BioREaCH Biodiversity-Remote sensing for Estuarine and Coastal Habitat research

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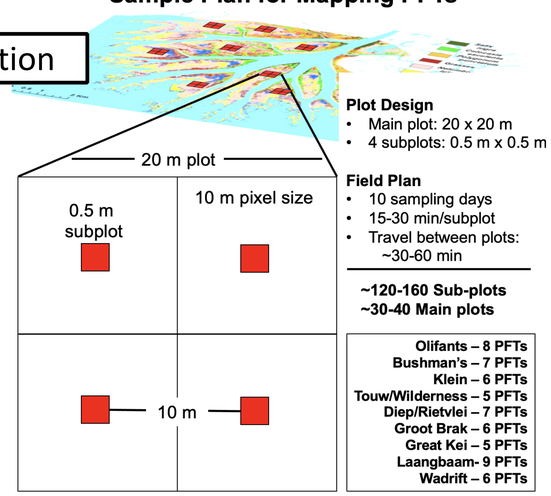
Proposed work

We will **create data products** from the **BioSCapes sensors** to **quantify physical and environmental drivers of biodiversity** across the **LOAC in the GCFR** and ascertain the **vulnerability and resilience** of these **biodiversity hotspots** to **projected climate and anthropogenic impacts.**

Task 1: Field data collection

We **hypothesize** that estuarine **biodiversity change** is driven by **disturbance, freshwater inputs reduction, and coastal squeeze.** We will **quantify past vegetation change** using the **Landsat** archive and **cloud computing** enabled **time-series** analysis

Sample Plan for Mapping PFTs



Plot Design
- Main plot: 20 x 20 m
- 4 subplots: 0.5 m x 0.5 m

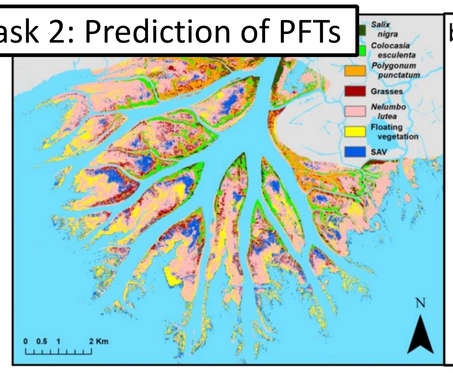
Field Plan
- 10 sampling days
- 15-30 min/subplot
- Travel between plots: ~30-60 min

~120-160 Sub-plots
~30-40 Main plots

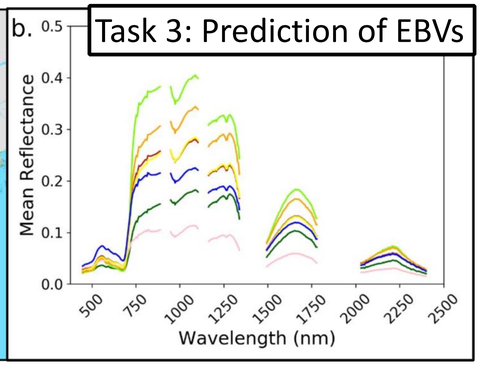
Olifants – 8 PFTs
Bushman's – 7 PFTs
Klein – 6 PFTs
Touw/Wilderness – 5 PFTs
Diep/Rietvlei – 7 PFTs
Groot Brak – 6 PFTs
Great Kei – 5 PFTs
Laangbaam- 9 PFTs
Wadrift – 6 PFTs

We will **collect EBVs in the field at 30-40 20 x 20 m main plots (4 nested subplots) across 9 estuaries for a total of ~120-160 *in-situ* measurement locations**

