

Evaluating The Suitability of GEDI-derived Structural Vegetation Information Metrics For Characterization of Savannah Ecosystems in Southern Africa

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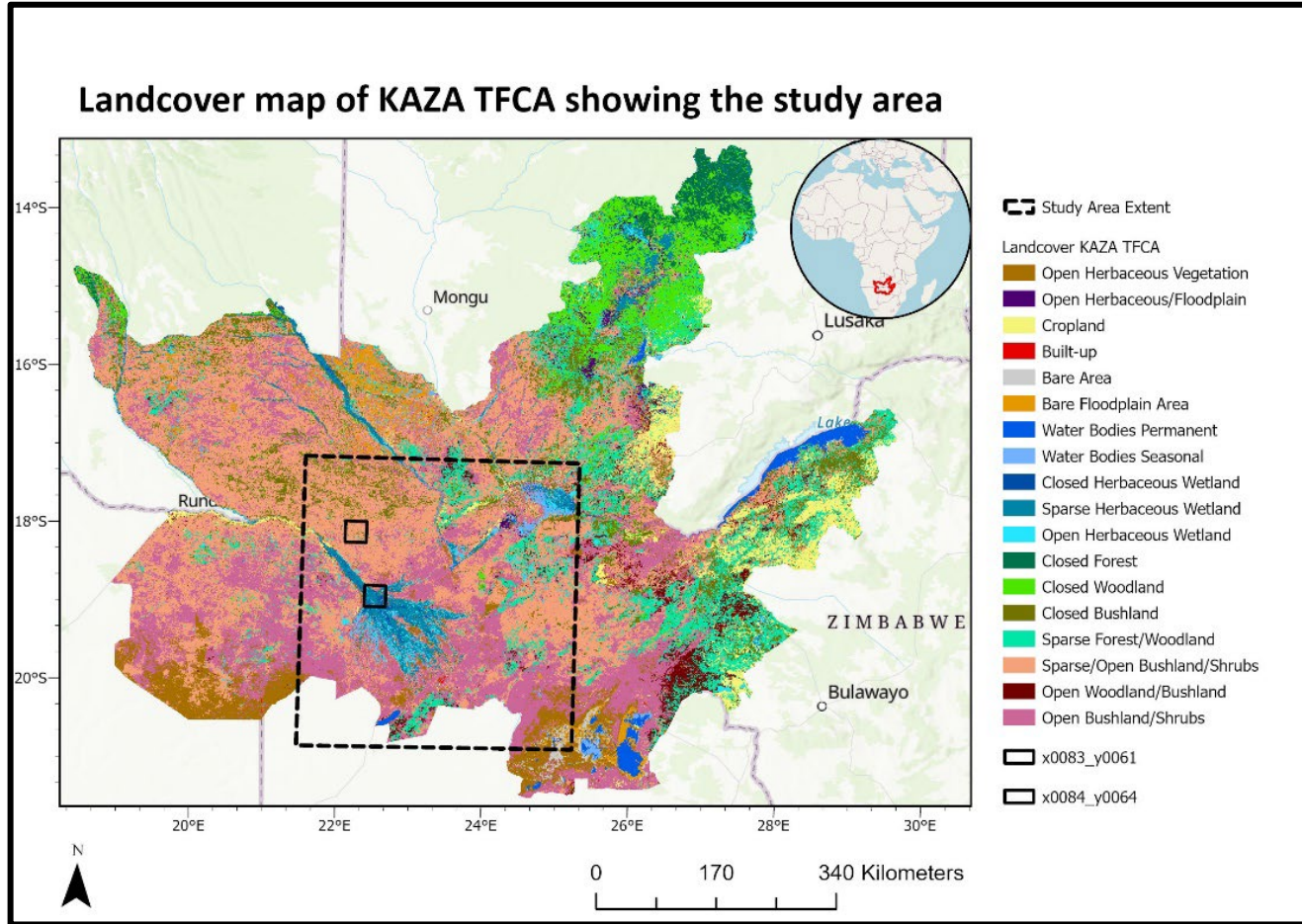
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 Adaptive Land Management



KAZA and Okavango Delta



Land cover map of KAZA TFCA (Gebhardt, S. 2021).

