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

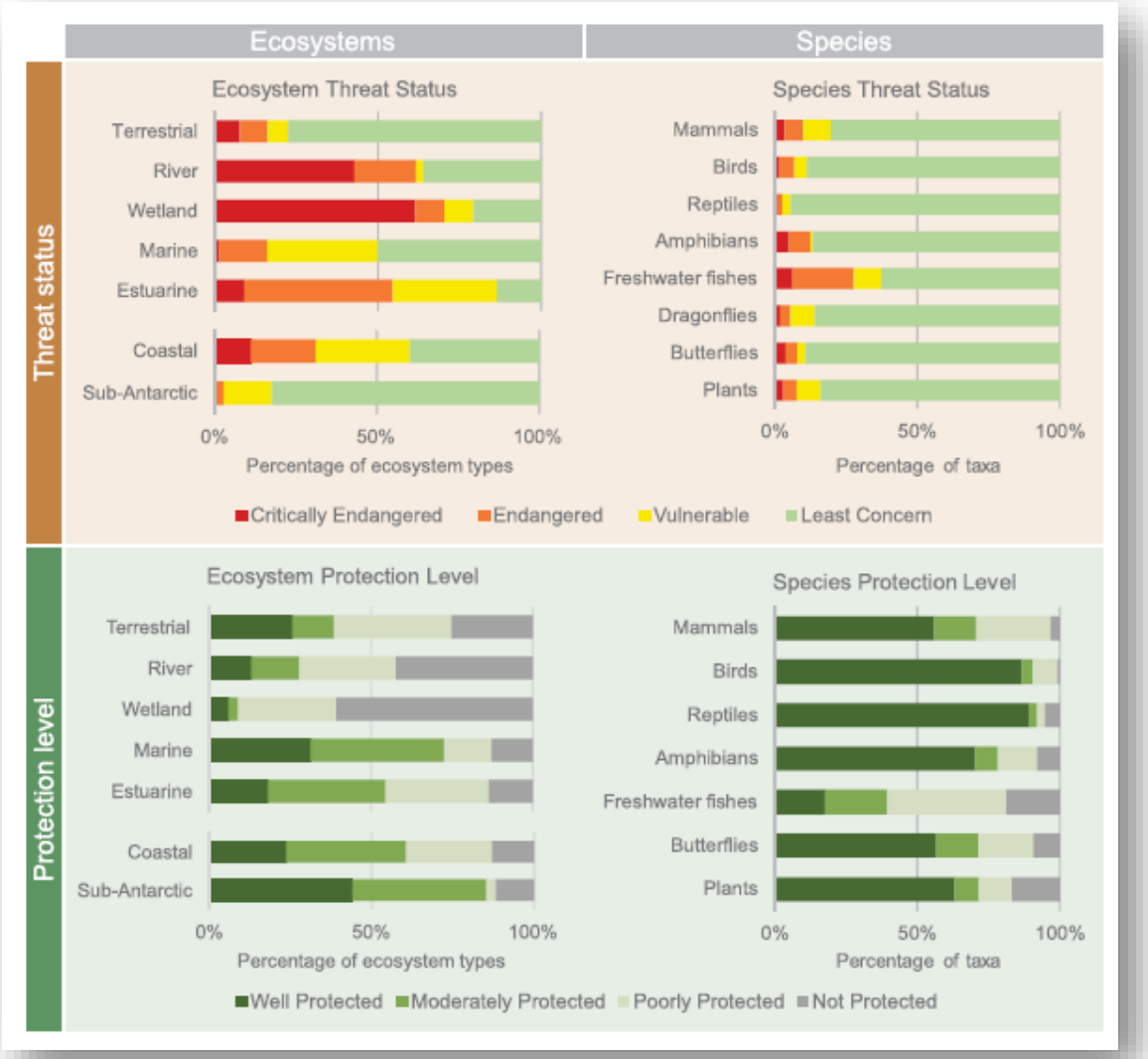
National Biodiversity Assessment

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

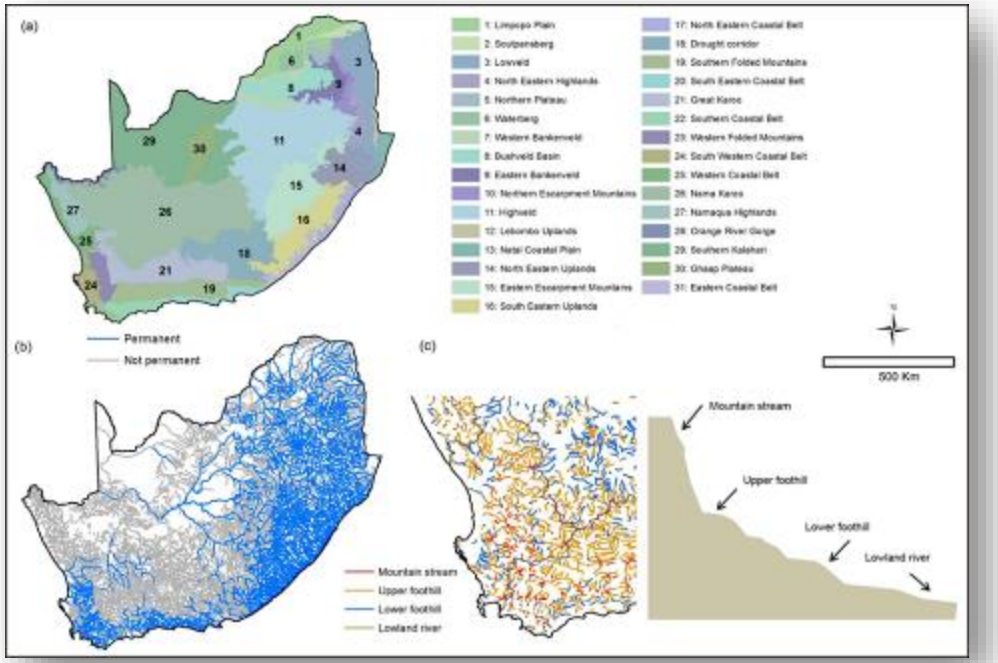


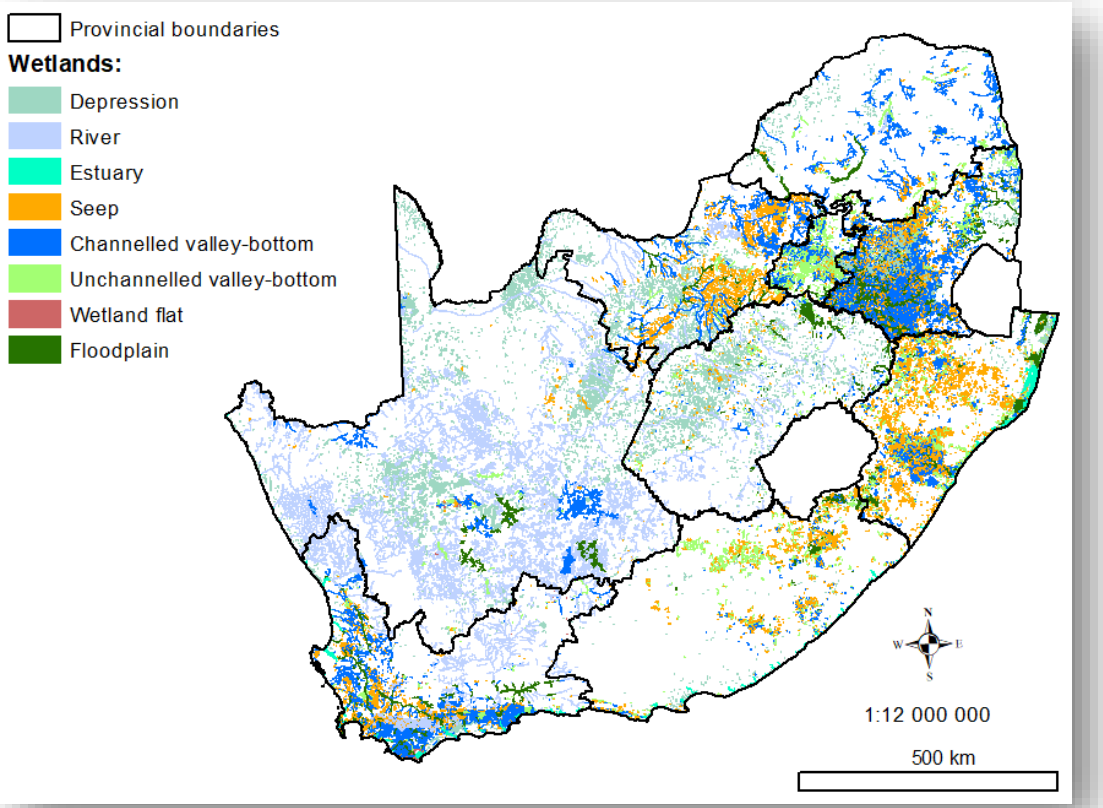
https://biodiversityadvisor.sanbi.org/

INLAND WETLANDS / FRESHWATER ECOSYSTEMS

Biodiversity types

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





Inland wetlands:

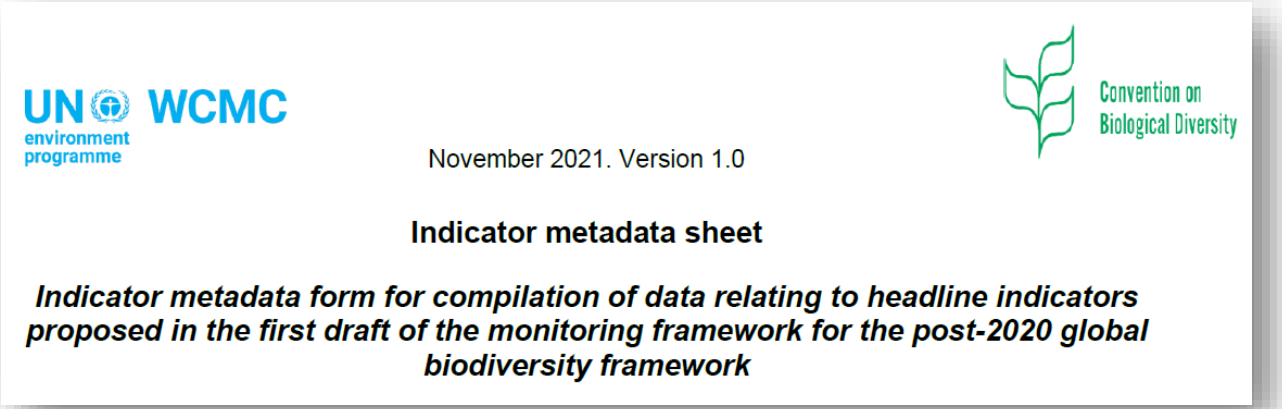
- Predominantly palustrine 55%
- Arid 34%
- Inundated / lacustrine 11%

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



UN environment programme WCMC

Convention on Biological Diversity

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

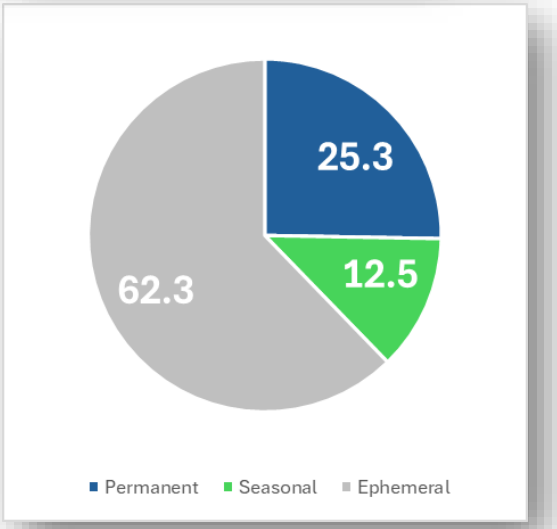
d) monitoring of **EBVs** such as above-ground biomass (i.a., for teal carbon), and ECVs soil moisture as well as the hydrological regime and phenology metrics.

