INVASIVE ALIEN SPECIES

Alien species wreak havoc but select examples show promising solutions

Report paints a sobering picture of the extent and impact of invasive species in South Africa, but highlights examples of how we can gain ground. Article by Petro Kotzé.

Hartbeespoort Dam, or Harties, as it's known locally, is a dam that's become as famous for its triumphs as its troubles. The 2063-hectare reservoir bears the brunt of upstream pollution but, a solution to one of the most vexing consequences was recently highlighted as an example to others in ***The Third National Status of Biological Invasives and their Management in South Africa*** report, released this March.

The Hartbeespoort Dam, located in today's North West Province, was completed in the 1920s for irrigation purposes and is one of South Africa's largest man-made lakes. It lies in a poort in the Magaliesberg Range through which the Crocodile River cuts its course. Over the past century, Harties has fed irrigation, towns and settlements and a lively tourism scene that includes plentiful watersports and golf courses plied along its waterline.

Sometime in the early 1900s, while the Union of South Africa was established, the country's involvement in the First World War momentarily waylaid the dam's construction, land was expropriated for the building site and communities relocated, another comparatively insignificant event took place. Water hyacinth (***Eichhornia crassipes***), a plant native to South America, entered South African shores. It was first discovered in KwaZulu-Natal in 1910 and was then dispersed by gardeners, aquarium owners and boaters throughout the country's rivers, lakes, impoundments and wetlands. Beyond the grasp of its natural

predators, the plant flourished and eventually invaded South Africa's water sources far beyond the point of control.

Harties, in the meantime, became part of a complex system that integrates the activities in the catchment upstream, including urban areas, industries mining and agriculture. The dam is extremely polluted and, due to high levels of phosphates and nitrates, highly eutrophicated. It became fertile ground for the water hyacinth, which feed on the excess nutrients in the water. The alien plant was reported there in the mid-sixties and by 2017, regardless of various attempts at mitigation, nearly 60% of the dam was impacted by the dense impenetrable mats of the plants, affecting boating, fishing, watersport activities and aquatic biodiversity.

The 'super invasive species' is the world's worst aquatic weed, says Prof Julie Coetzee, Deputy Director of the Centre for Biological Control at Rhodes University. And, she adds, one that's very difficult to control.

However, it's only one of many invasive species that settled in South Africa.

The state of biological invasives in South Africa

Speaking at the launch of the mentioned report, Minister of Forestry, Fisheries and the Environment, Barbara Creecy, said the findings paint a "sobering" picture. A multitude of invasive species have taken root in South Africa's ecosystems, altering native habitats, outcompeting indigenous species, and disrupting essential ecological processes to wreak havoc on our fragile ecosystems.

According to the report, there has been significant progress in collating a list of alien species in the country, with information, where available, on their distributions, impacts and management To date, the list includes records of over 3 500 alien species present outside of captivity or cultivation in South Africa, at least a third of which are recorded as invasive.

They are increasing every year. The research reported that new alien species continue to arrive through several different pathways. Over the last decade (2013–2022), 32 new alien species were either illegally or accidentally introduced, a rate of approximately three introductions per year. This is slightly lower than the numbers seen for 2010 to 2019 which were an average of about four new species introduced per year.

These species have been introduced in various ways including as contaminants of nursery material, for horticulture, and through a tightly regulated process for classical biological control.

The invasive species are distributed across the country, with most broad-scale administrative units and biogeographical regions invaded by a variety of taxa. Most alien species are found in the Western Cape, Eastern Cape, and KwaZulu-Natal, and around major urban centres. This is likely because some species are commensal with humans, most were first introduced to urban centres, and because of greater sampling around urban areas (in particular, there has been a rapid, recent increase in observations from citizen scientist platforms such as iNaturalist). Robust and reliable monitoring systems that consistently track the distribution and abundance of alien species across the country are, however, lacking. This means that the extent of invasions and the effectiveness of interventions cannot be assessed with a high degree of certainty.

Creecy pointed out the far-reaching consequences on South Africa's economy, agriculture, water resources and public health. Invasive species can devastate agricultural lands, leading to reduced crop yields and increased production costs. Additionally, some invasive species pose risks to human health by acting as carriers of diseases or causing allergic reactions. Eleven tree or shrub species, five fish species, two grass species and one invertebrate species have been assessed to cause 'major' or 'massive' negative impacts at a national level.

The adverse impact of invasive trees and freshwater fishes is particularly significant. Invasive trees reduce our water resources, degrade pasturelands, and exacerbate wildfires. Some alien plant species such as pine trees, for example, are highly flammable, whilst other species clog up our estuaries and watercourses that act as natural mitigation against flooding and cyclones. They can impair water quality and impact our ability to access clean drinking water. Alien freshwater fish reduce the diversity of our native fishes and other aquatic organisms.

