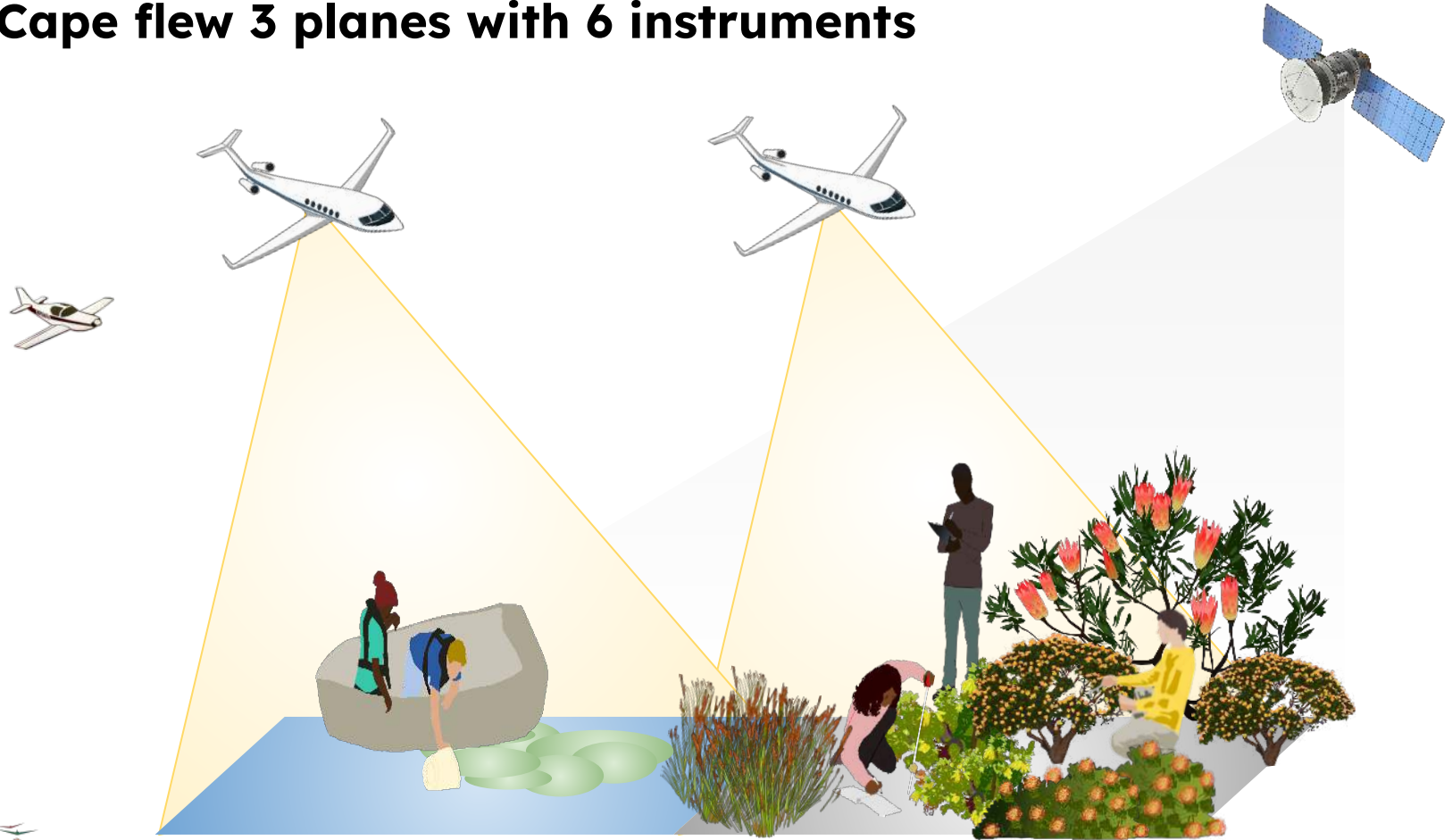




**BioSCape Airborne Data**  
Anabelle Cardoso



# BioSCape flew 3 planes with 6 instruments



# Unprecedented combination of instruments: 3 Imaging Spectrometers + 2 LiDAR + High Res Photos on 3 Aircraft



NRF  
National Research Foundation

SAEON  
South African Environmental  
Observation Network

Lidar  
RGB camera

Airborne Visible / Infrared Imaging Spectrometer

**AVIRIS**  
NEXT GENERATION

PORTABLE REMOTE IMAGING SPECTROMETER

**PRISM**

GODDARD SPACE FLIGHT CENTER  
