact, including the developmental footprint of infrastructure, the carbon footprint of travelling to and within parks and water usage and waste generation whilst in parks, yet at the same time, Smit says, tourists fund conservation. Today, around 80% of SANParks' revenue is generated through income derived from tourism, which cross-subsidises SANParks's conservation efforts.

Over and above the financial injection, through visiting the parks, tourists often become passionate ambassadors for conservation in society. As such, careful consideration should be given to how to mitigate the impacts, whilst enhancing the benefits, Smit says. "The goal is to work towards sustainability, creating social-ecological systems that are ecologically resilient and intact, financially viable and socially relevant."

One more step towards this goal was recently taken when a research project pinpointed a way for water to be used more efficiently in rest camp showers, one of the largest human water uses in the park. The project entailed the implementation of a novel technology combined with educational information. It provided management with new insights into the people that visit Kruger, their showering habits and how to reduce the volume of water used in the process.

Though the lessons and technology can be applied anywhere, it resonates loudly in Kruger, where many visitors might not realise that they use the same rivers as the wildlife that they admire.

The water users in Kruger

In fact, though the park also has artificial waterholes fed from boreholes to provide water for wildlife, people also share this resource with the plants and wildlife. Water for staff and visitors are necessary to wash linen, water the gardens and for direct use in homes and chalets, to wash up, flush and shower, says Smit.

For most of the largest camps such as Olifants, Letaba, Shingwedzi, Crocodile Bridge and Berg-en-Dal, water is abstracted from the rivers that run through the park, says Dr Eddie Riddell, SANParks Manager: Aquatic Biodiversity Management. Some smaller camps like Punda Maria, Pafuri, Orpen and Shimowini rely on boreholes. Those, like Satara, located far from a perennial river receive water via pipelines from another (the Olifants River, in the case of Satara).

All water uses in the rest camps are governed by individual Water Use Licenses issued by the Department of Water and Sanitation.

The water for Skukuza, Kruger's largest rest camp, is abstracted from the Sabie River that runs right past the camp and is often visited by wildlife in clear view of thousands of tourists on the other side of the fence.

The water is purified to South African standards after it is abstracted and, after it has been distributed and used, is treated in a series of maturation ponds and artificially constructed wetlands before being released back into the river, also according to the required standards, Riddell says.

SANParks management has already implemented a range of initiatives to keep water use in rest camps to a minimum. Most of Kruger's gardens have been changed to be more water-wise, with irrigation restricted to early mornings and later afternoons when evaporative loss is minimal, Smit says. In addition, closed circuit-greywater systems are integrated into the design of new developments like the Skukuza Safari Lodge.

Low-flow showerheads have also been fitted in the rest camps, but showering remains a major component of water use, not only in SANParks, but in tourist accommodation globally as well as in private households.

Watching water go down the drain

The topic came to the attention of Prof Nico de Bruyn from the Mammal Research Institute at the University of Pretoria, one day while on a visit to the Kalahari. His friend mentioned that he had just waited for seven or eight minutes for the water in the shower to heat up and that, all that time, the water simply washed down the drain before he got in.

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In addition to water for people, Kruger also maintains artificial waterholes for wildlife.

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Water for the Skukusa rest camp is abstracted from the Sabie River that runs past the camp.

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Did you know, if you shower one minute less in Kruger, you save water for two impalas for a day.

Back home, the friends, all involved in research and sticklers for solving problems, tinkered with ideas to stop shower water from being wasted before it reached the right temperature. Initial ideas included technologies to catch the water and reintegrate it into the system but, these became too complex. Eventually, we realised that we can create a circulation loop in the water system, de Bruyn says. In their final design, an electronically controlled mixer recirculates water and releases it from the showerhead only once the water is warm enough. It is the first commercially available product that solves the problem without the need for its own heating system or elaborate plumbing reconfiguration. It eliminates water wastage by simply installing the mixer unit between the hot water source and showerhead.

"Its very simple," de Bruyn says. The technology entails two components. The first is the controller unit, which looks like a remote. The second is the mixer unit, "where the real magic happens". The product includes a timer that terminates the shower after a pre-defined time, although it can be immediately restarted. "We felt it's important to not just physically save water, but also to change the behaviour of the user over time", de Bruyn says. The hope is that they become cognisant of the time they spend in the shower at home, and then also practice water use awareness when they shower elsewhere.

The technology is called the Triton Xerophyte. It's a nod to Triton Showers in the United Kingdom, which they partnered with to develop the product and, a group of plant species that use very little water. Fittingly, the efficiency of the device could be tested in the Skukuza Rest Camp.

Testing shower devices

The experimental trial was conducted over nine months in 2020 and 2021 to include both summer and winter seasons. Ten chalets were included in the study, and at the end, a total of 2 467 shower sessions were recorded.

