BioREaCH :Biodiversity-Remote sensing for Estuarine and Coastal Habitat research

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UMBC

BIOSCAPE

GODDARD EARTH SCIENCES

Jet Propulsion Laboratory
California Institute of Technology

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Project goals

- We propose to evaluate the drivers of biodiversity across the land ocean aquatic continuum with state-of-the-art remote sensing, and investigate the potential impacts of climate change on coastal biodiversity

  Map: Plant Functional Types and Essential Biodiversity Variables

  - **MFT1.3** Coastal saltmarshes and reedbeds
  - **M1.1**Seagrass meadows (Keith et al. 2023)

  Understand: Biodiversity Drivers

  Predict: Climate Impacts

Outline

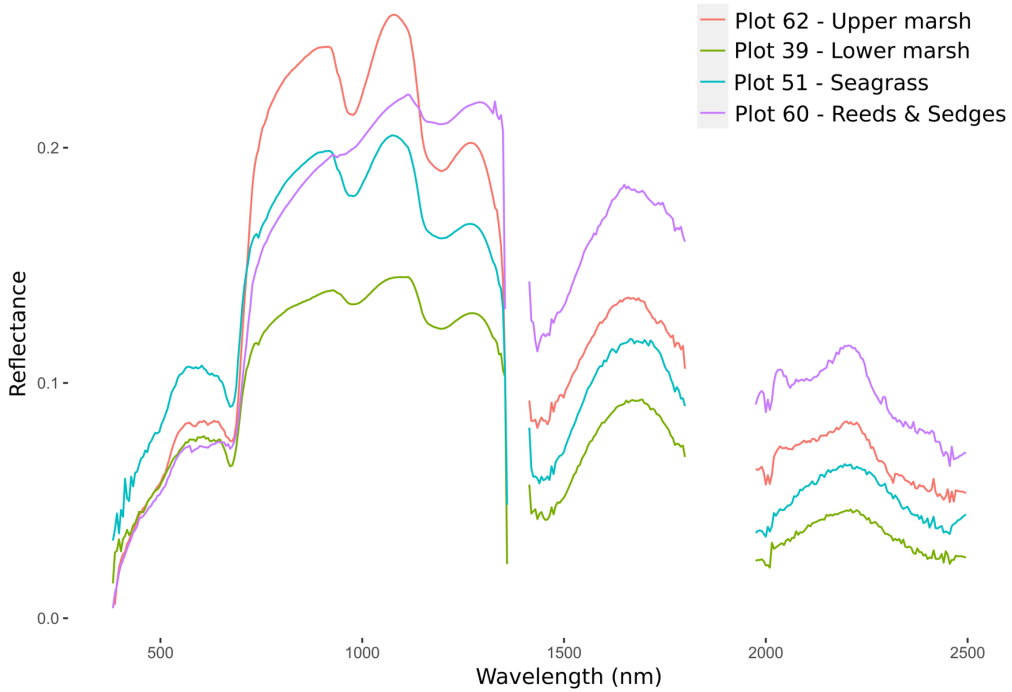
- Fieldwork
- Satellite study results
- height and vertical structure

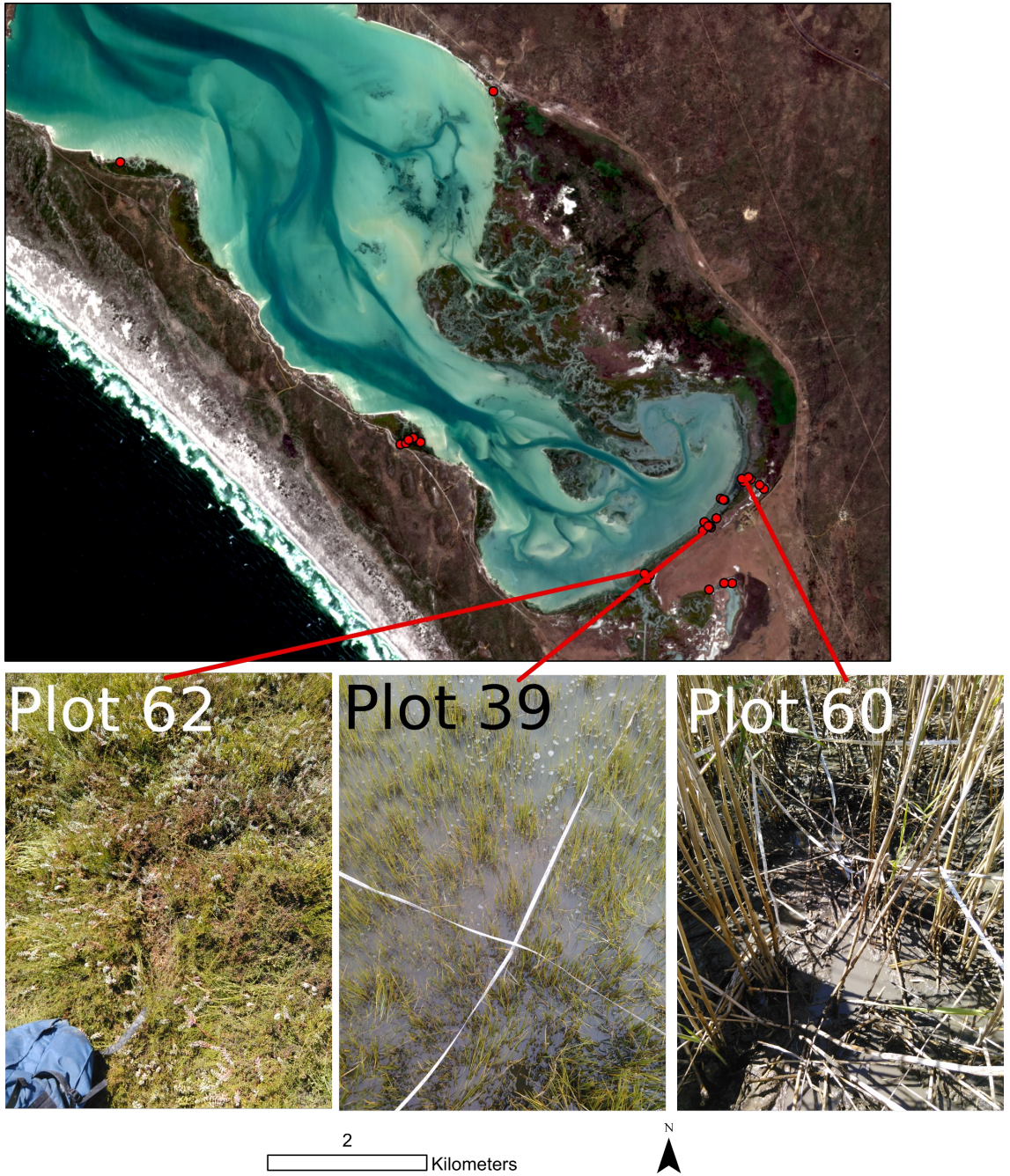
Field photos

Photo credit: Jeremy Shelton

Fieldwork

- 64 Plots across 3 estuaries
  - Many more GPS points associated with species location