NASA

HYPER SPECTRAL THERMAL EMISSION SPECTROMETER

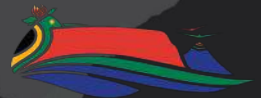
**HYTES**

NASA

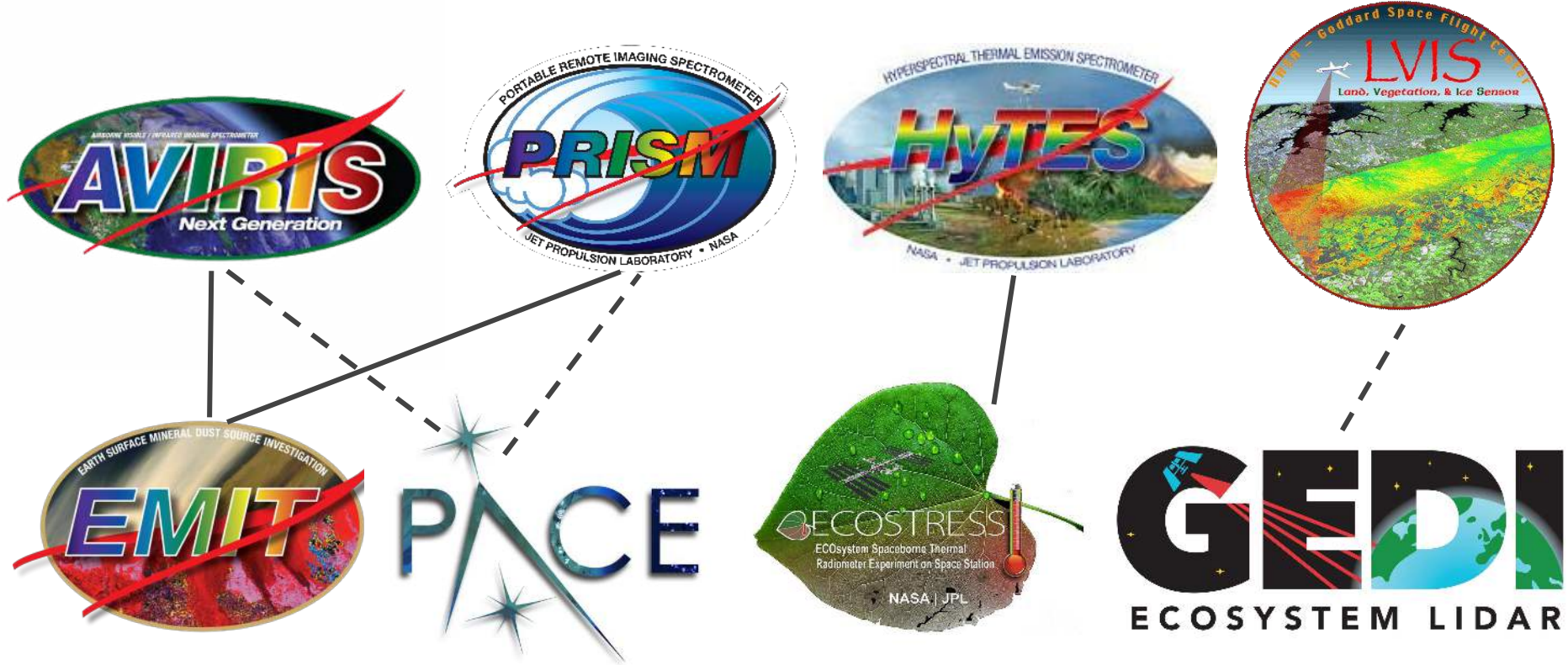
Goddard Space Flight Center

**LVIS**

Laser, Vegetation, & Ice Sensor



# Each BioSCape airborne sensor has a corresponding satellite sensor



# Information across the electromagnetic spectrum + 3D structure

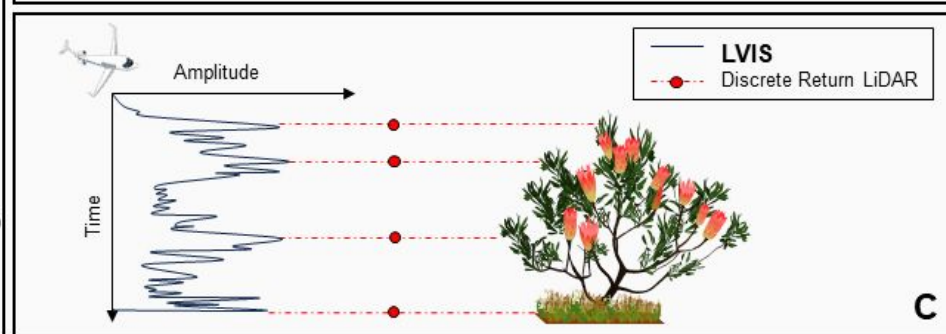
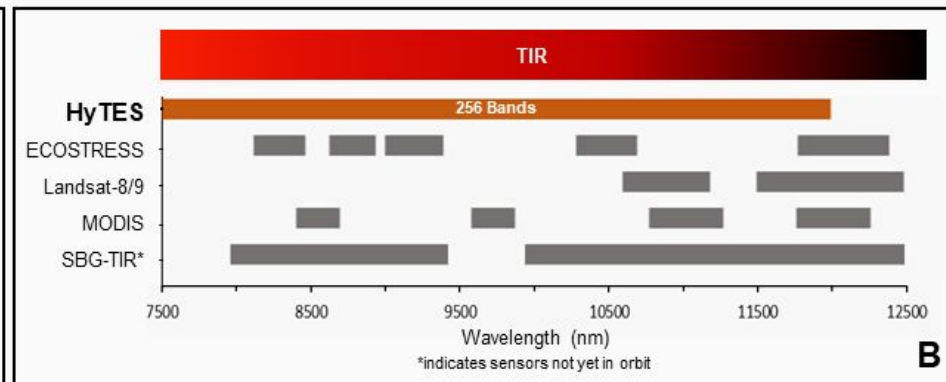
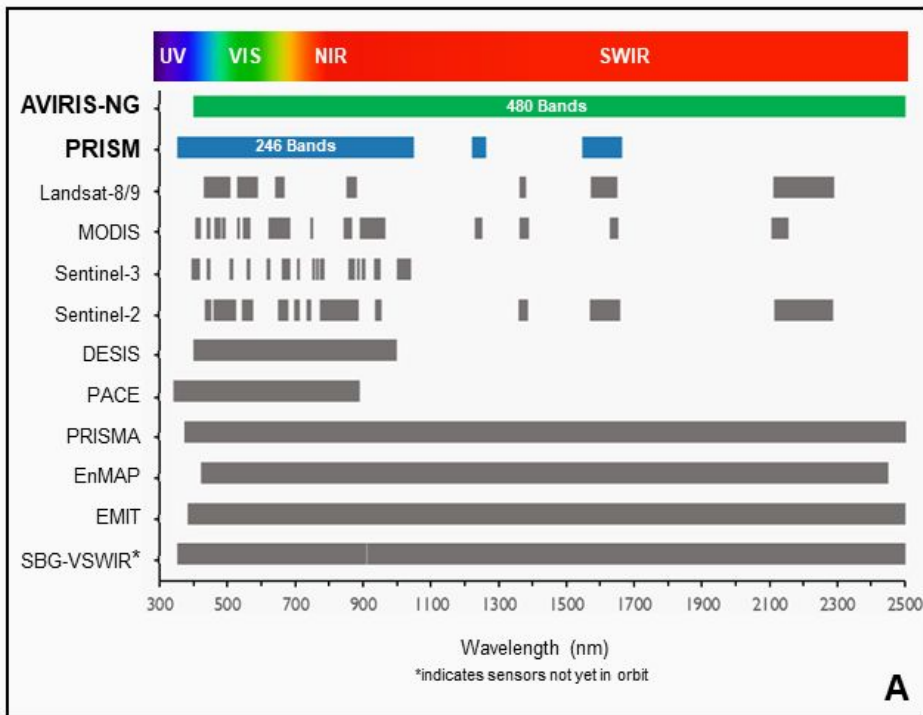
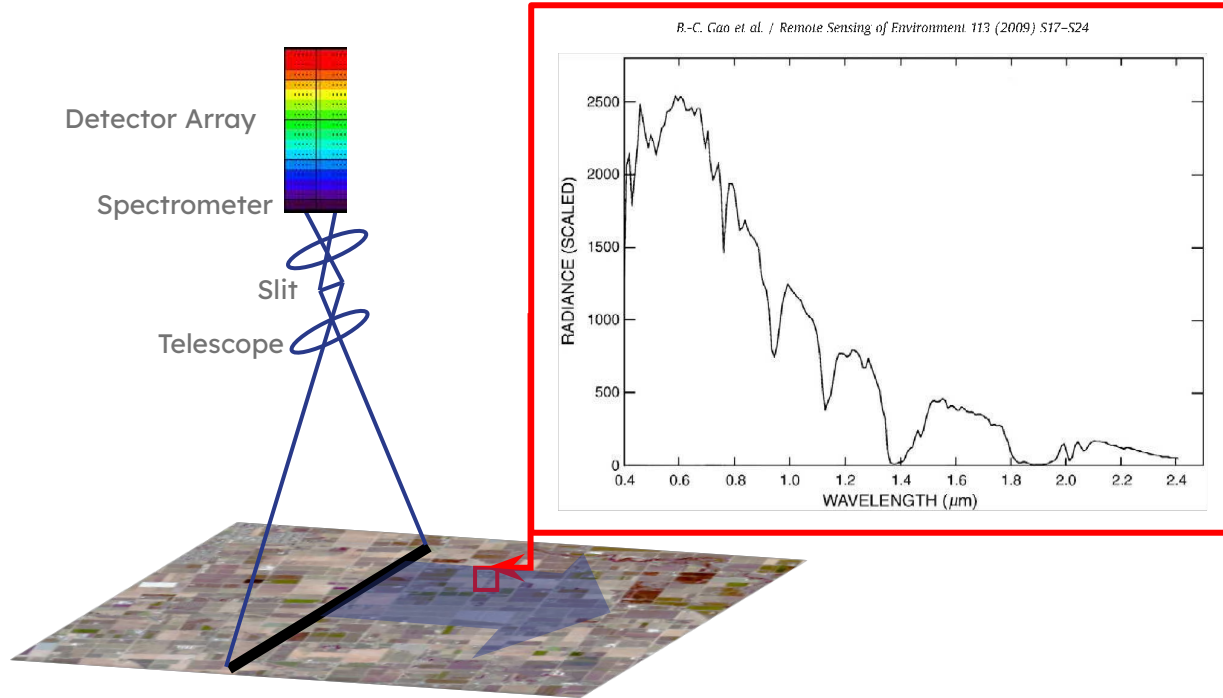


