

BioSpace25 - Biodiversity insight from Space  
10 - 14 February 2025 | ESA-ESRIN | Frascati - Italy

# Overview of the use of the ESA Sentinel-1 radar and -2 optical images for mapping and monitoring wetland biodiversity in South Africa

Presenter: Dr Heidi van Deventer (CSIR & UP)

Co-authors: Dr Laven Naidoo (GCRO & UP) & Dr Christel Hansen (UP), Pretoria, South Africa



# SOUTH AFRICA'S NATIONAL BIODIVERSITY ASSESSMENTS



NSBA 2004

NBA 2011

NBA 2018

NBA 2025 under way

## National Biodiversity Assessment

2018 National Biodiversity Assessment

- [Synthesis Report Book](#)
- In short: [Facts, Findings and Messages booklet](#)
- Pressures on biodiversity: [Provincial level extracts from NBA 2018](#)
- Click [here](#) for all technical reports, data and supplementary documents
- Play a short [slide show](#) with voice-over explaining NBA 2018
- View a short film: [SA's NBA - a Youthful Perspective](#)

Press releases relating to the NBA 2018 release:

- [SA coastal biodiversity status in spotlight on Clean-Up Day](#)
- [SA's incredible biodiversity, our natural heritage, provides many jobs and benefits](#)
- [Access to launch day media release](#) from Minister Creecy
- [Tenfold increase in Marine Protected Areas supports South Africa's Sustainable Oceans Economy](#)
- [SA's wetlands and rivers are crucial for water security](#)

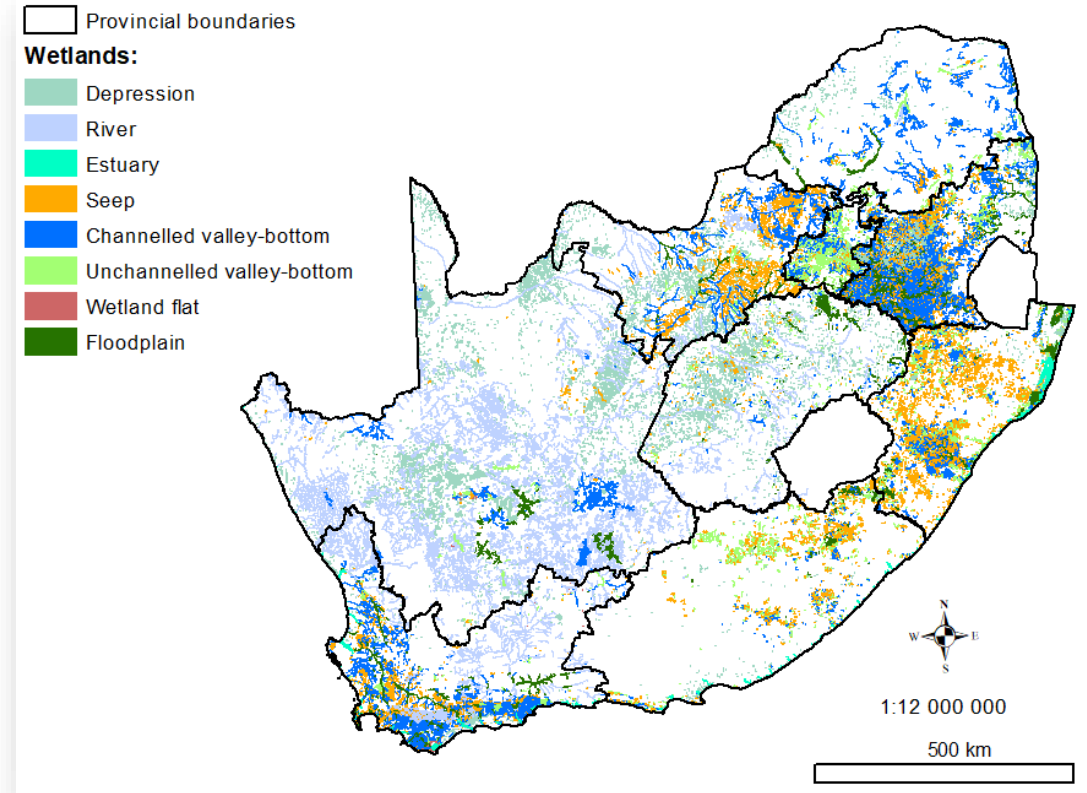
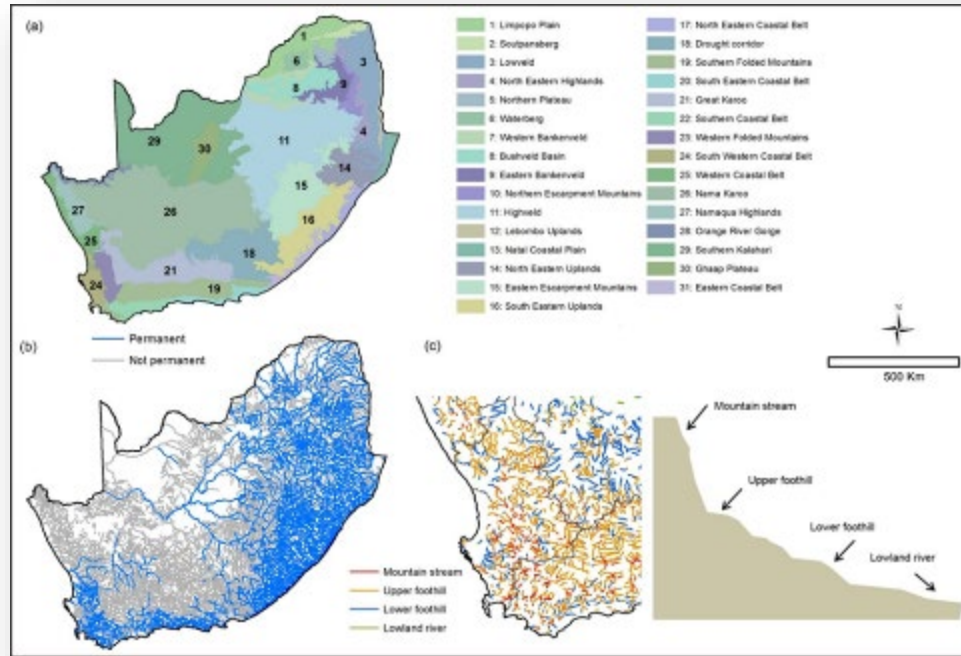
<https://biodiversityadvisor.sanbi.org/>



# INLAND WETLANDS / FRESHWATER ECOSYSTEMS

## Biodiversity types

- ✓ Inland wetlands (regions+HGM)
- ✓ Rivers (regions+flow+LGZ)



## Inland wetlands:

- Predominantly palustrine 55%
- Arid 34%
- Inundated / lacustrine 11%

# KUNMING-MONTREAL GLOBAL BIODIVERSITY FRAMEWORK (GBF)



Goal Milestones, Components	
A1: Natural systems	Area
	Connectivity
	Integrity
A2: Species Populations	Extinction rate
	Extinction risk, Threat status
	Population abundance (size)
	Population Distribution
A3: Species Genetics	Genetic diversity

Kunming-Montreal GBF set new targets for measuring changes in the extent and condition of wetlands, reporting by 2030 and 2050

- Target 1: Plan and manage all areas to reduce biodiversity loss
- Target 2: 30% of the extent of degraded systems to be under restoration by 2030
- Target 3: Minimum 30% extent of each type to be conserved

November 2021. Version 1.0

**Indicator metadata sheet**

*Indicator metadata form for compilation of data relating to headline indicators proposed in the first draft of the monitoring framework for the post-2020 global biodiversity framework*

CBD, 2021



# SENTINEL 1&2 => IMPROVED MAPPING/MONITORING OF WETLANDS



Improved delineation, mapping of EBV, and cycles; examples:

- a) biodiversity mapping and hydrological variation in **lacustrine wetlands**;
- b) tracking changes in the extent of estuarine and freshwater EFGs (**vegetated**);
- c) the importance of the Africa land cover for assessing **river ecosystem types** and their ecological condition; and
- d) monitoring of **EBVs** such as above-ground biomass (i.a., for teal carbon), and ECVs soil moisture as well as the hydrological regime and phenology metrics.