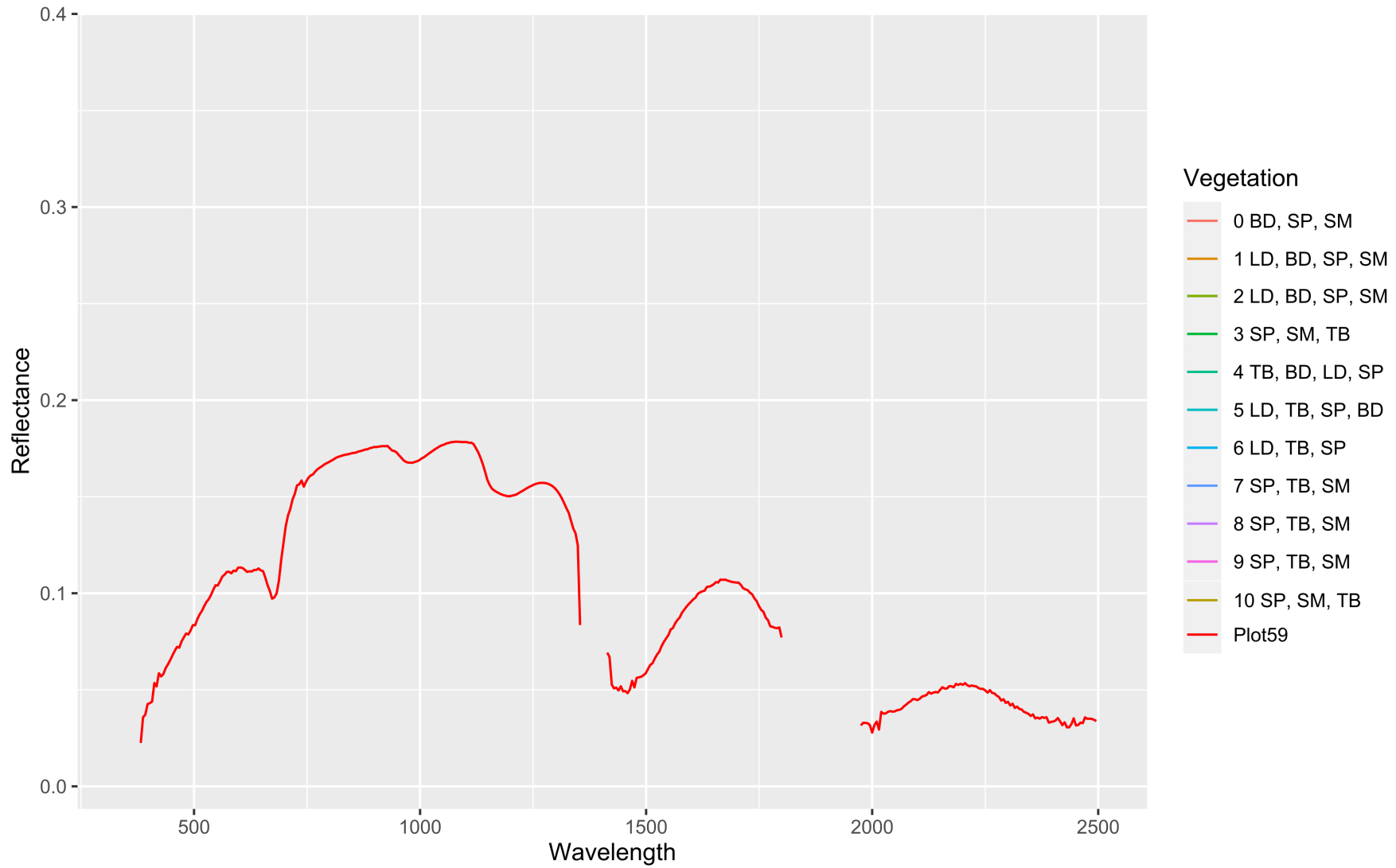




Field photos

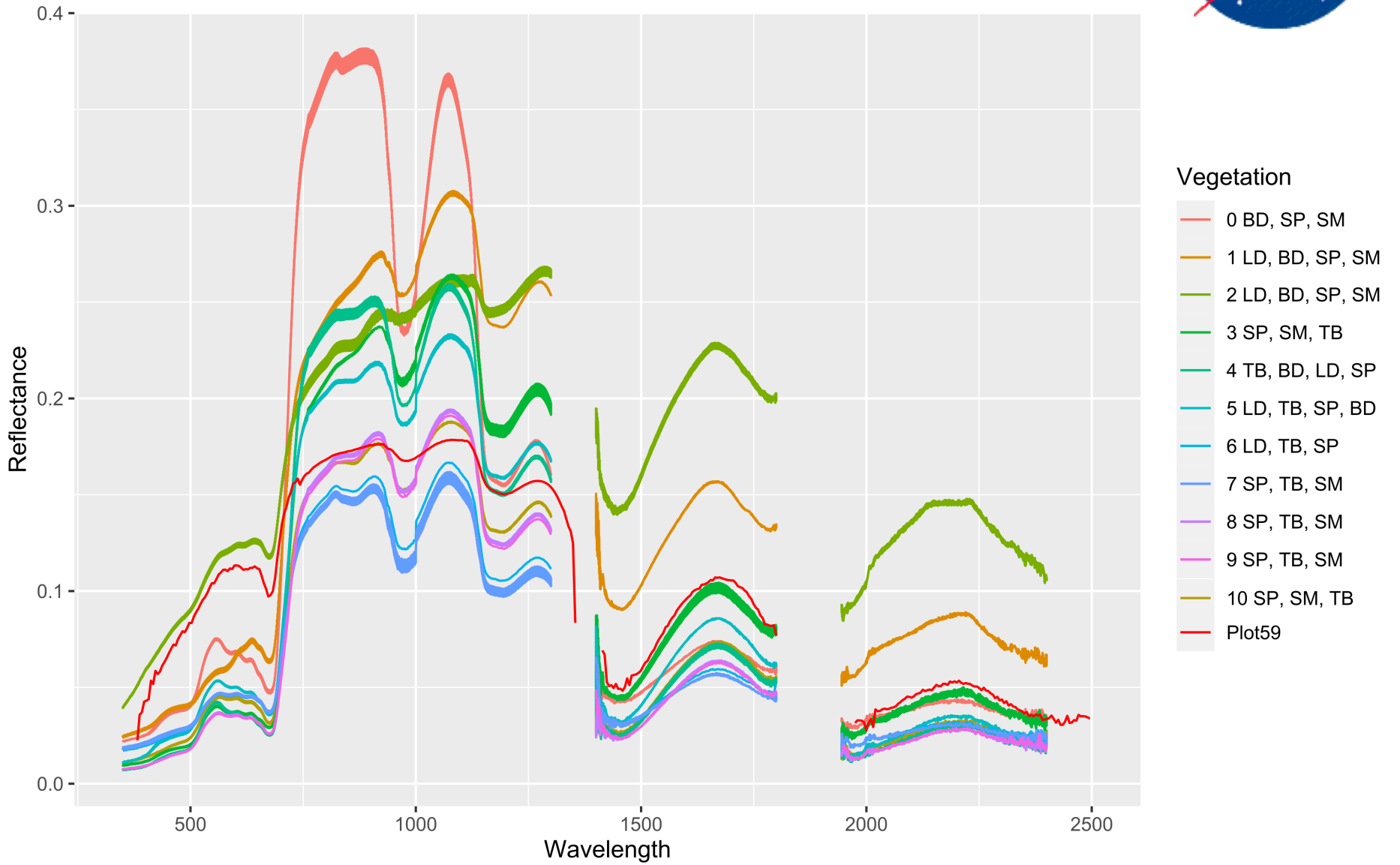
Photo credit: Jeremy Shelton

AVIRIS-ng Spectral Curve Plot 59



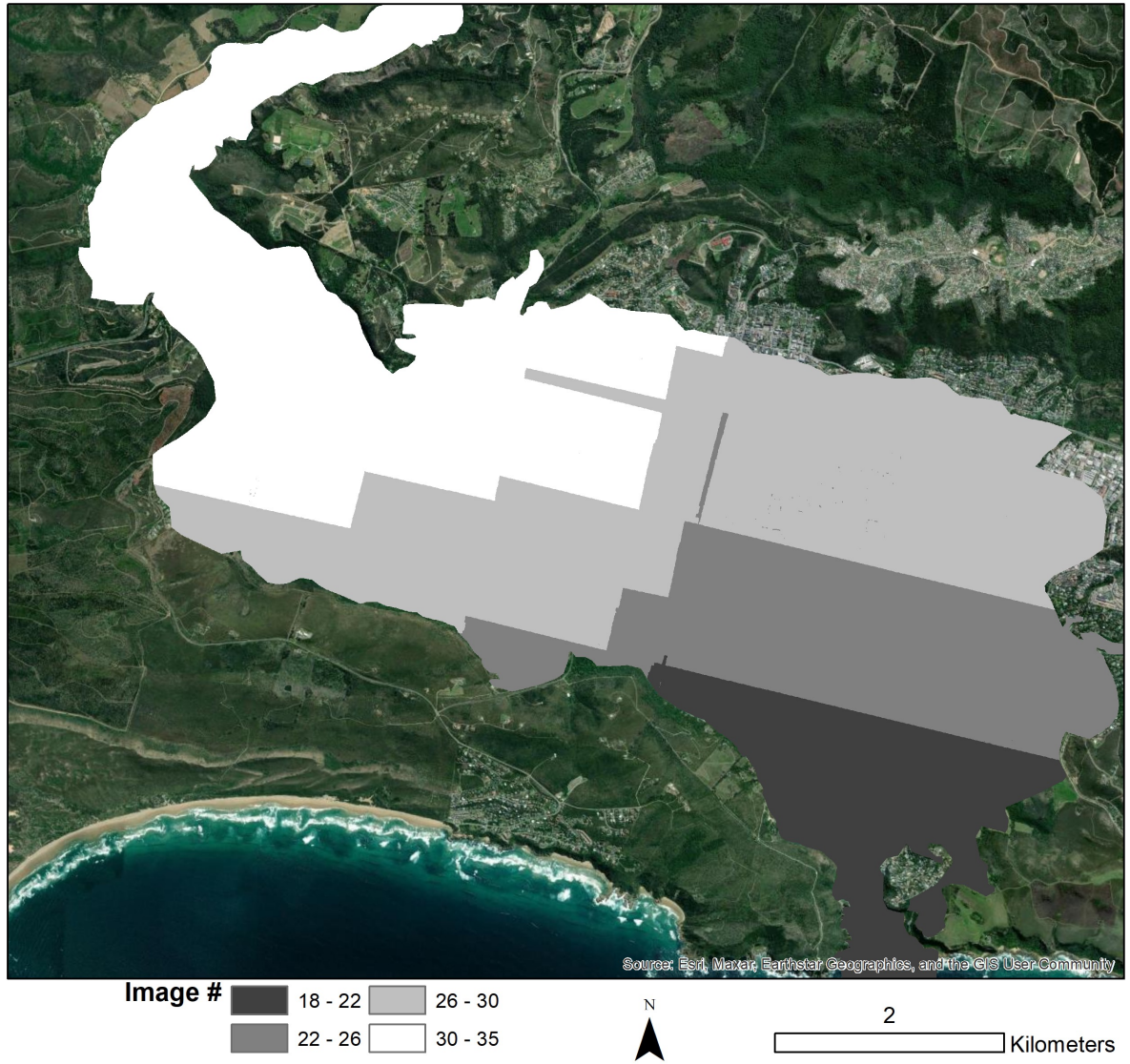
Plot 59- Spectral Survey

- Within plot spectral variability was high
- Plot overlapped lower and upper marsh