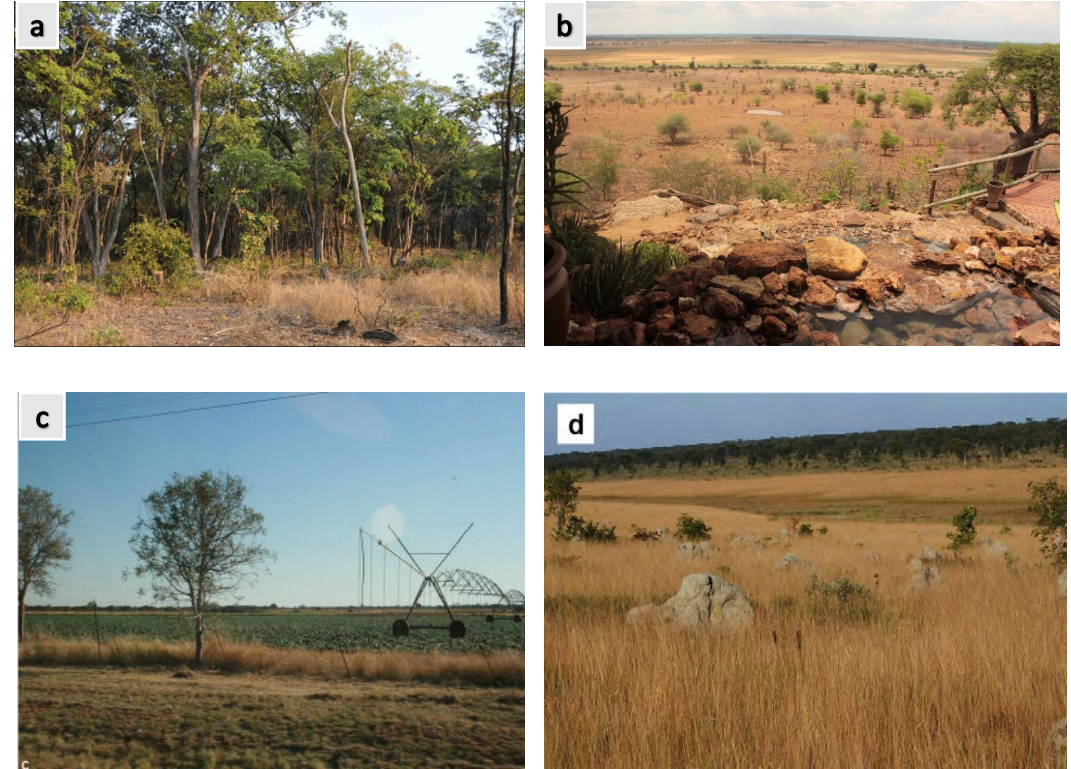
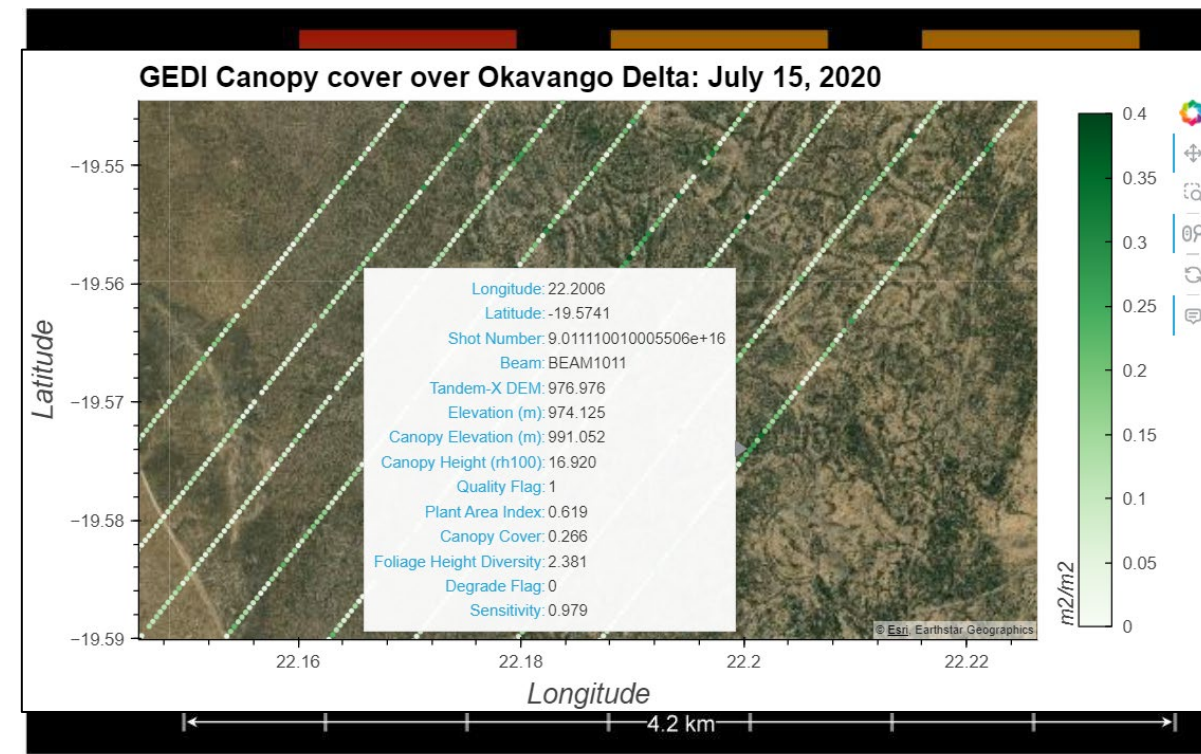
