Monitoring changes in the extent of lacustrine wetlands of Eswatini, Lesotho and South Africa

National Space Conference
29 August 2024

Presenter: Dr Heidi van Deventer
Principal Researcher
Council for Scientific and Industrial Research (CSIR)
South Africa
Freshwater Biodiversity Observation Network CC
C-rated NRF scientist & SAGC PGP 0117

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

FWBON
Freshwater Biodiversity Observation Network

CSIR
Touching lives through innovation

Wetlands are valuable but highly threatened

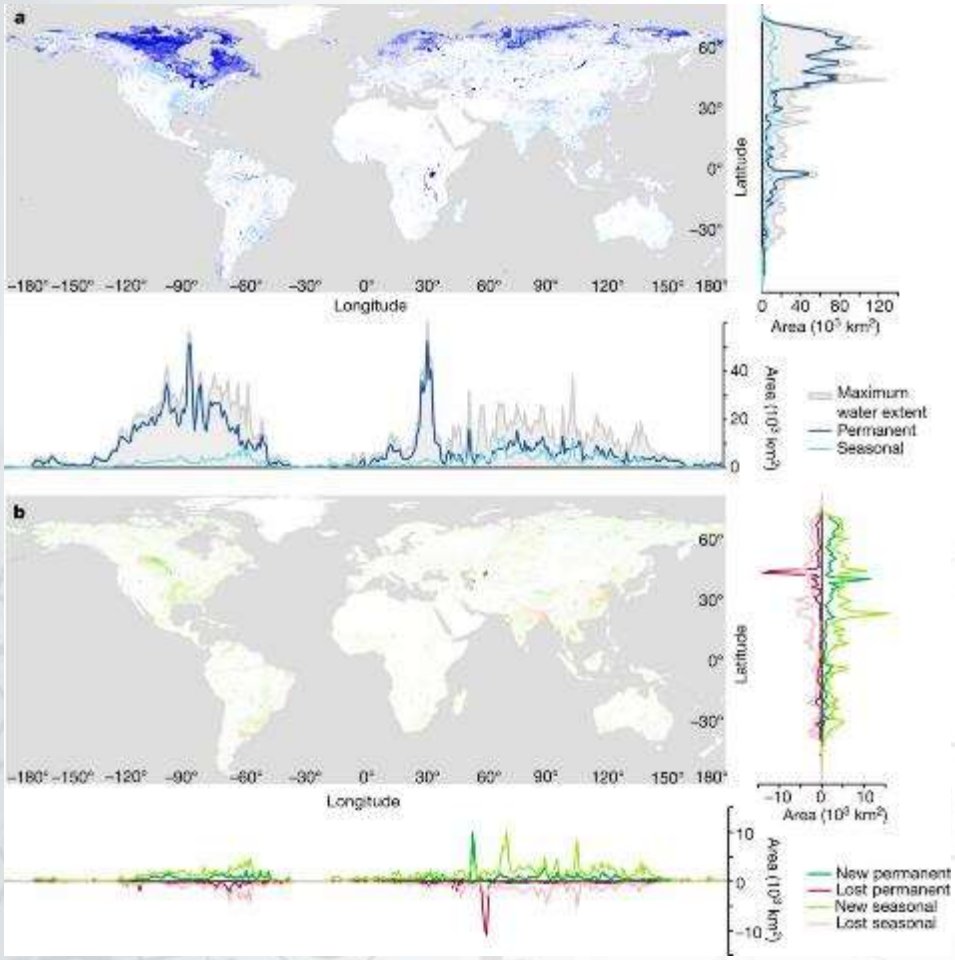
“75% of the land surface is significantly altered,

66% of the ocean area is experiencing increasing cumulative impacts,

and over 85% of wetlands (area) has been lost.”

(IPBES 2019)

EO of lacustrine wetlands



- EO enabled monitoring of open water (lacustrine) wetlands since 1984 through Landsat and since 2016 with Sentinel-2
- SDG indicator 6.6.1a
- In RSA, the GSWP represents only 13% of the extent of our wetlands mapped in NWM5: 11% open water, 2% seasonal

Lacustrine wetland biome:
(F2.1) Large permanent freshwater lakes
F3. (Large) Artificial reservoirs

nature

J Pekel *et al. Nature* 1–5 (2016) doi:10.1038/nature20584

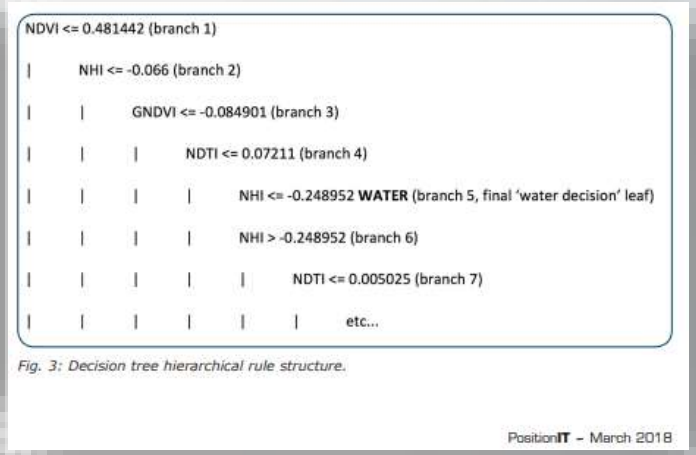
Essential biodiversity variables for freshwater

- Genetic composition
- Species populations
- Species traits
- Community composition
  - Extent of wetland vegetation distribution
- Ecosystem structure
  - Plant species communities
  - Above-ground biomass
- Ecosystem function
  - Hydrological regime metrics