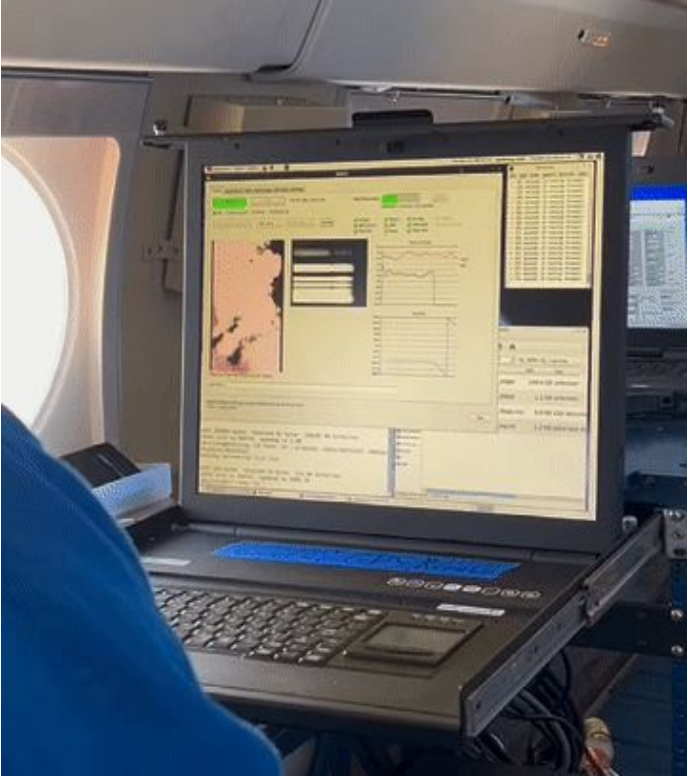
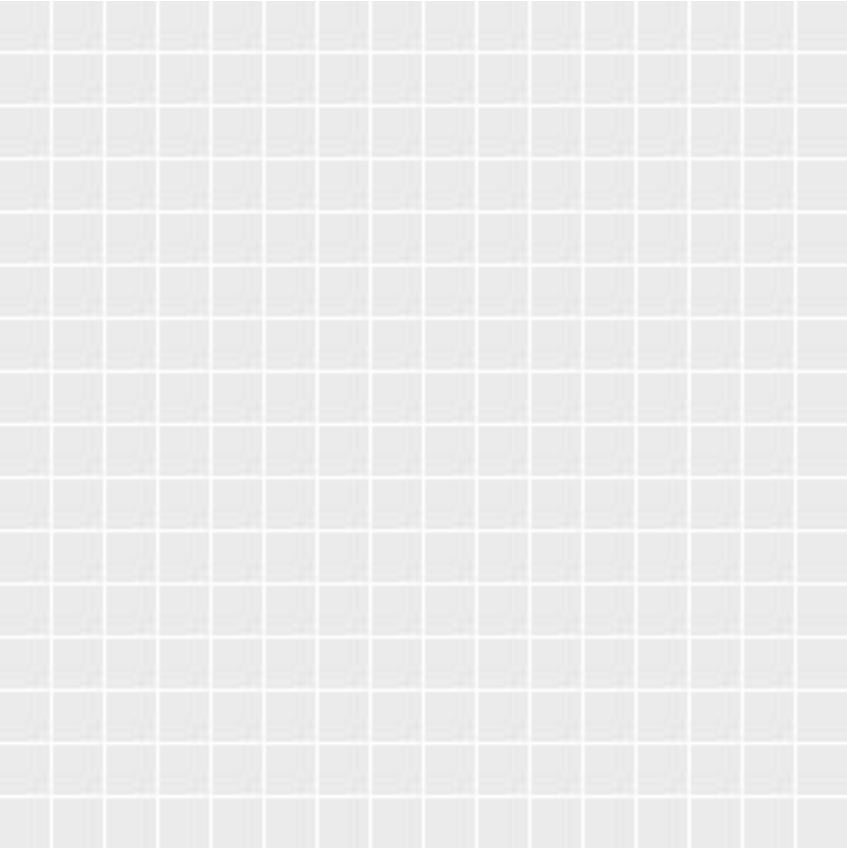
Figure: J. Nessler