Task 2: Prediction of PFTs



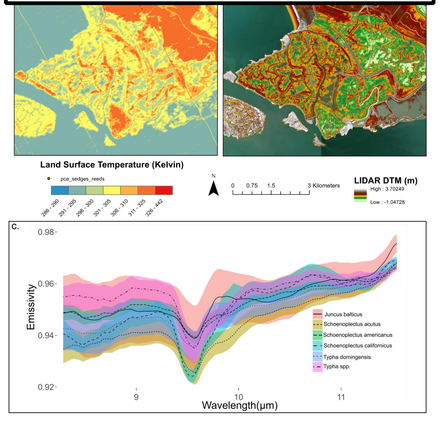
Task 3: Prediction of EBVs



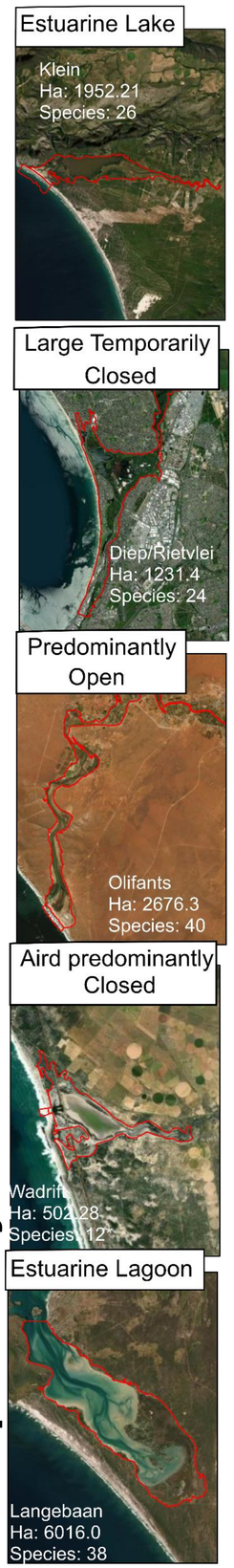
Task 4: Accuracy assessment

Machine learning algorithms will be trained using *in situ* vegetation plot data, with 70/30 split between training and validation, respectively. More precise species level classes for invasive species mapping (i.e., endmember mapping) will also be assessed. The accuracy assessment results for the validation set will be used to compare the ISODATA and machine learning algorithms. The best performing algorithm will be used to create the final data products.

Task 5: Calculate spectral diversity and dimensionality



Example study sites



Task 6: Relate spectral measure to PFT drivers

We will relate **spectral diversity** and **dimensionality** to potential **estuarine drivers of biodiversity** with **machine learning** and **non-parametric statistical analysis**. We **hypothesize** that **spectral dimensionality and diversity** are **indicators** of **biodiversity variation** at both the estuary and PFT scale.

Task 7: Expand to spaceborne data

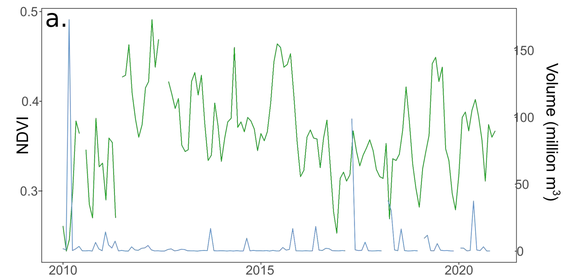
Regional Object-based PFT classification with Worldview will first be **trained and tested in estuaries** classified by the **AVIRIS-ng data**.

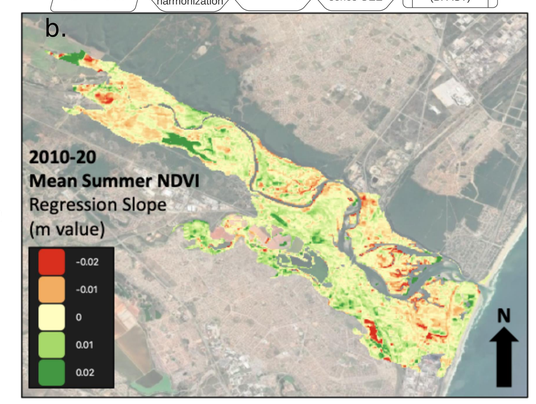
Task 8: Conduct time series analysis

To complete task 8, we will conduct a time-series analysis of the Landsat archive to determine disturbance and trend across the region's estuaries. We will then utilize our regional PFT classification to determine what PFTs are changing most across the GCFR i.e., their current resilience.

Task 9: Predict climate impacts

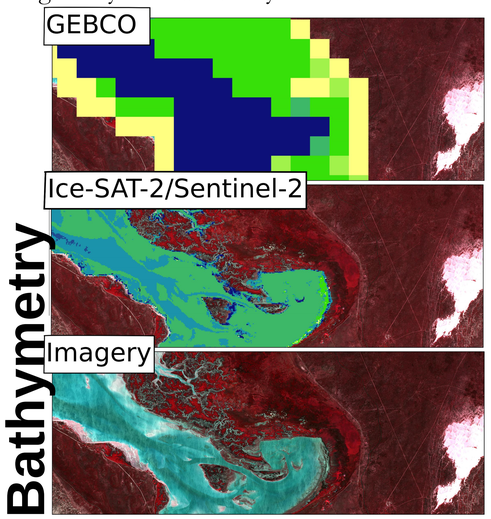
We will synthesize existing data and data products generated by this proposal to understand how climate change will impact estuaries. We will use the Landsat time-series result in conjunction with climatological variables derived from IPCC climate models to predict future change to estuaries. These results will inform management, restoration, and coastal planning.





Preliminary Results

We have begun processing IceSAT-2 data to create bathymetric maps of our study sites. This represents a significant spatial resolution improvement over the best globally available bathymetric data GEBCO.



We have also begun preliminary classifications of our study sites. These classifications will allow us to develop stratified random sampling of the GEDI locations within each of our plant function types thus both providing a robust accuracy assessment and