Extent &
Ecological condition/
Integrity indices

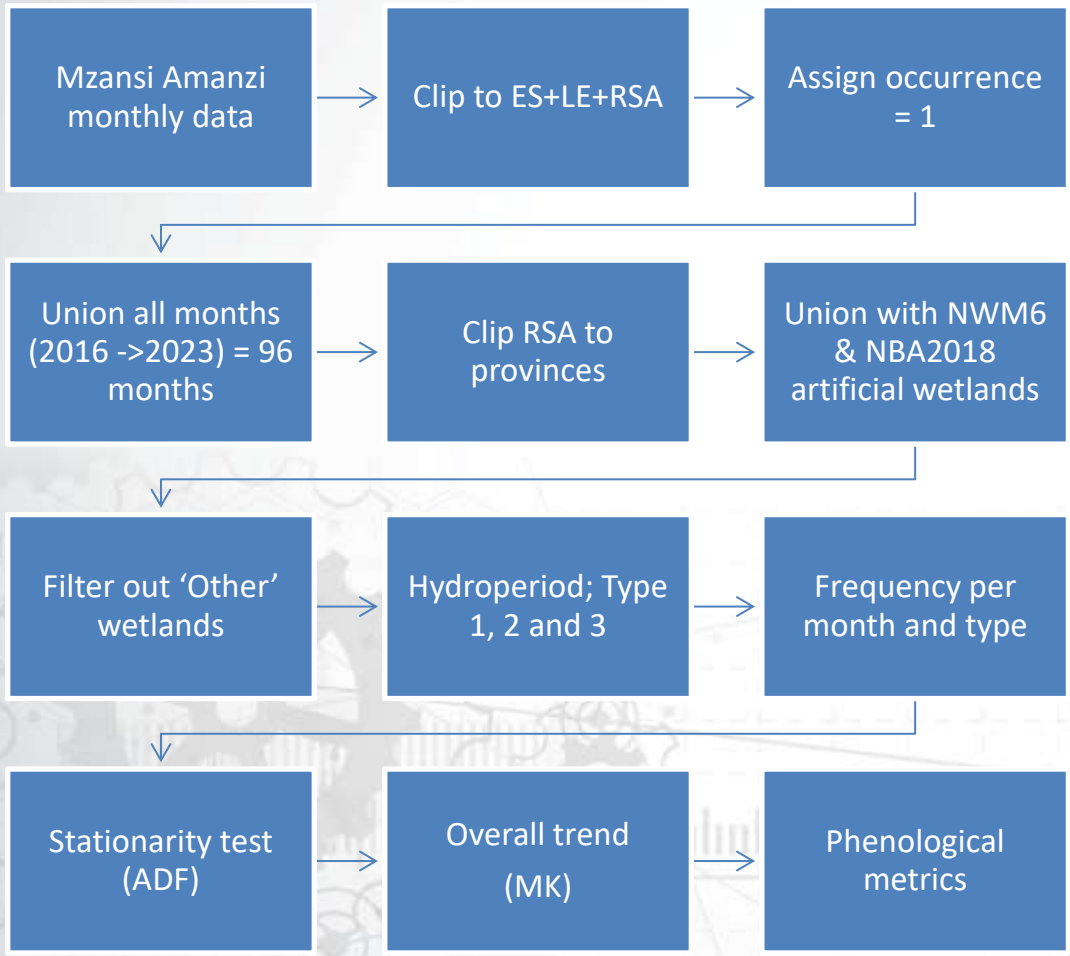
Turak et al. (2017)

Mzansi Amanzi data layers from SANSA



https://www.water-southafrica.co.za/

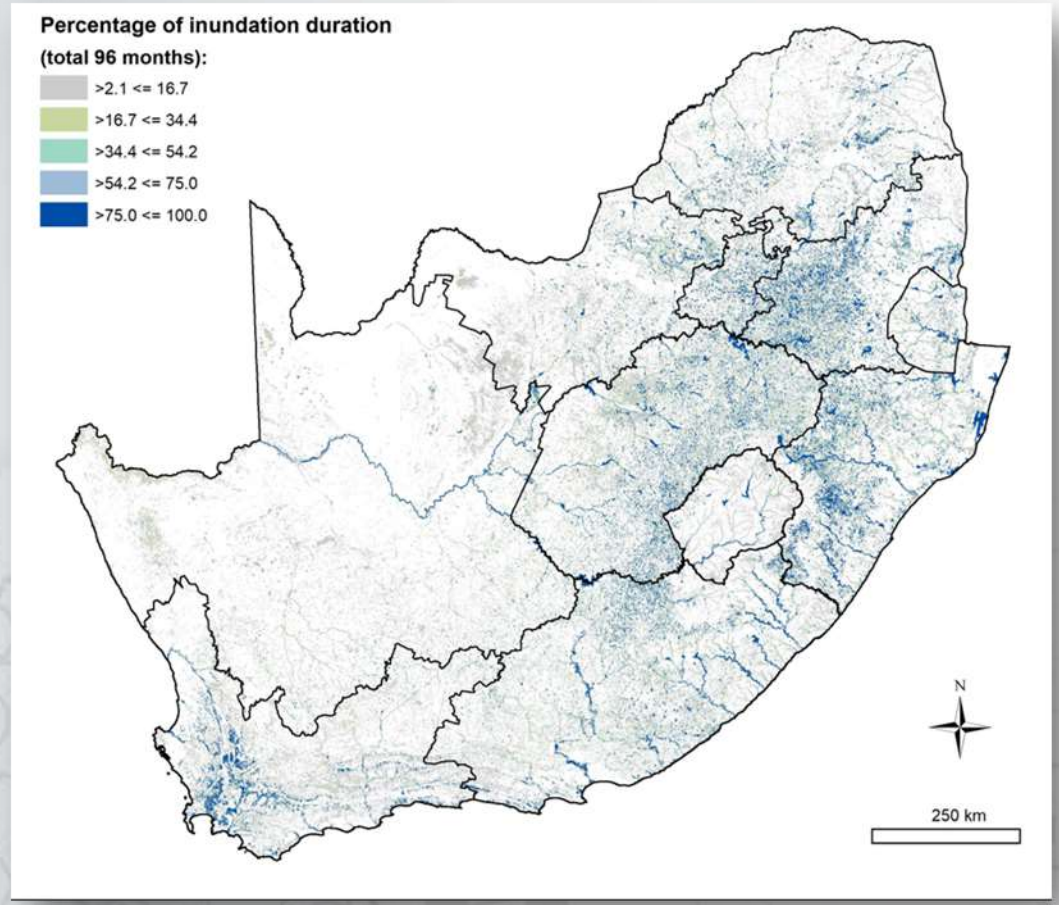
Process and number of records



- Total number of records for 54.7m
- At least > 1 month inundated

Province	# of records before filter	# of records after filter	%
EC	8 800 449	6 543 875	74
FS	12 034 310	8 804 956	73
GT	1 161 597	920 238	79
KZN	7 885 603	6 173 591	78
LP	4 536 427	3 434 058	76
MP	5 937 547	4 543 951	77
NC	7 274 471	4 810 892	66
NW	3 204 960	2 321 016	72
WC	6 350 925	4 749 825	75