Five of the chalets were fitted with the Triton Xerophyte mixer units and posters explaining how to use them. Additionally, one of these chalets also had extra water-saving information graphics included. One infographic, placed in the bathroom, converted volumes of water typically used for a range of everyday activities such as showering, toilet flushing and filling the washing basin into ecological metrics. For example, visitors were told that one minute of showering equals drinking water for two impalas for a day. The principle behind this infographic was to express the water usage in metrics that visitors to a national park are likely to care about, instead of the rather impersonal, but more familiar, volume metric.

The second infographic, placed at the washing basin in the kitchen, introduced visitors to the source of water used in the chalet, namely the Sabie River that all the chalets overlook. This infographic provided information about the biodiversity and human livelihoods dependent on the river. The idea was to reconnect visitors to the resource they are dependent on. The infographics were also placed in two more chalets that did not have the shower mixer units fitted.

The Triton Xerophytes were pre-set for three-minute showers at a temperature of 38°C and a flow rate of four litres per minute, though visitors could easily change all settings if they preferred. Daily ambient temperatures were also measured throughout the study at a nearby automated weather station.

Smit says the results help them better understand various behavioural aspects regarding showering patterns in Kruger that were previously unknown. "These lessons can help us plan going forward," he says

Lesson one: park visitors are water wise

The average time of a shower in the chalets without any interventions was four-and-a-half minutes, using an average volume of 25 litres. "Very encouragingly, the data revealed that the average volume of water used and the time spent in showers in the park are considerably lower than showering volumes and times available for other parts of South Africa and internationally," Smit says.

Study findings vary, but in the lower range, a typical shower in a suburban area in South Africa has been pegged at 59.1 litres. A study in the USA measured 59 litres per shower. An average shower time of seven minutes was found to be common in Brazilian apartments, and, over nine minutes at a South African university.

The lower volume of water used per shower in Skukuza can be partly attributed to the low-flow shower heads that were already in use, but that would not explain the significantly shorter shower times. "This may be indicative that the typical visitor to

the park is already cognisant of their water usage and mindful of saving the resource," Smit says.

Lesson 2: using information and technology in combination work best

In the trial chalets with infographics only, showers were 27 seconds shorter (a 10% reduction) than the 'normal' chalets. Showers in the chalets fitted with the Triton Xerophytes were 50 seconds shorter (an 18.3% reduction) and in the chalets with both infographics and water unit mixers combined, showers were 63 seconds shorter (a 23.4% reduction). Since the flow rate is also better regulated in showers with Triton Xerophytes installed, the average volume of water saved per showering event was around 30%.

We learned that this type of intervention [providing additional information to motivate behavioural change] works better when used in combination with water-saving technology, Smit says. "Through the research process, we generated new ideas on how one can further increase the impact of behavioural change."

Lesson 3: more water can be saved when and where it's cold

Showers became longer, and used more water, as temperatures dropped, though much less so in the chalets where the Triton Xerophyte were fitted. Rather, the water-saving margin between the 'normal' chalets and those with trial shower units increased as temperatures decreased. At temperatures lower than 5°C, savings of 16 litres (about a 50% reduction) in comparison to control showers were achieved. "The savings were actually surprising even to us," de Bruyn says. "It was extraordinary."

"We learned that showering volume was higher, and the time a shower tap was running was considerably longer, during colder rather than warmer conditions in the absence of the Triton Xerophyte, but where the technology was installed, the water usage was less dependent on the ambient temperature," Smit says. This result provides important insight into which parks may be best suited for this type of technology intervention. Their value, Smit says, will be highest in parks with very cold winter evenings and mornings, when visitors typically take their showers, and where water is scarce such as the Kalahari and Karoo national parks.

Scaling up the benefits

Over and above the volume of water that can be saved, which reduces the impact of water abstraction on aquatic ecosystems, there are also knock-on financial and environmental savings. These include the cost and impact of water purification, distribution and treatment after use. Another critical saving is the energy saved by heating smaller volumes of water to the required temperature.

The researchers figured that taking the average shower volume of 17.3 litres in mind, when both the technology and infographic interventions are implemented, in comparison to the average shower volume of 25.5 litres without any intervention, the park could have saved 3.28 million litres of water and 72 000 kWh in the 2019/20 financial year when just over 400 000 overnight visitors stayed in Kruger (if each overnight visitor showered once per day and no water was lost through leaks).

Initially, however, such savings will not come cheap. Each Triton Xerophyte unit retails at R9 985. It is unlikely that SANParks will be able to invest on a large scale in this type of technology," Smit says. However, he adds that corporate sponsorship may be a possibility to explore in order to operationalise these and/or other technology to reduce water usage in some of our national parks. "This will not only result in water saving within the parks, but may also have an educational role to play, hopefully resulting in pro-water saving behaviour of tourists when they return to their homes."

In this way, our protected areas can act as catalysts for change in the broader society. The study results point out that this is also one of the responsibilities of our national parks. However, the message is also clear that safeguarding the precious water resources of our protected areas is as much the responsibility of SANParks and those that share the catchments, as the tourists that visit from afar.

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Tourists and staff are the main human water users in the Kruger National Park.

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