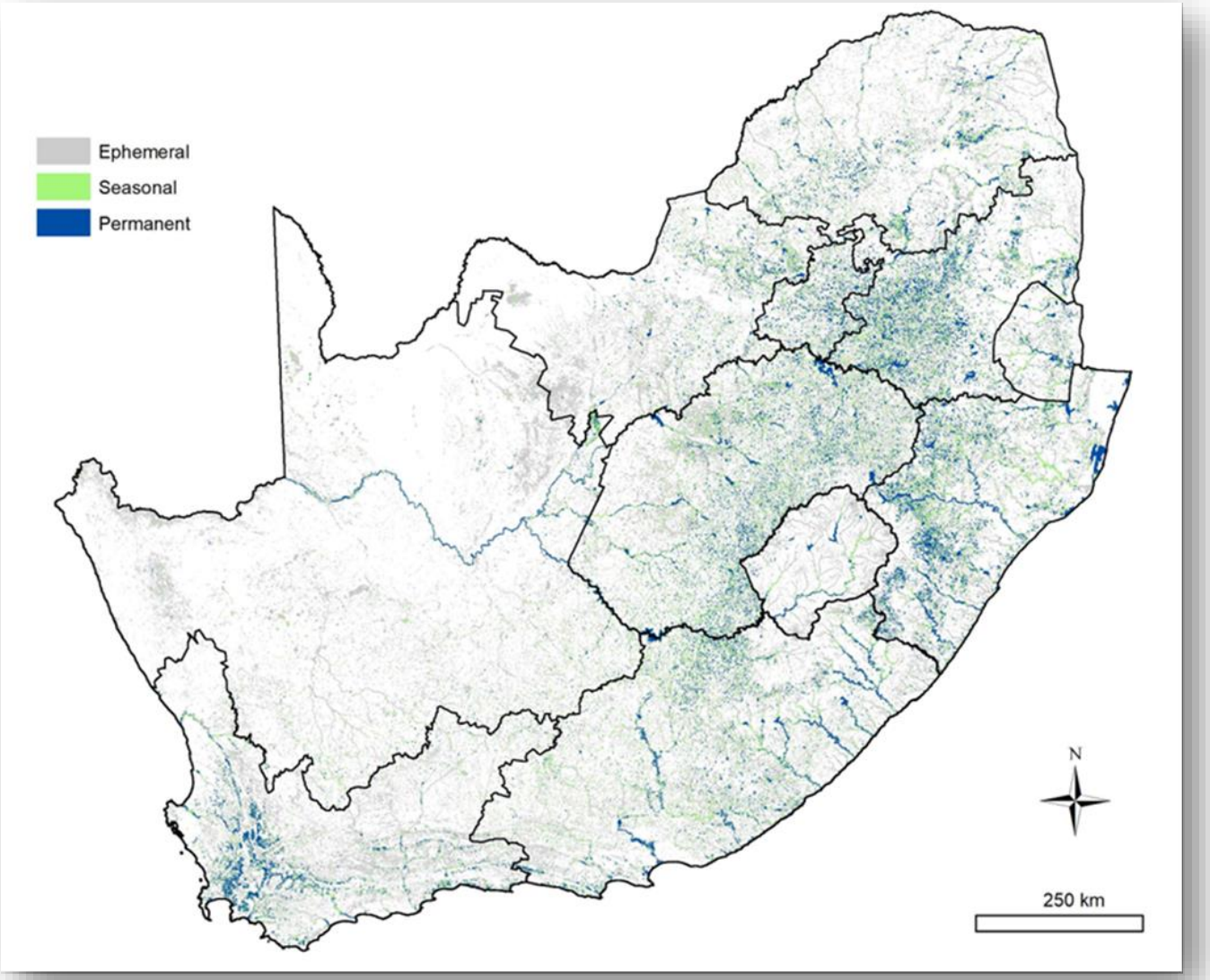
EBV - Essential Biodiversity Variables

ECV – Essential Climate variable

EFG – Ecosystem Functional Group

A1/3) LACUSTRINE WETLAND BIODIVERSITY TYPES





Van Deventer in prep

* RSA 72% arid/semi-arid

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

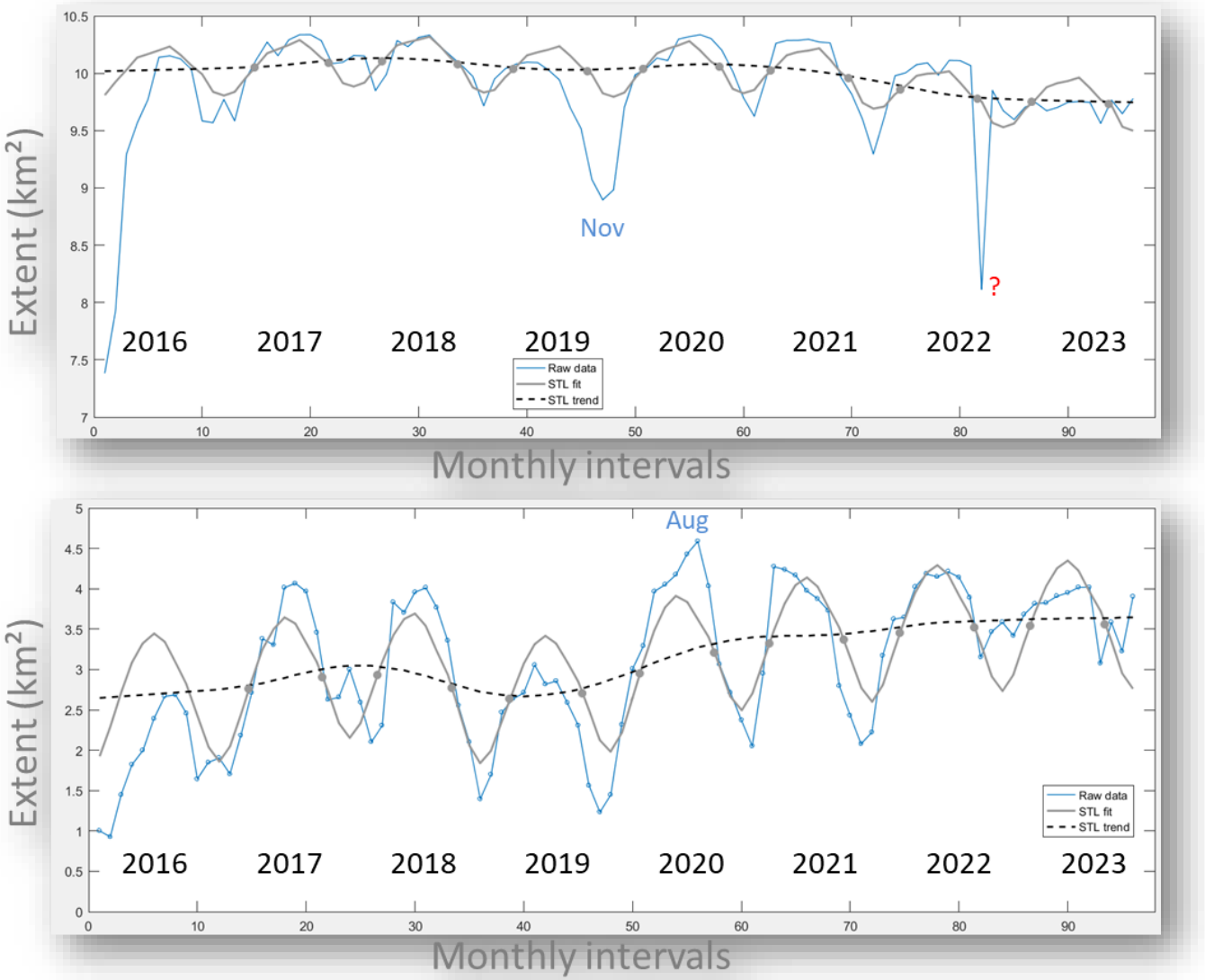
Permanent:

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

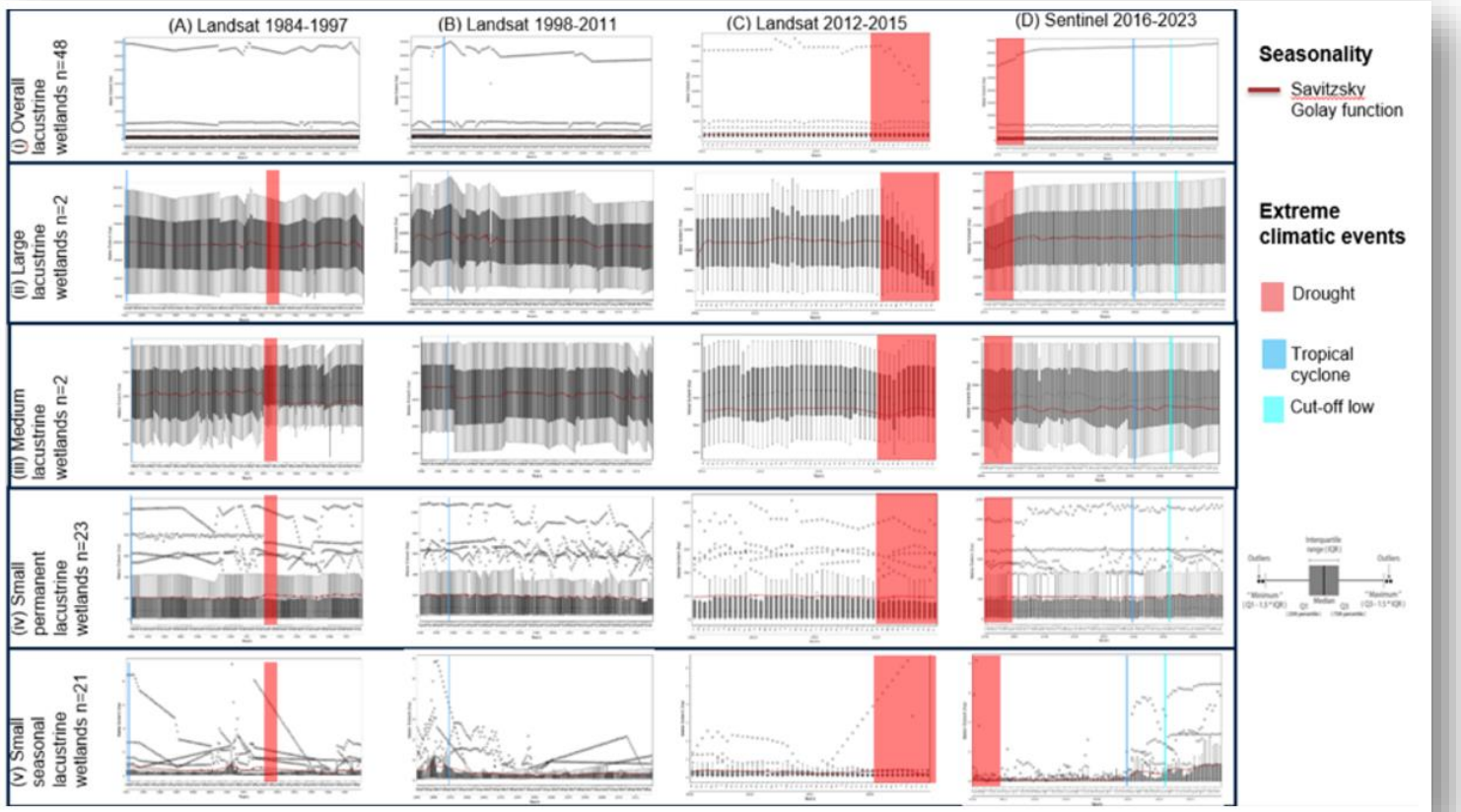
Seasonal:

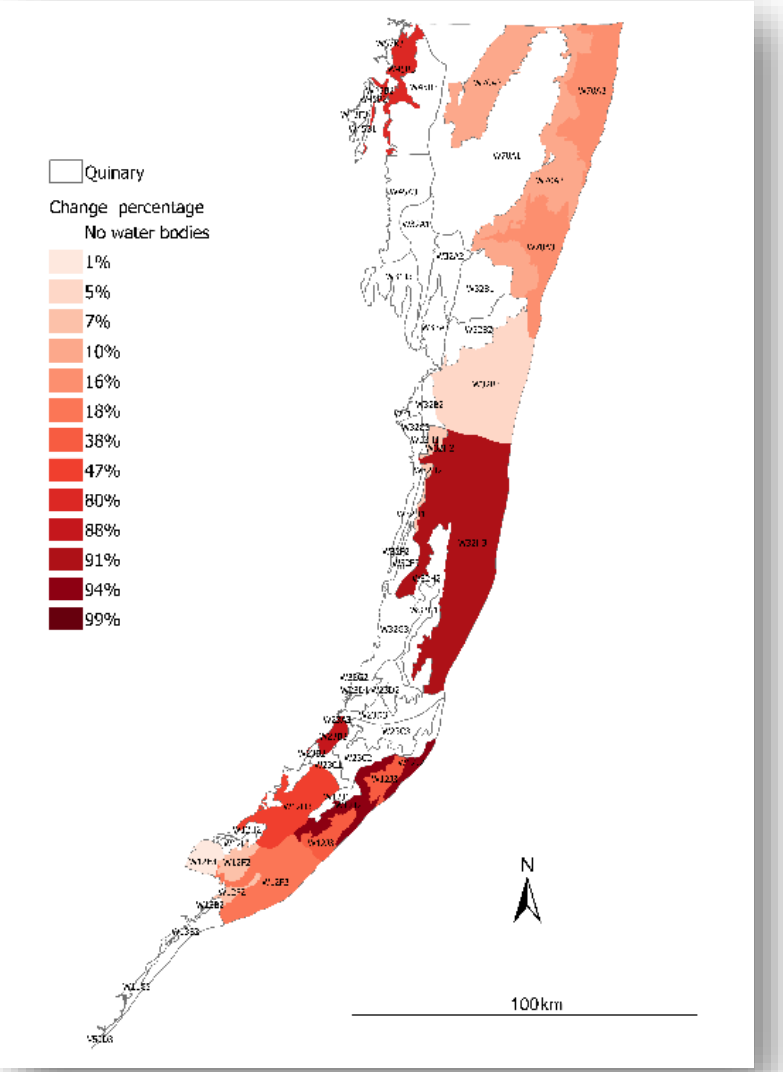
- SOS - Mar
- EOS - Sep/Oct
- POS - Jun
- Duration on average 7 months

