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Media release

Space-based sensors offer promising tools for wetland monitoring

Remote sensing from orbiting satellites provides unprecedented opportunities for monitoring changes in terrestrial and marine ecosystems. The Water Research Commission is funding a three-year project, led by the Council for Scientific and Industrial Research (CSIR), to assess whether the same can be said for South Africa's wetlands, many of which are hidden beneath forest canopies or other vegetation, or exist only as temporary pans after rainfall.

The project is focused on the Maputaland Coastal Plain, which makes up more than 8 000 km² of northern KwaZulu-Natal, along the eastern coastline. This area is a biodiversity hotspot with a diverse range of wetland types, from swamp forests, mangroves and floodplain forests, to grass and sedge wetlands and the country's largest natural open-water wetlands. These include Lake St Lucia, the Kosi Bay system and the freshwater Lake Sibaya, all of which are designated Ramsar Wetlands of International Importance and protected within the iSimangaliso Wetland Park – listed as South Africa's first World Heritage Site in December 1999. Wetlands are currently estimated to make up about a quarter of the total area of the Maputaland Coastal Plain.

The region is home to local communities that depend on the wetlands for fish and other foods, water supply, and materials used in construction and crafts, such as thatching, mats and baskets. The project team will be engaging with these communities to understand their perceptions, beliefs and attitudes about the wetlands and their conservation, as well as with other stakeholders in the area. In addition, wetlands are important regulators of the hydrological system, acting as sponges to filter water and slow down floodwaters among others.

The most recent National Biodiversity Assessment of 2018 found wetlands to be the country's most threatened ecosystems. On the Maputaland Coastal Plain, wetlands are negatively impacted by slash-and-burn agriculture; excessive water abstraction particularly during droughts; alien invasive vegetation and timber plantations. Plantation trees cause a lowering of groundwater levels because their root systems are deeper and their evapotranspiration rates are higher than those of the indigenous trees. This, combined with natural dry cycles in general, but especially the severe drought in 2015/16, has contributed to an increase in the number and extent of desiccation of peatland, and, in some instances, these peatlands burn after surface fires in the region. There are also concerns about the additional pressures that climate change (rising surface temperatures and extreme droughts) will exert on the region's wetlands.

Project leader Dr Heidi van Deventer says that remote sensing could be a valuable tool for monitoring the Maputaland Coastal Plain's wetlands, which are often difficult and dangerous to access due to muddy environments and potential encounters with animals such as hippo, crocodile, buffalo and elephant.

"Remote sensing will hopefully allow us to detect what type of changes are taking place in the landscape, and quantify the rate and extent of those changes," she explains. "It is already being used in South Africa for monitoring large waterbodies, mostly dams. Our natural wetlands are predominantly vegetated rather than open-water systems. The study will use the more recent Sentinel-1 and -2 satellites to examine a 10 x 10-metre pixel. This will allow the team to conduct weekly time-series analyses for accurately quantifying wetland change in future."



The Sentinel satellites form part of a series of satellite missions developed by the European Space Agency for Copernicus, the European Union's Earth observation programme. The two Sentinel-1 twin satellites, A and B, each have a Synthetic Aperture Radar instrument that acquires data in any weather conditions and during the day and night. The radar data is useful for detecting water and moisture, even when it is beneath some of the grass and sedge vegetation canopy. By contrast, the two Sentinel-2 satellites have a MultiSpectral Instrument that provides optical data sampled from 13 bands across the electromagnetic spectrum, from visible light to short-wave infrared.

Van Deventer explains that the research project involves fieldwork to validate the satellite data through ground-truthing.

"Ultimately, we hope to use remote sensing for automated monitoring of wetland changes on a regional scale. The points collected during a field campaign are then used in software programmes with machine learning algorithms to assess the accuracy of our classification. A map is then produced with each of the classes, showing the extent across the Maputaland Coastal Plain. We can then quantify the extent and measure changes against the original extent mapped. In this way, areas in need of rehabilitation could be more easily identified and prioritised. If successful, the intention is to incorporate this capability into the National Wetland Monitoring Programme."

The Water Research Commission's research manager overseeing the project, Mr Bonani Madikizela, notes that the project ties in well with the World Wetlands Day 2022 theme, "Wetlands Action for People and Nature".

"Many of the wetlands of the Maputaland Coastal Plain are under severe stress, yet they are so important to the marginalised sectors of our communities that rely on them for food and other ecosystem services," he says. "Caring for our wetlands while they care for us is our responsibility as citizens!"

- The Project is co-funded through two CSIR Parliamentary Grant projects on aspects of this research.
- World Wetlands Day is celebrated each year on 2 February to raise awareness about wetlands. The date also marks the anniversary of the Convention on Wetlands, commonly known as the Ramsar Convention, which was adopted as an international treaty in 1971. World Wetlands Day has been celebrated by Contracting Parties to the Convention since its initiation in 1997, but the 2022 event is the first to be celebrated as a United Nations International Day following the adoption of Resolution 75/317 by the UN General Assembly, which specifically proclaimed 2 February as World Wetlands Day.

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