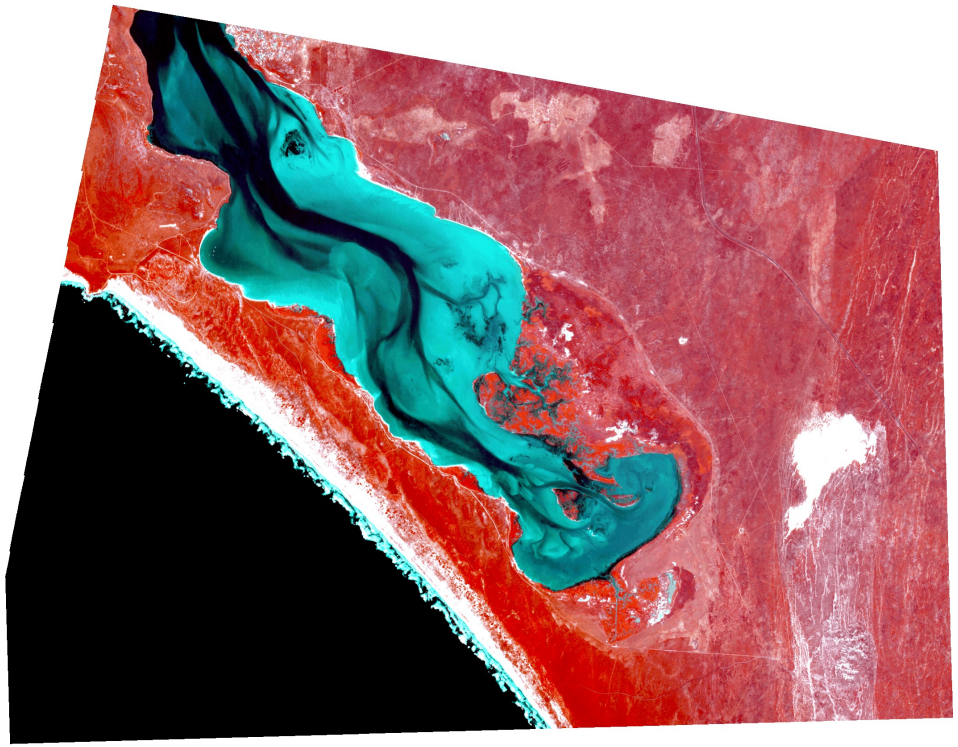


Results-Regional Analysis

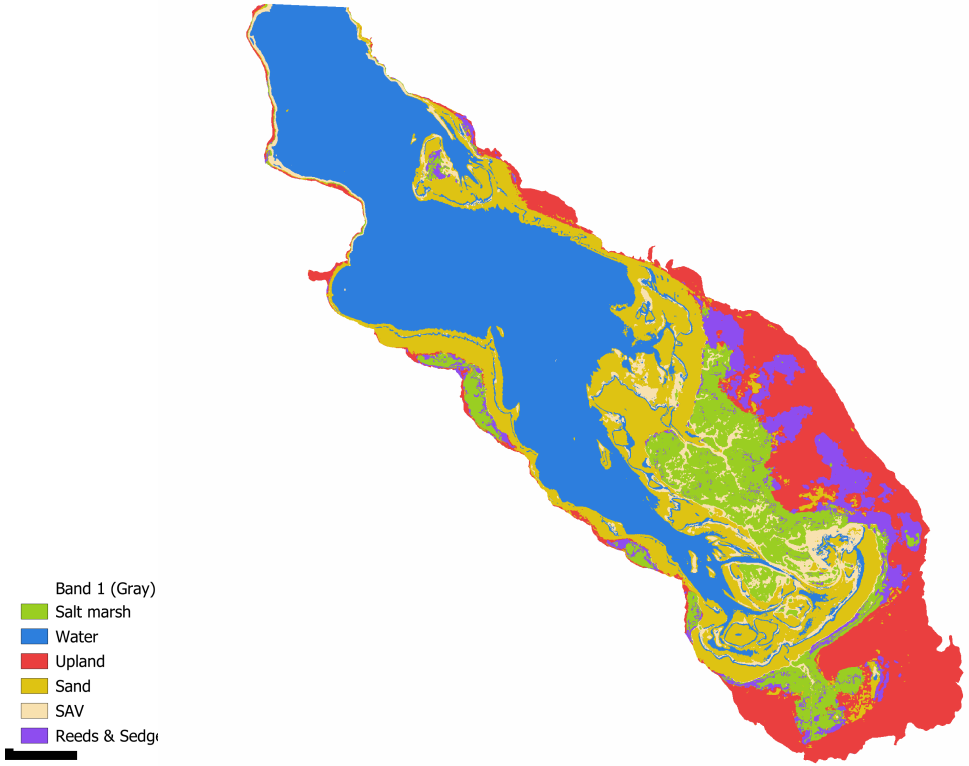
- Train convolution neural network on planet images to classify six landcovers,
  - three plant functional communities of interest (Submerged Aquatic Vegetation (SAV), salt marsh, and reeds & sedges).
- Model applied to all estuaries across the region and all cloud free images from December to January (~16-30 images).