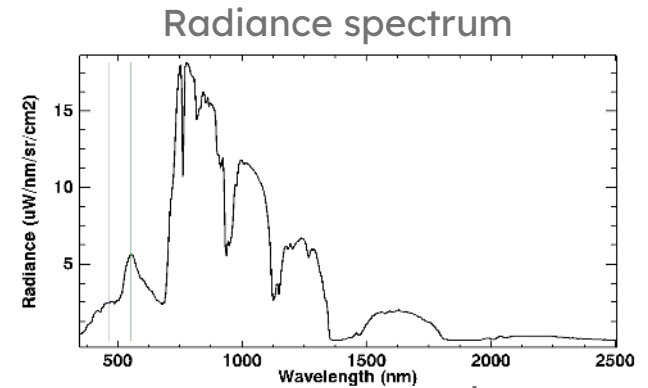
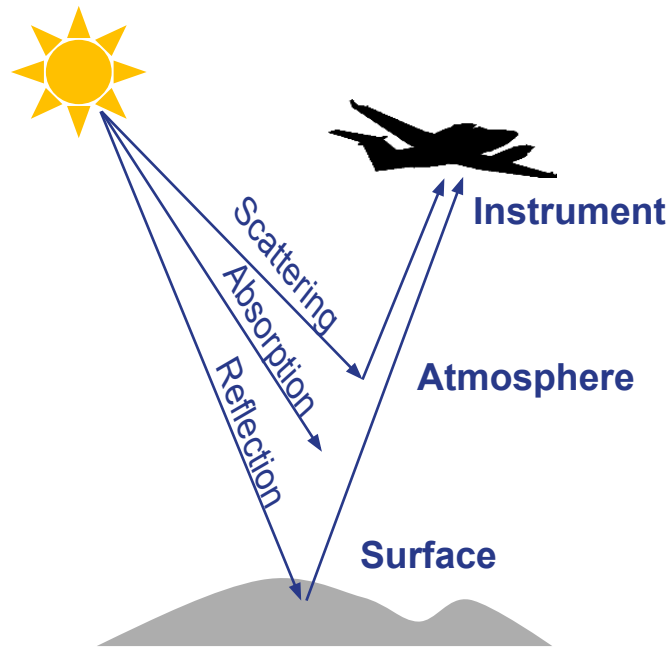
# Measurement process – 100s of parallel spectrometers



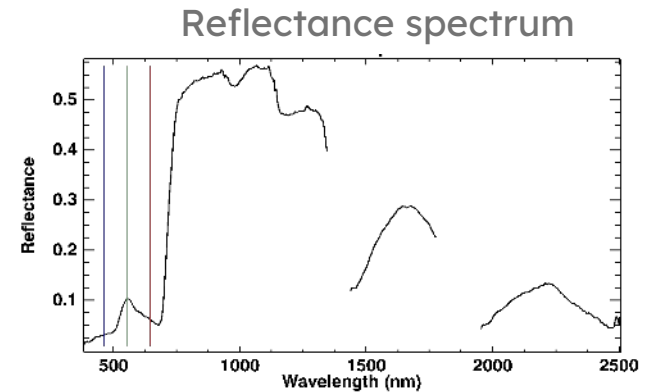
# Measurement process – Push broom spectrometer



# From radiance to surface reflectance



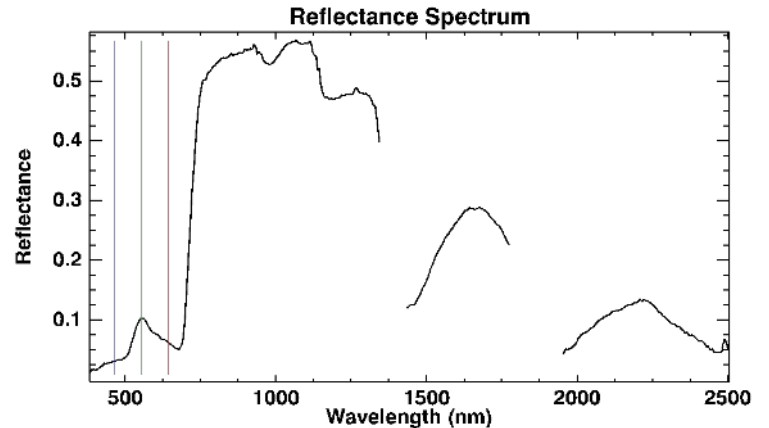
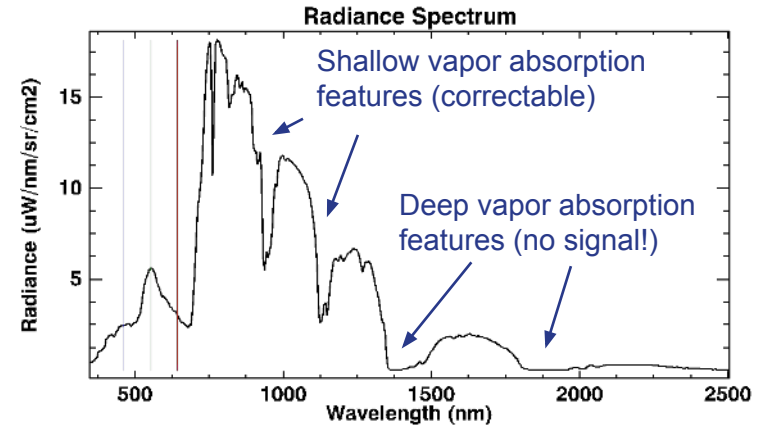
*Atmospheric correction*





# Deep water vapor absorption

- Features near 1380 nm and 1880 nm, and beyond 2500 nm, are nearly opaque due to strong water vapor absorption.
- This results in a noisy reflectance estimate.
- Exclude these intervals from your calculations!

