

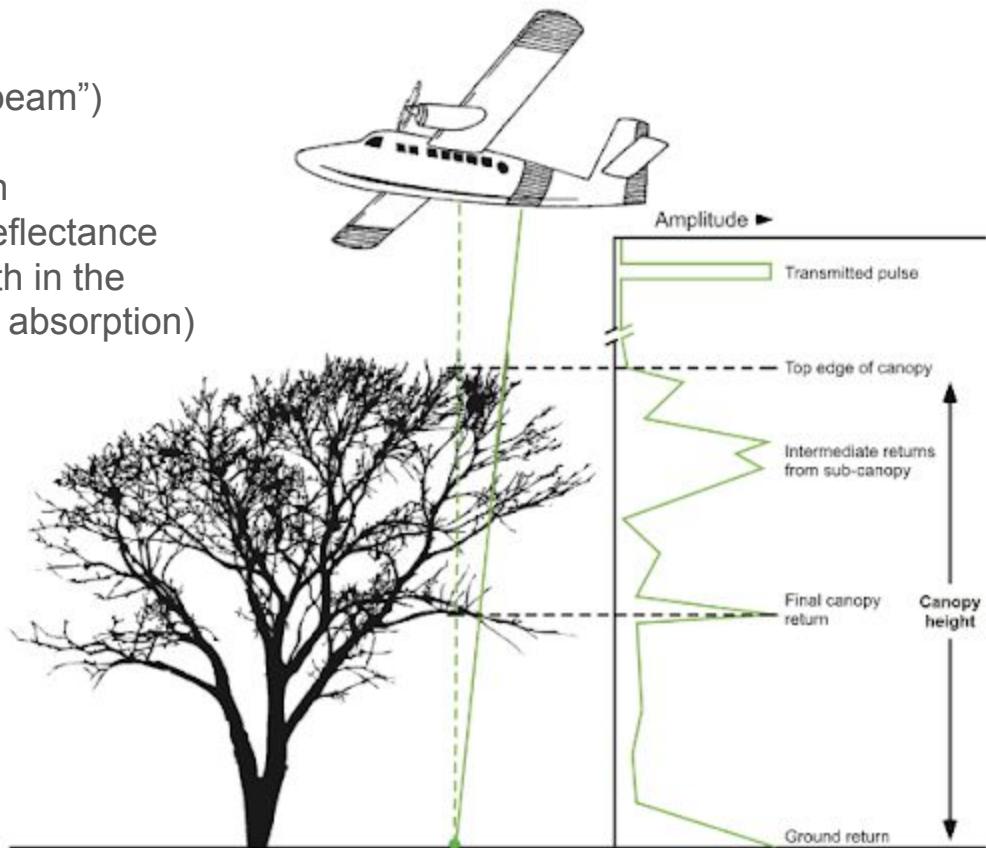


**LVIS and GEDI for post-fire  
vegetation growth**  
Jasper Slingsby



# Light Detection and Ranging - lidar / LiDAR

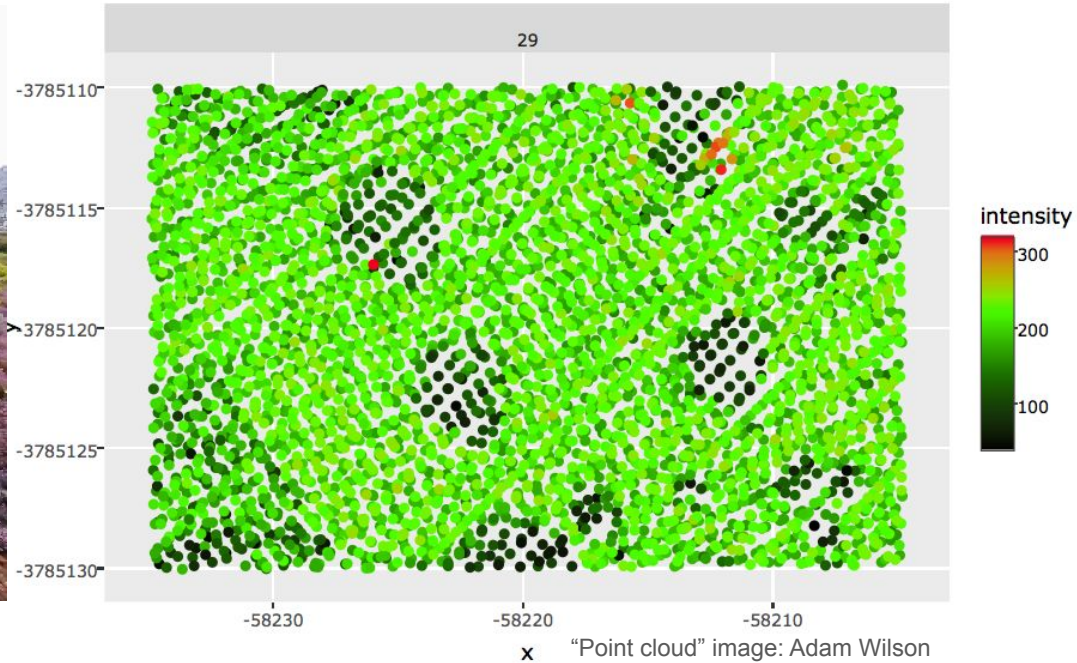
- Active remote sensing
- Fires energy pulses (“laser beam”)
- Measures the return
  - Height ~ Time to return
