

Satellites and high-tech solutions help African farmers face historic drought

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African and European researchers are employing high-tech water management research methods to help low-tech South African smallholders improve food security. Additionally, extremely high levels

of Microcystin toxicity and uranium contamination in important river systems spark calls for extra research on bioaccumulation through the human food chain

South Africa is experiencing its severest drought in more than a century. Savannahs – grasslands scattered with trees and scrubs, which cover about half of Africa – are some of the most productive environments of the continent, supporting livestock and rural livelihoods. Drought jeopardises the productivity and resilience of these ecosystems.

Researchers from South African and European universities, and other organisations, are trying to create the first savannah-water-use-and-stress-maps, to help smallholder farmers face the lack of precipitation and plan irrigation.

Field and Earth observation data, obtained from the European Space Agency's (ESA) Sentinel satellites, will allow the researchers, led by Timothy Dube, at the University of KwaZulu-Natal in South Africa, and Ana Andreu, at UNU-FLORES in Germany, to determine the health and vulnerability of the ecosystem. They recently collected their first field data in arguably one of Africa's best-known patches of savannah – the Kruger National Park.

In this context, the ESA has just released the African mosaic, which offers a cloud-free view of the continent through 7,000 images captured by the Sentinel-2A satellite. It provides information that can be used to map changes in land cover and improve agricultural practices.

Research determining water use efficiency, using satellite imagery and developing irrigation strategies, is normally associated with high-tech commercial farming in southern Africa. But this data is now also used to help poor small-scale farmers, mainly concentrated in rural areas in South Africa's former apartheid homelands and peri-urban regions.

When water is available, irrigated agriculture plays a major role in [food security](#). "The irrigated area, which is only 10 per cent of South Africa's agricultural production area, provides more than 30 per cent of the food. Hence the vital importance of agricultural water management research," says Felix Reinders, from South Africa's Agricultural Research Council.

For example, near the town of Giyani, about 500 kilometres northeast of Johannesburg, smallholder tomato farmers have experienced the impact of smart agricultural water management coordinated by Stellenbosch University. As a result, their yields increased from below five tonne per hectare (t/ha) to an average of 26.5 t/ha when they implemented a scheduled drip irrigation system, based on soil moisture monitoring.

This demonstration was part of trans-disciplinary research conducted by the EAU4Food project (European Union and African Union cooperative research to increase Food production in irrigated farming systems in Africa) in five African countries.

They were purposely selected to be in the southern hemisphere (Mozambique and South Africa), the northern hemisphere (Tunisia), West Africa (Mali) and East Africa (Ethiopia), "to fully benefit from the potential of cross distributing promising strategies and innovations". The Alterra Wageningen University and Research Centre in the Netherlands managed this project.

High-tech-acquired-data should also help scientists study pollution of the South Africa's precious water resources, according Anthony Turton, professor of Environmental Management at the University of the Free State. He is working in the world's largest known gold deposit, the Witwatersrand Goldfields. The area is also home to southern Africa's biggest metropolis, Johannesburg.

Population growth, associated with industrial development, drought,

global warming and a failing sewage infrastructure, create favourable conditions for blue-green algae. "It contaminates rivers biologically with direct human health risks arising from irrigation," explains Turton.

Hence, his call for research on Microcystin toxicity – a toxin produced by blue-green algae – and uranium bioaccumulation through water and the [food chain](#). "In both cases we have the highest levels of localised contamination in the world, but in neither do we have any credible peer-reviewed research that quantifies the fate and pathway into the human population," he says.

The current drought will end, but South Africa's history of reoccurring droughts also means another one is on the cards. Current trends indicate the country's growing demand for [water](#) will need even more careful management from every angle and in every industry in the future.

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