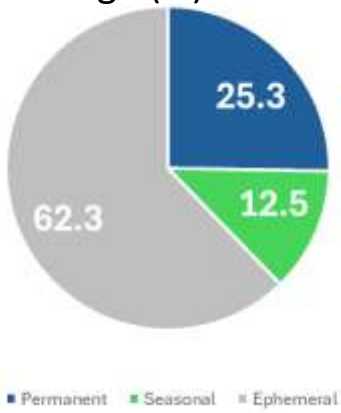
Thresholds for hydroperiod categories



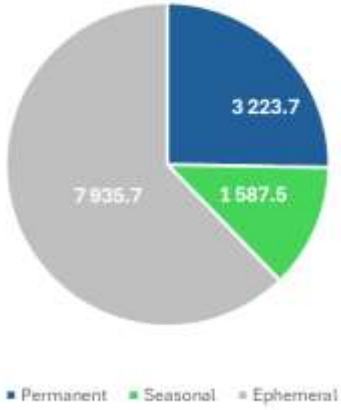
- Jenks natural breaks, 5 classes
  - >75% permanently inundated
  - >34.4% <=75% seasonally inundated
  - <= 34.4% ephemeral

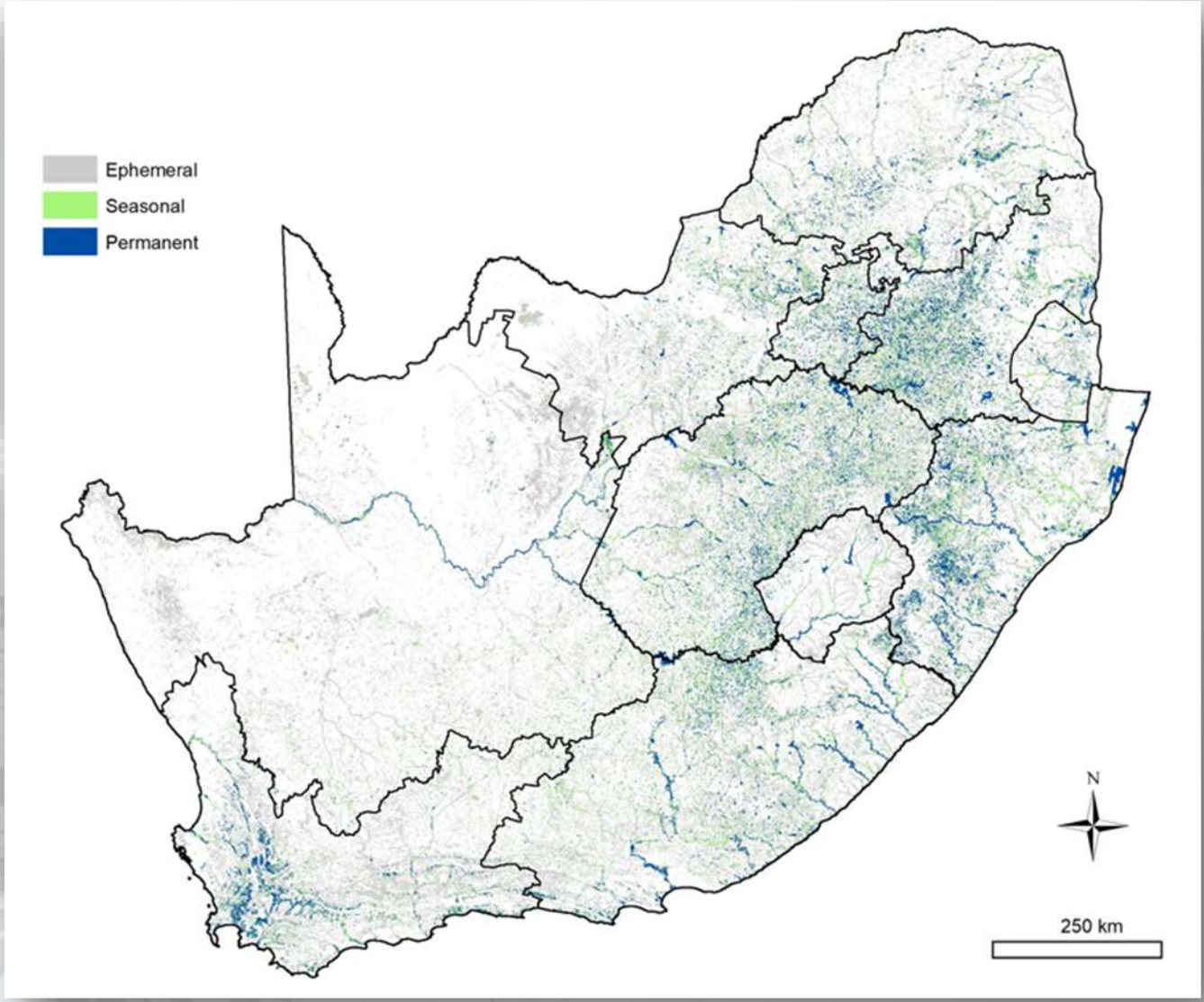
Inundation hydroperiod

Percentage (%)