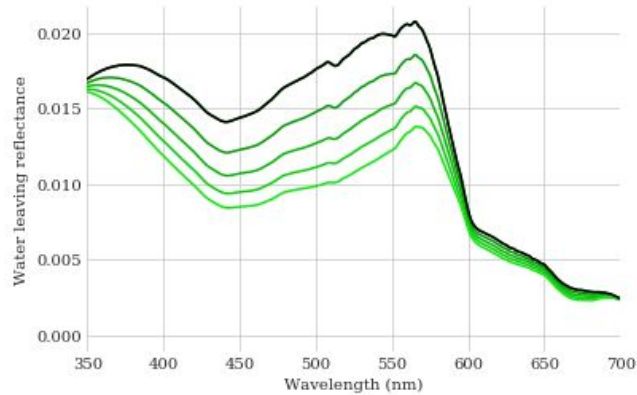


# Reflectance Spectrum: Water

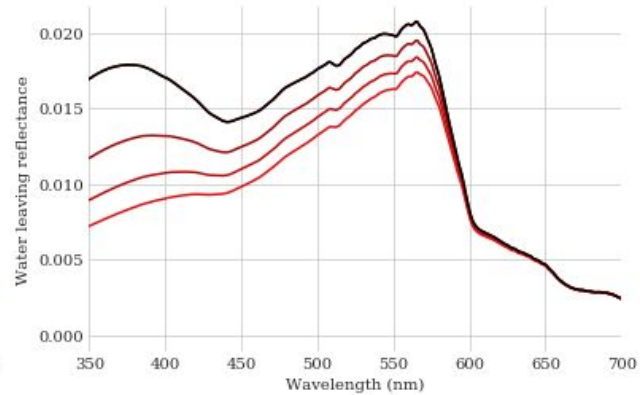


Image: T. Fioreze

## Increasing Phytoplankton



## Increasing Colored Dissolved Organic Matter

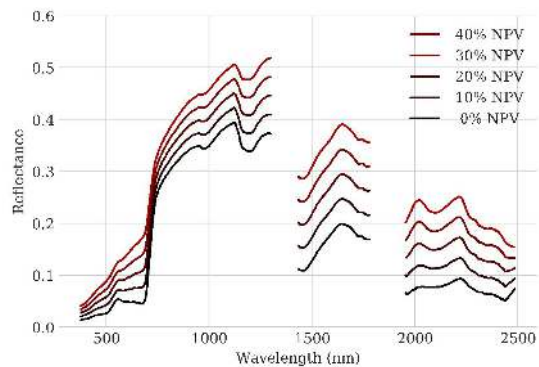


# Reflectance Spectrum: Vegetation

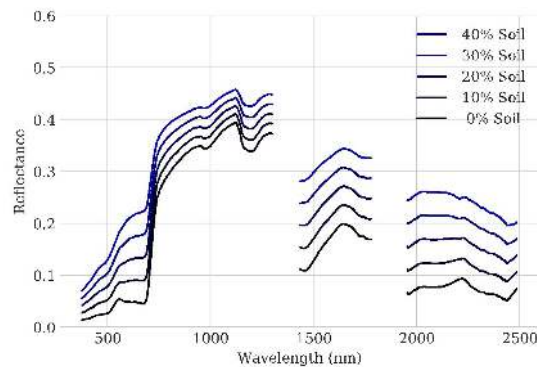


Credit: I,Bms4880, Roaring Fork, Great Smoky Mountains (Wikipedia)

### Increasing Non-photosynthetic Vegetation



### Increasing Soil Fraction



Spectra from USGS spectral library version 7.0



# Full waveform lidar



# Largest Open Access hyperspectral and structural high-resolution mapping endeavour

Area acquired: ~45 000 km<sup>2</sup>

Coincident field measurements: Many!

Satellite overpasses during campaign:

EMIT: 240

ECOSTRESS: 101

Landsat: 168

Sentinel 2: 1,051



Image Correction:  
Kyle Kovach

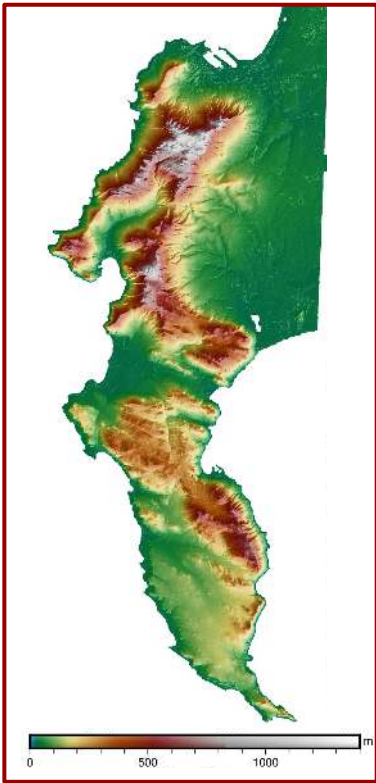


Imaging  
Spectroscopy data  
with 2.5-10m pixels  
(most at 5m)

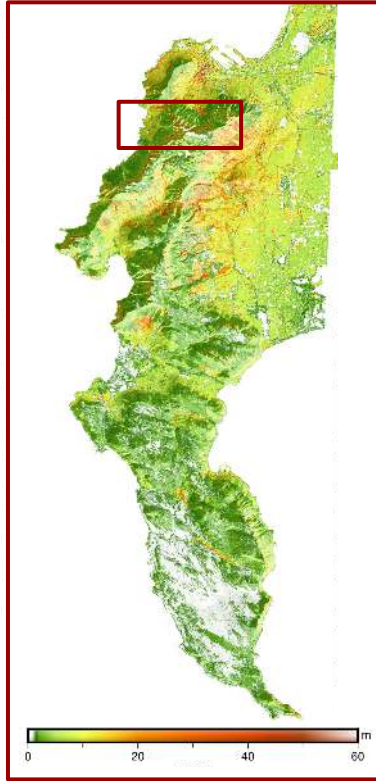


[bioscape.io](http://bioscape.io)

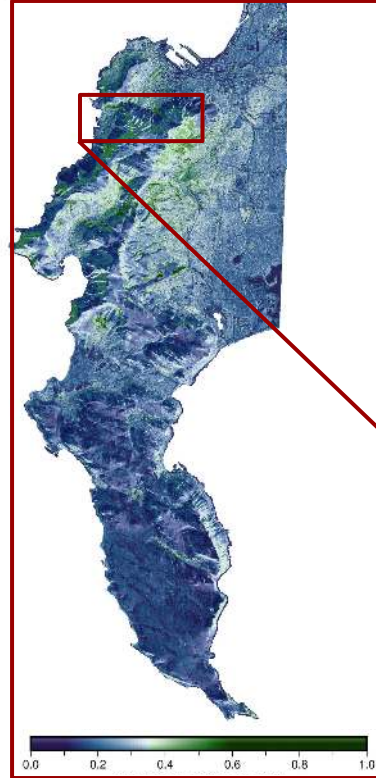
# Full waveform LiDAR at 5-15m footprints