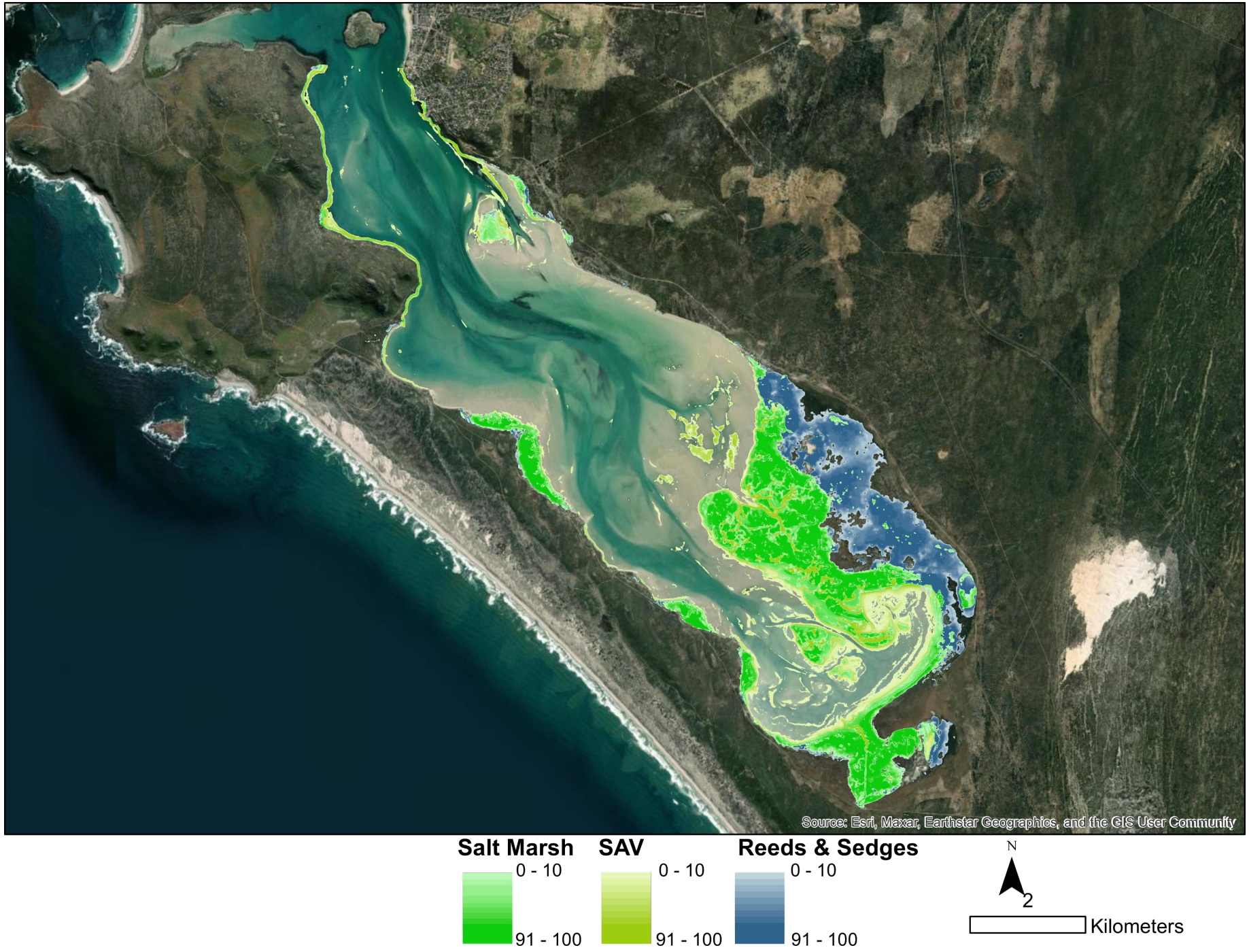
Base images



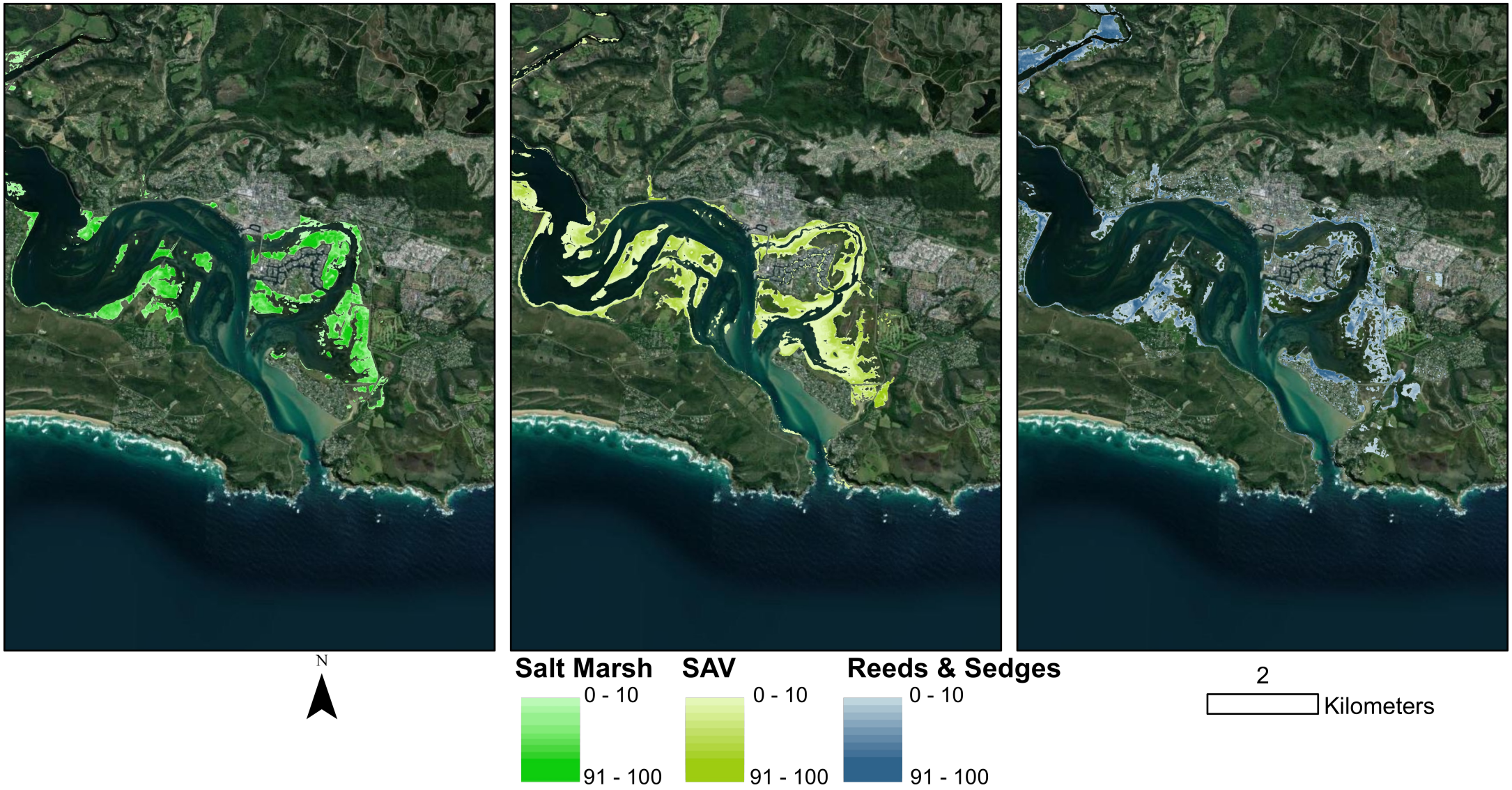
Classified outputs



Langebaan coastal wetland probability raster:

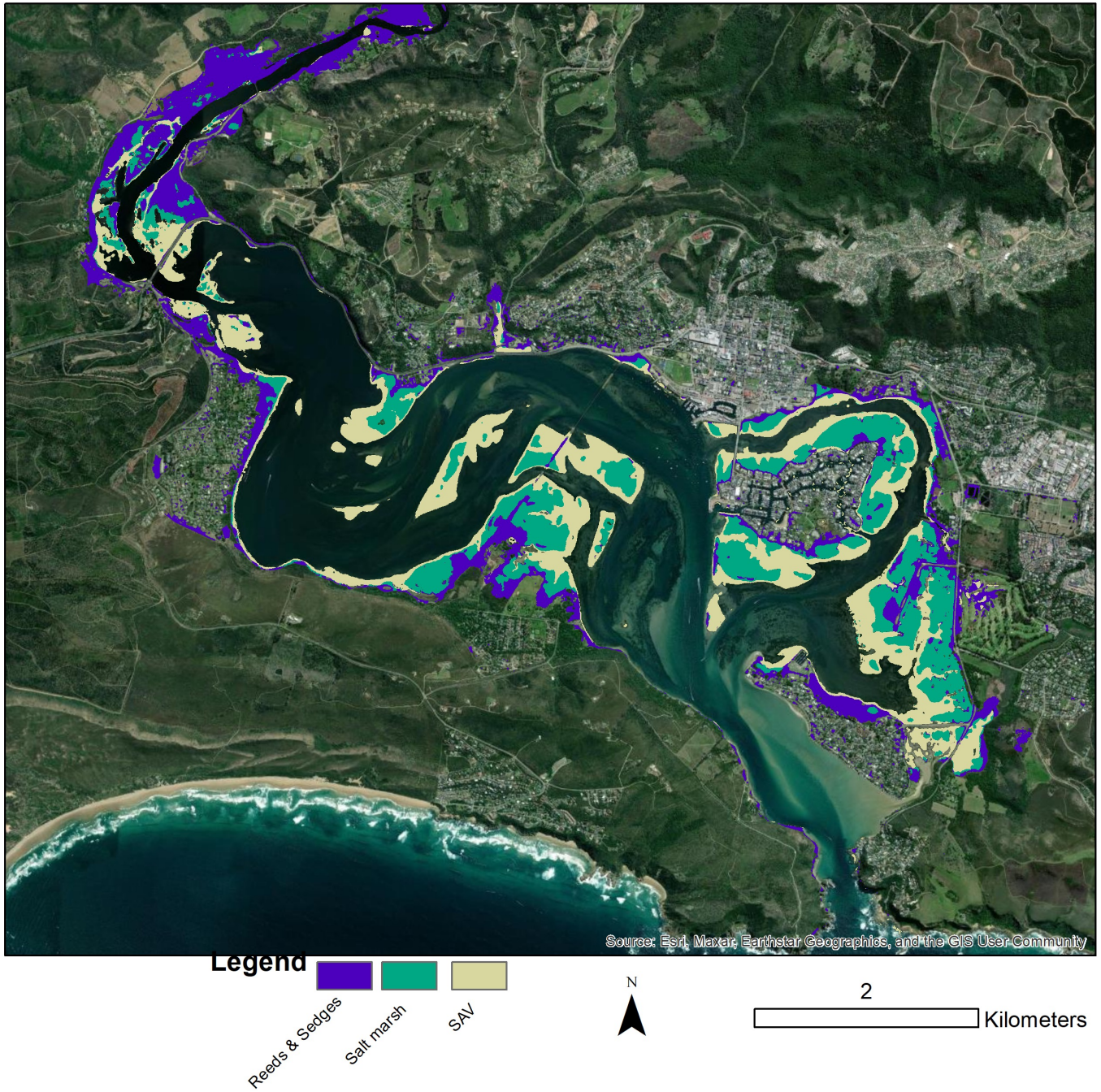


Knysna coastal wetland probability



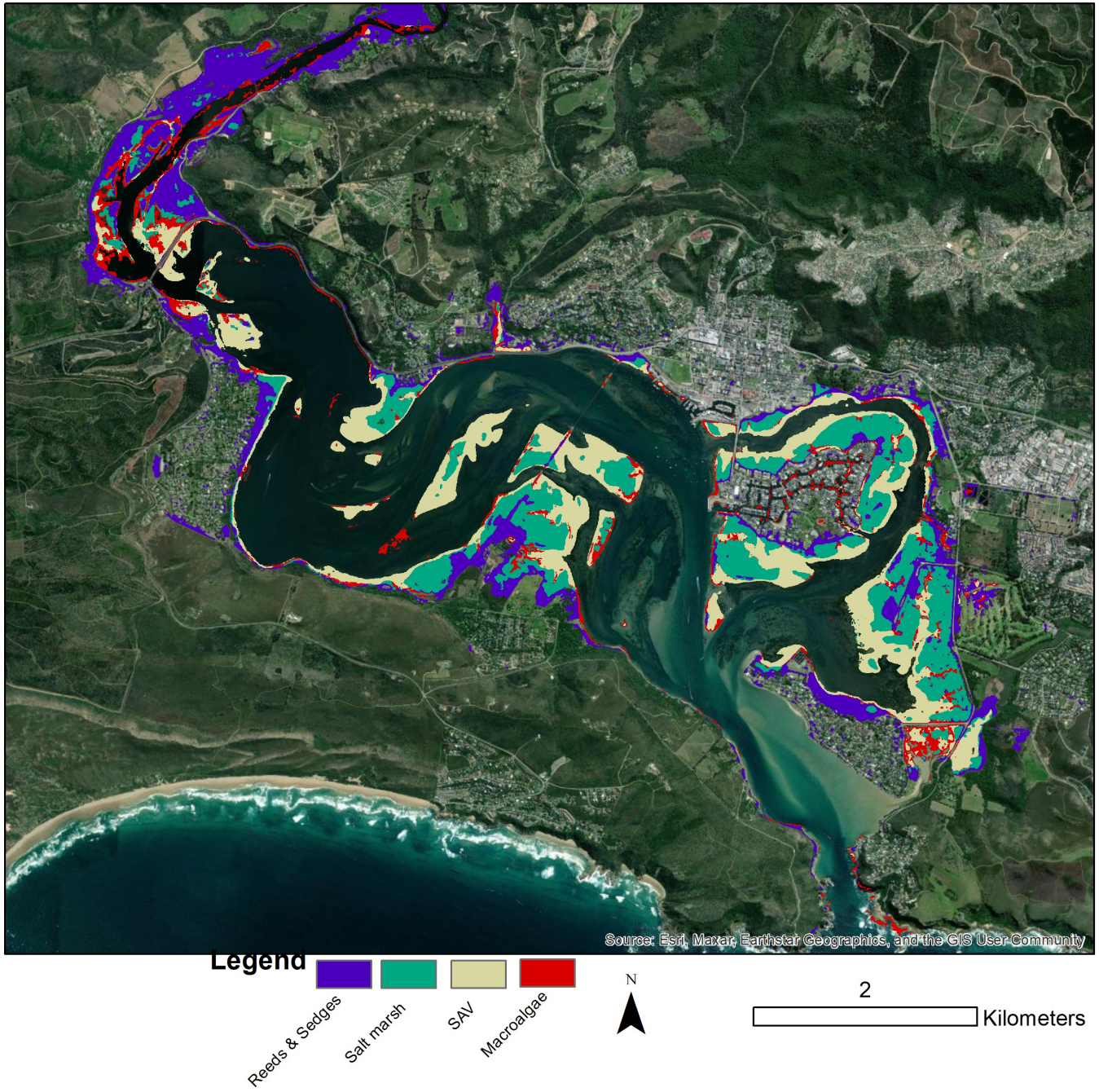
Discrete Extent Maps

We predicted coastal wetland extent for 74 estuaries in the Western Cape Province.
We mapped a total of **12,643.4 ± 614.1** ha of salt marsh & reed beds
2491.0 ± 34.2 ha of SAV
Salt marsh: **2627.0 ± 17 ha**
Reeds & sedges: **10016.42 ± 597 ha**

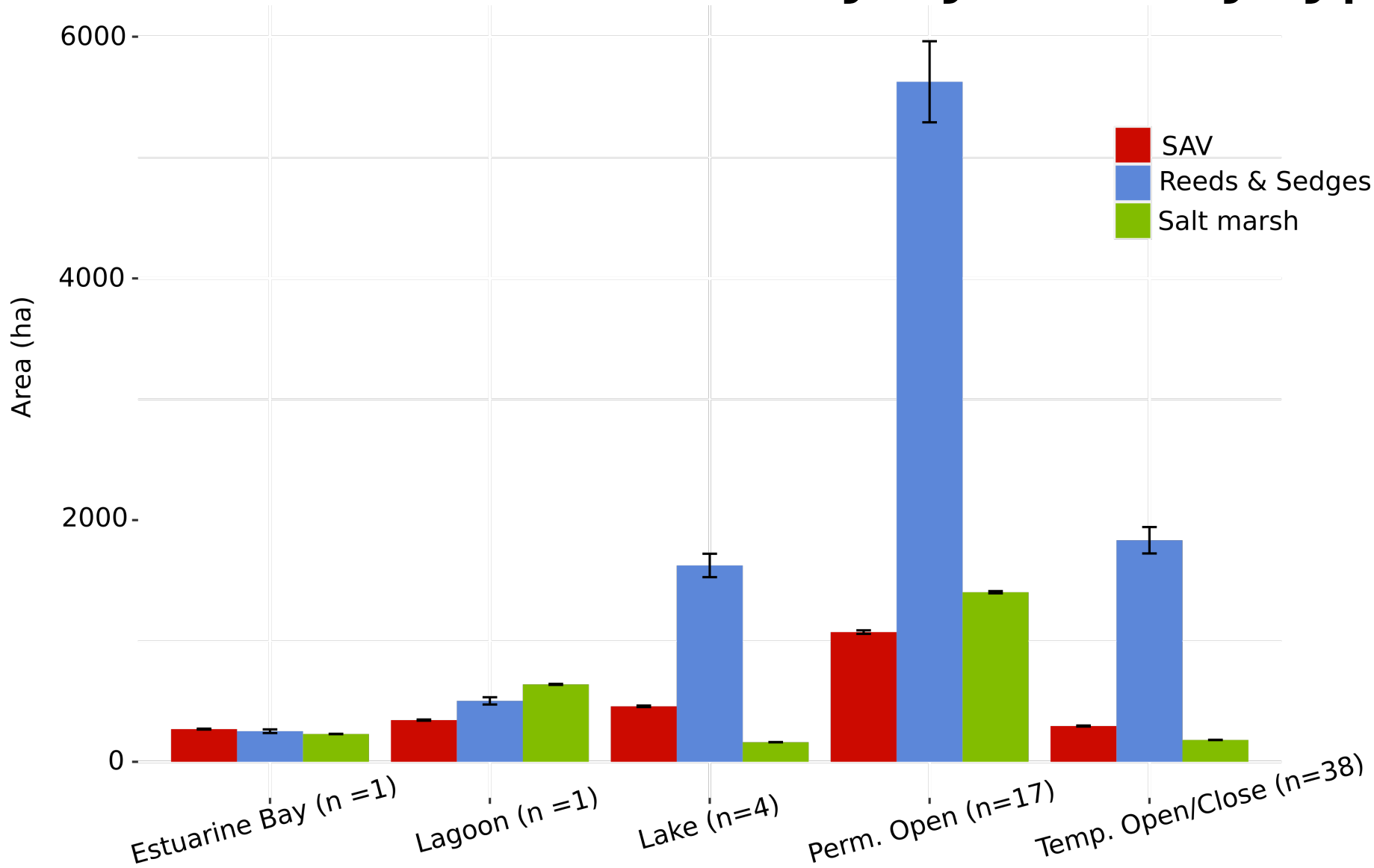


Discrete Extent Maps

The temporal probability raster also allow for mapping of other important marine climate variables such as Macroalgae extent.



