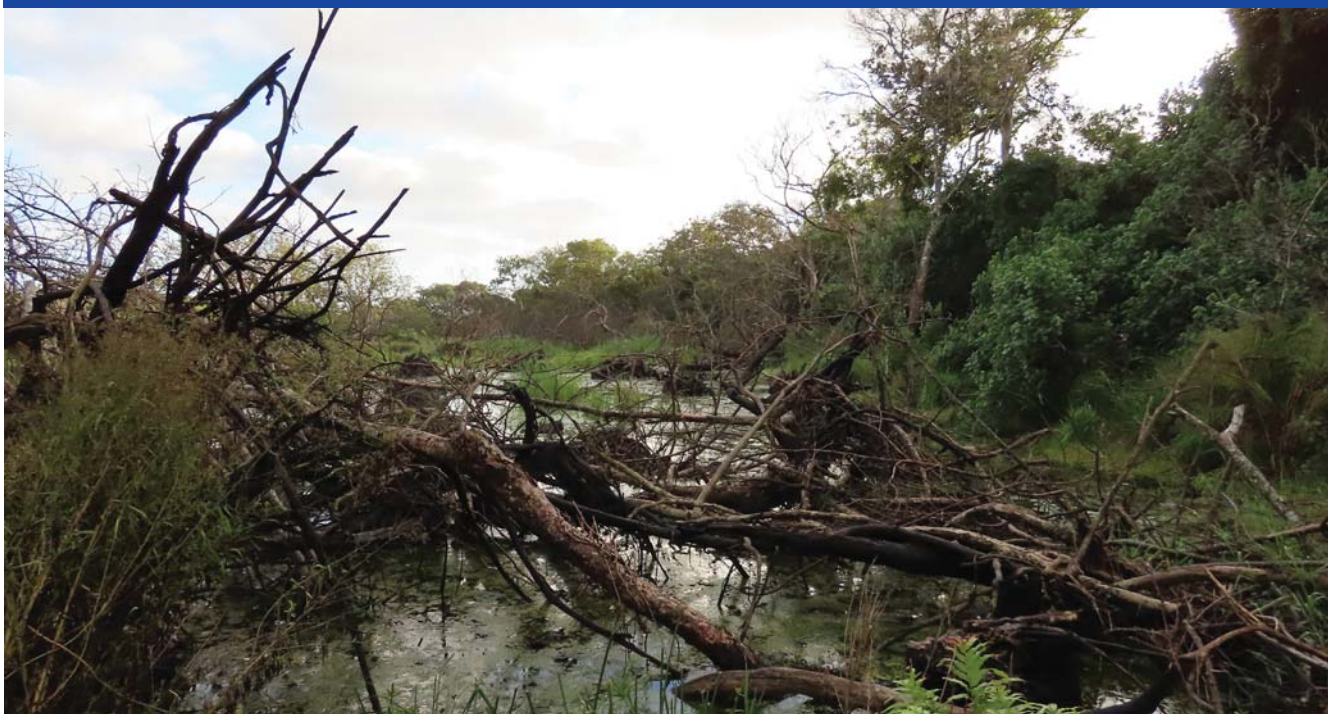
WETLANDS AND SOCIETY

Bringing science, policy and society closer together for the Maputaland Coastal Plain's wetlands management

In a project funded by the Water Research Commission (WRC), scientists are applying remote sensing technologies to quantify and determine the extent and rate of change in the wetlands of the Maputaland Coastal Plain. Article by Dr Heidi van Deventer (CSIR), Dr Karen Nortje (CSIR), Dr Laven Naidoo (GCRO), Philani Apleni (UP), Philemon Tsele (UP), Johan Bester (DFFE), Dr Piet-Louis Grundling (DFFE), Susan Janse van Rensburg (SAEON), Dr Ilse Aucamp (Equispectives Pty Ltd).



The Maputaland Coastal Plain (MCP) presents a variety of forested, grass, sedge, and open water wetland cover types that have been surveyed by botanists and earth observation (EO) specialists at local scales. The wetlands transition from freshwater to estuarine systems in this coastal corridor and landscape.

Several pressures influence the MCP wetlands negatively, ranging from water abstraction, alien invasive tree species, exotic timber plantations, and slash-and-burn of swamp forests, while uncertainties prevail on the further impact of climate change within this region. Owing to the scale of the anthropogenic and climate change impacts across the landscape, and the limitations in accessing parts of the MCP, remote sensing technologies can play a key role in quantifying and determining the extent and rate of change in wetlands and their catchments for the MCP, and potentially, the types of land covers resulting from anthropogenic impacts.