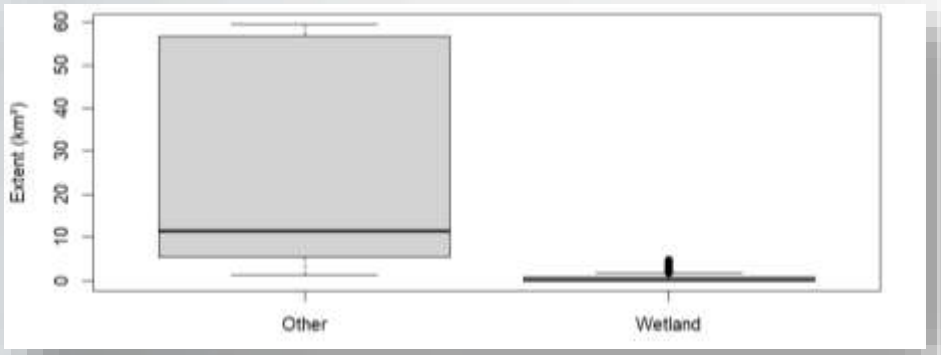
Extent (km²) 12 746.9



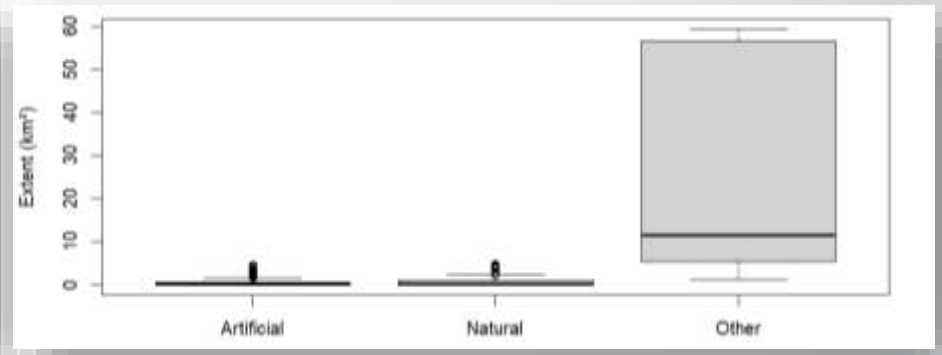


Gauteng ~ extent of inundated Mzansi pixels

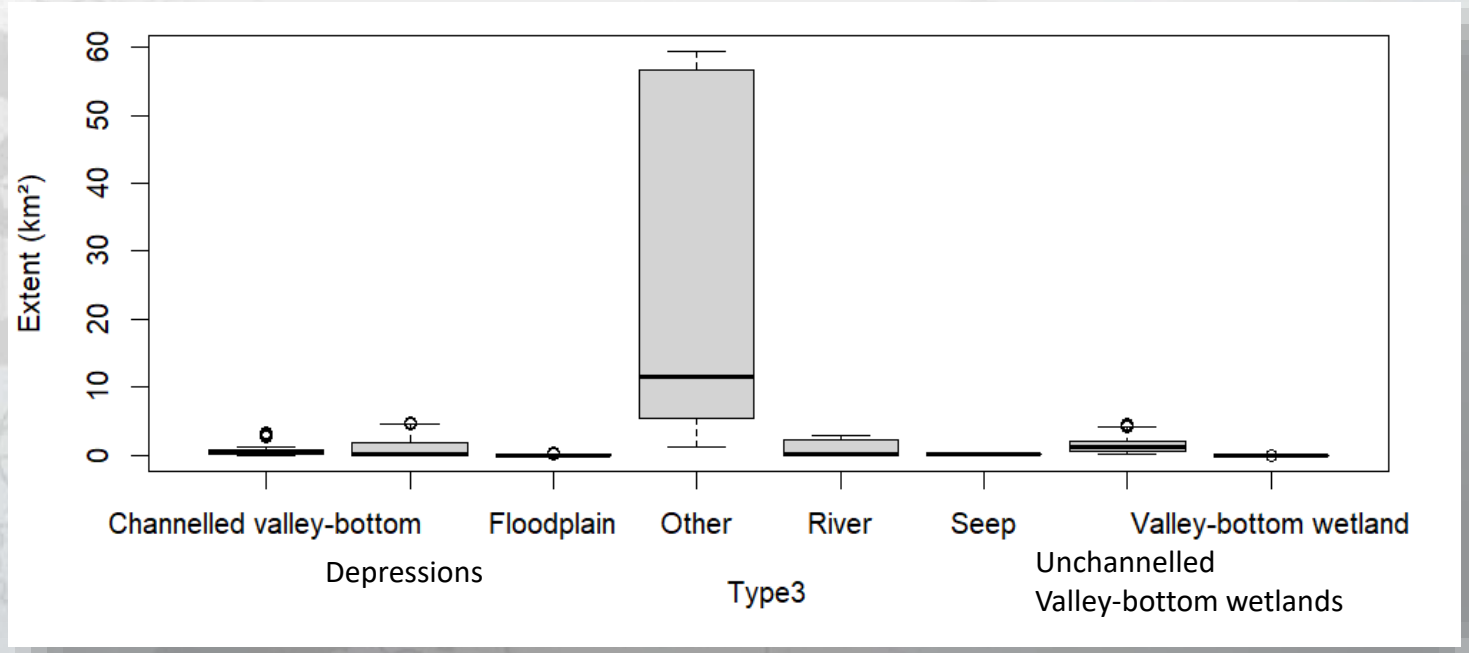
Type 1