EBV - Essential Biodiversity Variables

ECV – Essential Climate variable

EFG – Ecosystem Functional Group

# A1/3) LACUSTRINE WETLAND BIODIVERSITY TYPES



GEOBON

CEOS



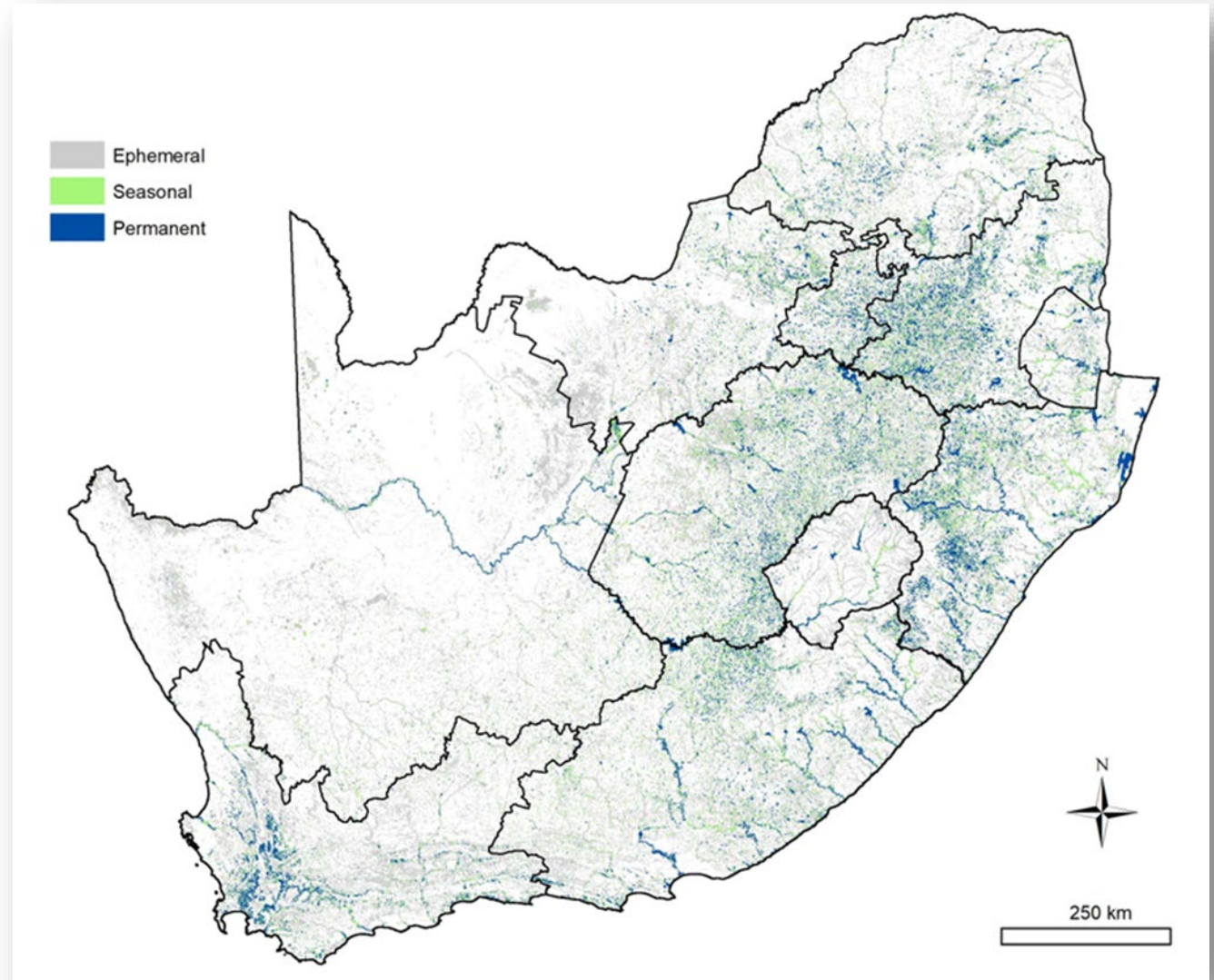
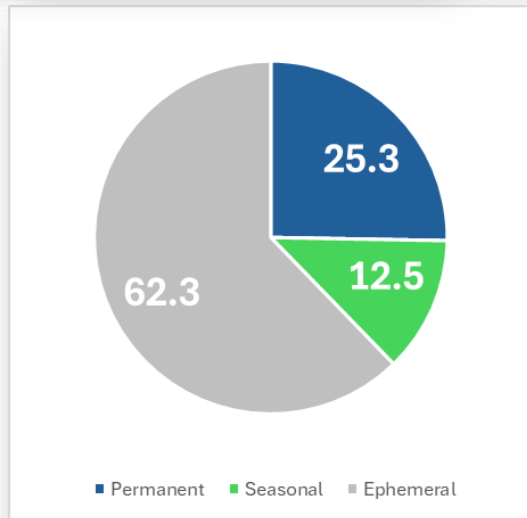
**GEOTERRA**  
IMAGE

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Consistent, accurate and reliable water resource monitoring for successful water management.



Van Deventer in prep  
\* RSA 72% arid/semi-arid



# A2/3) HYDROLOGICAL REGIME OF GAUTENG PROVINCE'S WETLANDS

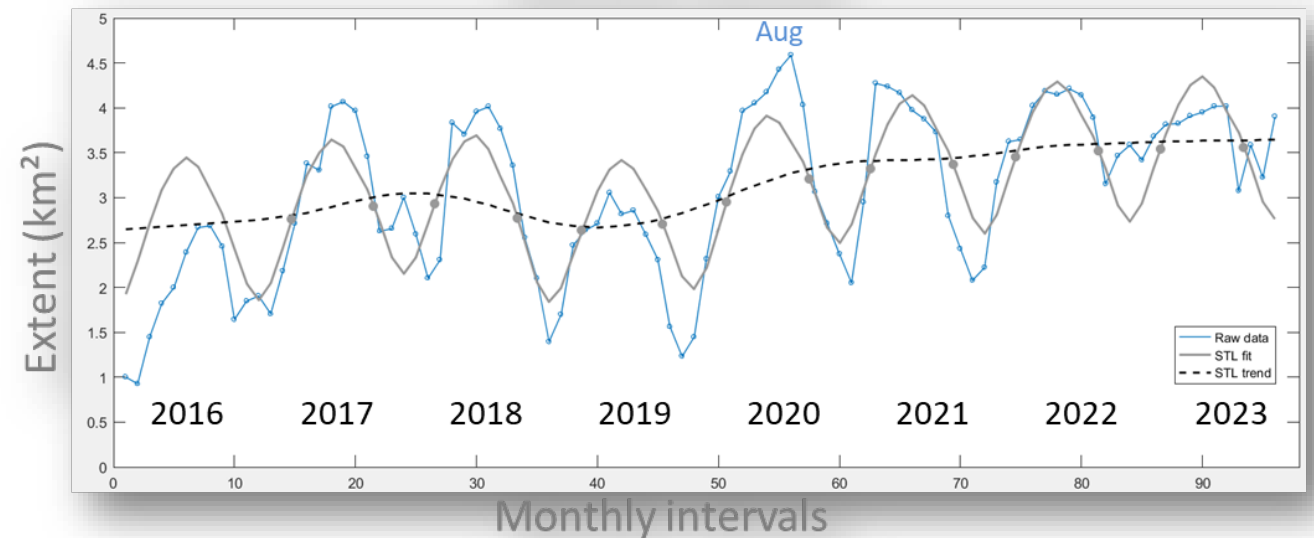
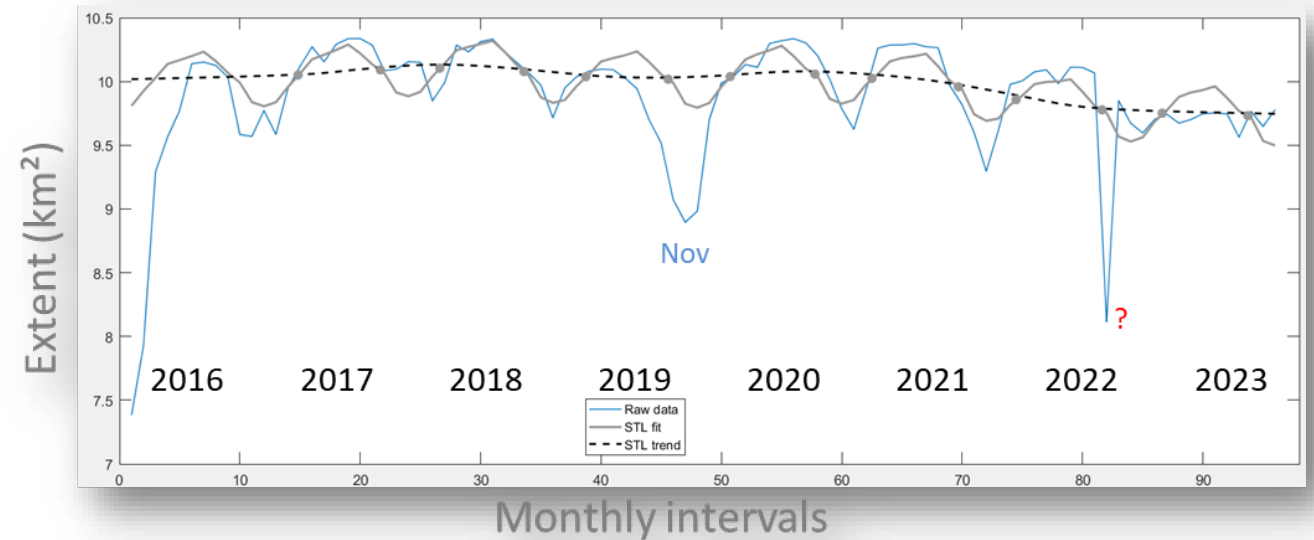


