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Why UP researchers like rooibos, Nguni cows and 50 000-piece microbial puzzles

Professor Thulani Makhalanyane and Professor Emma Archer say that life found only in Africa, from invisibly tiny microbes to huge mammal herds and our kaleidoscope of plants, can give us medicines, technologies and ways to manage climate change.

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Prof Archer is a researcher at UP's Department of Geography, Geoinformatics and Meteorology. She studies the effects of climate change on biodiversity and sustainable agriculture in the Waterberg biosphe in Limpopo and the eastern Karoo in the Northern Cape.

"South Africa has an amazing richness of biodiversity ecosystem services, and we're one of the last place that have large assemblages of large mammals," she says.

Professor Emma Archer, researcher at UP's Department of Geography, Geoinformatics and Meteorology

As co-chair of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Prof Archer recently outlined how climate change threatens biodiversity in southern Africa, and h this biodiversity underpins the unique genetic diversity found in the region's agriculture.

For example, rooibos tea is unique to South Africa, and there is ongoing research on the many wild types that are resilient to climate change. The Nguni cow is unique as well – it is essential to the South African be market mainly for its hardiness. Currently, UP researchers are looking at how the genetic diversity of other southern African cattle can boost economic growth.

Microscopic organisms in various complex African ecosystems are just as genetically diverse as these larger fauna and flora.

Prof Makhalanyane, a researcher at UP's Centre for Microbial Ecology and Genomics, says microbial biodiversity affects all aspects of life, from the carbon cycle that affects climate change, the cycling of nitrogen which is important for agriculture, to microbes found in your gut.

"I'm interested in microbes that live in extreme environments and to understand the molecular mechanism to harness the capabilities for biotechnology," he says. In other words, he wants to find microbes that have evolved enzymes that may be useful, such as enzymes that could degrade plastic waste, clean contaminated water or replace harmful chemicals in factories.

Professor Thulani Makhalanyane is a researcher at UP's Centre for Microbial Ecology and Genomics.

Prof Makhalanyane and other UP researchers are looking specifically at the more than 99% uncharacterise microbes found in arid zones and coastal areas across the continent. With commercial partners, they use cutting-edge technologies in bioinformatics and artificial intelligence to pinpoint these valuable enzymes within a soup of microbes sampled from different locations.

"These methods allow us to directly extract DNA from any environment, and we use bioinformatics and AI

put together that 50 000-piece puzzle to get an idea of what's there and what they do," Prof Makhalanyane says.

Microorganisms that live comfortably in extreme environments can also help scientists develop crops that cope better in unpredictable climates, Prof Makhalanyane says. For example, former UP researcher Dr Habibu Aliyu looked at how the bacterium Nesterenkonia can thrive in the extremely cold and dry soils of eastern Antarctica.

Many other UP researchers are finding new ways of using African biodiversity to help tackle global change like rising temperatures and ocean acidification and help grow the continent's bio-economy. But they are a looking at how economies and global change threaten biodiversity.

Prof Makhalanyane says the nature of micro-ecosystems means researchers can see the effects of clima change faster at a small scale than at the scale of the macro-ecosystem. This is known as microcosm research, and Prof Makhalanyane is leading an effort to study the effects of climate change on microbiom of the south Atlantic ocean.

On the macro-scale, Prof Archer says she is looking forward to Professor Nigel Barker's Great Escarpme Biodiversity Programme, which will help close gaps in our knowledge about key sources of ecosystem services in South Africa.

"I think we still have a long way to go in accounting for the true value of ecosystem services in South Africa and Africa," she says. "Scientists have a big responsibility to pull together the best biodiversity research a to communicate it well."

https://www.up.ac.za/news/post_3006777-why-up-researchers-like-rooibos-nguni-cows-and-50-000-piece microbial-puzzles

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