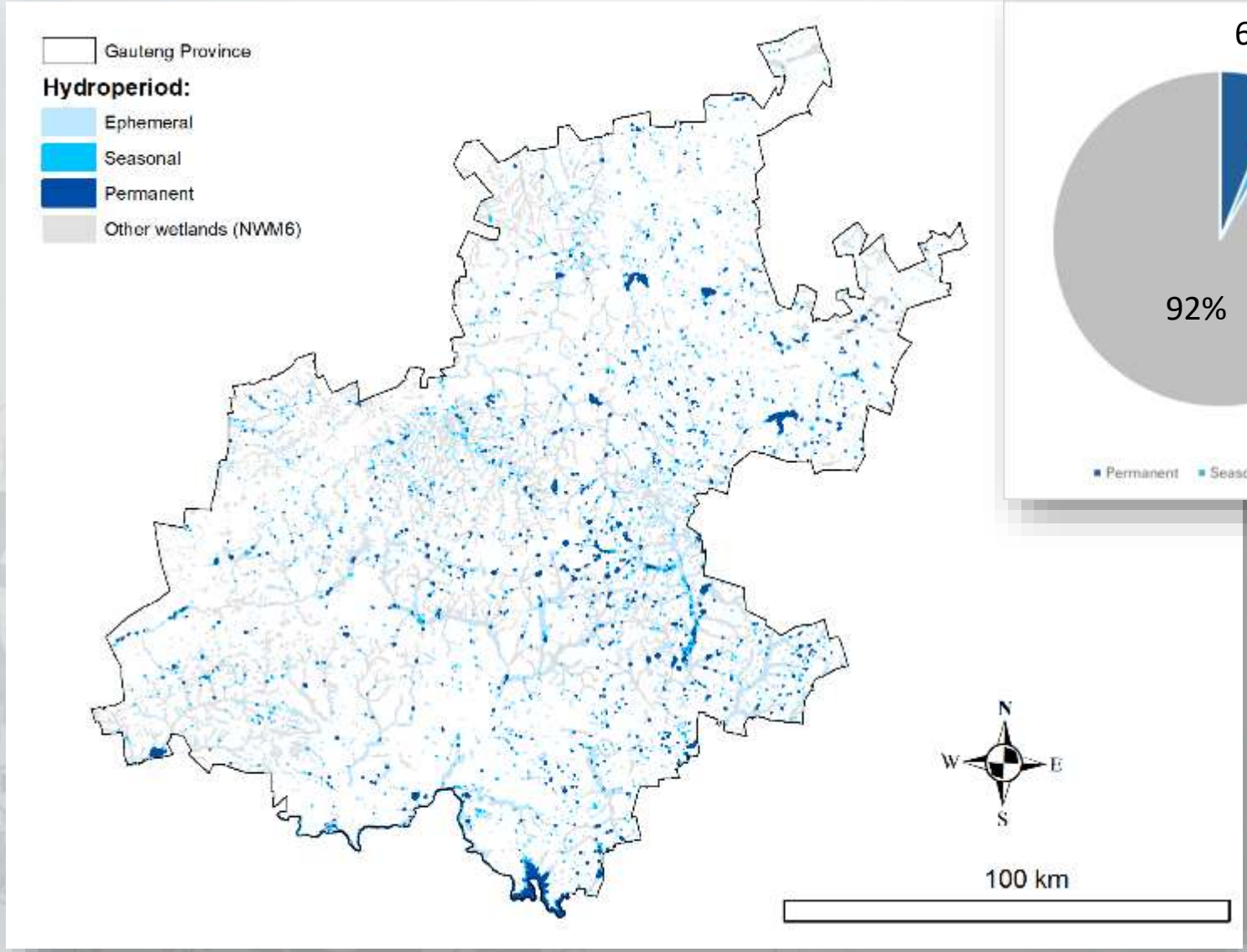
Type 2

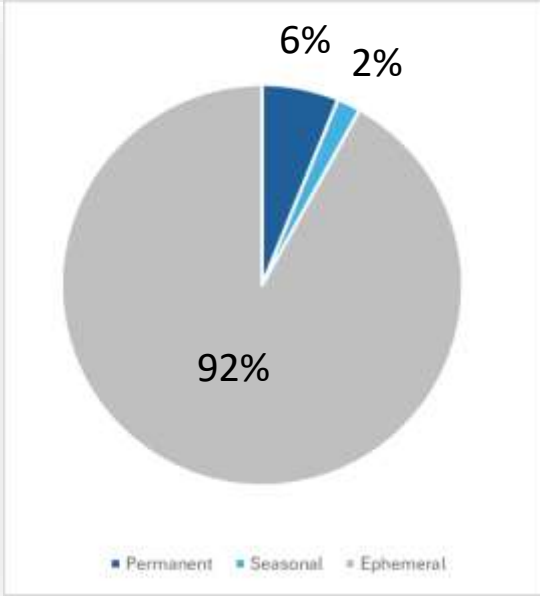


Type 3

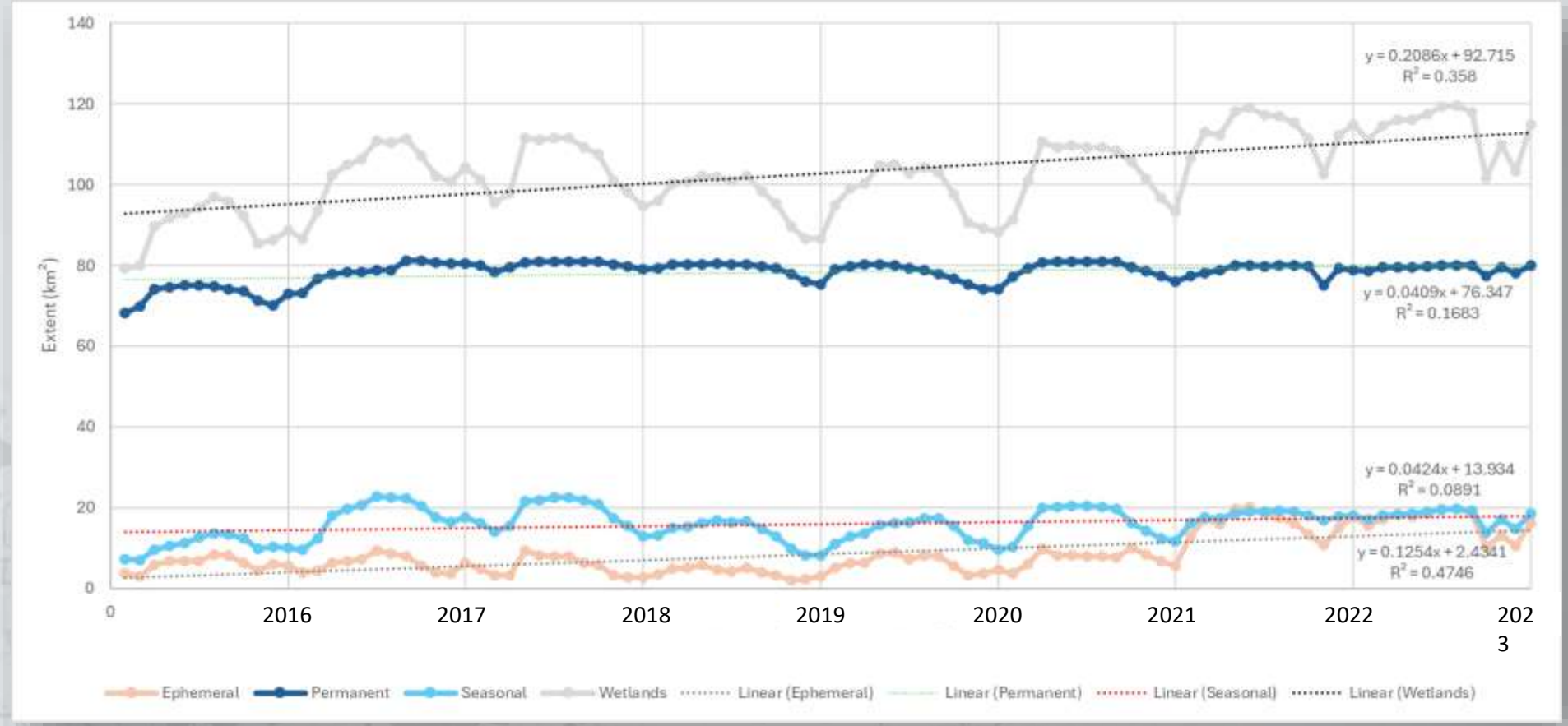


Hydroperiod of Gauteng's wetlands



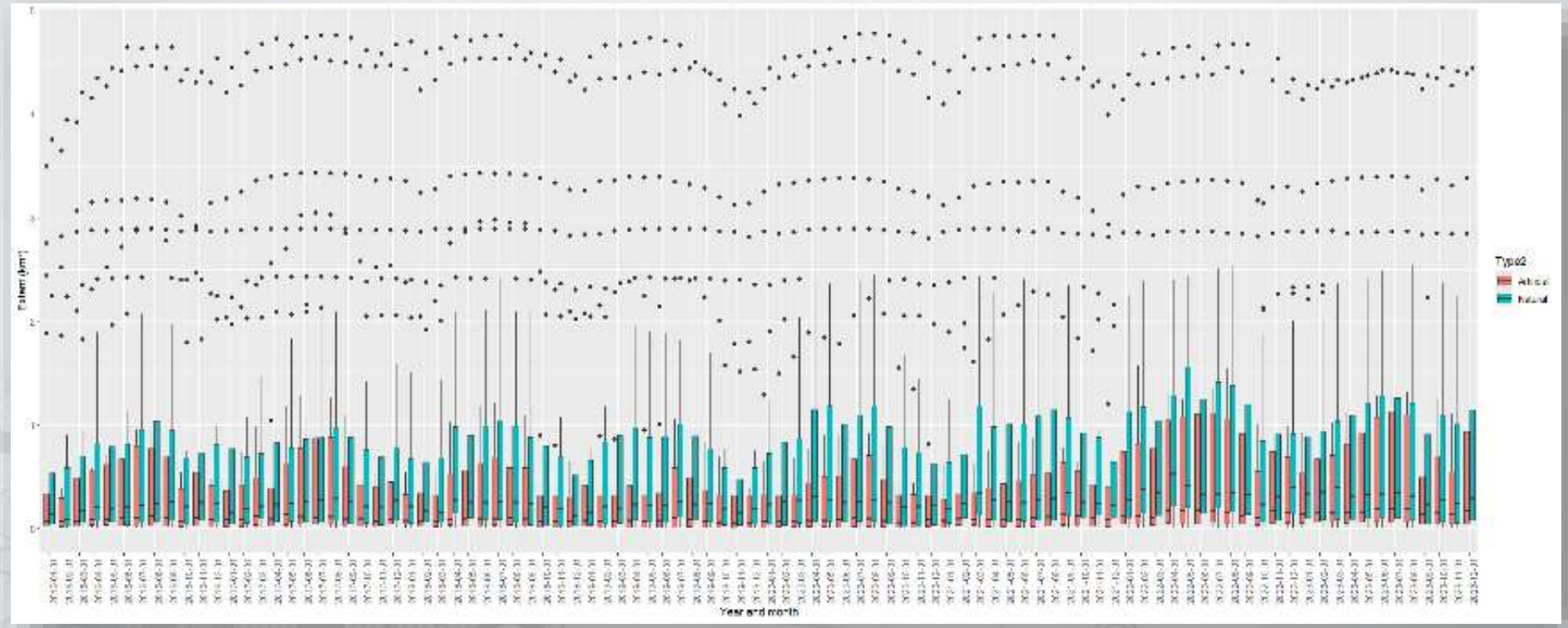