## Permanent:

- SOS - Mar
- EOS - Oct
- POS - Jun
- Duration on average 7 months

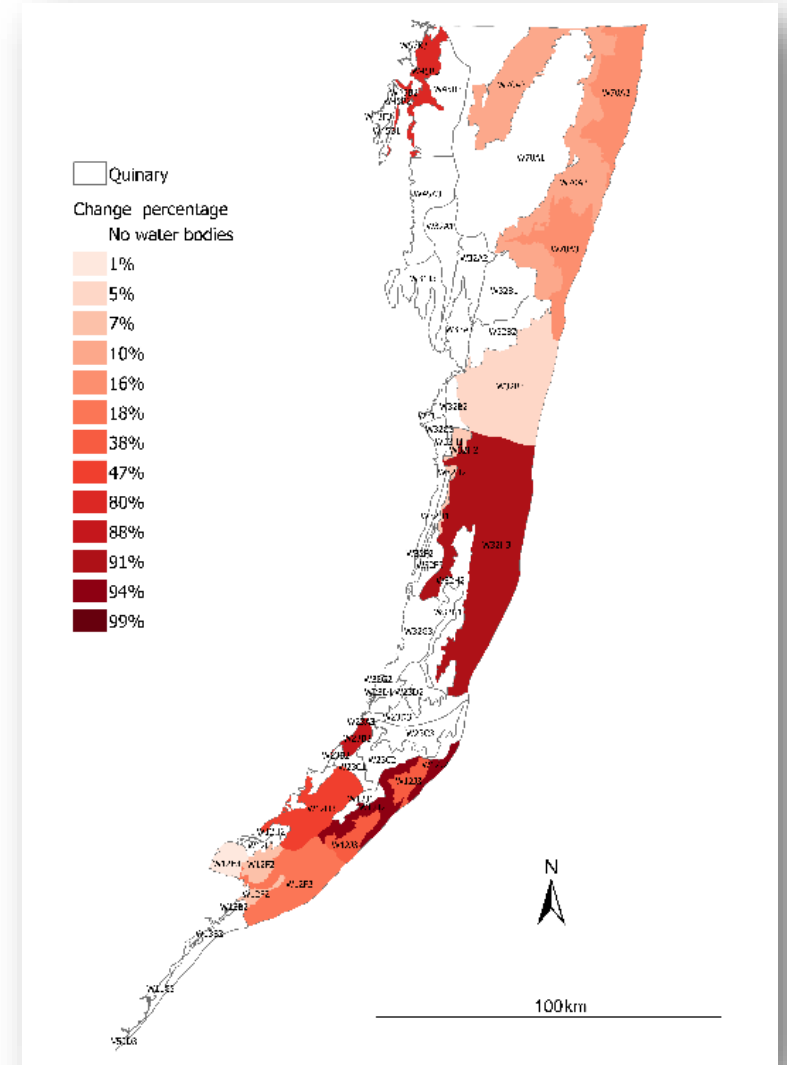
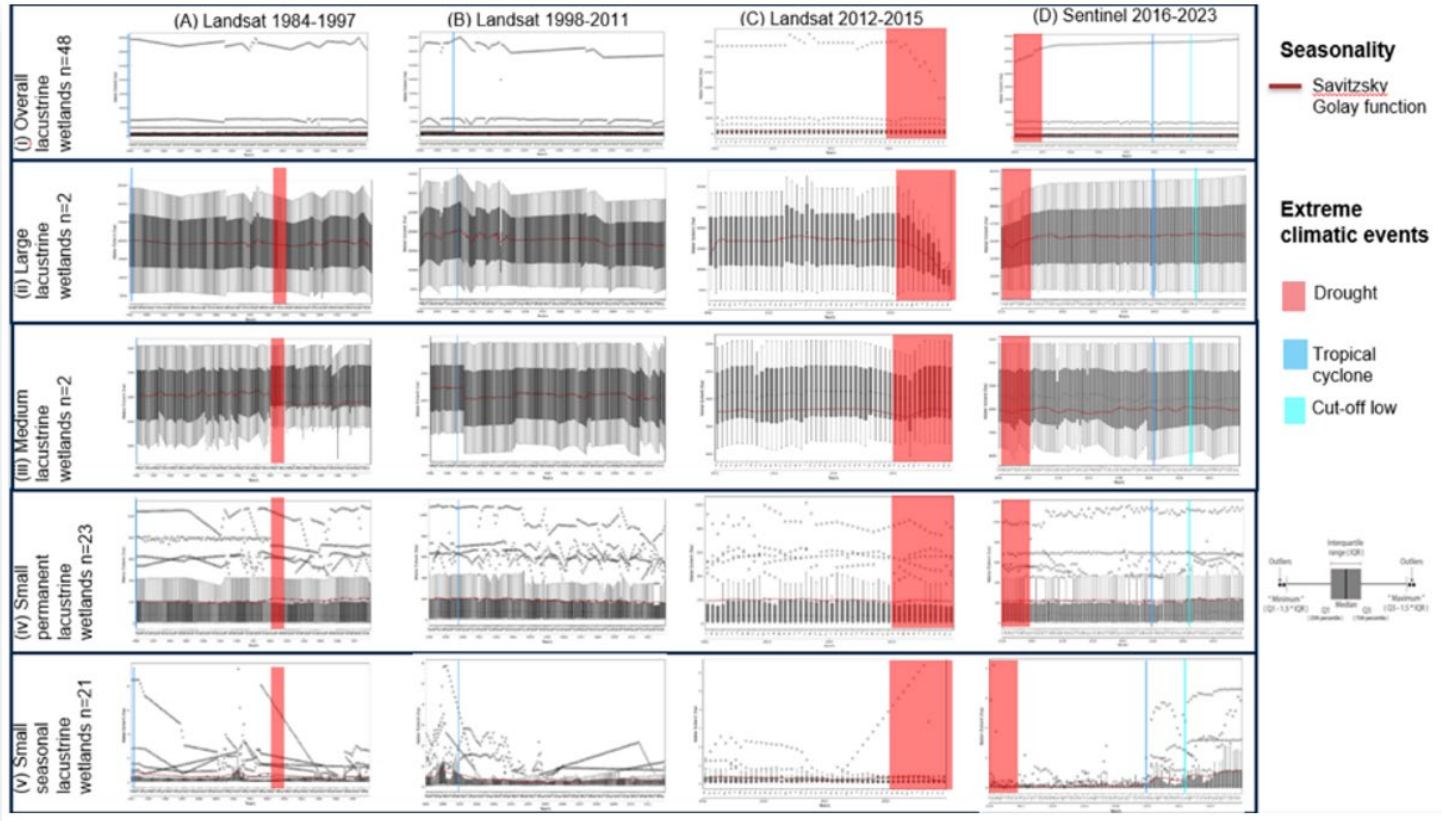
## Seasonal:

- SOS - Mar
- EOS - Sep/Oct
- POS - Jun
- Duration on average 7 months



Van Deventer in prep

# A3/3) CHANGES IN LACUSTRINE WETLAND EXTENT gw-SWSA

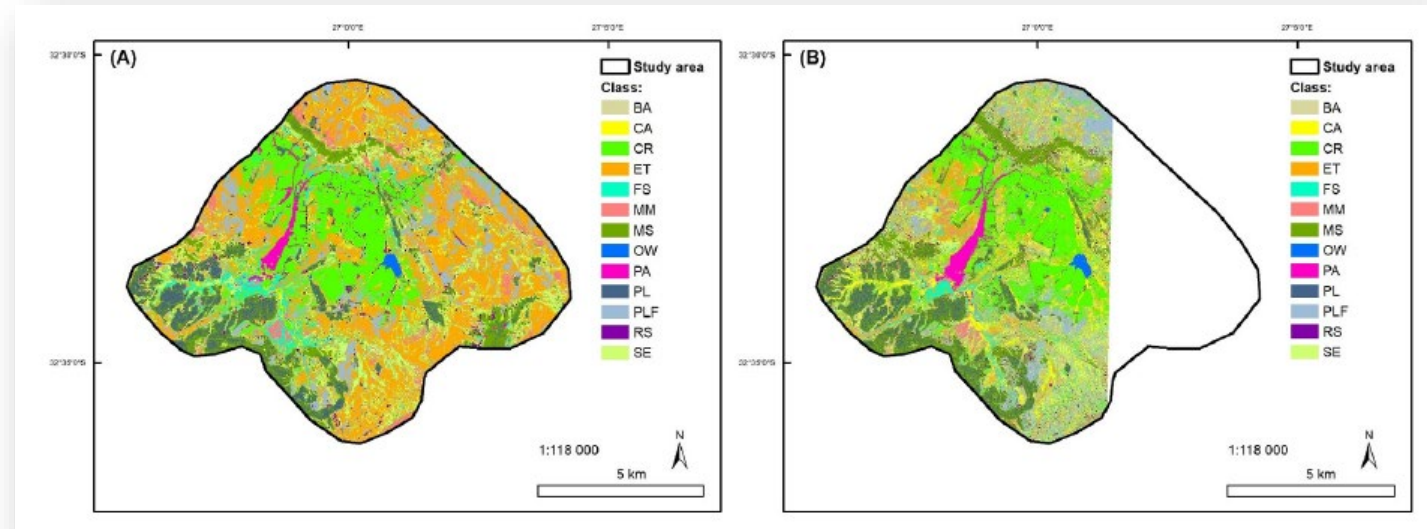
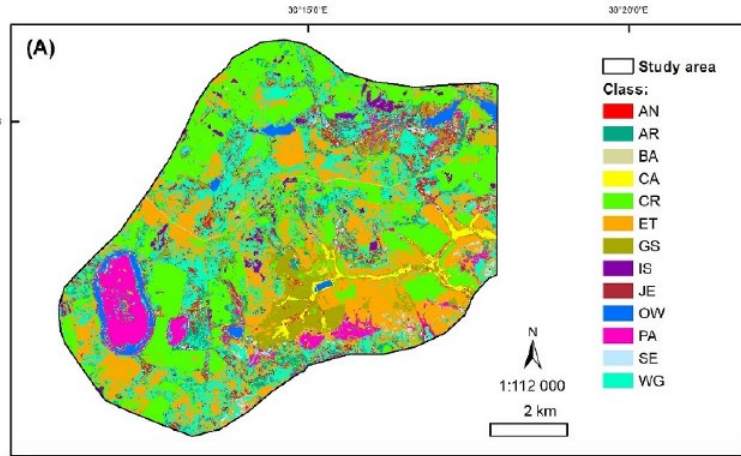


Ndlovu, N. Van Deventer, H., Hansen, C., Landman, W. (in prep).  
Assessing changes in the hydrological regime of lacustrine wetlands on the Maputaland Coastal Plain, South Africa.





# B1/4) WETLAND VEGETATION COMMUNITIES



Hogsback OA: 83%WV3 78% S2

Tevredenpan OA: 79%WV3 74% S2



Van Deventer, H.; Linström, A.; Naidoo, L.; Job, N.; Sieben, E.J.J. & Cho, M.A. 2022. Comparison between Sentinel-2 and WorldView-3 sensors in mapping wetland vegetation communities of the Grassland Biome of South Africa, for monitoring under climate change. Remote Sensing Applications: Society and Environment, 28. DOI: <https://doi.org/10.1016/j.rsase.2022.100875>.