Soldiering on in the fights against invasive species

The Minister also pointed out that South Africa is recognised as a global leader in invasion science, with research as the foundation pillar of our work against biological invasions. We are one of a few countries to have an institute dedicated to researching, monitoring, and reporting on issues relating to the conservation and sustainable use of our biodiversity.

This pillar is led by SANBI, with key partners including the Department of Science and Innovation's National Research Foundation's Centre of Excellence for Invasion Biology at Stellenbosch University, as well as the Centre for Biological Control at Rhodes University (RU), which DFFE's Environmental Programmes Branch funds.

She also announced that the South African government invested over R 1.5 billion to address biological invasions between

Julie Coetzee

The Hartbeespoort Dam in 2010. The dam is heavily polluted and impacted by cyanobacteria.

*The water hyacinth planthopper (*Megamellus scutellaris*) is the most recent agent to be released on water hyacinth invasions in South Africa.*

2020-2022; targeting priority areas such as strategic water source areas, protected areas and biodiversity hotspots. It is, however, not enough.

One successful model that the report mentions can be replicated in other catchments and priority areas is the Greater Cape Town Water Fund. The fund is coordinated by the Nature Conservancy and is a partnership between national, provincial, and local government departments, corporate sponsors and NGOs. It raised over R180 million from the private sector to fund the control of invasive freshwater fishes and alien plants in the water catchments around Cape Town. The fund was based on research that found that clearing Cape Town's priority water catchments by removing invasive trees could generate annual water gains of 50 billion litres within five years (one-sixth of the city's current supply needs). These gains could double to 100 billion litres annually within 30 years. This approach was estimated to be significantly more cost-effective than other water augmentation solutions.

Another successful intervention highlighted is biological control, also reported as the most cost-effective and sustainable method for gaining control of alien plant invasions.

The report states that investment in biological control of invasive species has resulted in at least 17 species being brought under permanent control and the reduction of many other invasions. During 2020–2022, 48 biological control agents (released to control alien plants) were actively managed to increase their abundance or extent, either through mass rearing, re-release or distribution to new areas.

Six new biological control agents were released against five invasive plant species during 2020–2022. This brings the total of biological control agents released against invasive plant species to 142, with 92 biological control agents established in the field on 66 invasive plant species.

One example is the weevil ***Cyrtobagous salviniae,*** a biocontrol agent that targets the alien aquatic plant ***Salvinia molesta*** (Kariba weed). It facilitated the recovery of epilithic algae and aquatic macroinvertebrate communities.

Another is the release of the biological control agent ***Megamelus scutellaris*** at Hartbeespoort Dam. The tiny bug has resulted in a reduction in the cover of water hyacinth from over 37% to less than 6% over two consecutive years.

Authorities have over the years tried various measures, including biocontrol and herbicides, at Harties, but nothing could stave off the advance of water hyacinth over time. When the Department of Forestry, Fisheries and the Environment (DFFE) approached the Centre for Biological Control with a plea to improve the state of the dam in 2018, they decided on a different approach than before, Coetzee says.

Getting to the heart of water hyacinth at Harties

The Hartbeespoort Dam is a difficult site to manage with biocontrol, Coetzee explains. In a classical case, the agents would be released at the site once, or maybe twice, which would usually clear the infestation. This approach works especially well in the tropics, she says, but at Harties, during the cold Highveld winters, the plants die back, as do the agents that they feed on them.

