

# *EXPLORING AQUATIC WEED CO-EXISTENCE USING SENTINEL-2 DATA*



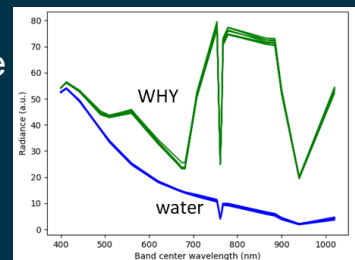
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## Background

- Water hyacinth (WHY) is one of the world's most disturbing invasive aquatic plant species
- Hartbeespoortdam reservoir in South Africa is strongly affected by aquatic weeds, like WHY
- Weeds form dense mats that move with water flow and wind
- Different removal strategies are being applied, but their effectivity is not systematically investigated

## Data sources

- Sentinel-2 Level-2 MSI reflectances and NDVI
- Sentinel-3 Level-1C OLCI reflectances
- ERA5 10m wind vectors
- South African Weather Service (SAWS) local weather station data (precipitation, wind speed and direction)



## Objectives

- Create long time series of daily aquatic weed observations over Hartbeespoortdam reservoir, South Africa
- Unravel effects of herbicide spraying and meteorology on aquatic weed patterns using time-series analysis
- Develop algorithm that uses Sentinel-2 data to discriminate WHY from giant Salvinia
- Collect field observations of aquatic weed coverage
- Validate weed detection and discrimination algorithms

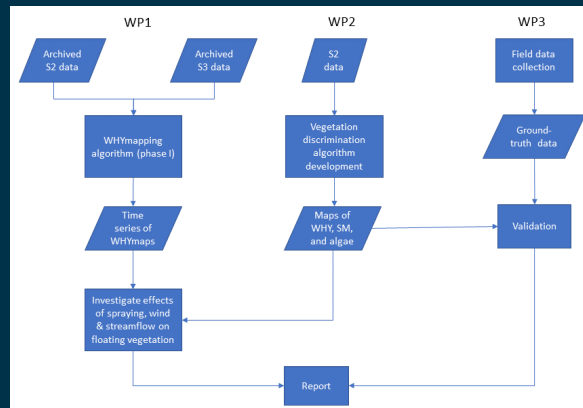


## Main aim

- Examine effects of meteorology and herbicide spraying on the co-existence balance between algae and macrophytes in Hartbeespoort dam

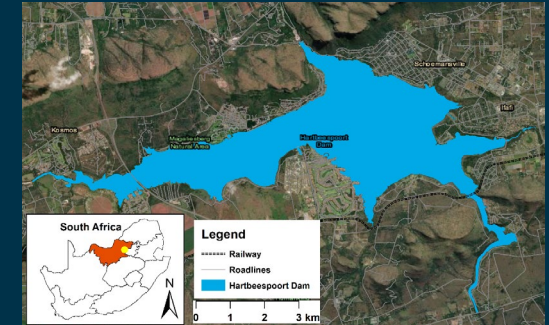
## Objectives

- Create long-term data set of WHYmaps
- Examine relationships between meteorological variables, herbicide spraying, and vegetation
- Develop Sentinel-2 algorithm to discriminate between WHY, SM, and other aquatic vegetation
- Perform field measurements to validate satellite data



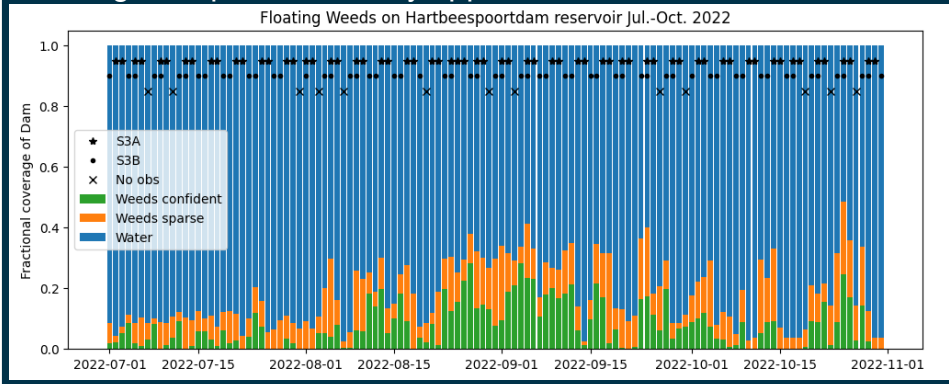
## Hartbeespoortdam reservoir, South Africa

- Recreational and drinking water source
- Polluted by waste water
- Seriously affected by invasive aquatic weeds
- Since April 2021, stakeholders have been spraying the dam to control water hyacinth.



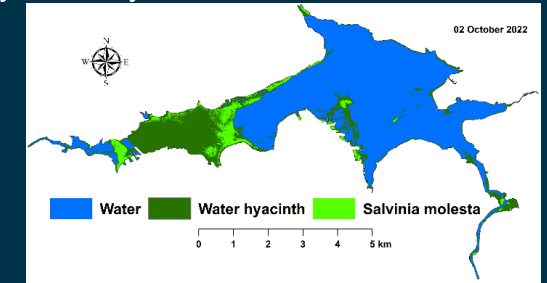
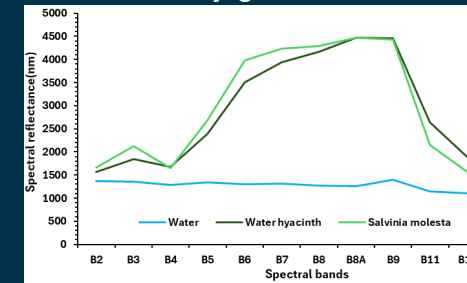
## 1. Water hyacinth time series

- Daily maps of WHY derived from Sentinel-3 OLCI data
- High temporal variability apparent in time series Jul.-Oct. 2022



## 3. Sentinel-2 vegetation discrimination algorithm

- Classification uses Sentinel-2 data and random forest machine learning
- Subtle differences in spectral response allow separation of signals
- On October 2, 2022, water covered the majority of the dam; 10% was covered by giant salvinia and 25% by water hyacinths



## 4. Field observations and validation

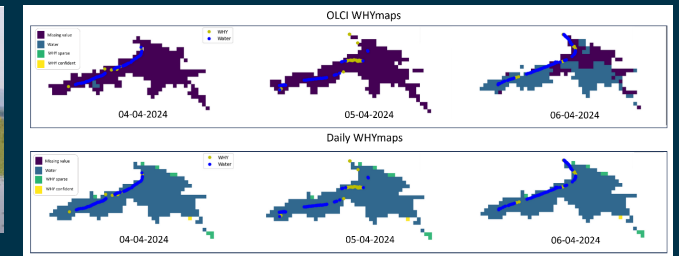
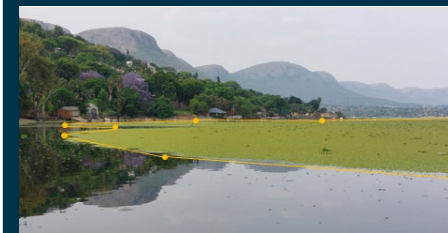


Illustration of field measurements: GPS coordinates are recorded while tracing the outline of vegetation patches with a boat.

WHYmaps of April 4-6, 2024 overlaid with validation data. Upper panels: WHYmaps from OLCI data directly, with missing values in dark blue. Lower panels: gap-filled WHYmaps.

## 2. Effects of meteorology

- Wind and precipitation data available from ERA5 is too coarse (upper panel)
- Data from nearby SA Weather Service station (lower panel)
- No linear relationship found between WHY cover and temperature, wind, precip