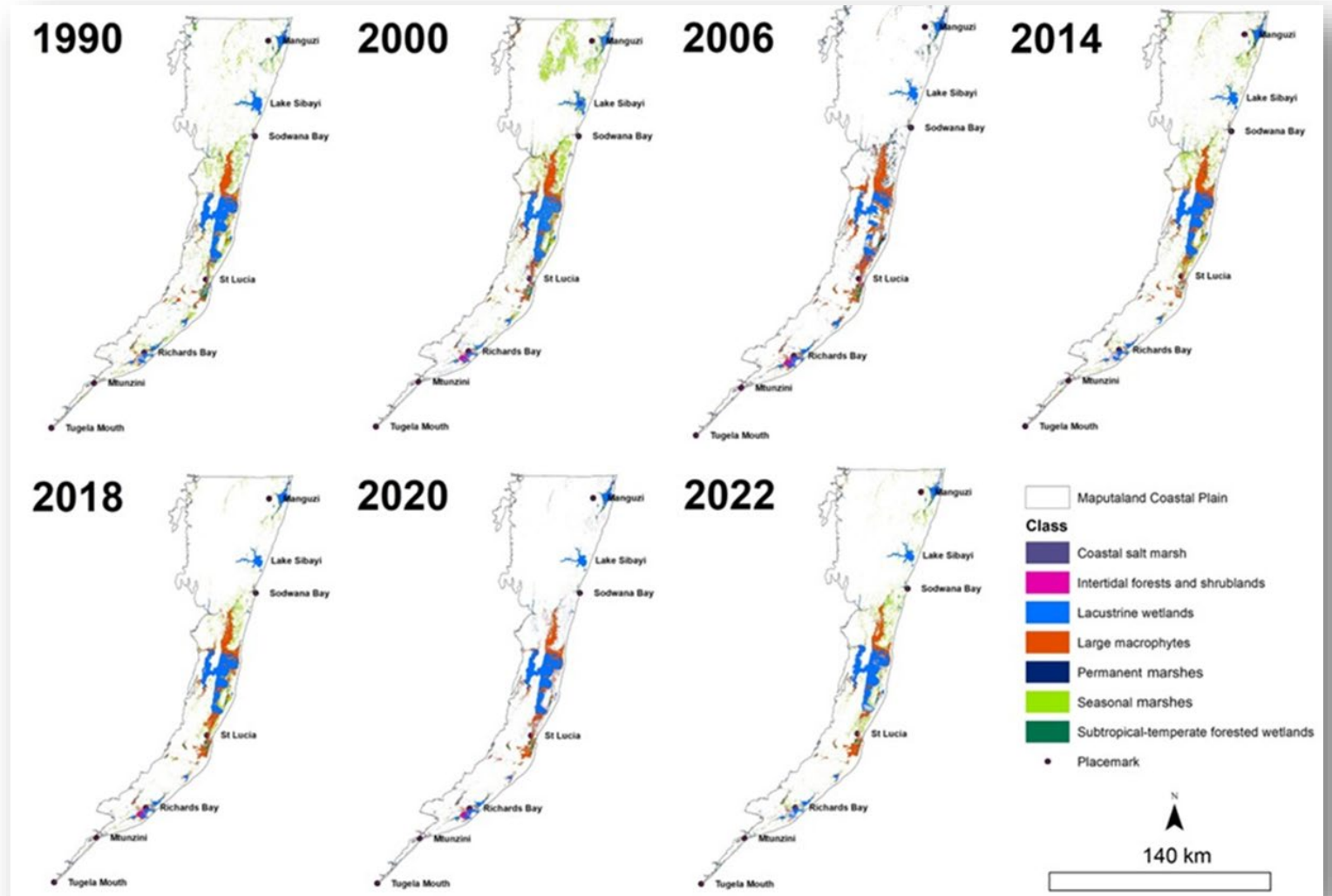
# B2/4) WETLAND VEGETATION COMMUNITIES



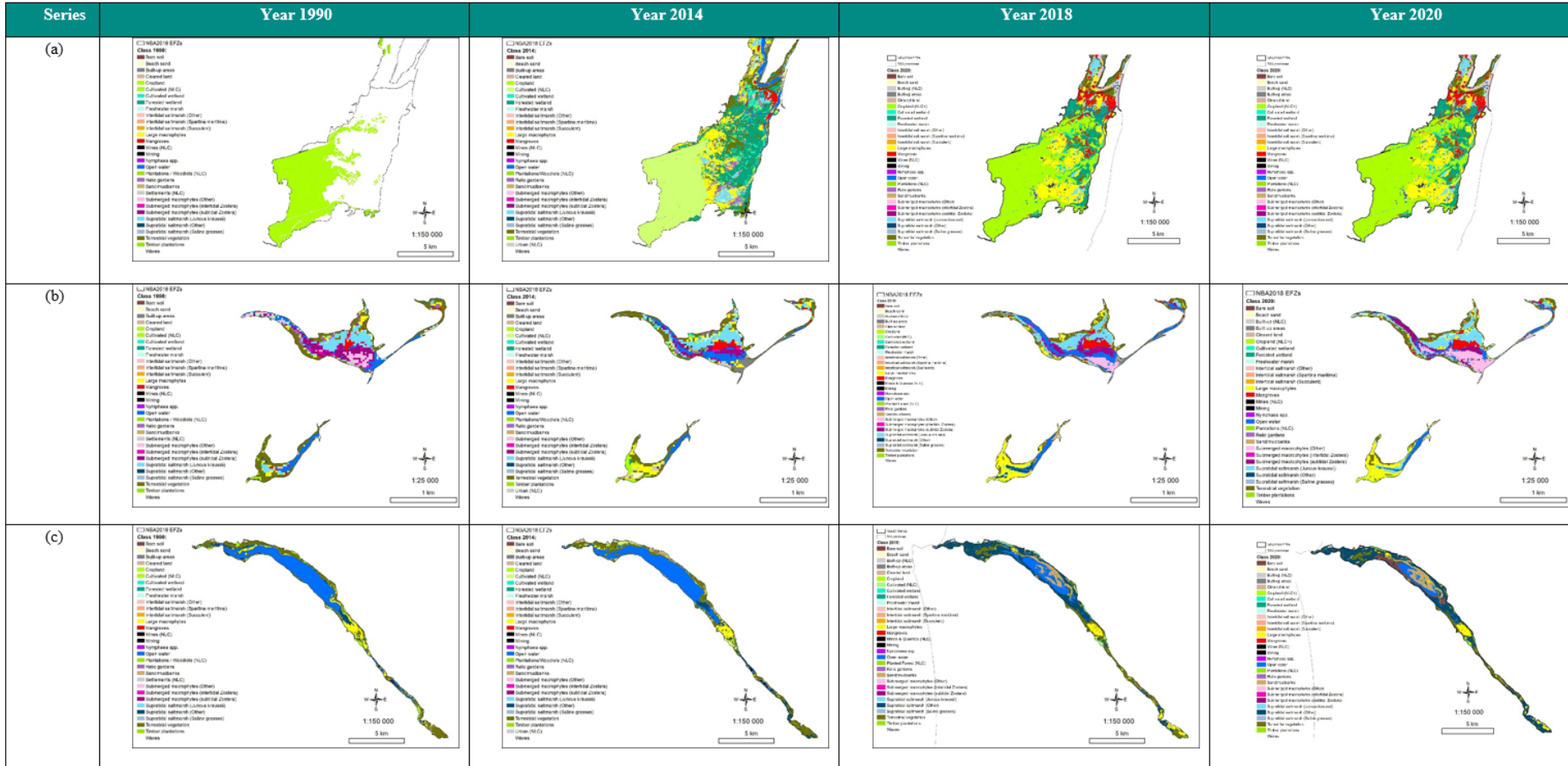
Apleni, P., Van Deventer, H., Naidoo, L., & Tsele, P. In prep. Quantifying the extent and rate of changes in wetland types of the Maputaland Coastal Plain with remote sensing.



WATER RESEARCH COMMISSION



# B3/4) EFGs IN ESTUARIES AND MICRO-ESTUARIES OF SA



Van Deventer et al. (2025) Assessing the feasibility of mapping changes of EFGs in South African estuaries using Landsat and Sentinel images of 1990, 2014, 2018 and 2020. *Wetlands, Ecology & Management*, 33:12, DOI: <https://doi.org/10.1007/s11273-024-10027-y>.



# B2/4) PLANETSCOPE IMPROVES ESTUARINE HABITAT EXTENT MAPPING



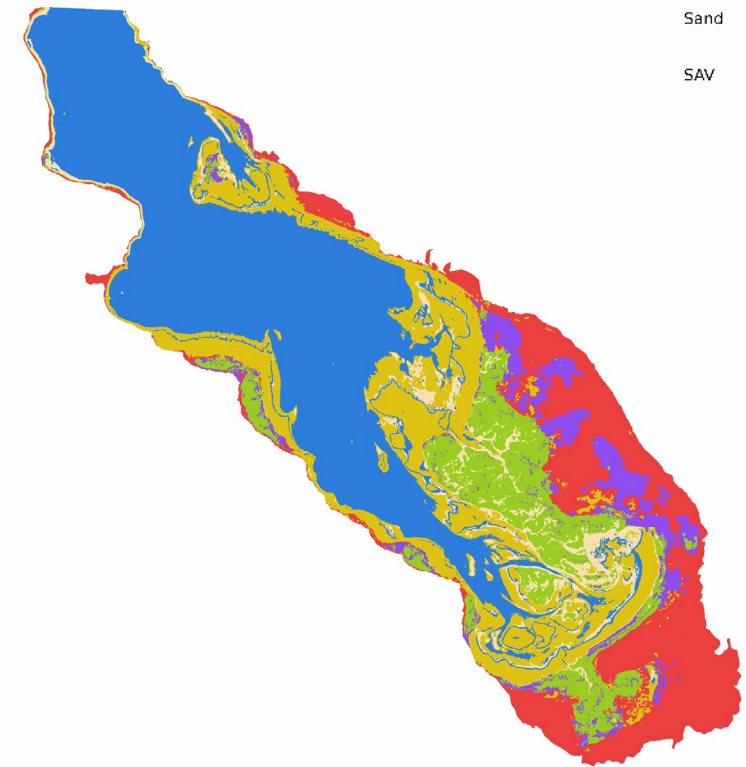
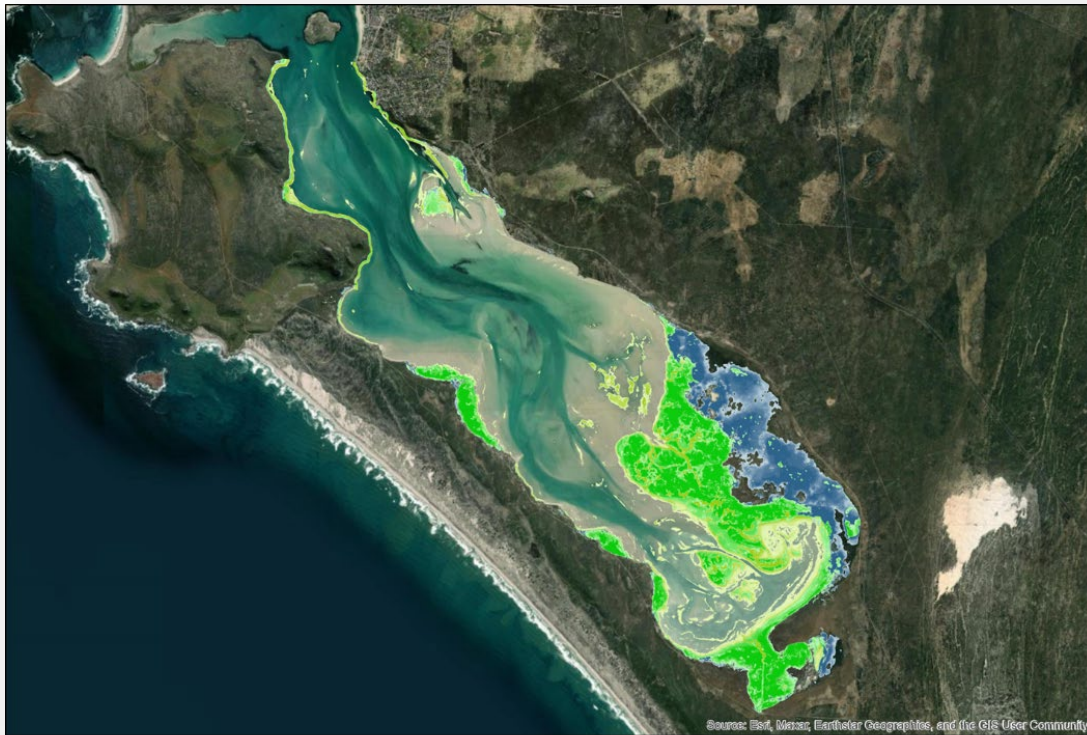
GEOBON

CEOS

esa



Campbell, A., Adam, E., Adams, J.B., Barrenblit, A., Fatoyinbo, L., Fisher, R-M., Jensen, D., Naidoo, L., Ridden, T., Simard, M., Smith, K., Thakali, P., Van Deventer, H., Van Niekerk, L., Stovall, A. In prep. Monitoring Coastal estuarine habitats for biodiversity along the temperate bioregion of South Africa.