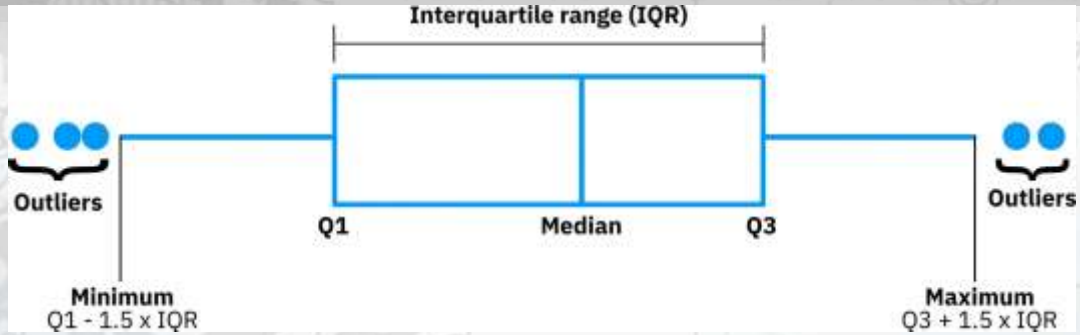
Gauteng ~ overall changes per hydroperiod class



ADF: Permanent and seasonal natural wetlands are not stationary
MK: permanent = not significant; seasonal natural wetlands = significant