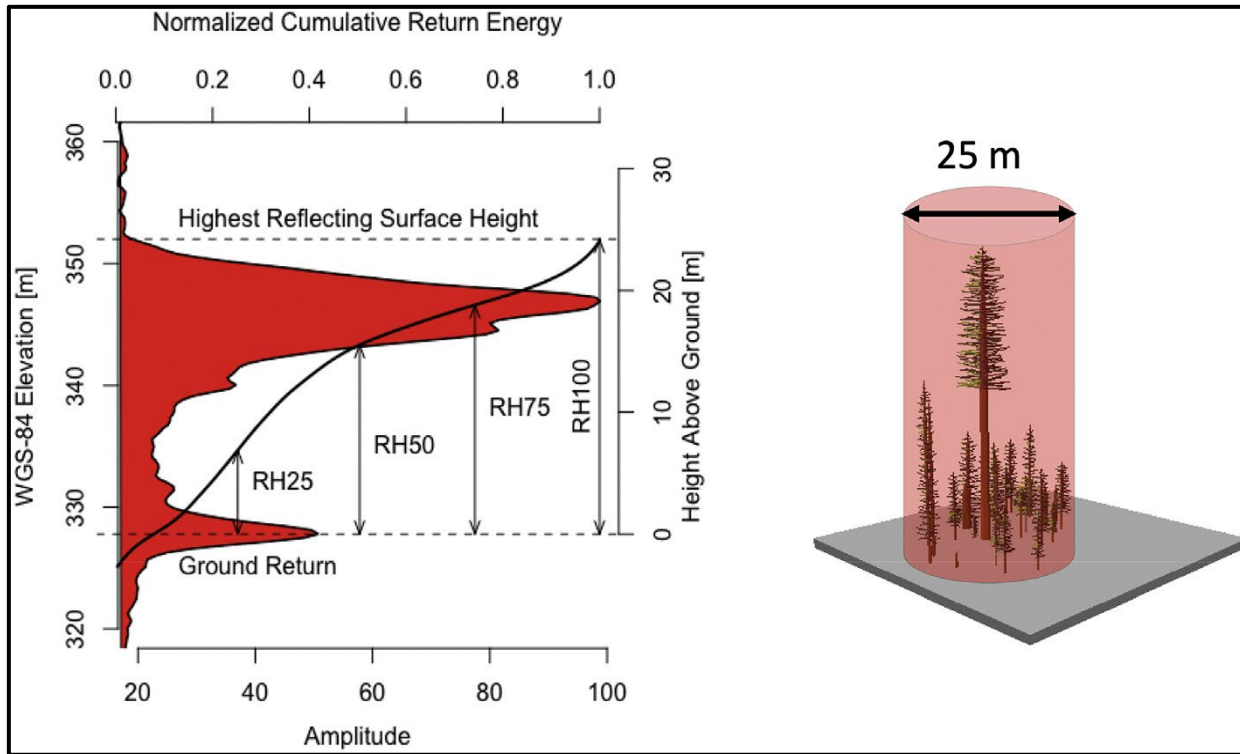