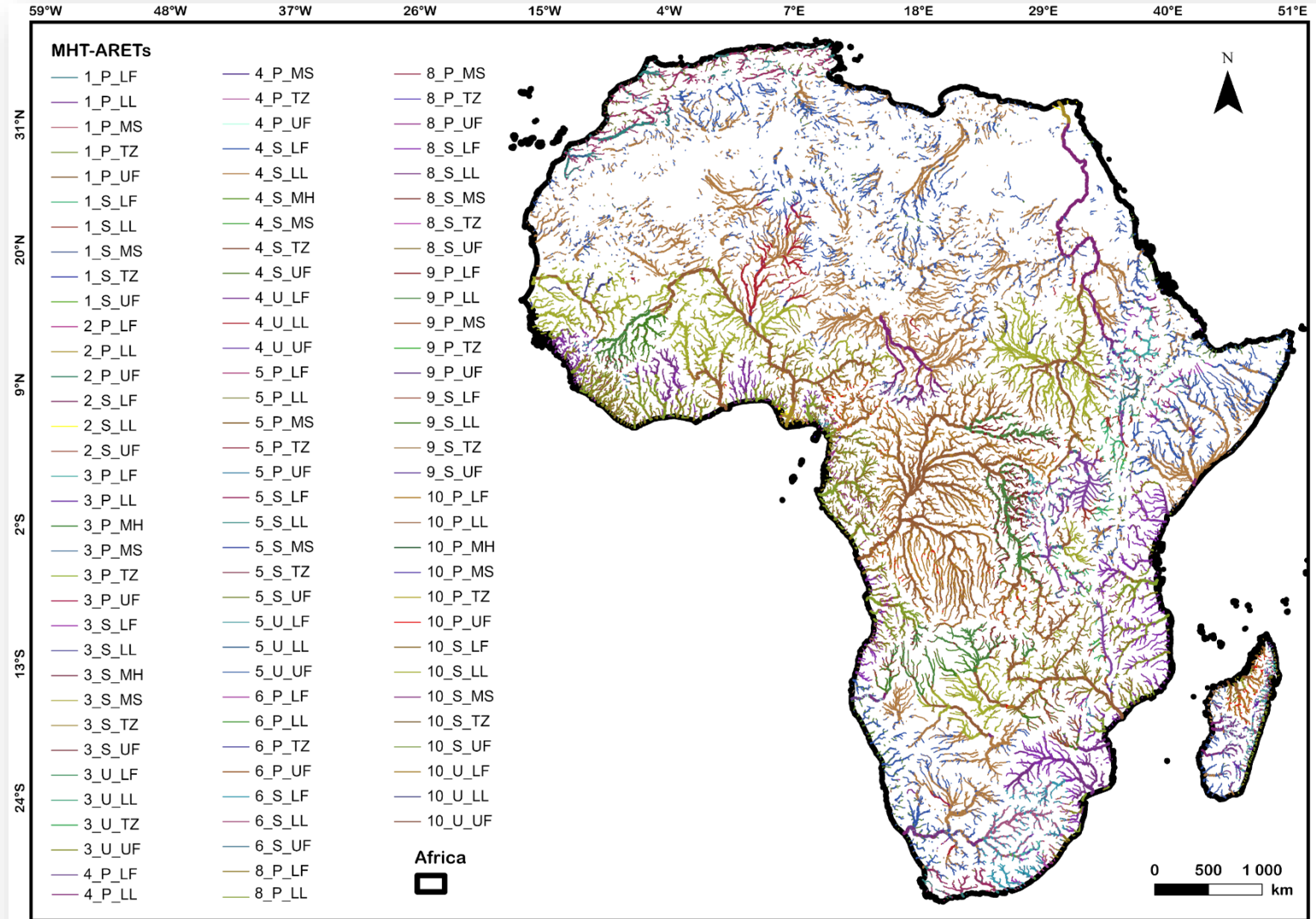
# C1/2) AFRICA'S RIVER ECOSYSTEM TYPES



Goso, L., Van Deventer, H., Hansen, C., Smith-Adao, L., Sadiki, M. (in prep).  
Assessing the biodiversity, threat status and protection levels of Africa's rivers using geospatial methods.

Biodiversity types:

- River Atlas (Linke et al.)
- MHT/FEOW (Abell et al.)
- Flow types
- LGZs

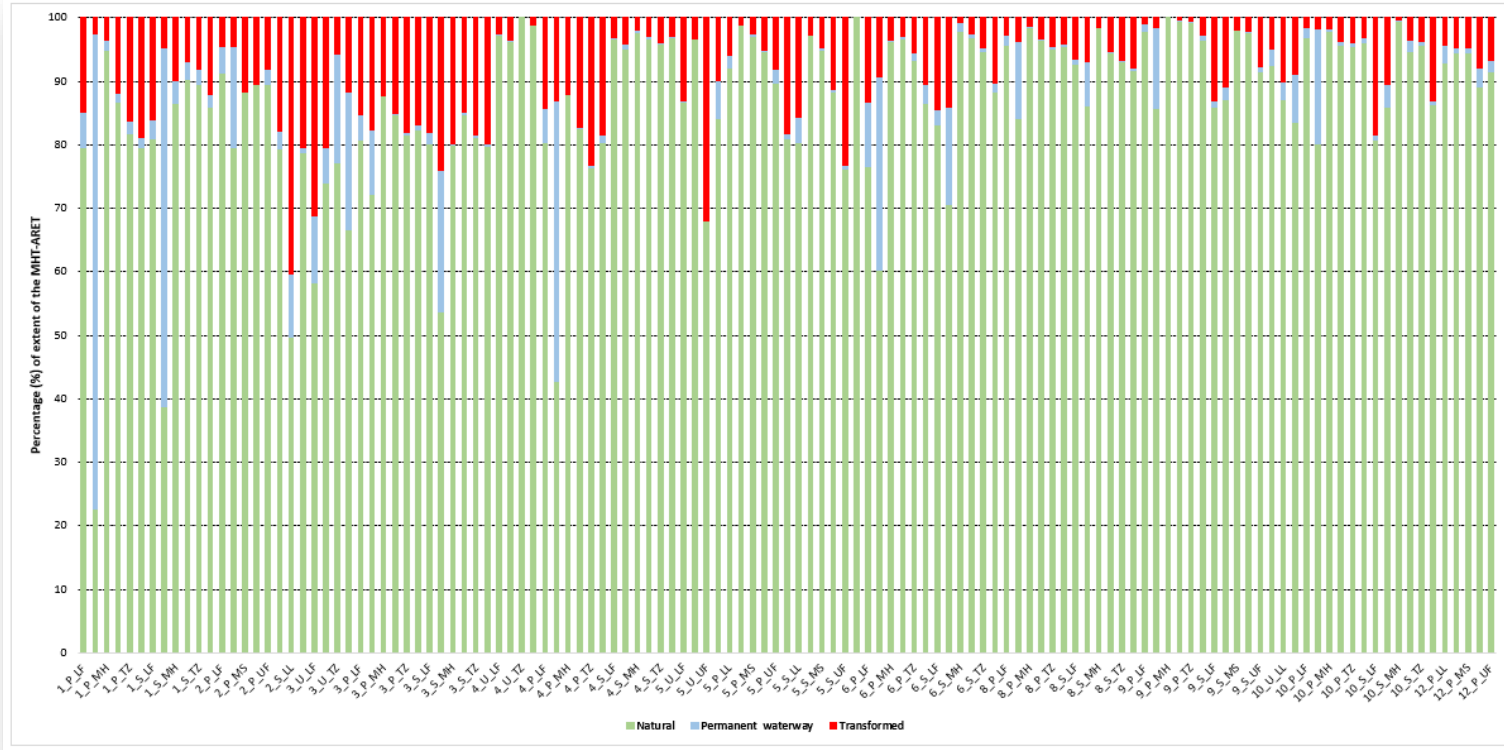
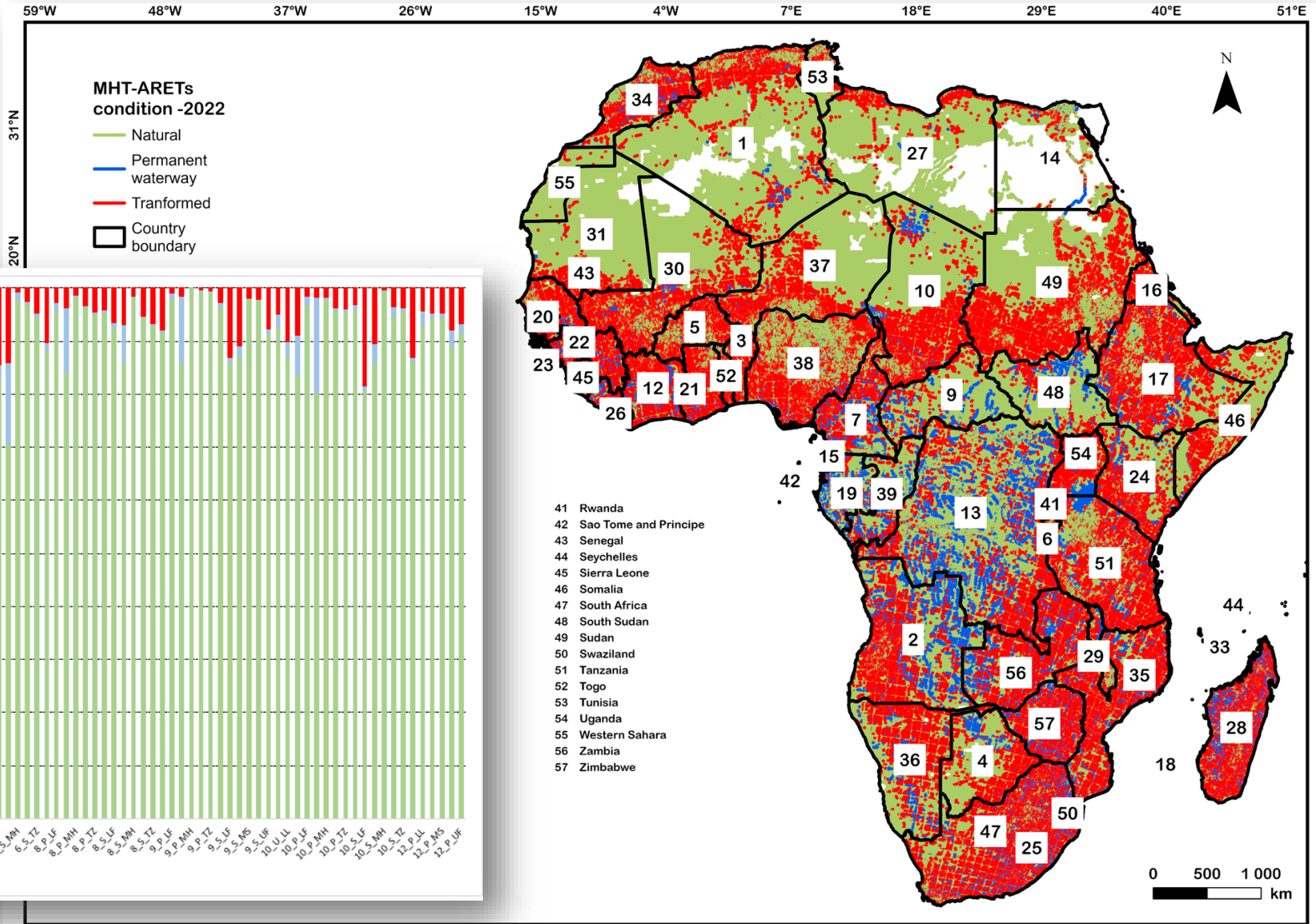


# C2/2) AFRICAN RIVER TYPES ~ ECOLOGICAL CONDITION



WATER RESEARCH COMMISSION

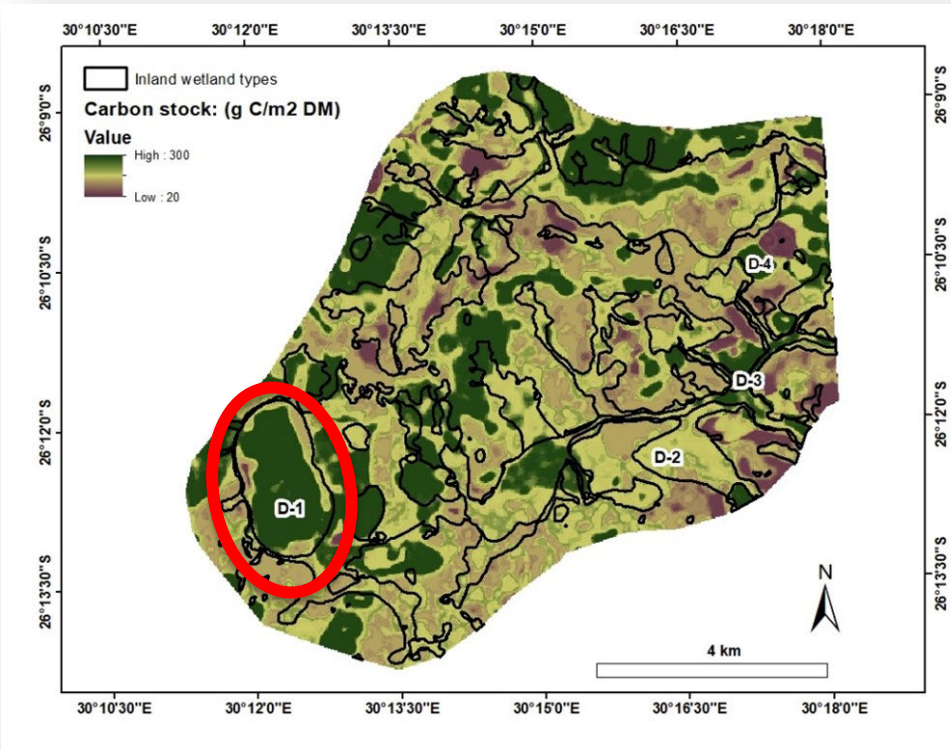
## ESA's WorldCover 2022 (Zanaga et al., 2022)



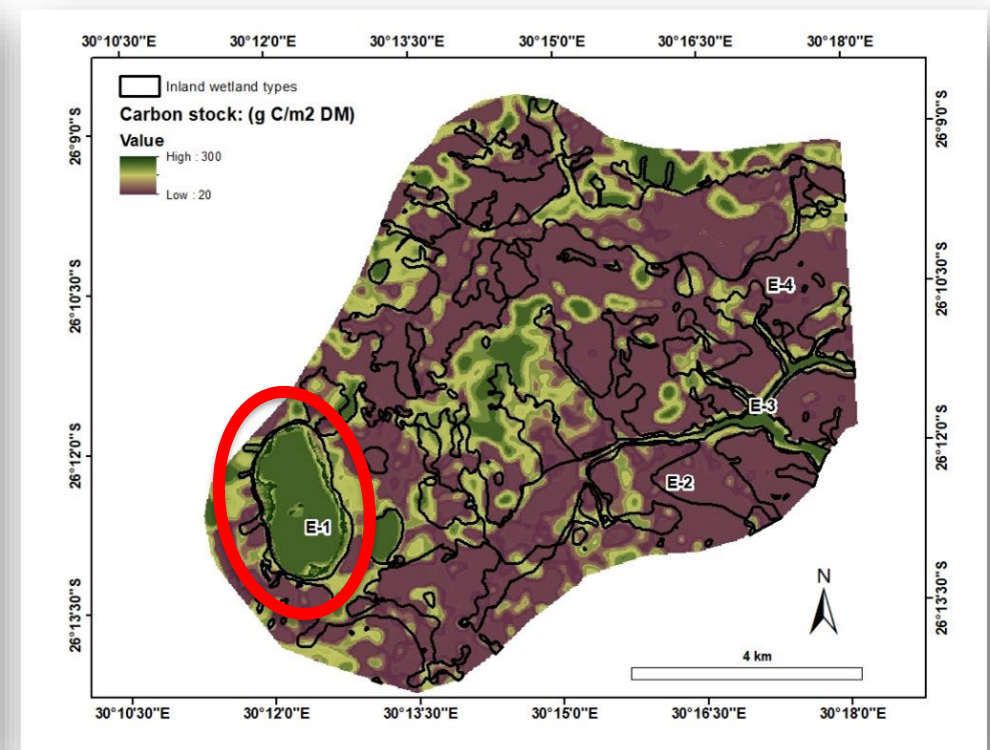
# D1/3) EBV : ABOVE-GROUND BIOMASS (AGB)