  - Surface properties ~ reflectance
- Most sensors use wavelength in the region 1000-1100 nm (water absorption)



[Purkis and Klemas 2011](#)



# Discrete-return lidar (in Fynbos)



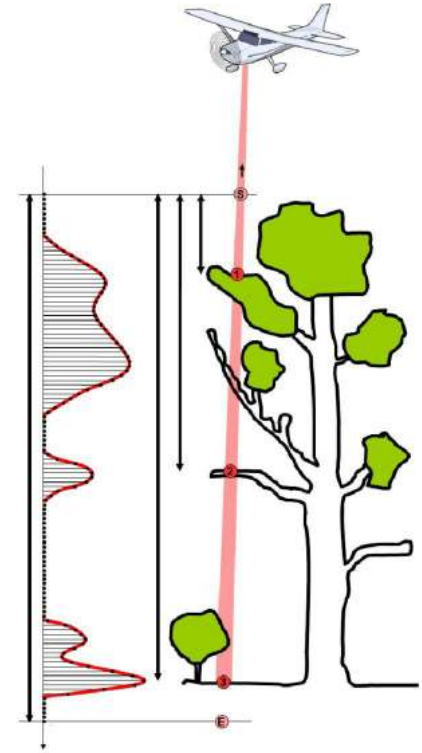
Large Proteaceae shrubs (dark green) among lower ericoid shrubs and graminoids