Plant functional community by estuary type



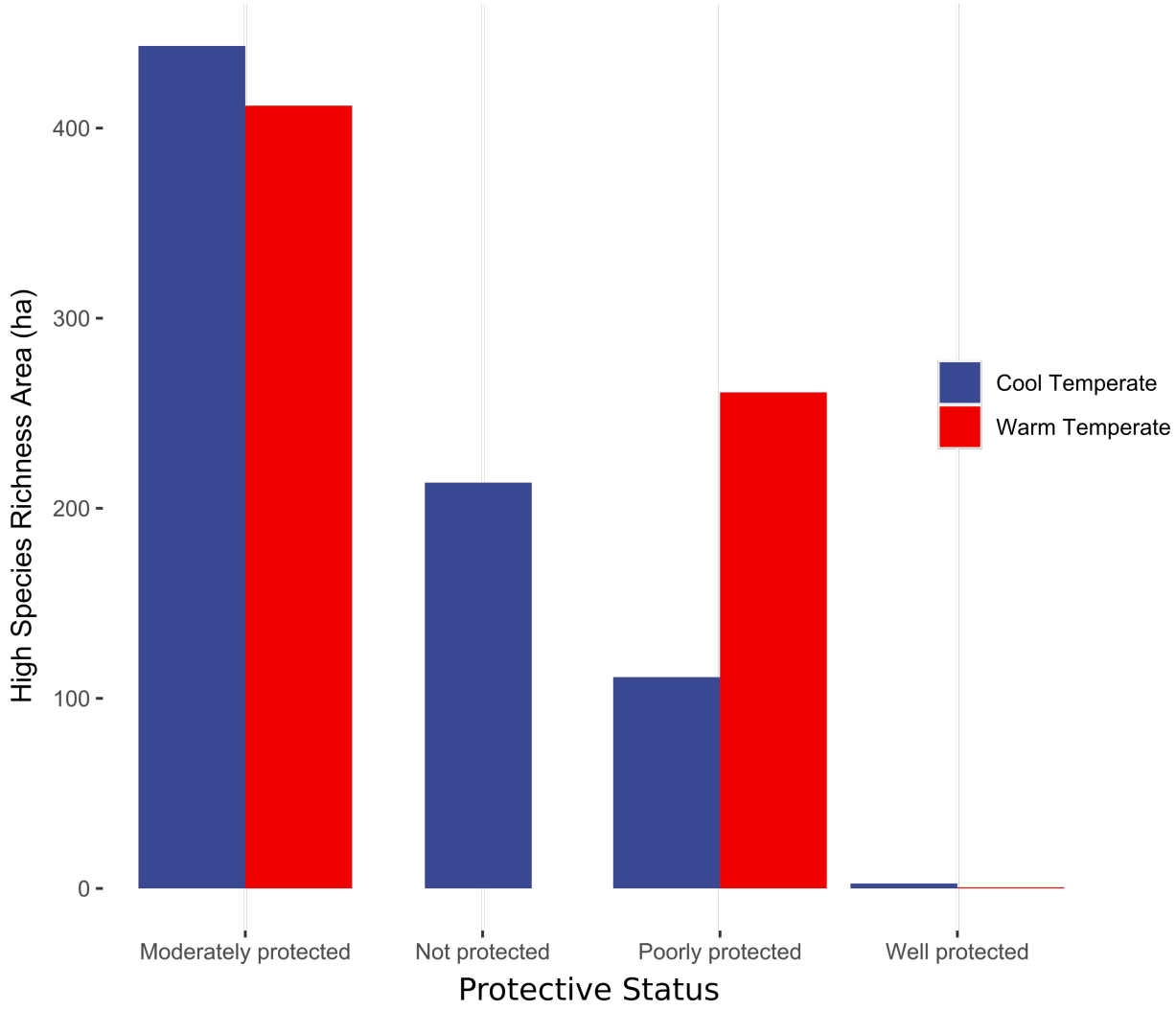
Open/Close Estuary

Open

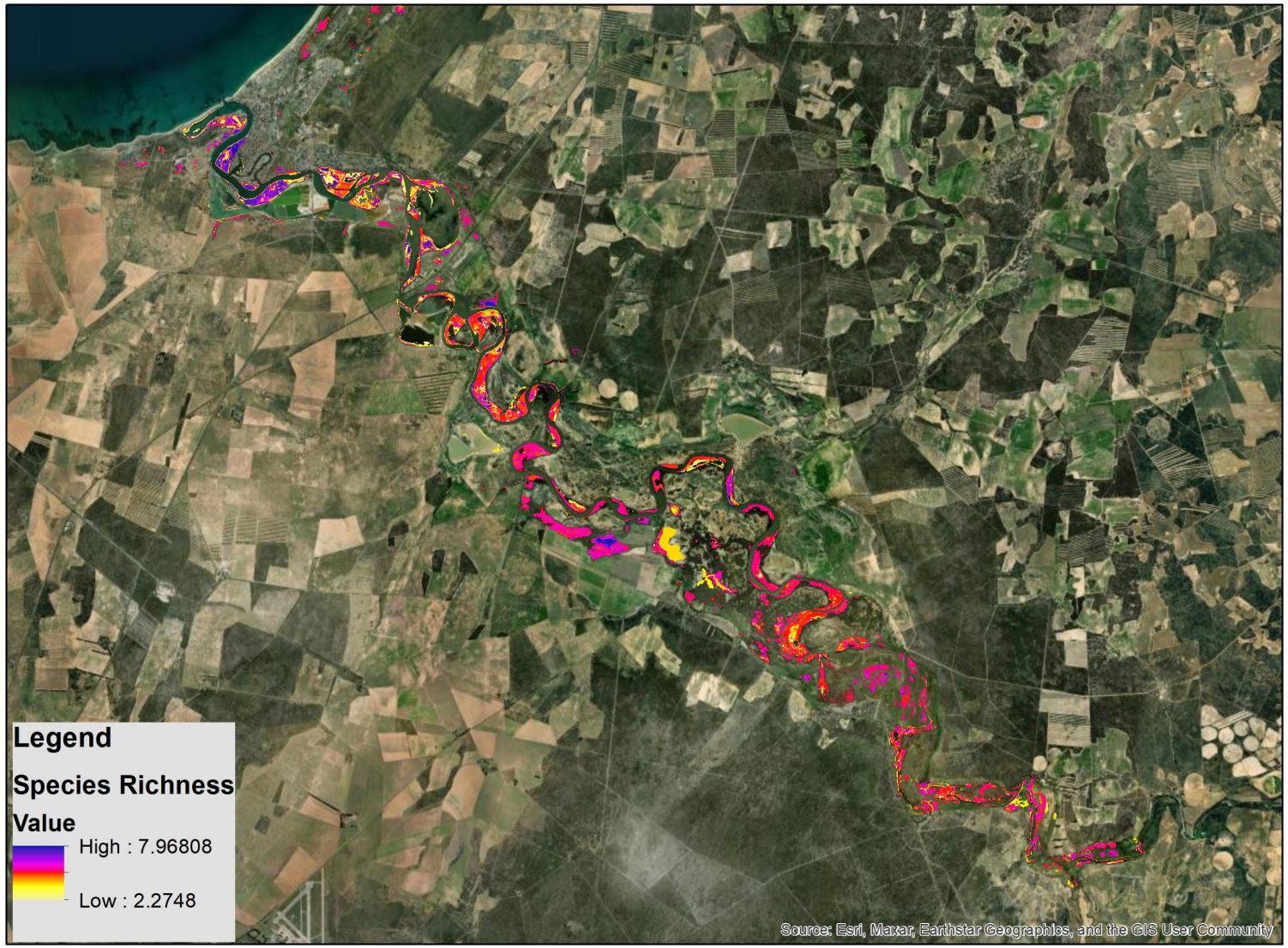
Close

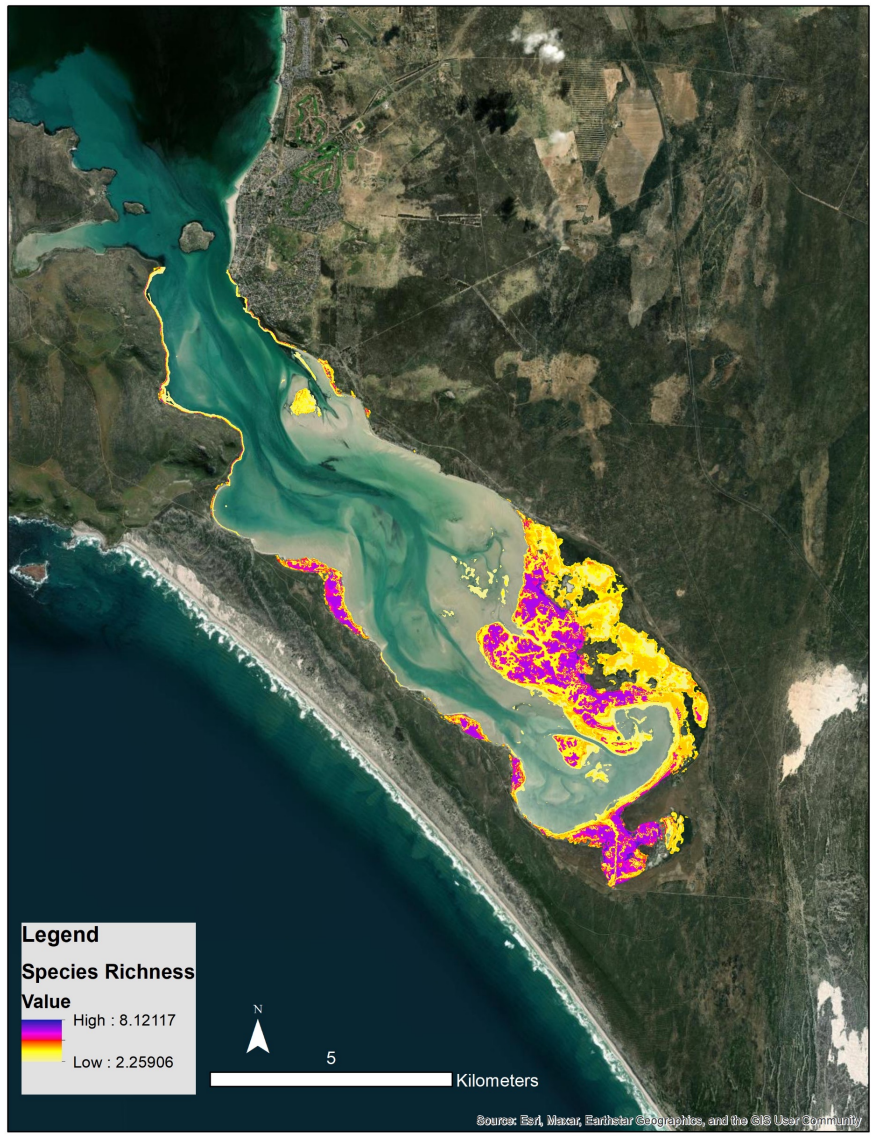
Coastal wetland species richness

- Predicted richness based on satellite classification and vegetation plot data
- *In situ* the third quartile of species richness was 5
- High wetland species considered areas predicted as having greater than 5 species