Van Deventer in prep



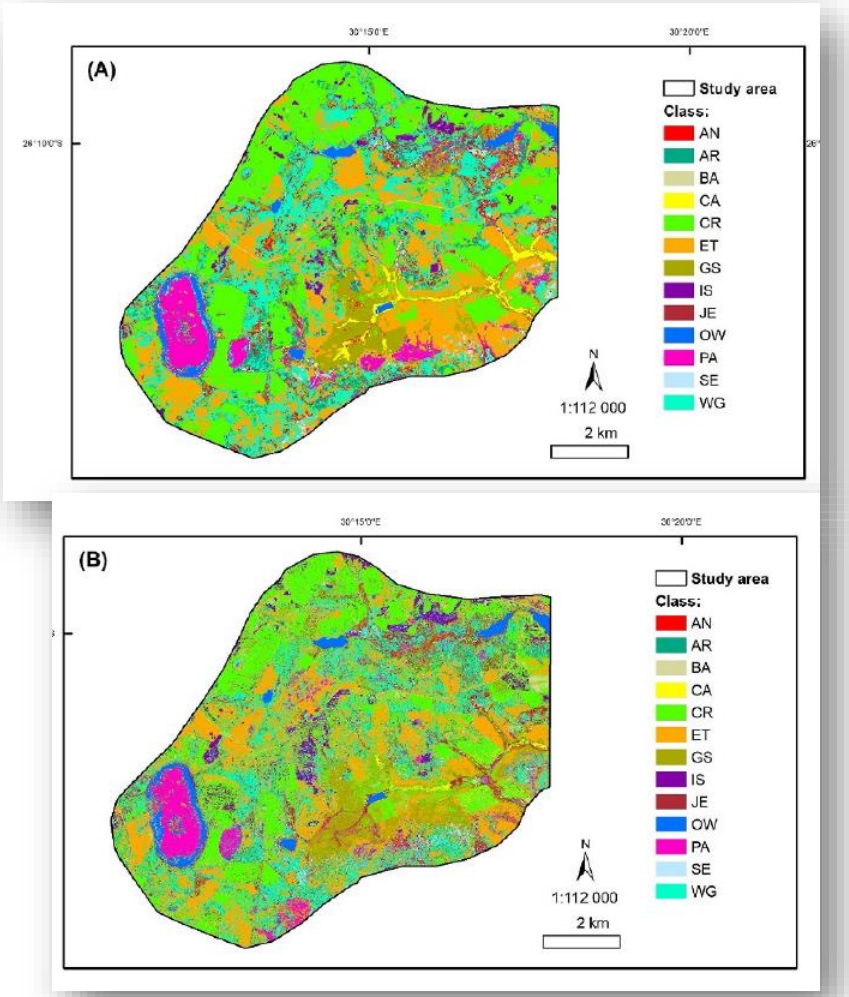
A3/3) CHANGES IN LACUSTRINE WETLAND EXTENT gw-SWSA

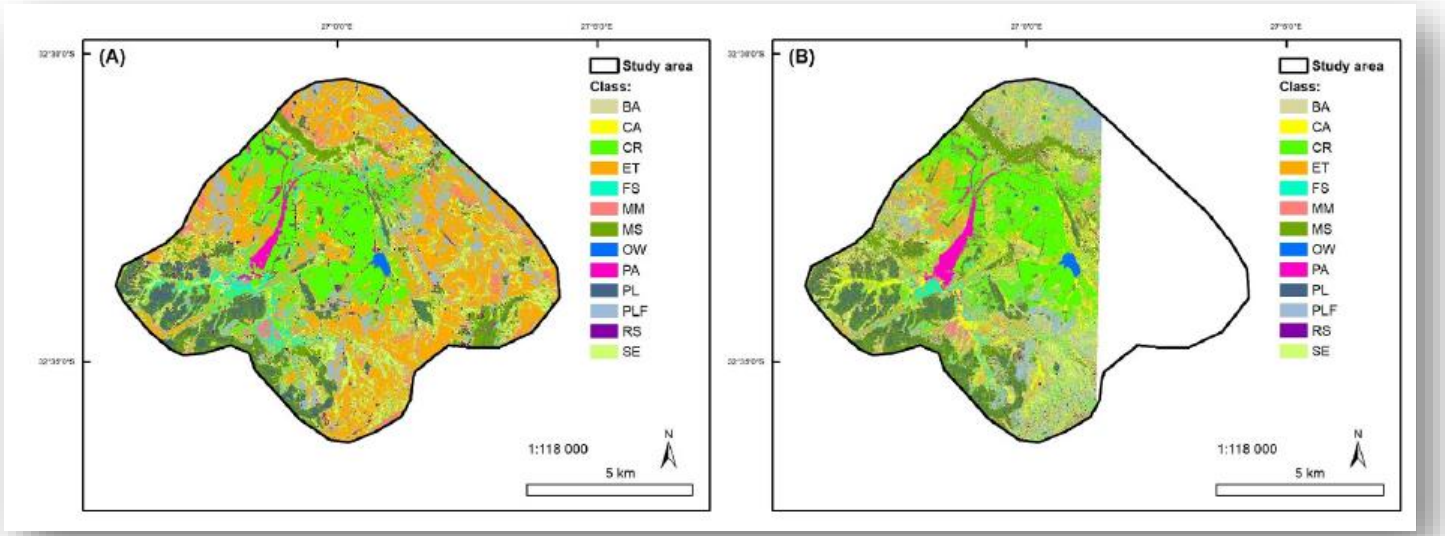




Ndlovu, N. Van Deventer, H., Hansen, C., Landman, W. (in prep). Assessing changes in the hydrological regime of lacustrine wetlands on the Maputaland Coastal Plain, South Africa.

B1/4) WETLAND VEGETATION COMMUNITIES





Hogsback OA: 83%WV3 78% S2

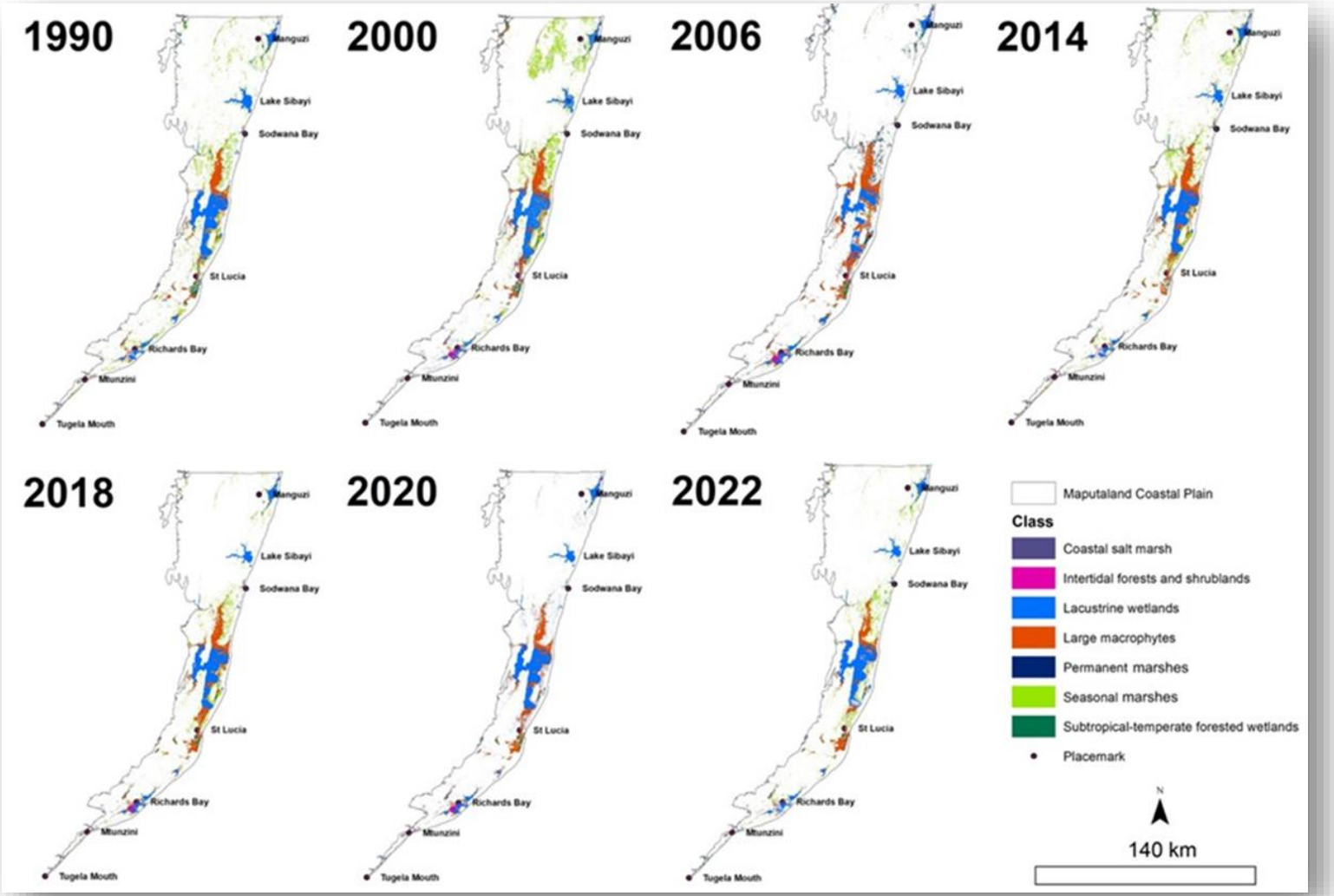
Tevredenpan OA: 79%WV3 74% S2

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.