Some of the impacts on wetlands observed to date include the increasing number of peatlands that have become desiccated and burnt (Grundling et al., 2021). In addition, a continuing trend in the transformation of forested wetlands is also concerning (Van Deventer et al., 2021a&b). Climatic trends remain uncertain, because of poor representation of rainfall stations in the northern part of the MCP, though.

Changes in the landscape also occur within a social context, with different perspectives and realities influencing choices and

behaviour. People's perception of the value of wetlands, changes in the extent of different types of wetlands, and the need to conserve these different wetland types may differ tremendously between stakeholders of the MCP. A full list of stakeholders of the MCP remains to be compiled, and a social study is required to inform possible reasons for changes in wetlands observed and quantified through remote sensing studies.

The WRC is funding a three-year project (project no. WRC C2020-2021-000427), investigating the capability of remote sensing to quantify changes in wetlands of the MCP. The project is being led by Dr Heidi van Deventer of the Earth Observation Research Group of the Council for Scientific and Industrial Research (CSIR), with funding contributions also made by the CSIR.

Aims and objectives of the study

The aim of the WRC project is to quantify the rate of change of different wetland types on the MCP using remote sensing. In addition, a subcomponent of the work is aimed to understand the social context of these changes, through enabling stakeholder engagement and communication through sharing the remote sensing output with these stakeholders.

The objectives of the project are to:

- Compile an inventory of available ***in situ*** coordinates for wetland cover types;
- Evaluate the possible wetland classes that could be used in (optical) change detection for the MCP;
- Facilitate a learning exchange between EO products and local stakeholders for knowledge co-production;
- Quantify the areal extent, rate, and types of change observed for wetlands on the MCP; and
- Draft a strategic framework for the inclusion of EO products and community engagement in the National Wetland Monitoring Programme (NWMP).

Remote sensing methods

Several remote sensing studies of palustrine wetlands in South Africa showed that these vegetated wetlands are highly separable from adjacent terrestrial vegetation, particularly in the Grassland and Indian Ocean Coastal Belt biomes (see review in Van Deventer et al., 2020 funded by the WRC). A wide range of space-borne remote sensing sensors such as the Landsat series, RapidEye, WorldView –2 and –3, and more recently the Sentinel–1 radar and –2 optical sensors proved valuable in classifying various categories of wetland trees to communities at the local to landscape scale.

A main gap, however, is the assessment of time-series data to quantify the extent and types of changes that have taken place over time. Such information is critical in the red list assessments of freshwater habitats, considering that the rate of change is one of the criteria prescribed by the International Union for Conservation of Nature (IUCN, Bland et al., 2017). In applying these criteria for forested wetlands on the MCP, land cover data was found to underrepresent the rate and types of decline of these critically endangered habitats (Van Deventer et al., 2021a&b). Improvements in the spatial representation of forestry wetlands, and other types of wetlands is therefore necessary.

The remote sensing component intends to build on the previous remote sensing studies of the MCPs wetlands, while also improving the mapping of the extent of swamp forests, a critically endangered ecosystem of the MCP (Van Deventer et al., 2021). We intend to use cloud computing, multi-seasonal data and time-series analysis to improve the detection of wetland types and quantify the types of changes in wetlands taking place in the wetland types. Philani Apeleni is an MSc student registered with the University of Pretoria (UP), that will focus on the remote sensing of the wetland types and their changes, with supervision from Heidi, Laven and Philemon.

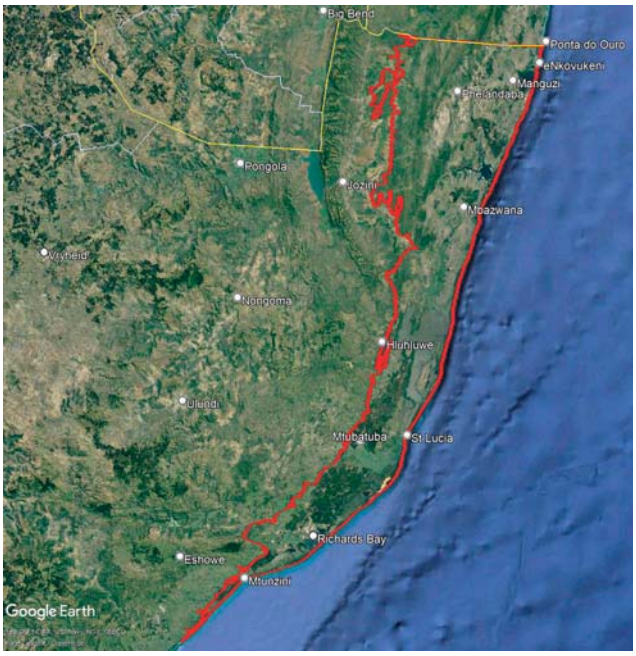
Social component

The social component will work hand in hand with the technical EO component of this project to ensure that the research and learning gained from this project includes the input from local stakeholders as well as ensures benefits to not only science, but also society – in particular local stakeholders living in the area. The social component, under the leadership of Dr Karen Nortje from the CSIR, seeks to enhance our current understanding of the area in terms of people and their relationship with the freshwater environment.