Figure 1. Vegetation types in the study area.
a) woodlands b) open shrubland, c) cropland, d) grassland with closed forest to the left

Global Ecosystem Dynamics Investigation (GEDI)



- Vertical structural vegetation data
- 25m diameter footprint
- Canopy height - RH98
- Canopy cover
- Foliage height diversity (FHD)
- Plant area index (PAI)

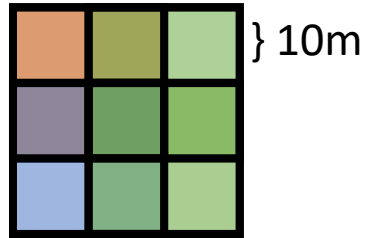
- Launched in 2018
- 2019-2022 data used in this study
- Each overpass 4 tracks
- Sparse coverage (60m, 600m apart)
- Geolocation uncertainty of ~10m (Tang, et al., 2023)

Sentinel-2 STM, Phenology

Why Sentinel-2?

Sentinel-2 Raster Data

13 reflectance bands
10m (partly resampled)

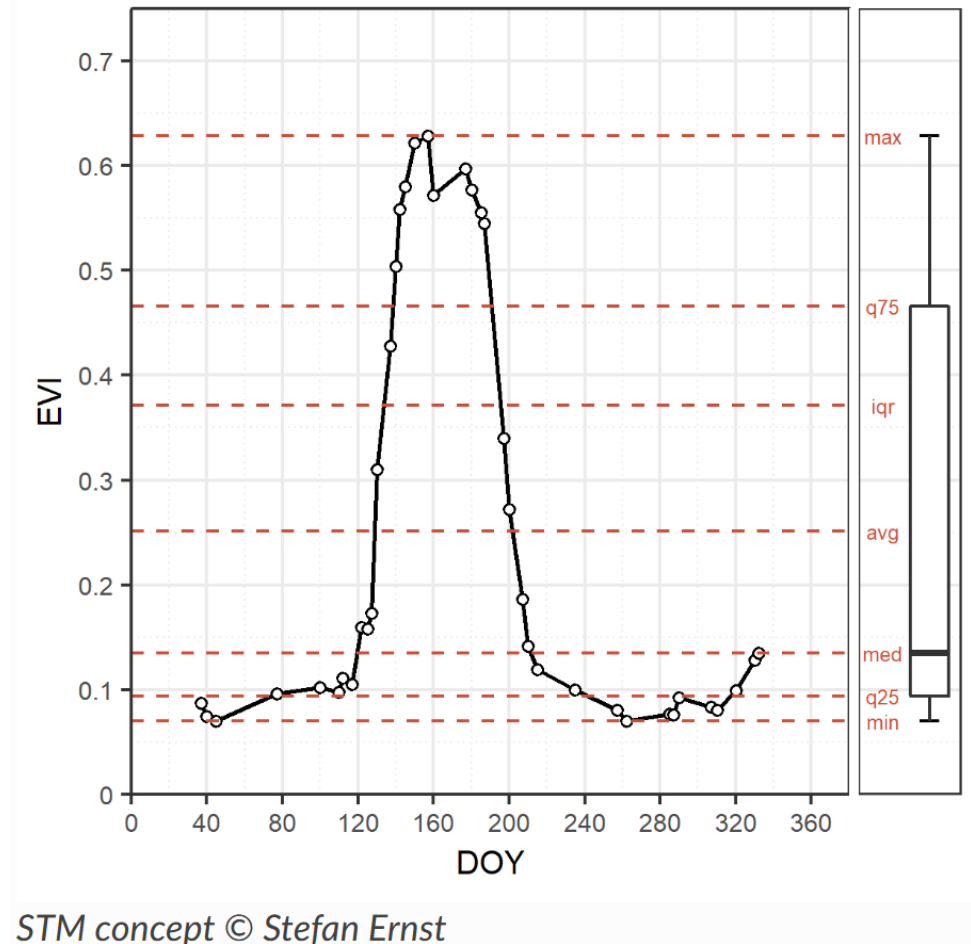


Spectral Temporal Metrics (STM)

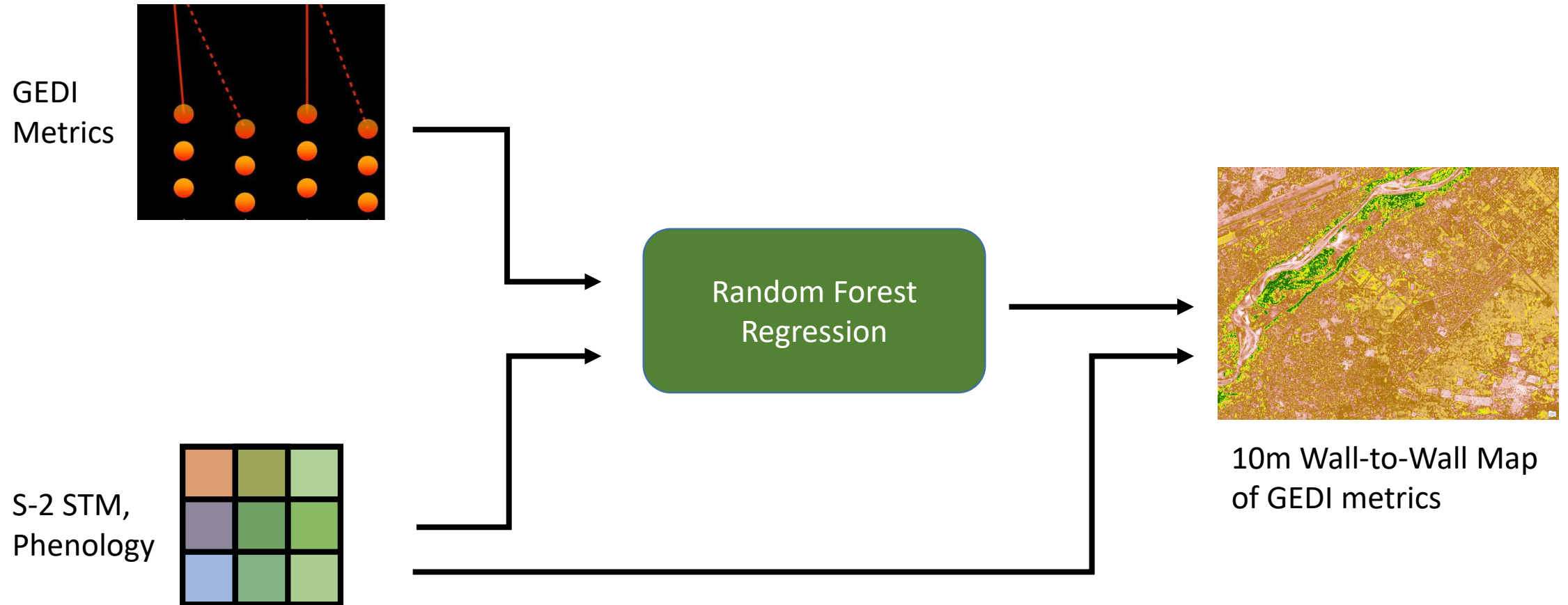
Statistical aggregation of time series (2019-2022)
Q10, Q25, median, Q75, Q90, AVG, STD