Gauteng ~ seasonality of extents of artificial and natural wetlands

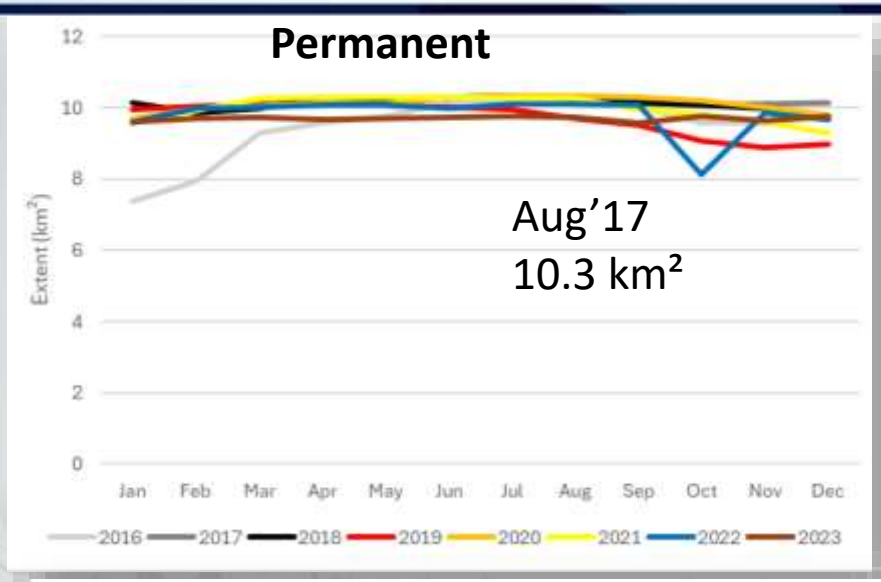


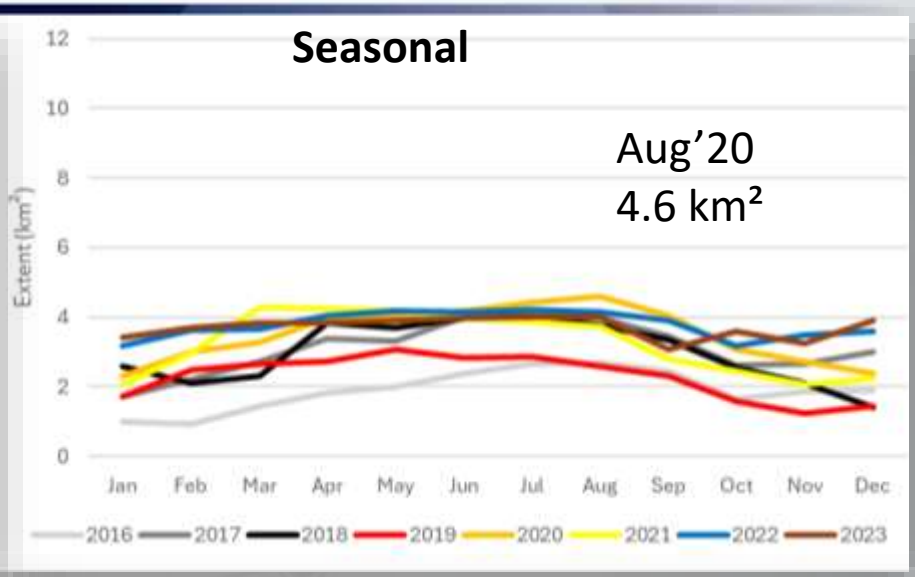


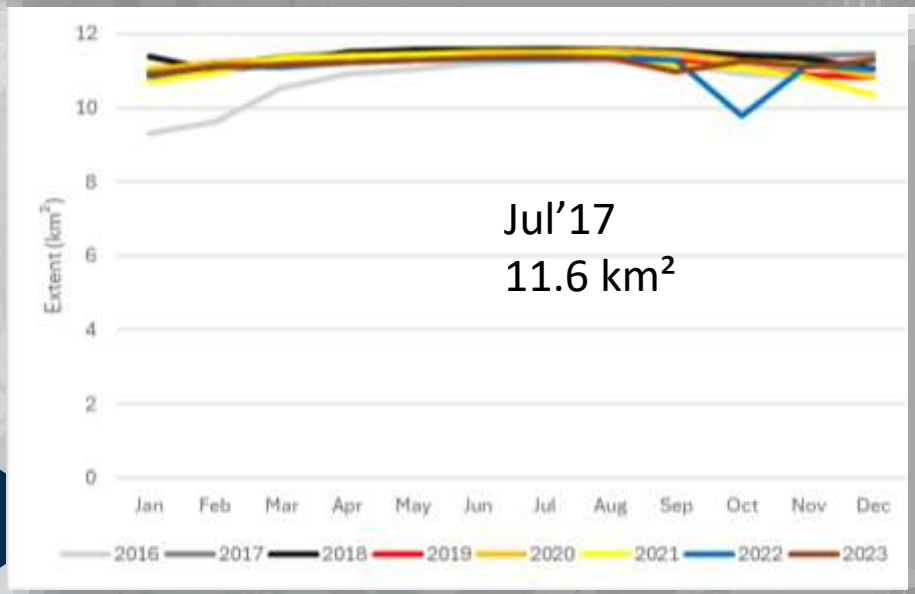
Gauteng ~ Maximum extent across hydrological phenology

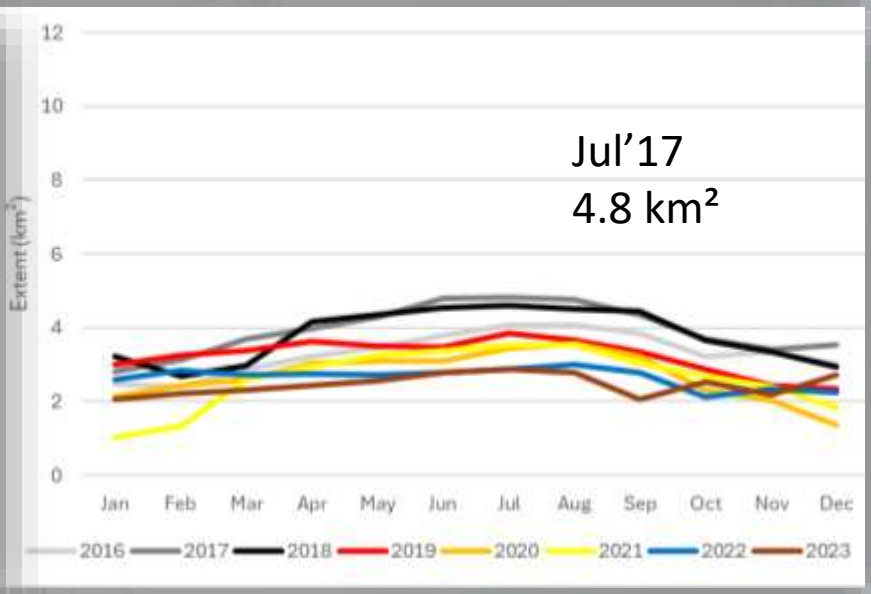
Natural

Artificial





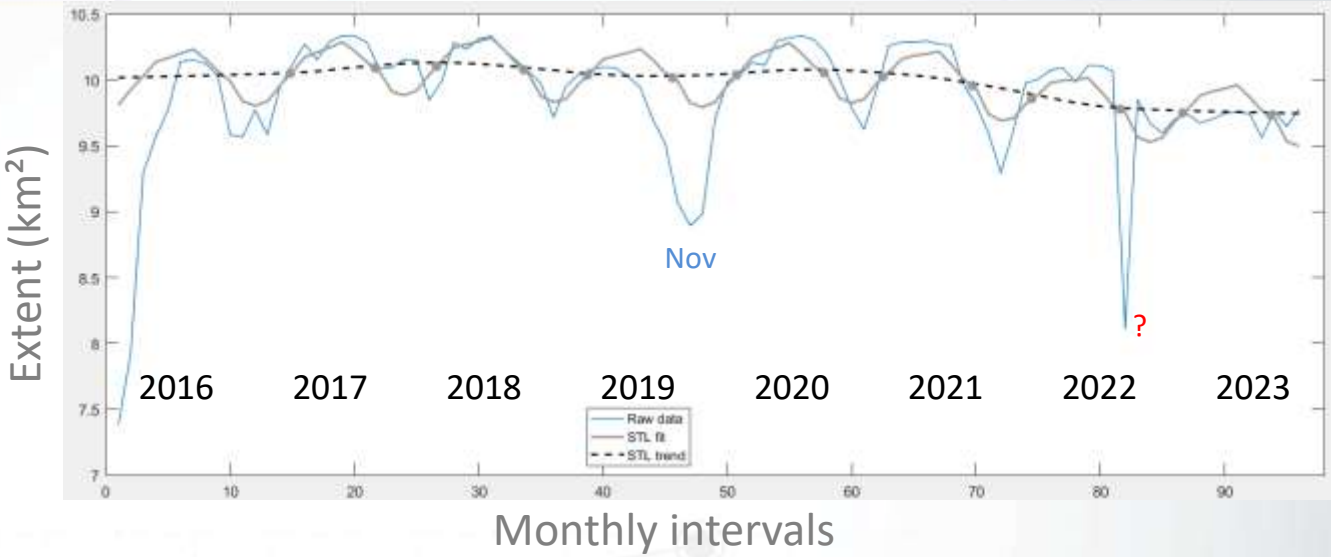




Gauteng ~ natural wetlands (STL)