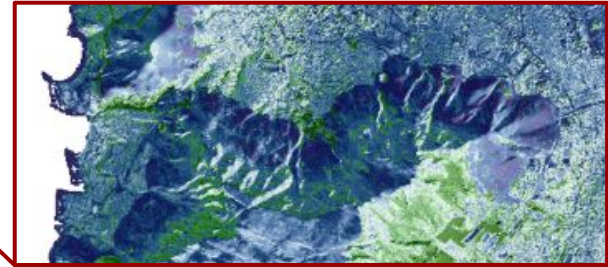
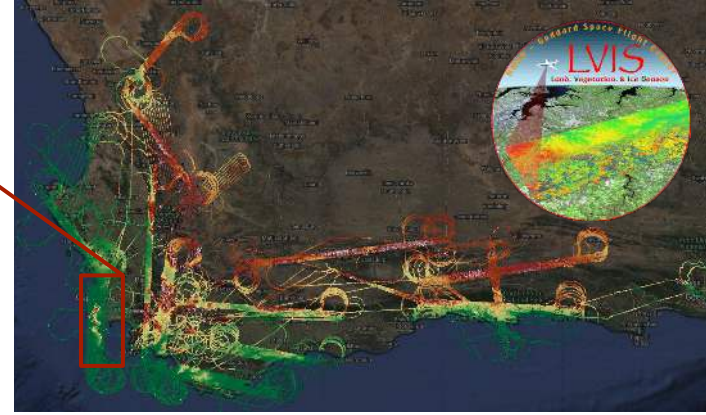
Elevation



RH95  
Vertical Extent



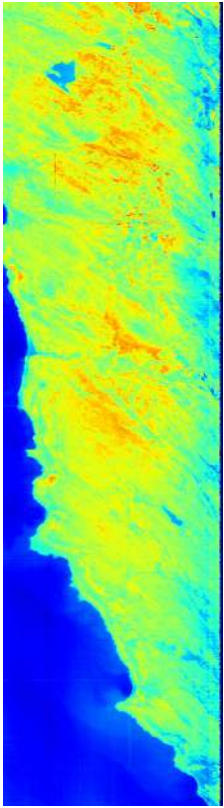
Waveform  
Complexity



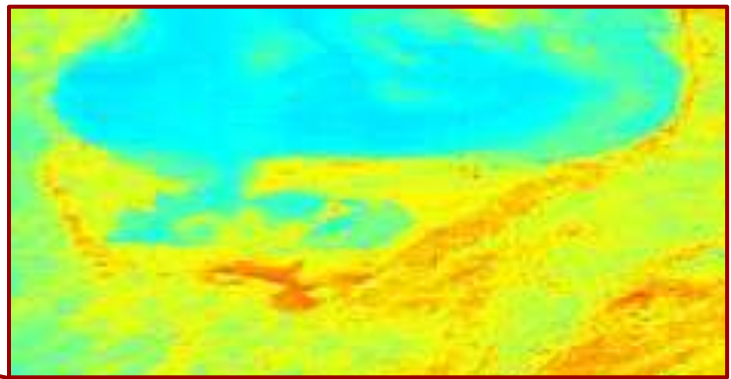
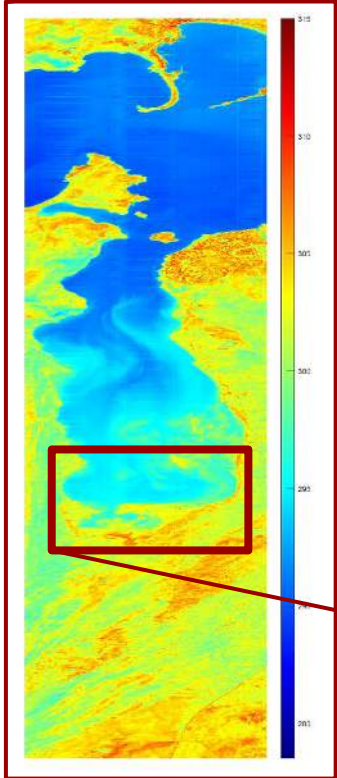
False Color Emissivity  
10.07, 9.25, 8.21  $\mu\text{m}$