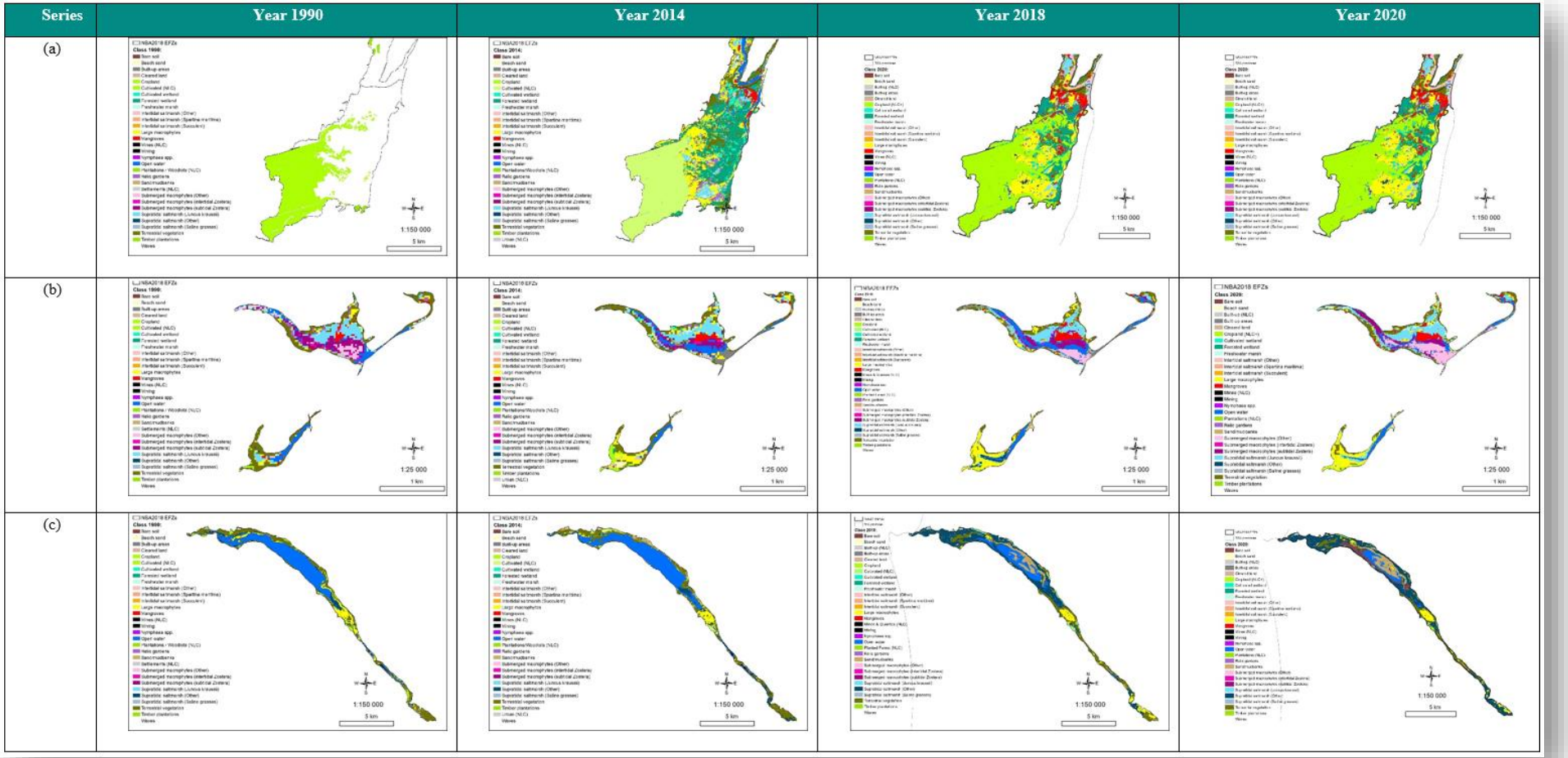
B2/4) WETLAND VEGETATION COMMUNITIES

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

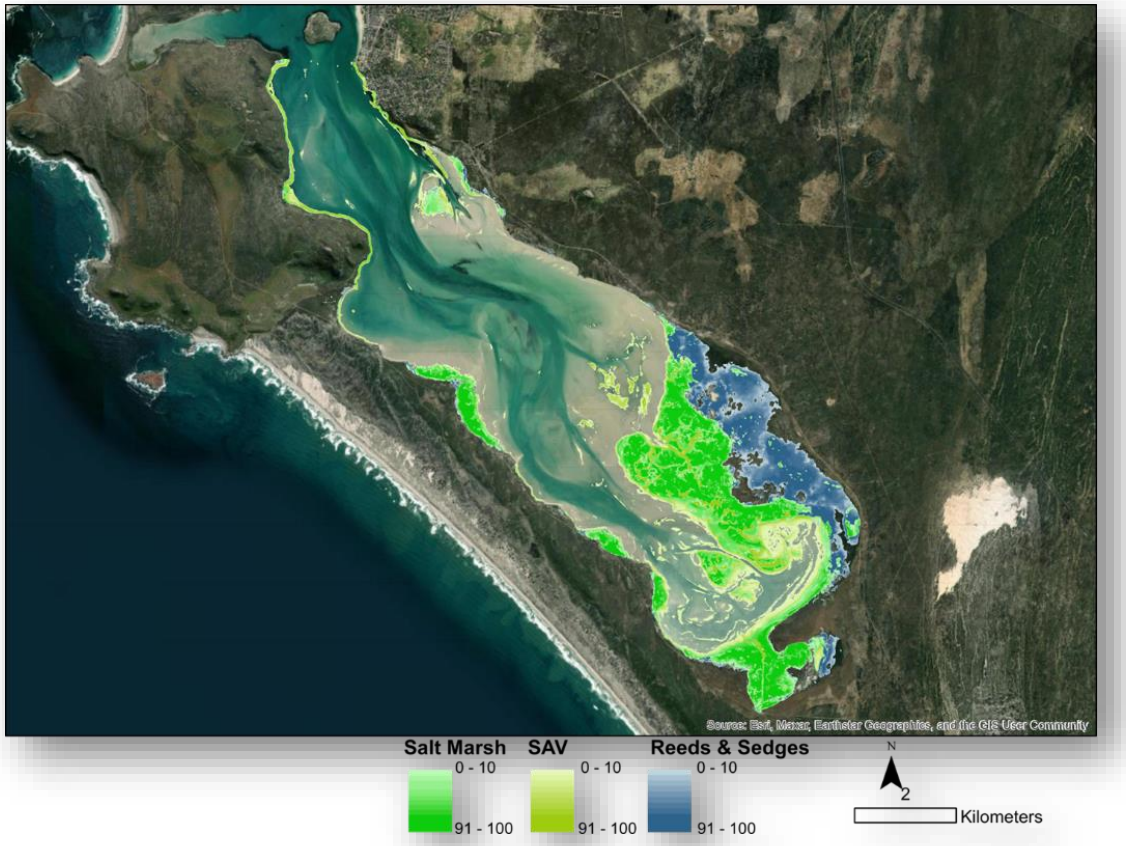


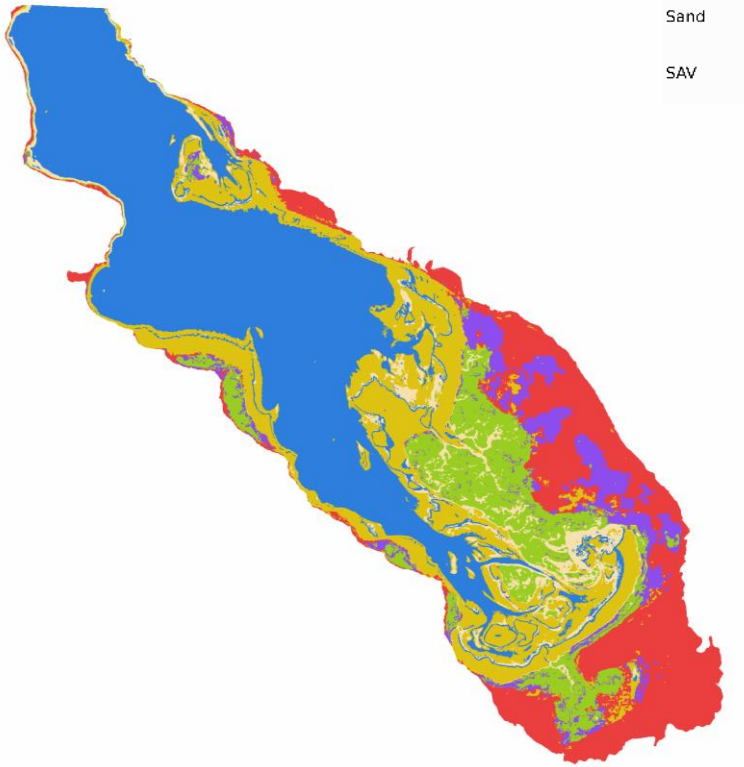
Van Deventer et al. (2025) Assessing the feasibility of mapping changes of EFGs in South African estuaries using Landsat and Sentinel images of 1990, 2014, 2018 and 2020. Wetlands, Ecology & Management, 33:12, DOI: https://doi.org/10.1007/s11273-024-10027-y.