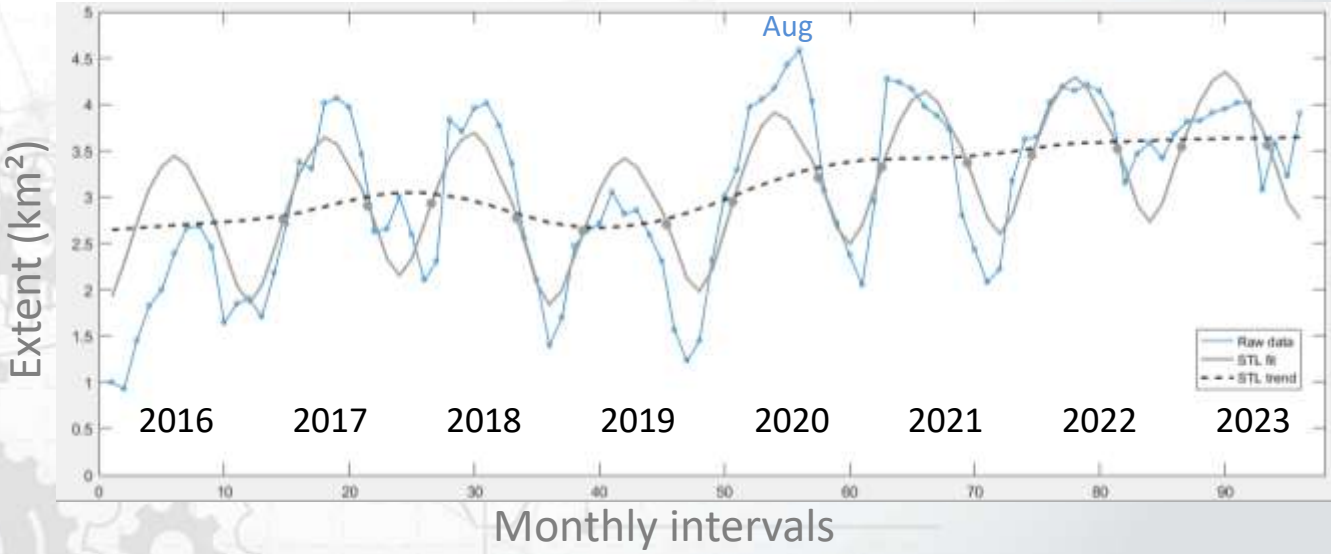
Permanent:

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



Seasonal:

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



Understanding biodiversity types

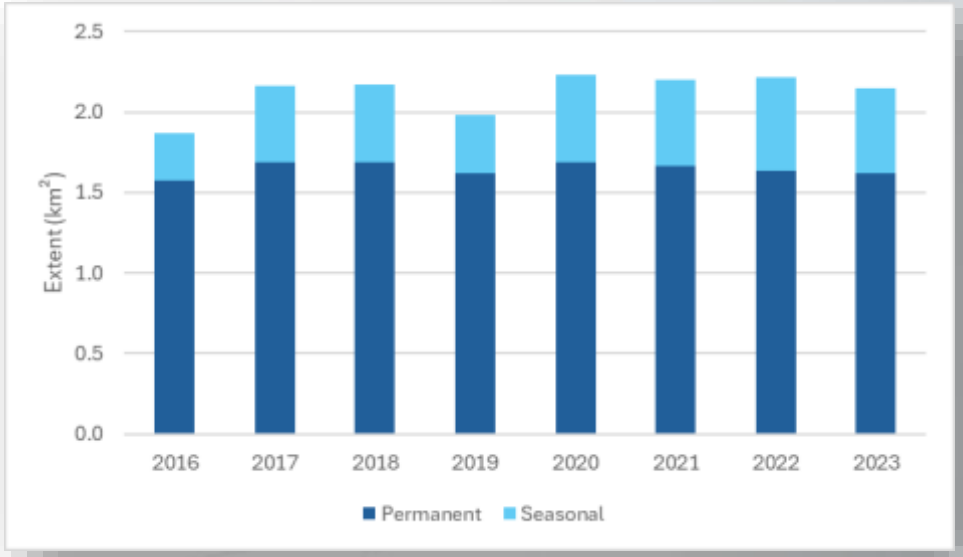
- Improved mapping of biodiversity types
- Improved monitoring and reporting to the Global Biodiversity Framework (GBF)

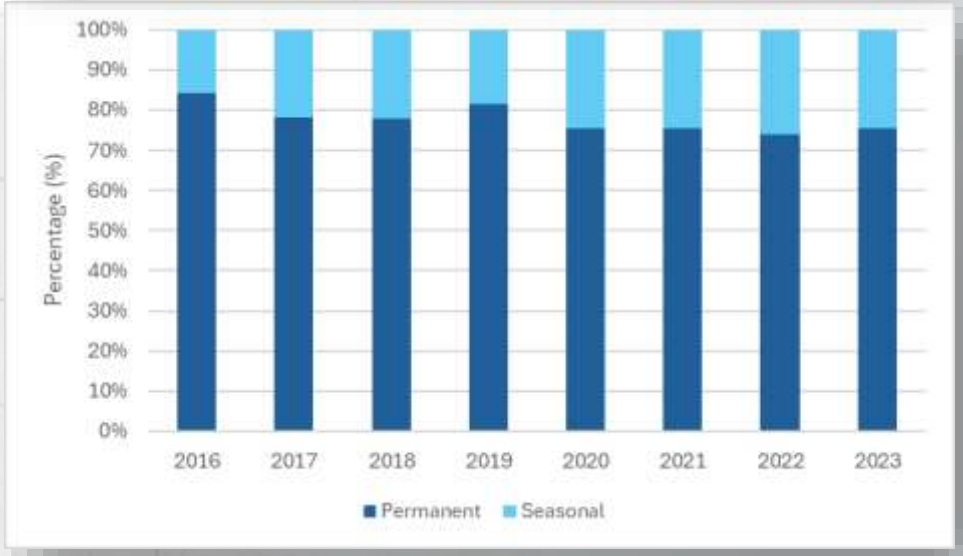
Codes:

- CVB = channelled valley-bottom
- DPR = depression
- FLP = floodplain
- RIV = river
- SP = seep
- UVB = unchanneled valley-bottom

Reporting to Sustainable Development Goal 6.6.1a ~ Gauteng's natural wetlands

- Natural wetlands hydroperiod categories
- Interval of reporting 3-years
- 2017 reference baseline, km²
- Decline in extent of permanent wetlands -> seasonal or palustrine





Limitations / way forward

- Sentinel 1&2 enabled monthly monitoring of open water pixels
  - Changes in extent to SDG 6.6.1.a
  - Biodiversity reporting to the Kunming-Montral Global Biodiversity Framework

- Key issues:
  - Large extent of ‘other’ inundated pixels
  - Ephemeral

- Changes are visible and quantifiable in only eight years of analysis

- Progressing with remaining provinces and other countries

HvDeventer@csir.co.za

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

FWBON
Freshwater Biodiversity Observation Network

CSIR
Touching lives through innovation