Phenology Parameters

Description of EVI phenology curve
E.g. Area under the curve, Date/Value Peak of Season

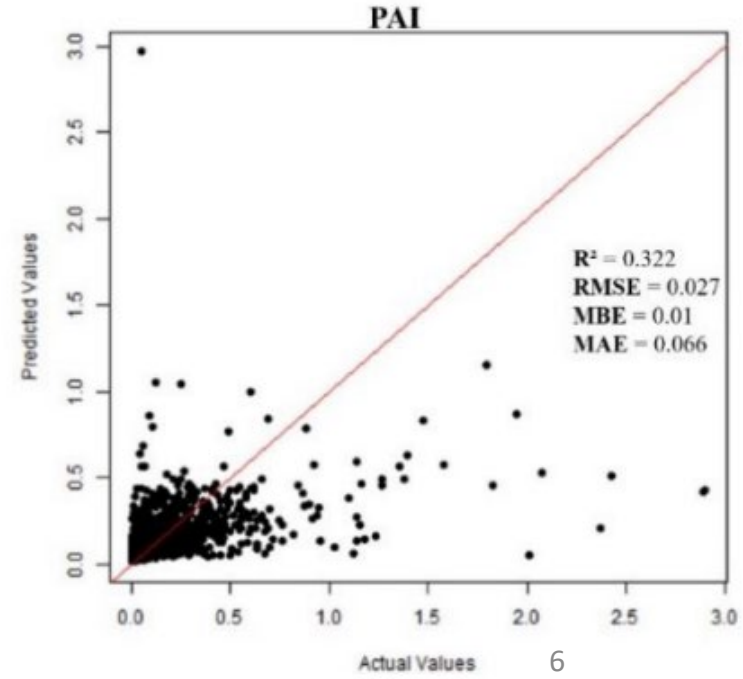