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

B2/4) PLANETSCOPE IMPROVES ESTUARINE HABITAT EXTENT MAPPING

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

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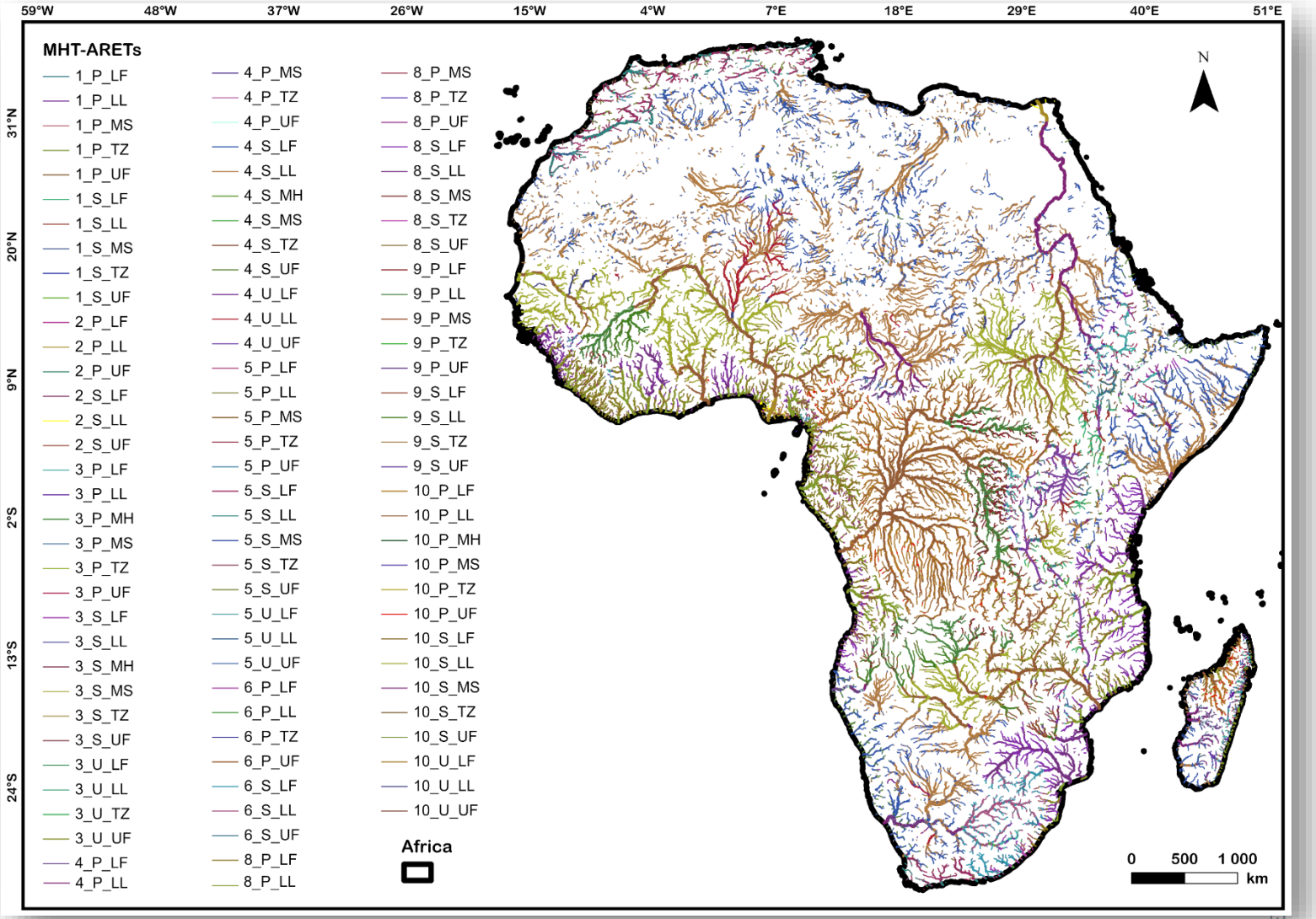