# Discrete-return lidar (in Fynbos)



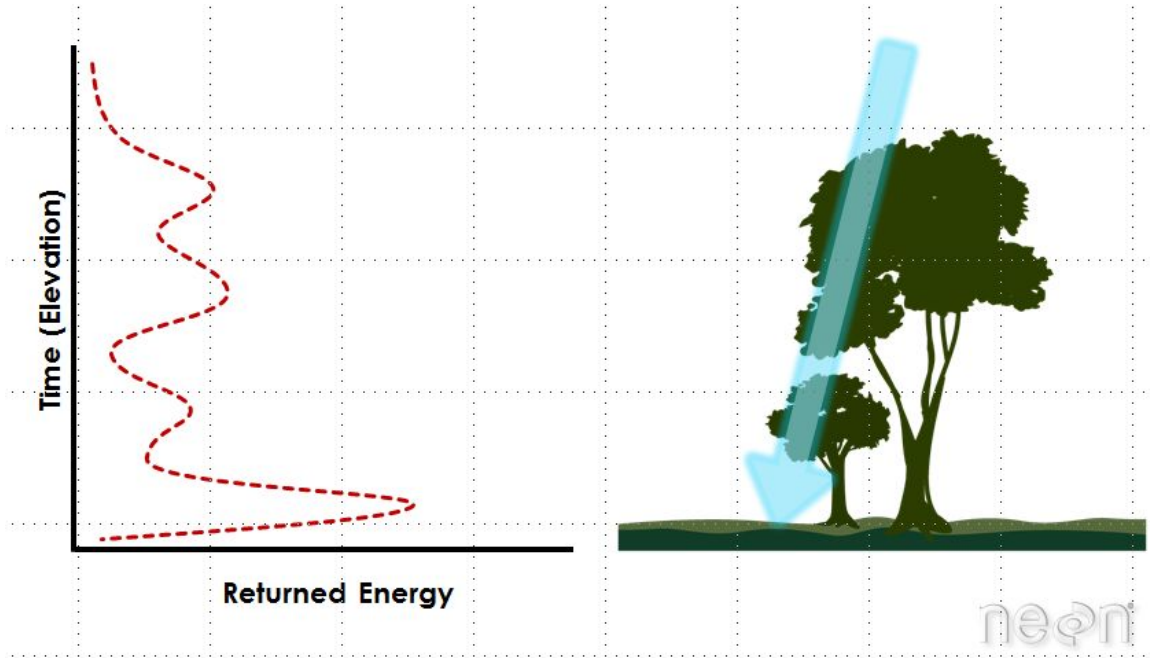
Point cloud from <https://www.neonscience.org/resources/learning-hub/tutorials/lidar-basics>



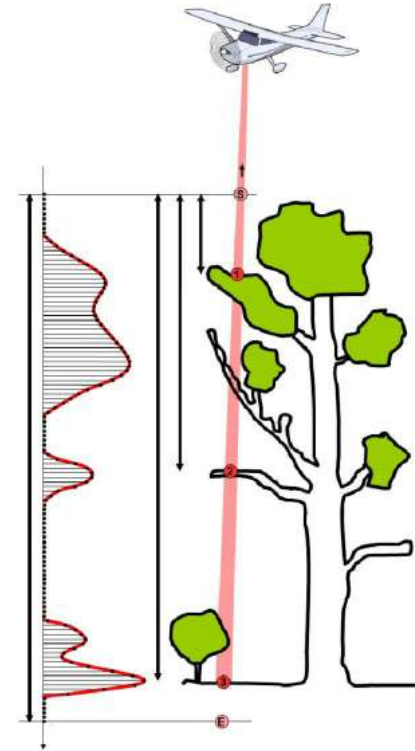
From <http://dx.doi.org/10.13140/RG.2.2.19444.09609>