However, water hyacinth generates a huge seed bank that rests

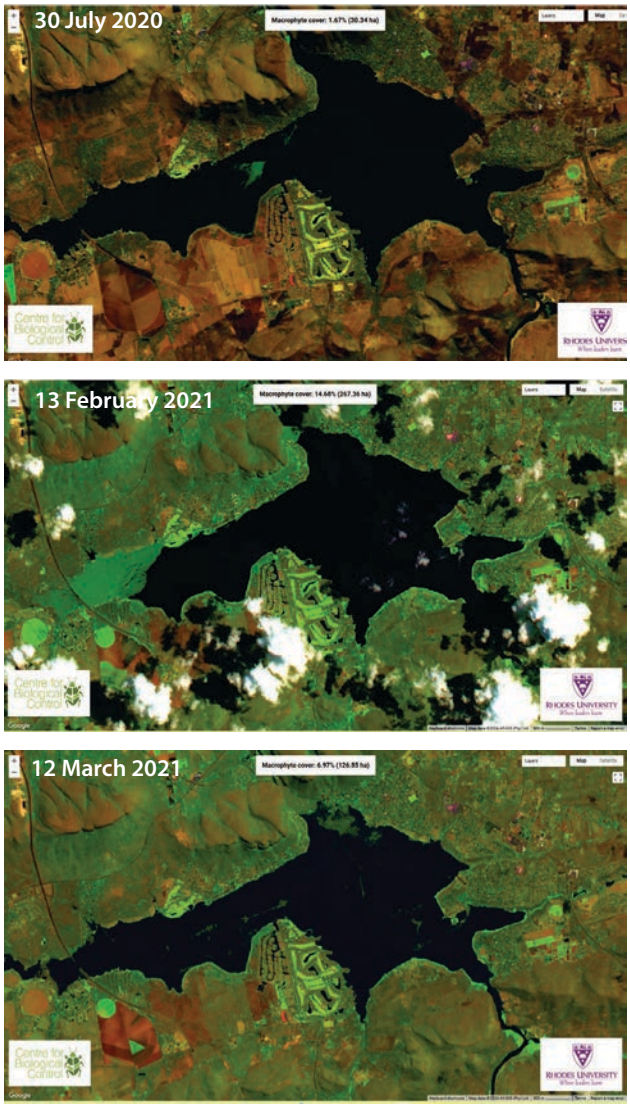
A handful of influential historical studies have indicated the severe impacts of invasions on water resources, rangeland productivity and biodiversity. These studies showed that invasive trees use 3–5% of South Africa's surface water runoff each year. Invasive plants reduce the value of livestock production from natural rangelands by R 340 million per year and biological invasions are responsible for 25% of all biodiversity loss, placing them as the largest impact to South Africa's biodiversity after cultivation and land degradation. These negative impacts have not recently been reassessed, the report states, and workflows are required to improve the applicability and repeatability of the methods.

in the sediment, and each flower produces thousands of seeds every year. In spring, when the biocontrol agents have died off after the cold winter, the seeds germinate and start a new infestation.

This time, they decided to try an agent not released at Harties before. The water hyacinth planthopper (***Megamelus scutellaris***) is the most recent agent to be released on water hyacinth in South Africa. Adults are about 3 mm long, and they suck the sap out of hyacinth leaves and petioles, killing the plants. They live for up to 80 days, and the females lay many eggs in a lifetime.

The plan was to inundate the dam with them. Tens of thousands of insects were raised at the RU's Makhanda facilities and released as frequently as possible throughout 2019.

But by January 2020, residents phoned them to say that somebody had illegally sprayed the dam with herbicide, potentially killing all the bugs. When they arrived to see the damage, they realised it was, however, the planthoppers at work. "Every single plant on the dam was brown and dying," Coetzee says. She says they not only saw huge patches of dying water hyacinth but also other healthy plants, that would usually be found there, growing from underneath. "Then we knew it was working."



Biocontrol and hyacinth follow a seasonal cycle at Hartbeespoort Dam. During the cold Highveld winters, the plants die back, as do the agents that feed on them. In spring, when the biocontrol agents have died off, the seeds germinate and start a new infestation. By the end of March 2020, less than 5% of the water surface was impacted by hyacinth but the cycle of winter die-offs and spring regeneration continued. Researchers have since started releasing the agent in spring.

By the end of March 2020, less than 5% of the water surface was impacted by hyacinth but the cycle of winter die-offs and spring regeneration continued. "Come springtime, the seeds regenerated, and the cycle repeated," Coetzee says.

They have since started releasing the agents in spring, as soon as the plants are seen to germinate. However, the RU does not have to go at it alone, anymore. Communities of people around the dam are now rearing and releasing insects. Funding to keep going is also privately raised. Coetzee explains that people even stay in touch via a WhatsApp group, for bugs to be released as soon as possible where necessary.

At the beginning of March, the percentage of the dam affected by hyacinth was down to 10% and, at the time of the interview three quarters through the month, Coetzee says it was at about 2.5%, going into winter.

They are hoping to launch a research project on changes to the hyacinth seed bank, soon. "We are hoping that the biocontrol agents are 'mopping up' the seeds because the plants are prevented from flowering," Coetzee says.

However, she adds that the biocontrol is merely a bandaid on the wound. To permanently get rid of the problem, the pollutions that enter the dam need to be improved.

This was echoed by Creecy. Addressing the challenges posed by biological invasions, she said, requires a coordinated and collaborative effort. "No single entity can tackle this issue alone." Governments, academics, civil society organisations and communities must come together, pooling their knowledge, resources, and expertise to develop effective prevention, early detection and control strategies.

To download ***The Third National Status of Biological Invasives and their Management in South Africa*** , Visit: https://www.sanbi.org/wp-content/uploads/2024/03/Biological-invasions-Report-in-South-Africa-in-2022.pdf