C2/2) AFRICAN RIVER TYPES ~ ECOLOGICAL CONDITION

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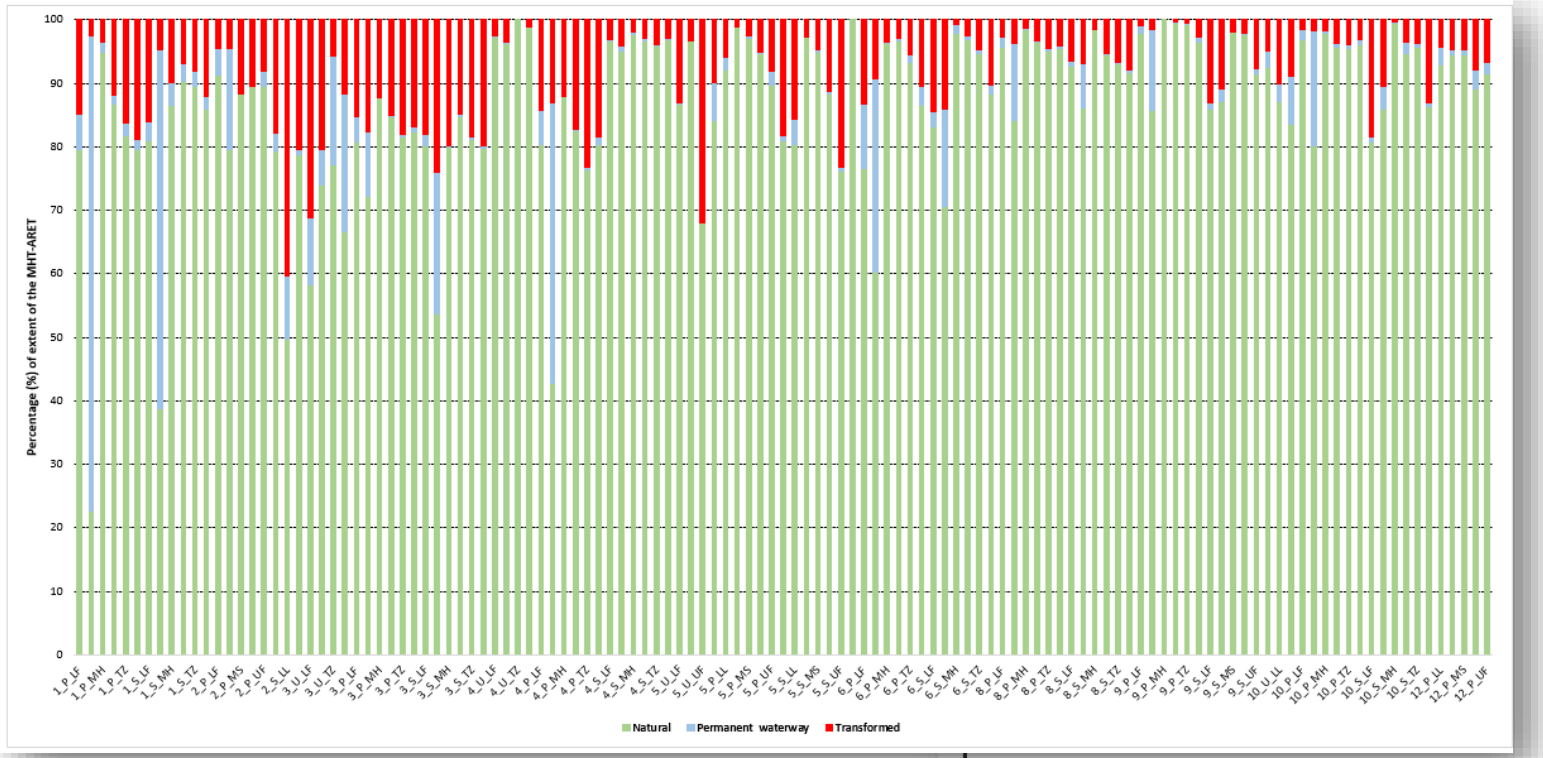
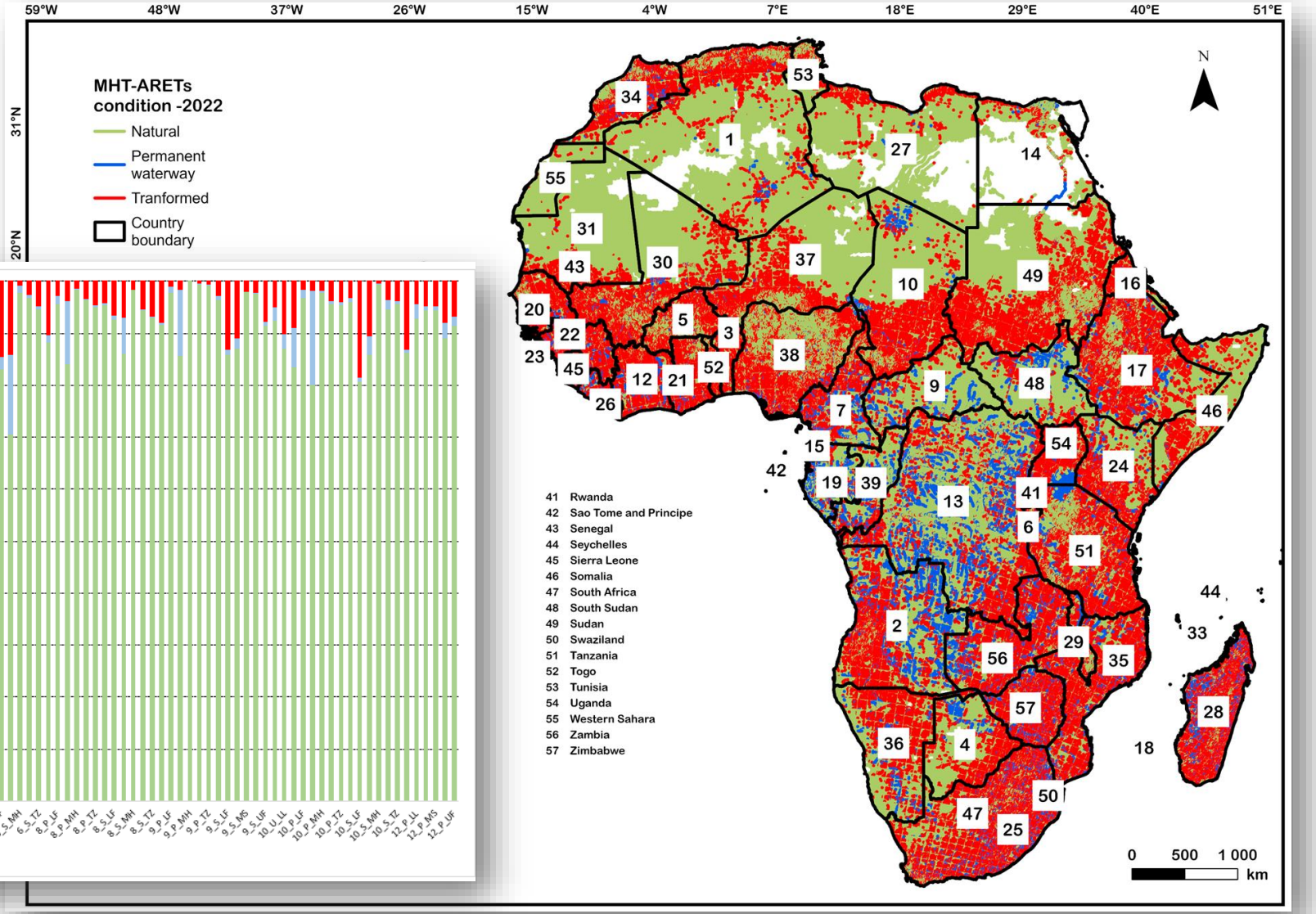
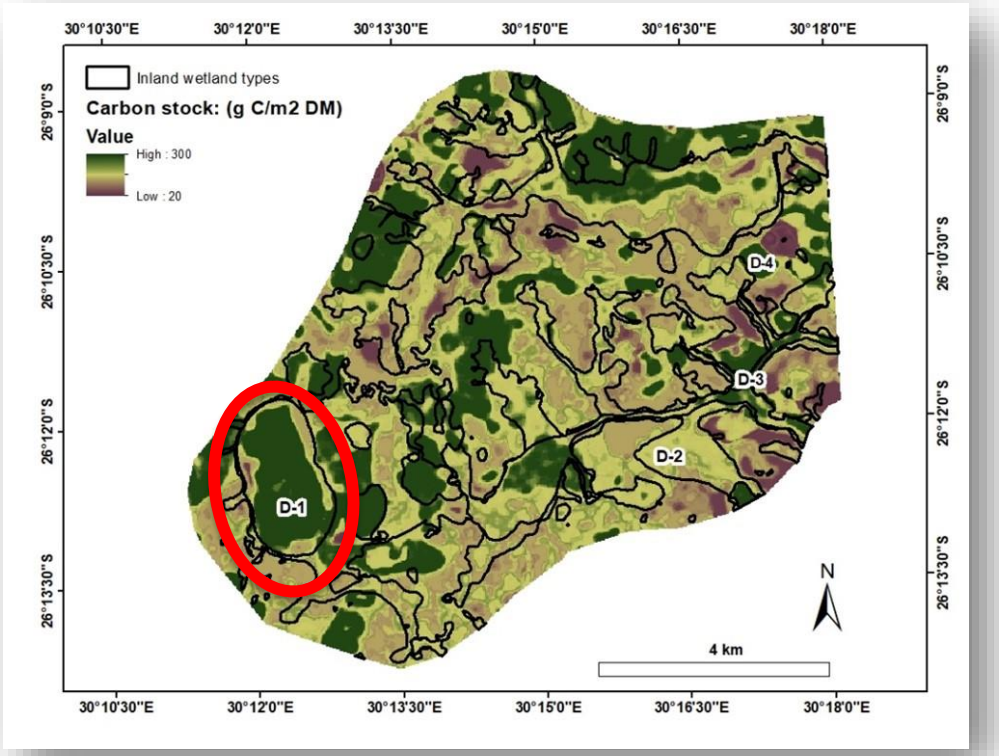
ESA's WorldCover 2022 (Zanaga et al., 2022)



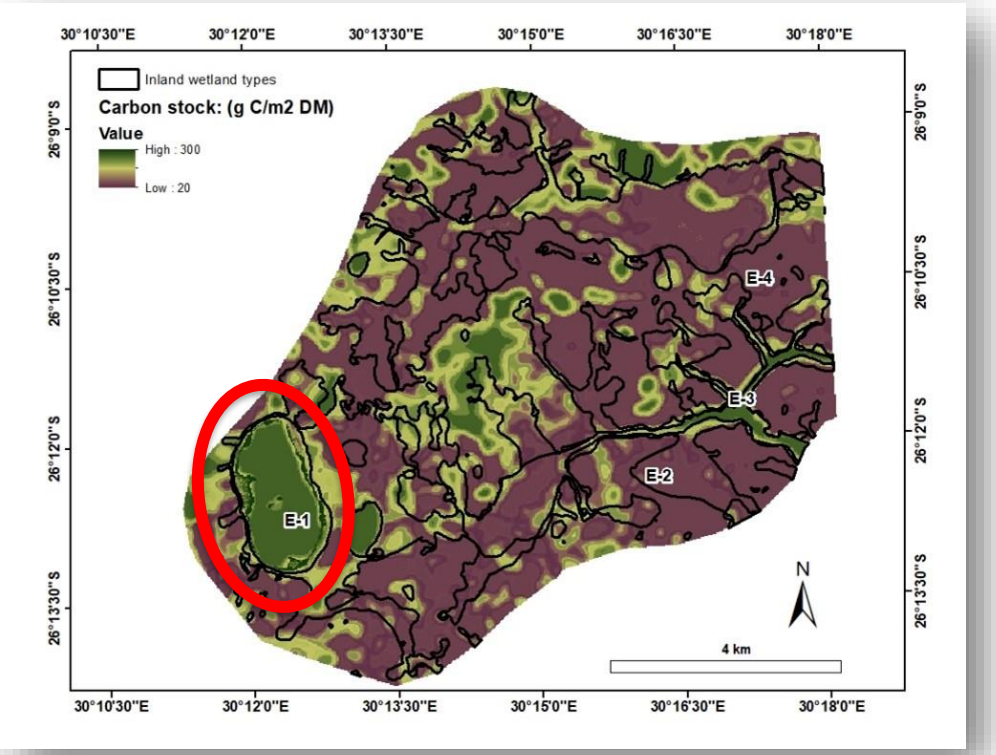


D1/3) EBV : ABOVE-GROUND BIOMASS (AGB)