Brightness  
Temperature



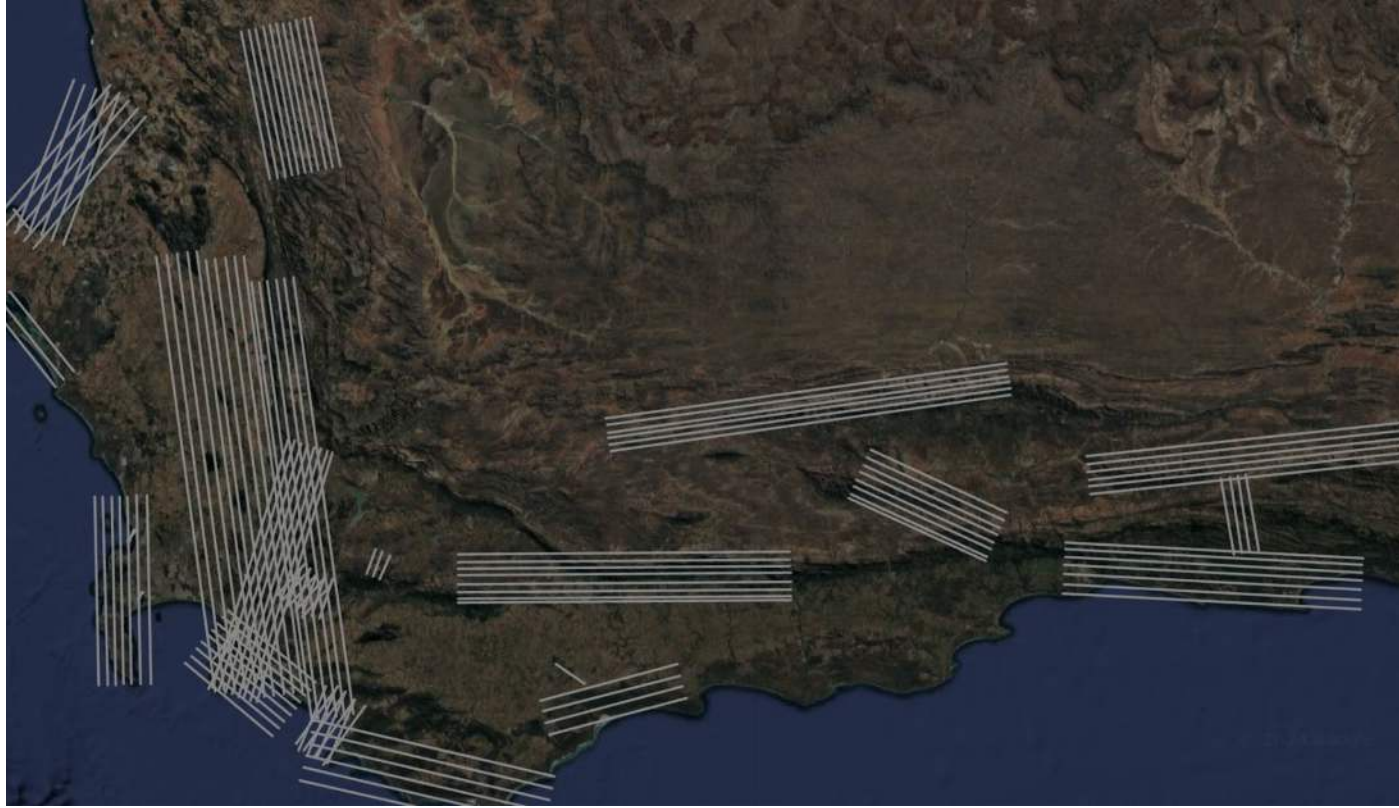
Brightness  
Temperature



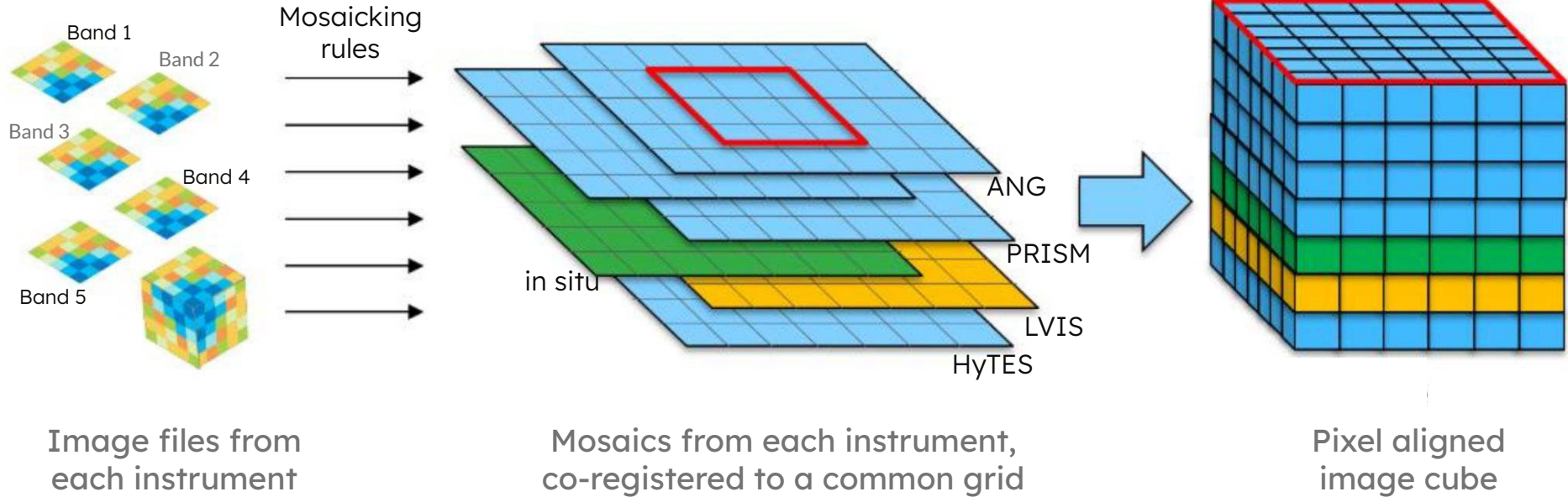
Analysis: Glynn Hulley



# Data was collected in flight lines that covered flight boxes



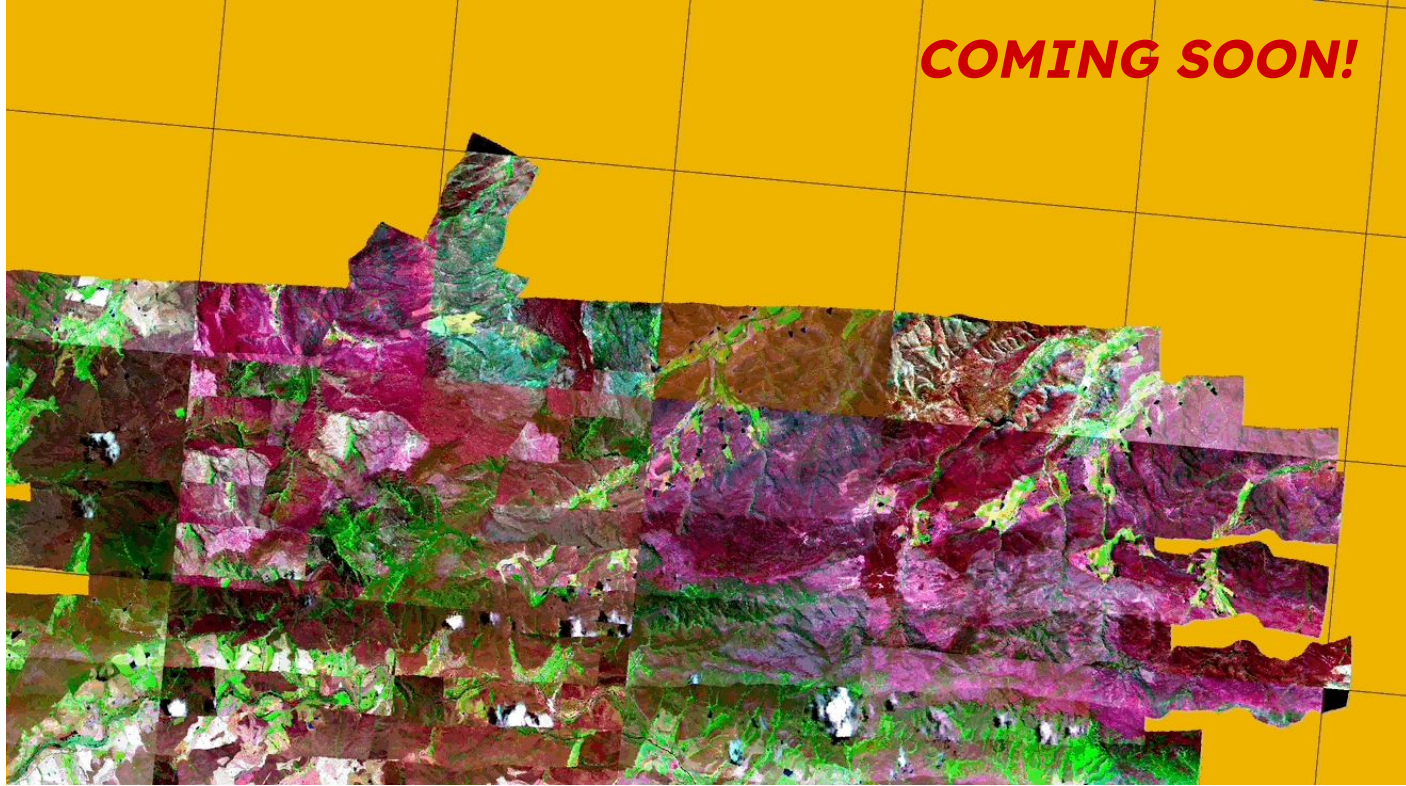
# But we are transitioning this to **TILES** (also called **SCENES**) on a **COMMON GRID** (5x5m)