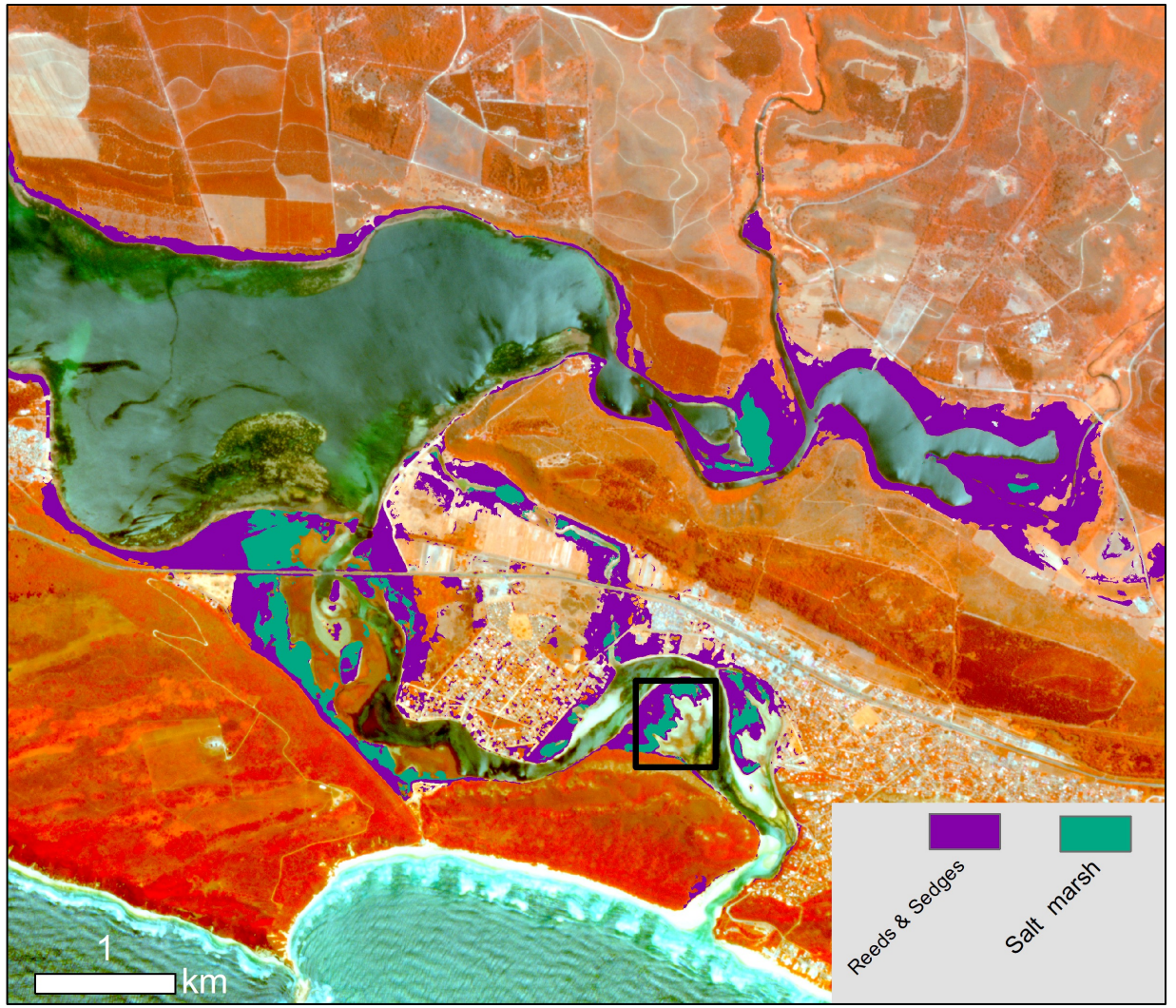
Regional-Coastal wetland species richness





Swartvlei

- 5 vegetation plots collected throughout the area of the scanes
- Vegetation heights from 8 cm to 200 cm



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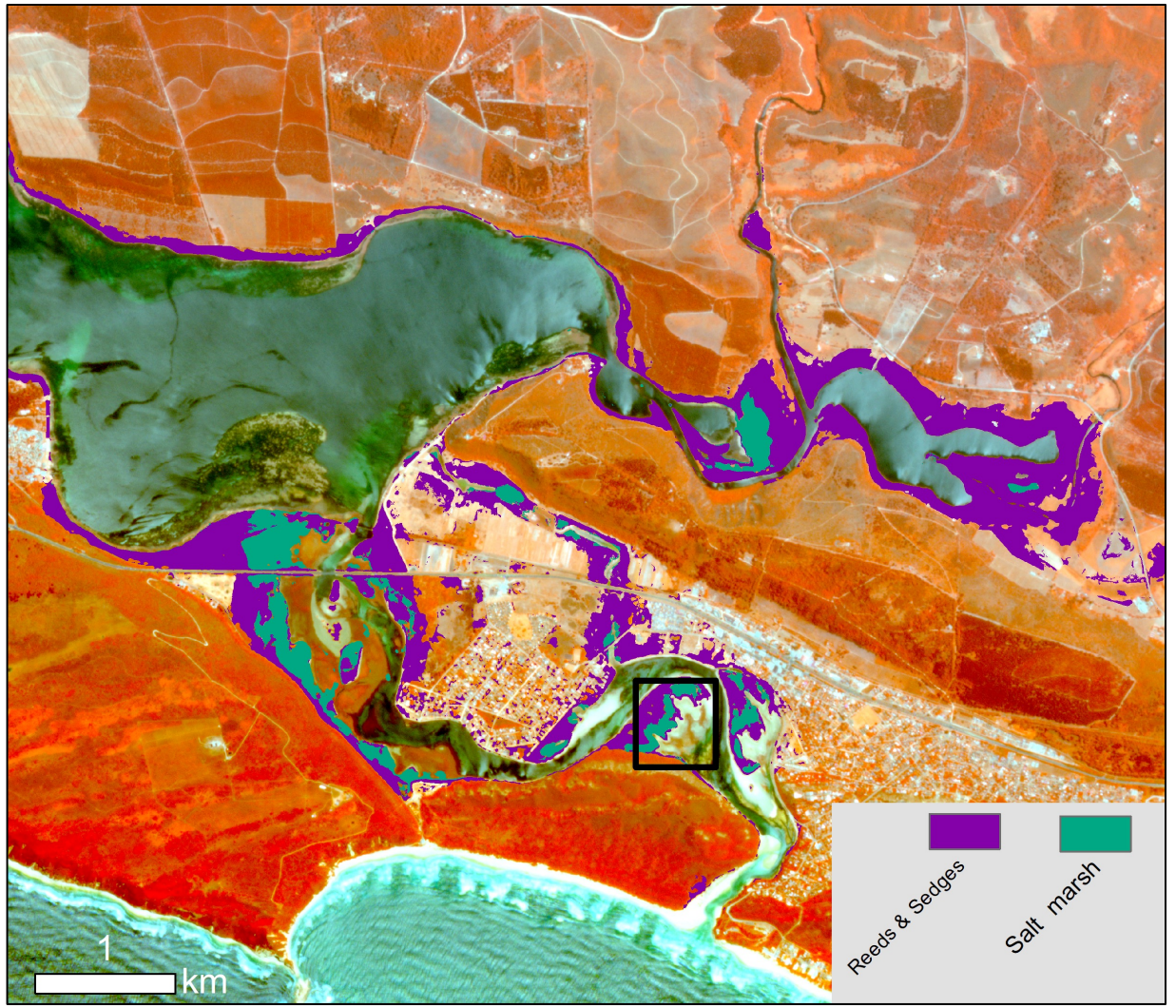
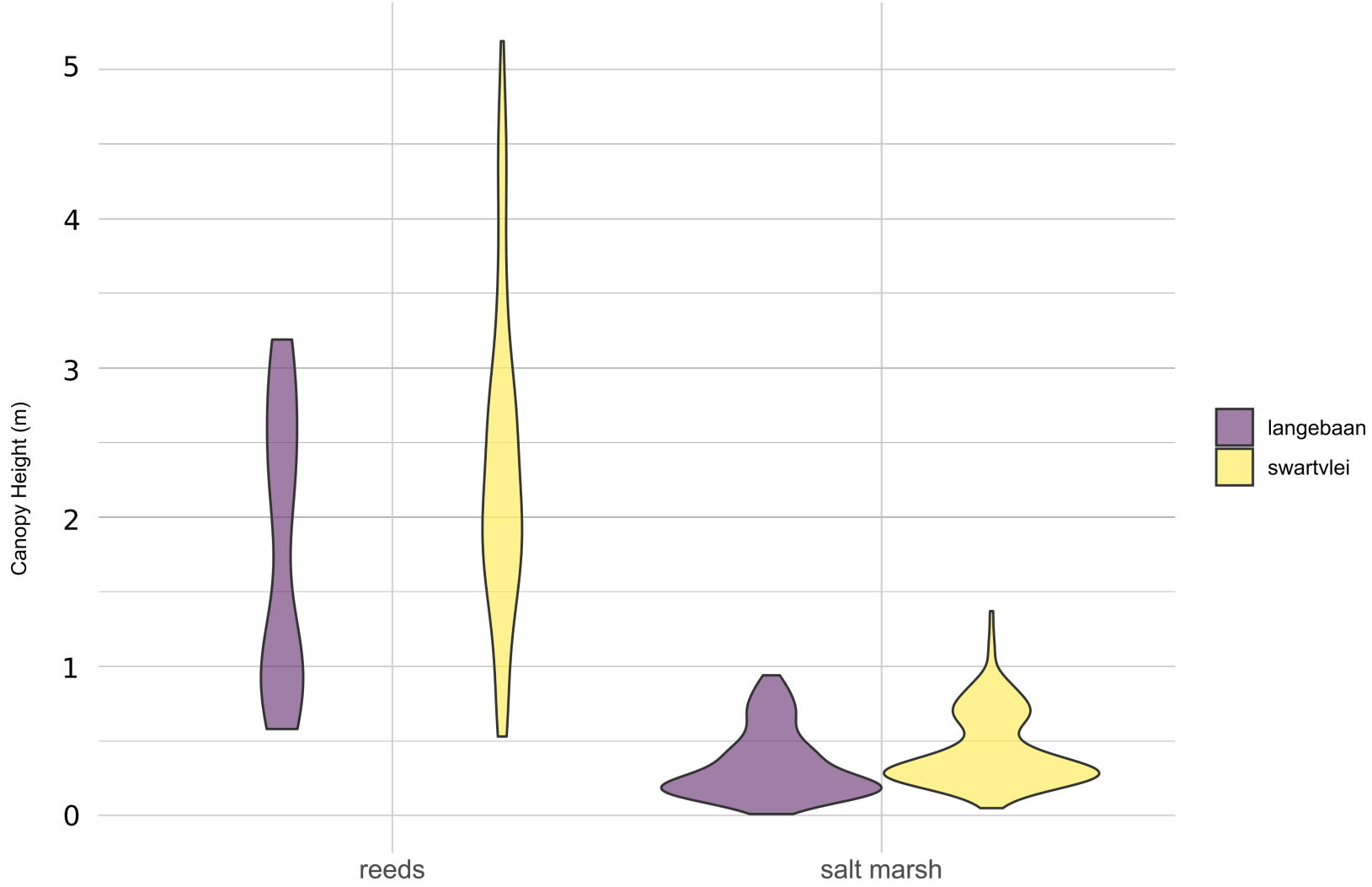