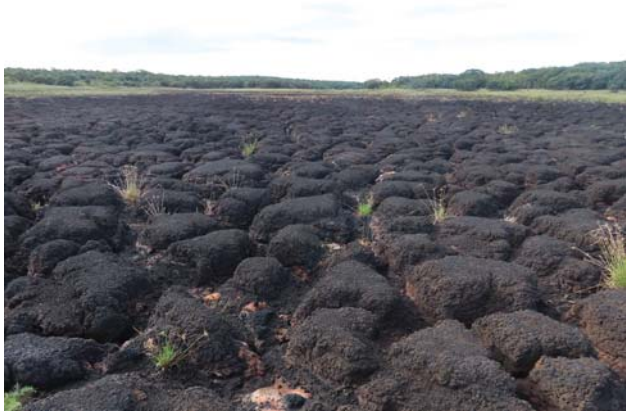
Here the focus will be on understanding the perceptions, beliefs, and attitudes of different stakeholders in terms of the wetlands and swamp forests, and the concept of conservation. There are several different stakeholder groups in this area that have an interest in the wetlands and the conservation thereof, and the intention is to ensure that the project uncovers the diverse ways in which wetlands provide value to these stakeholders.

Outcomes and outputs

One of the important outcomes of this project is to bring society and science closer together. This will be done through participative meetings and workshops through which different perspectives of the wetlands and its value will be shared. The goal here is to create opportunity for the emergence of new perspectives of wetlands, and an appreciation for different ways



The Maputaland Coastal Plain in northern KwaZulu-Natal covers an area of more than 8 000 km², with about a quarter of this made up of wetlands.



At Vasi Pan in the northern reaches of the region, natural dry periods combined with desiccation due to a lowering of the water table by adjacent timber plantations allowed surface fires to spread into the wetland's peat, which continued burning for months.

in which natural resources may be valued, and how this may translate as an input to collaborate ways of management and conservation of these natural resources.

The first step in the process of bringing science and society closer on this topic happened during the first week of June 2021. During this week, the team had the opportunity to present the project idea and plan to the Tembe Traditional Authority and the Mabasa Traditional Authority. During this engagement the team also requested permission to work with and engage with the local community during the project.

The project was met with enthusiasm and the team's request was approved. The team also used this opportunity to start sharing information with the community, as such two posters detailing the project aim and objectives, as well as information on key indicator tree species for swamp forests, were distributed to the Traditional Authorities at the meetings. These posters were designed by Heidi and translated by Philani (with acknowledged support from family and friends!) from English to Zulu (Van Deventer & Apleni, 2021).

Collaborators

A number of key collaborating organisations include the Department of Forestry, Fisheries and the Environment (DFFE), the Agricultural Research Council (ARC) and the South African Environmental Observation Network (SAEON). Dr Piet-Louis Grundling from DFFE has extensive years of experience on wetlands of the MCP, and has published some of the earliest reports on the MCP's peatlands. Dr Althea Grundling from the ARC has previously published remote sensing mapping of wetlands on the MCP as part of PhD work, and currently also has a WRC project on the MCP (WRC project no. C2019/2020-00098) focusing on determining peat loss.

Sue van Rensburg from SAEON will also closely collaborate with the CSIR team on the transformation of wetlands on the MCP, and how the EO can contribute to the longer-term monitoring under the Expanded Freshwater and Terrestrial Environmental Observation Network (EFTEON). The EFTEON project has interests in monitoring changes in freshwater ecosystems at various scales, and to ensure that collaboration also occurs across realms (estuarine, marine, terrestrial and freshwater).

Implementers/ future work

We hope that the framework generated through this research project would inform future studies on the changes in wetlands, not only through the use of remote sensing, but methods and findings generated through the social component. Our intention is to inform on methods and approaches to consider in the National Wetland Monitoring Programme, managed by the Department of Water and Sanitation, but also have impact globally through this work. Bonani Madikizela, Research Manager at the WRC, also added that such wetlands extent change provides the most required data and information on SDG:2030, Goal No.6, indicator No.6.6.1.

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