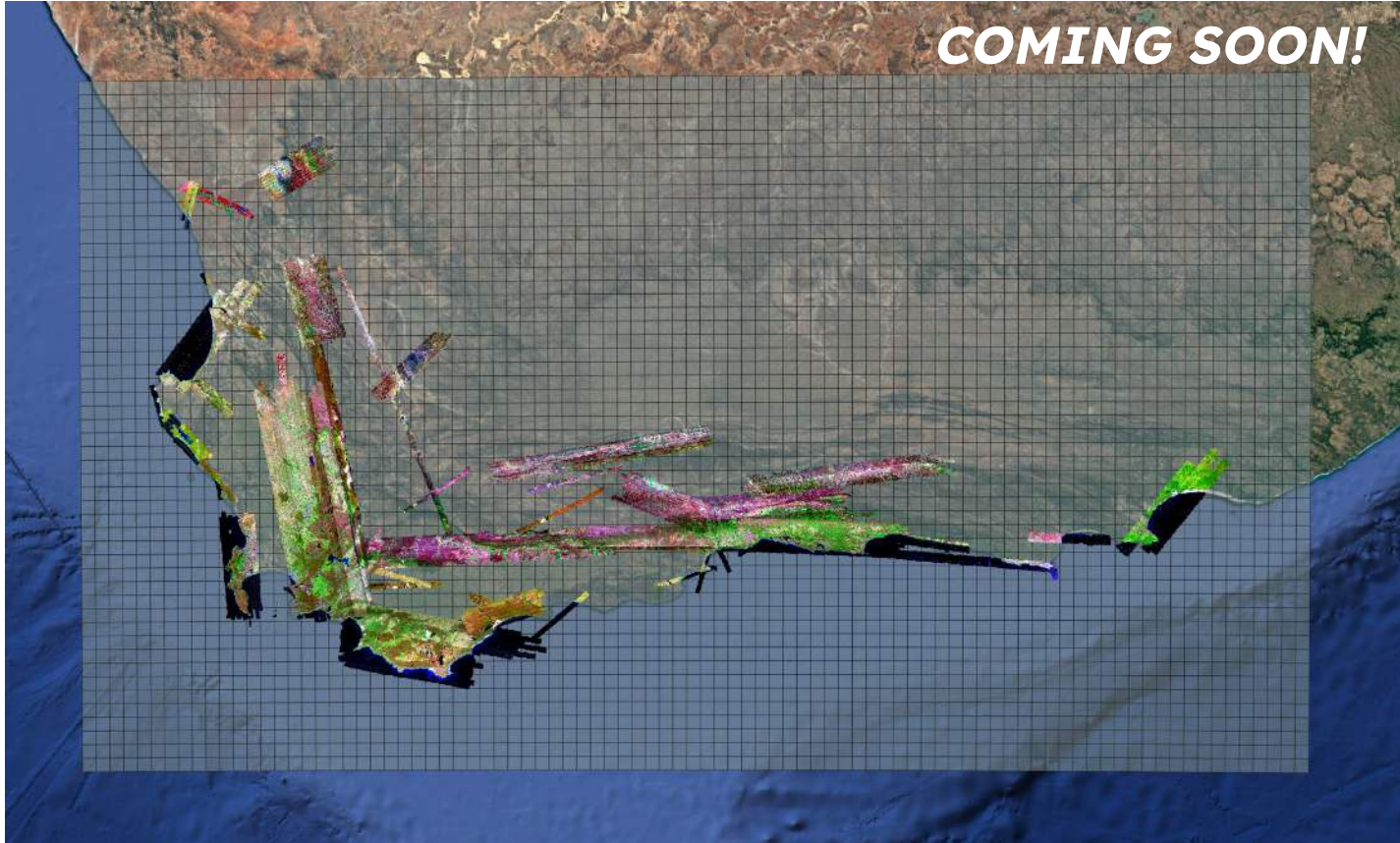
Based on: Kopp et al., 2019



**But we are transitioning this to TILES (also called SCENES)  
on a COMMON GRID (5x5m)**



**But we are transitioning this to TILES (also called SCENES)  
on a COMMON GRID (5x5m)**



# Townsend team is delivering BRDF and Geo corrected imagery



## Download data via MMGIS/Visions



BioSCape Data Portal:

<https://www.bioscape.io/data>



## Download data via MMGIS/Visions

- Find a point of interest in Google maps.
  - Right click to copy coords.
- On MMGIS, click “pick coordinates” button (bottom right).
- Paste in x and y separately and click go.
- Browse tiles around your site of interest.