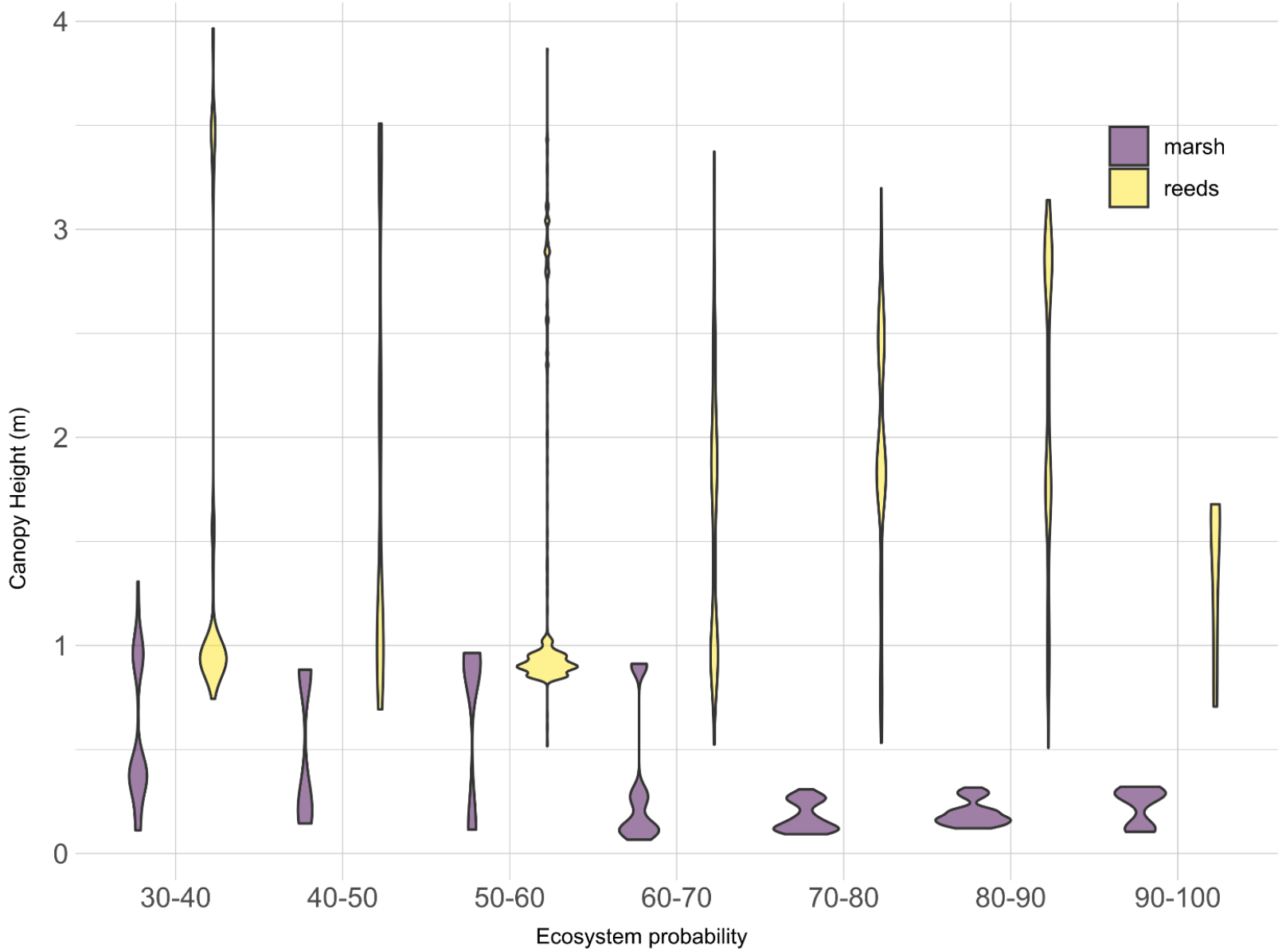
In situ vegetation height

- Collected ten top of canopy vegetation heights for each vegetation plot.
- Classified by plant functional community



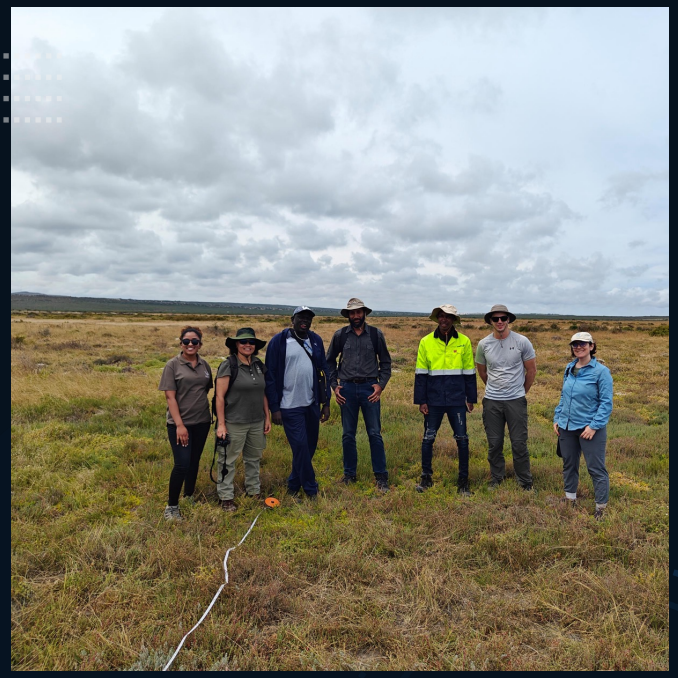
ICESat-2

Processed ATL-03 data to estimate ground surface and low-stature canopy heights.
Can ICESat-2 capture low stature vegetation?



Takeaways

- Mapped key plant functional communities and species richness across all estuary of the GCFR.
- Satellite data is demonstrating success in monitoring
- Excited for additional context and insight that can be provided by the Airborne data



A Huge Thanks to those who helped with fieldwork!