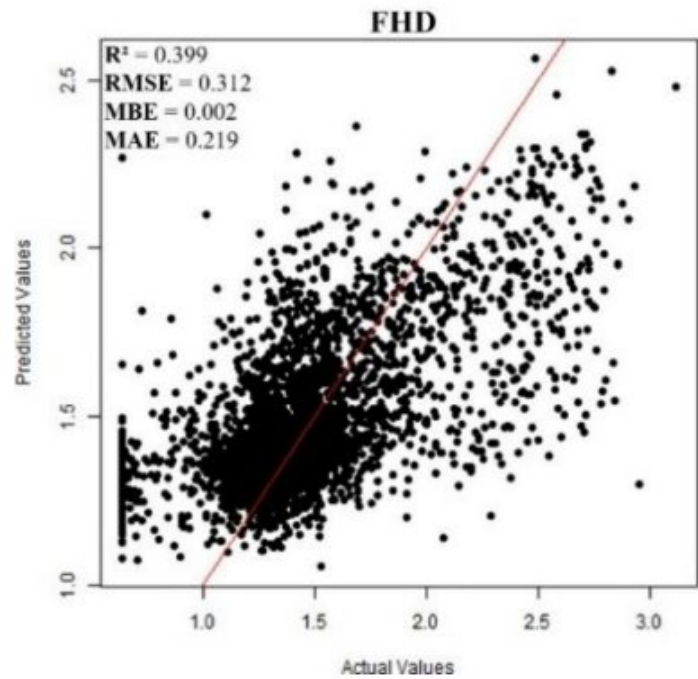
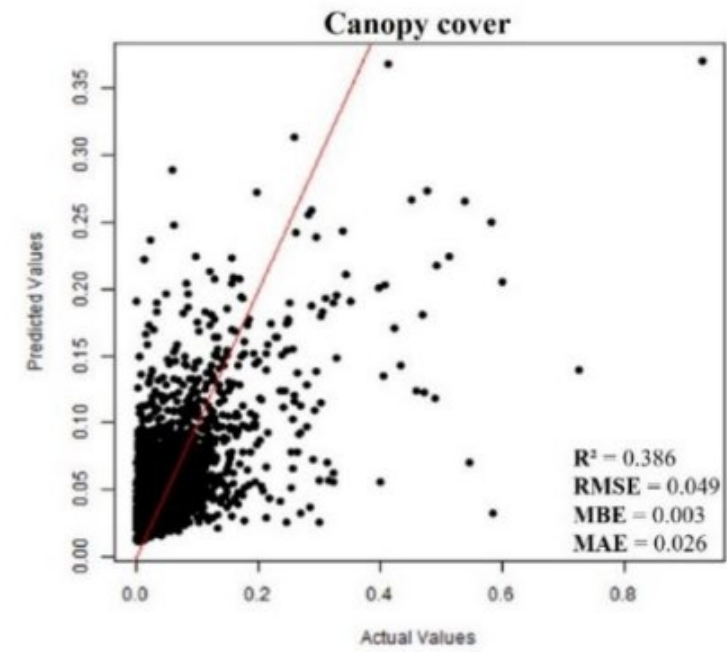
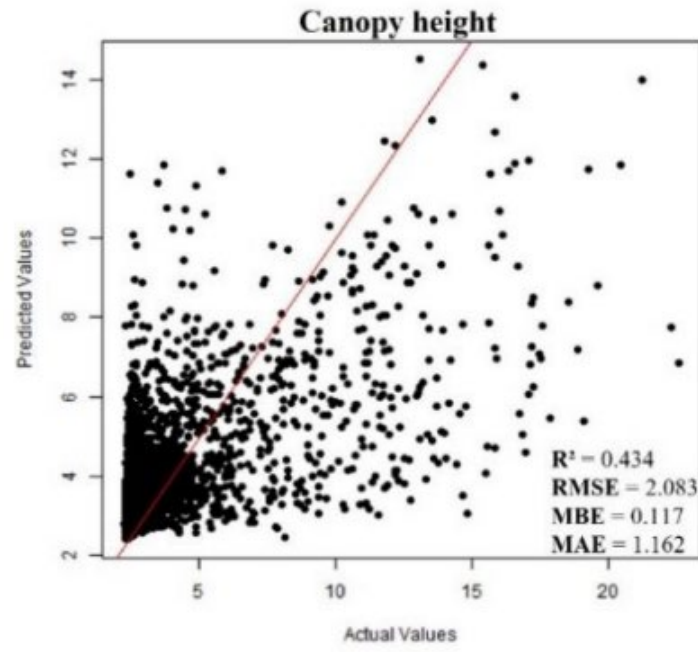
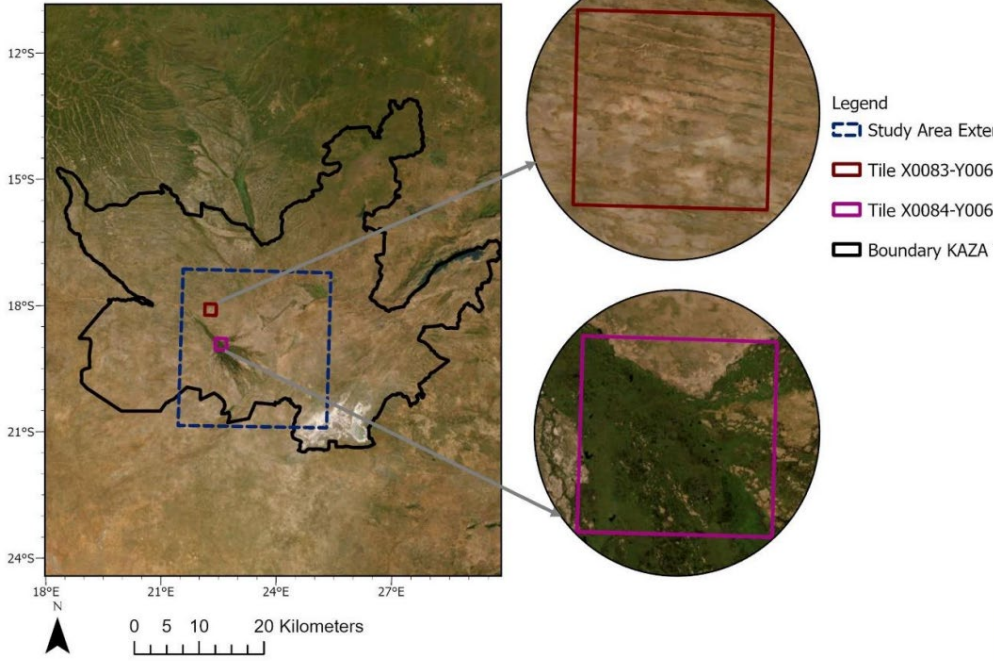