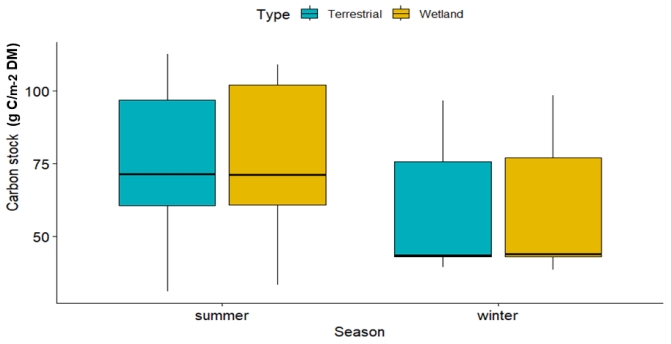
Ngebe, S., Naidoo, L., Van Deventer, H. & Tsele, P. In prep. Assessment of seasonal variations in teal carbon of palustrine wetlands in the grassland biome of South Africa



Summer 2017



Winter 2017



Grassland biome

WATER RESEARCH COMMISSION

D2/3) ECV: SOIL MOISTURE OF PALUSTRINE WETLANDS

Grassland biome

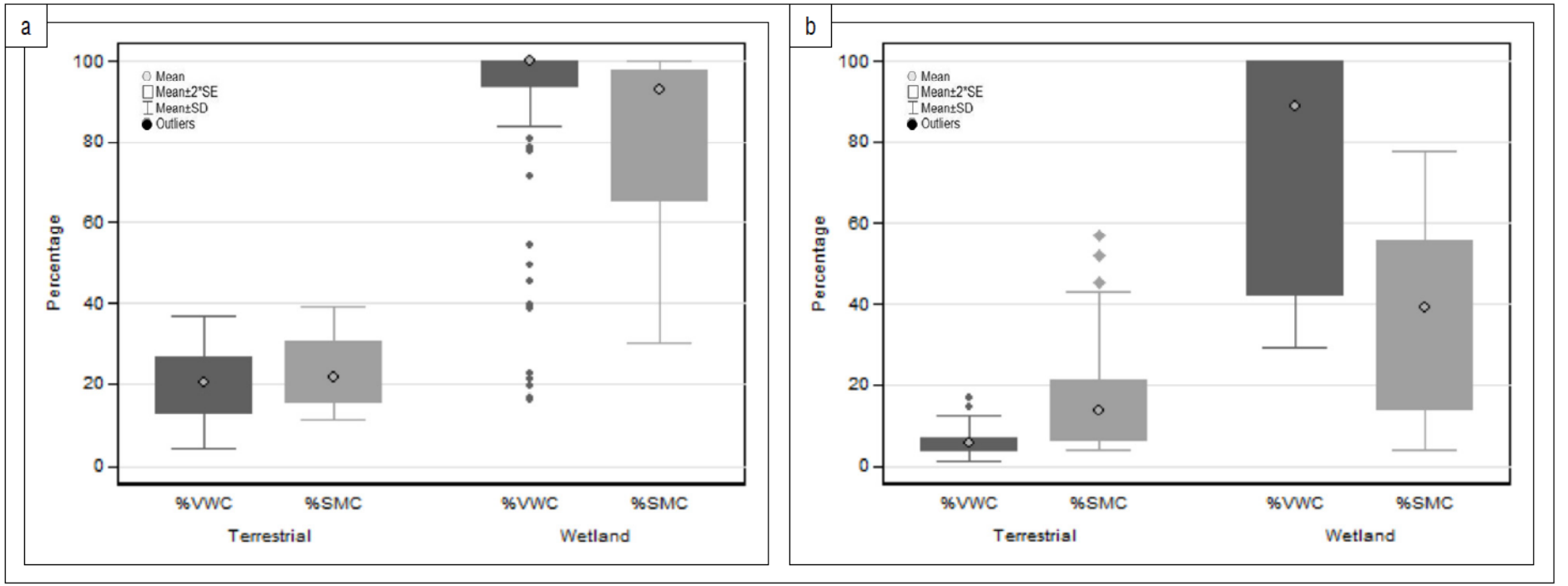
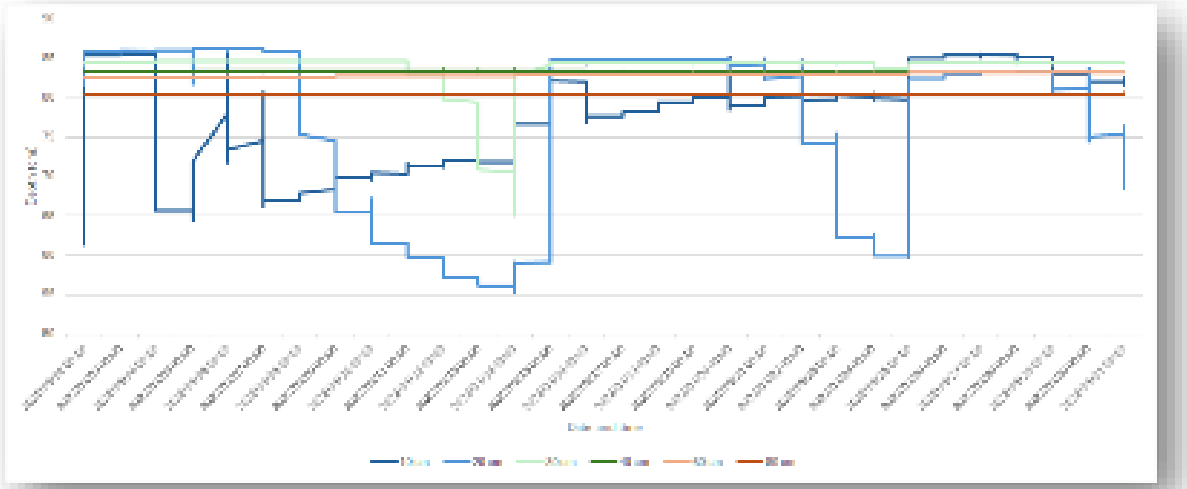


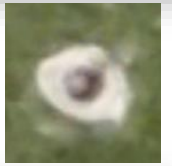
Figure 2: Percentage volumetric water content (%VWC) and predicted percentage of soil moisture content (%SMC) values between terrestrial and wetland areas for (a) Sentinel-1B on 28 March 2018 and (b) Sentinel-2B on 2 May 2018.

WATER RESEARCH COMMISSION

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 ->

National Research Foundation

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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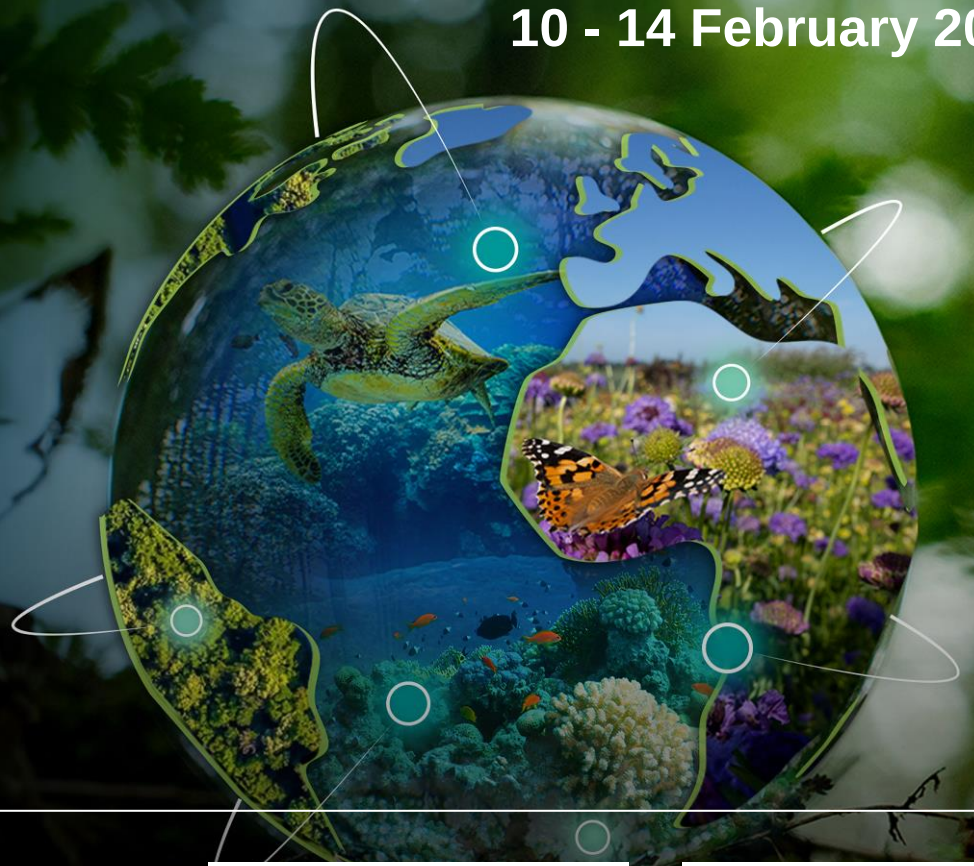

HvDeventer@csir.co.za