Ngebe, S., Naidoo, L., Van Deventer, H. & Tsele, P. In prep. Assessment of seasonal variations in teal carbon of palustrine wetlands in the grassland biome of South Africa

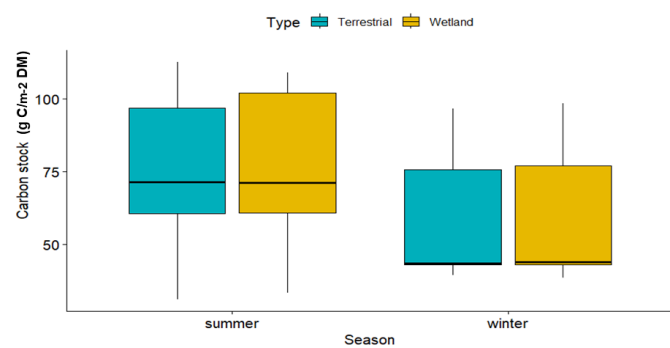


Summer 2017



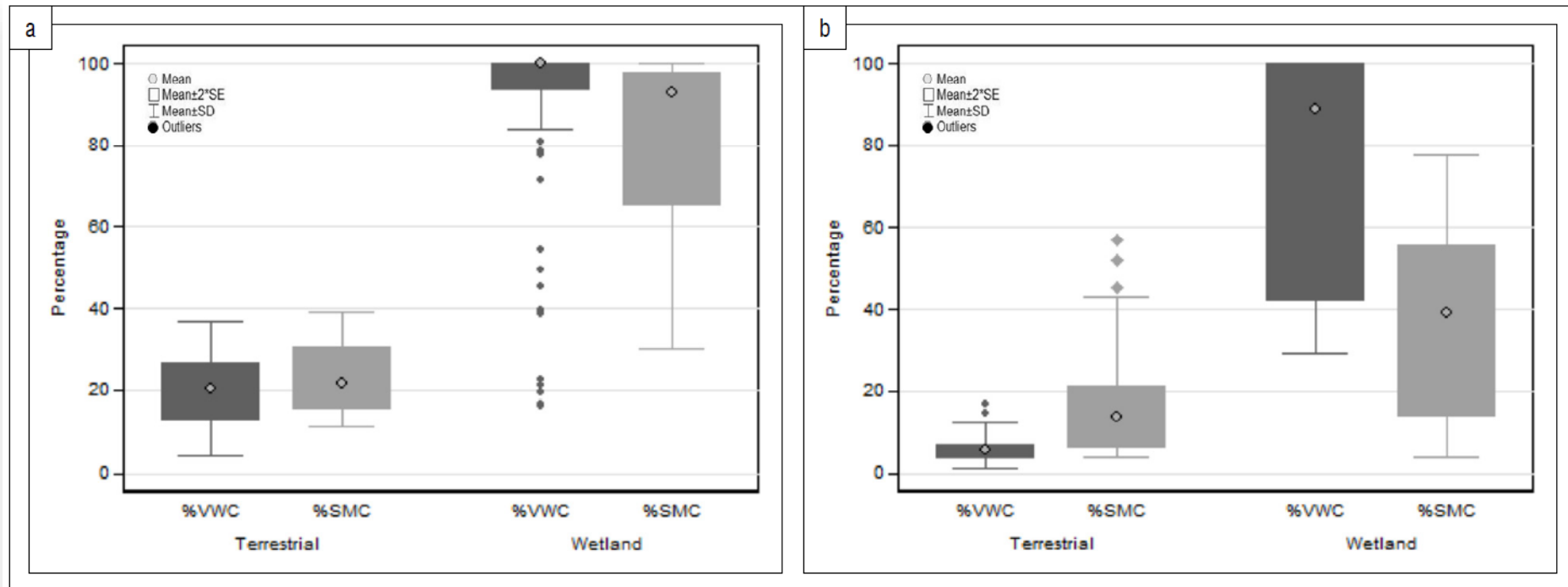
Winter 2017

## Grassland biome



# D2/3) ECV: SOIL MOISTURE OF PALUSTRINE WETLANDS

## Grassland biome



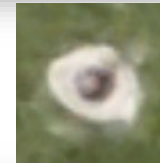
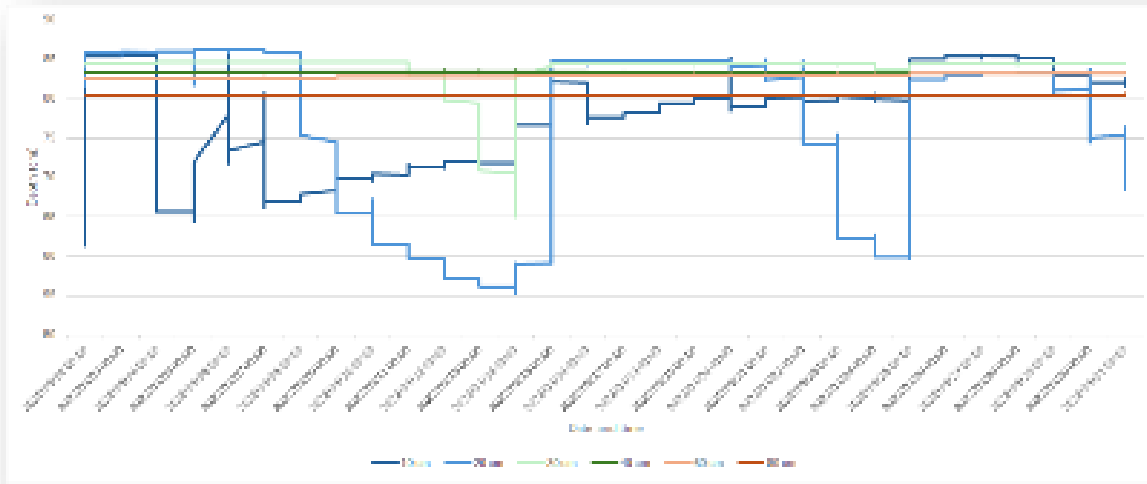
**Figure 2:** Percentage volumetric water content (%VWC) and predicted percentage of soil moisture content (%SMC) values between terrestrial and wetland areas for (a) Sentinel-1B on 28 March 2018 and (b) Sentinel-2B on 2 May 2018.



Gangat, R.; Van Deventer, H.; Naidoo, L. & Adam, E. 2020. Estimating soil moisture using Sentinel-1 and Sentinel-2 sensors for dryland and palustrine wetland areas. S Afr J Sci, 116(7/8): Art. #6535, 9 pages. DOI: <https://doi.org/10.17159/sajs.2020/6535>.



# D3/3) ECV -> EBV SOIL MOISTURE FOR PALUSTRINE WETLANDS



Airborne C & L-band SAR 2022



Drone image Sept 2024 ->



# THREE KEY RECOMMENDATIONS



1. Funding for wetland validation remains challenging for African FWBON members;
2. Citizen Science App to monitor wetlands ecosystem types (wetlands, rivers and springs) and pollution (macro plastics); &
3. Hybrid attendance and presentation of African FWBON members.



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[HvDeventer@csir.co.za](mailto:HvDeventer@csir.co.za)