Random Forest Model



Accuracy Test Tiles

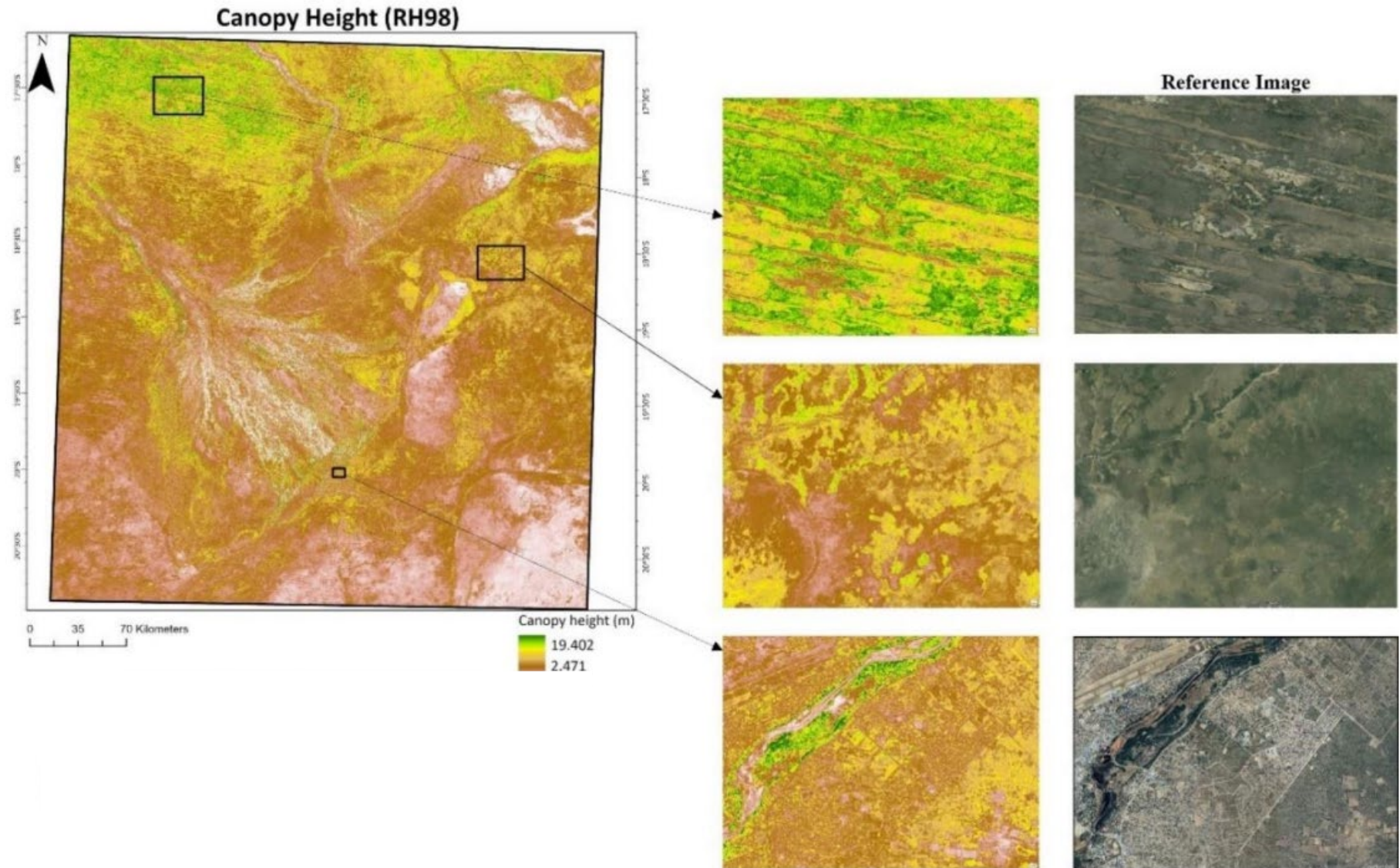
Test Sites



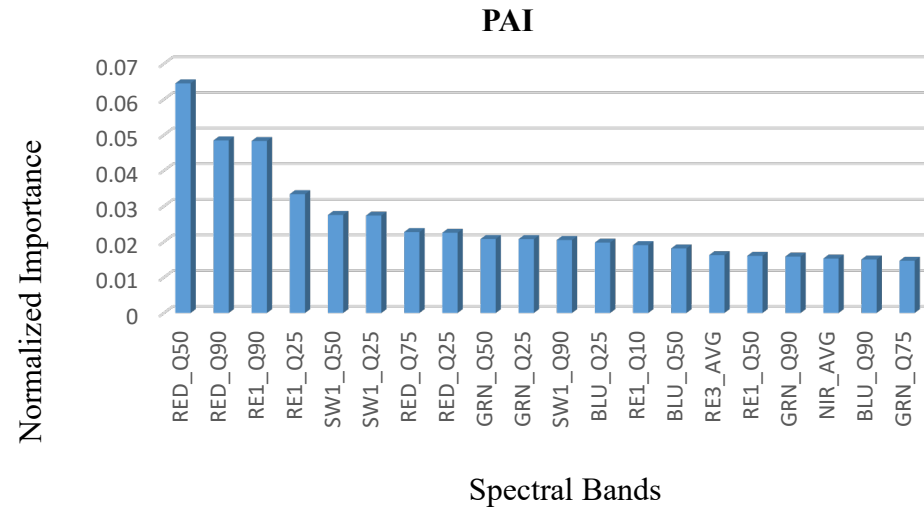
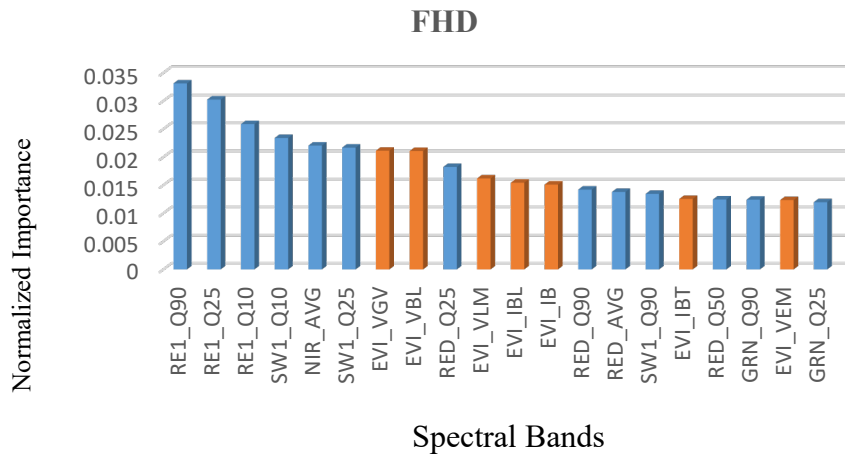
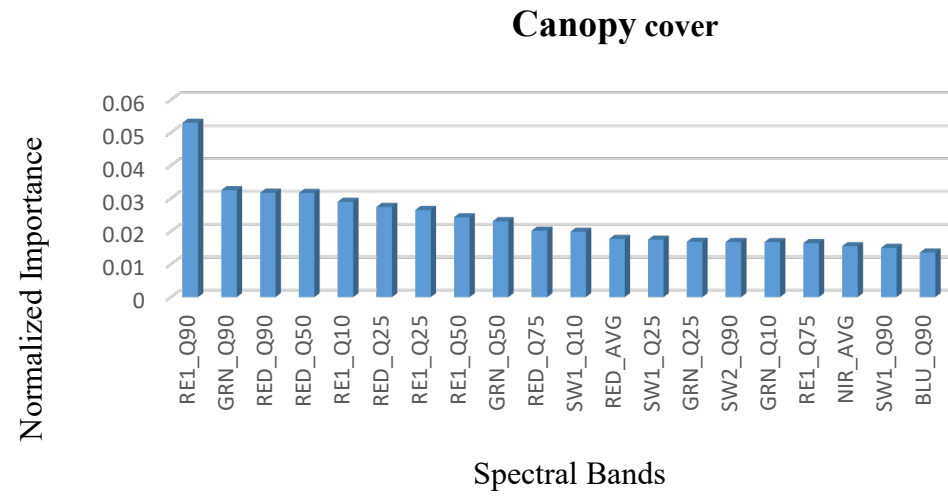
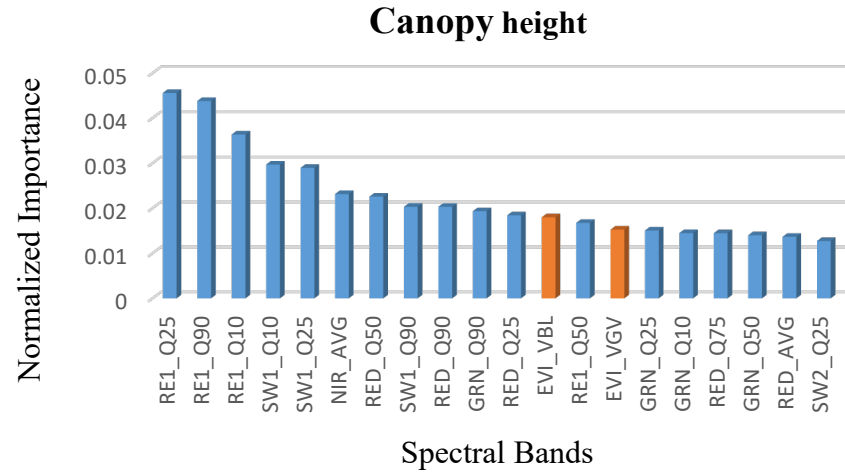
Accuracy Total Study Area

Total Study Area

GEDI Metrics	R ²	RMSE
Canopy height	0.502	1.857
Canopy cover	0.451	0.045
FHD	0.487	0.293
PAI***	0.339	0.135



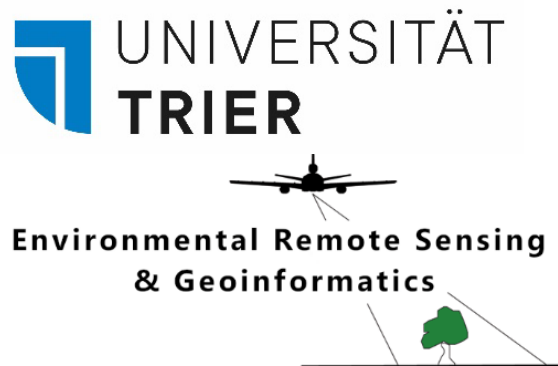
Feature Importance, Random Forest Model



Conclusion

- Sources of Error
 - GEDI data itself is inaccurate
 - GEDI vs. Sentinel-2 footprint (25m circle vs. 10m x10m)
 - Geolocation error
 - GEDI date and S-2 feature time frame
 - Explanatory limitation of temporal-spectral data for vertical structure data
- Is the GEDI-Sentinel2-Fusion suitable to characterize savannah ecosystems in Southern Africa?
- Originally designed for homogenous, tall and dense vegetation but seems to also provide valuable information in lower-stature, discontinuous savannah vegetation

Thank you for your attention!



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Accelerated Climate Change**