# Full waveform lidar...



From <https://www.neonscience.org/resources/learning-hub/tutorials/lidar-basics>



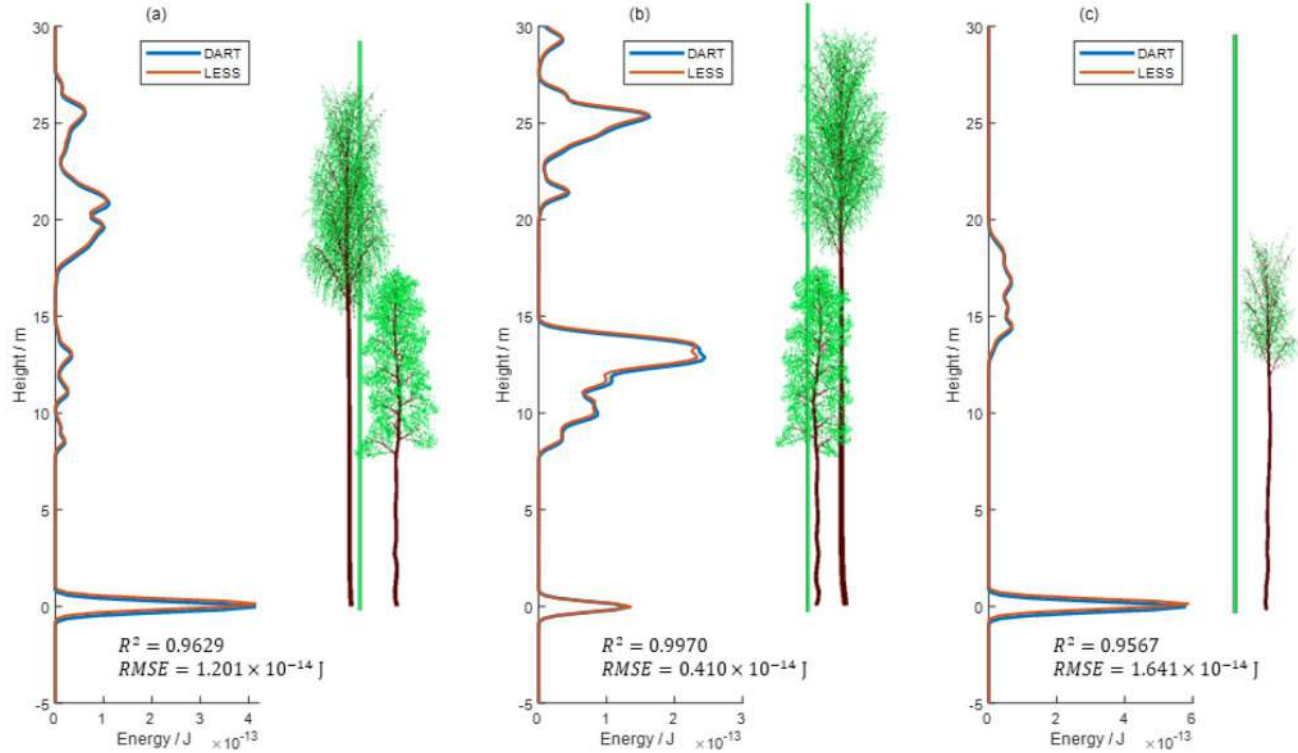
From <http://dx.doi.org/10.13140/RG.2.2.19444.09609>



## Full waveform lidar...



# Full waveform lidar...



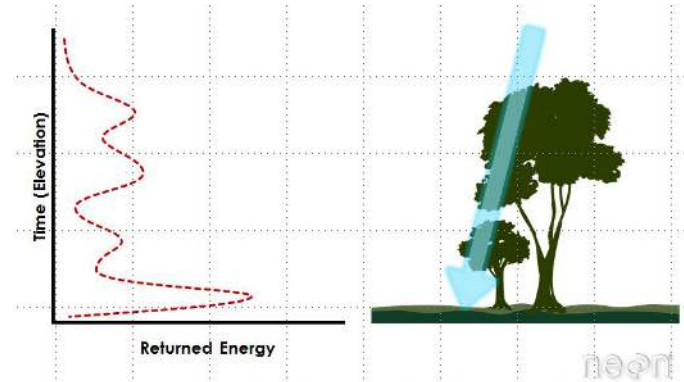
From Luo et al. 2023, <https://doi.org/10.3390/rs15184529>



# Discrete-return (e.g. SAEON plane) vs Full waveform (GEDI, LVIS)



- Point measurements (creates a point cloud)
- One or multiple returns per point
- Point density (e.g. points/m<sup>2</sup>)
  - Depends on instrument and flight height...
  - Can estimate distribution by aggregating points to a grid
- “Better” for airborne or UAV (closer)
  - High energy requirement
  - Tricky to have high point density if high altitude or moving fast...



- Full waveform (creates a distribution)
- Distribution return per footprint
- Footprint
  - ground sample distance / pixel size
- “Better” for orbital
  - Lower energy requirement
  - Further away





## Veg height in The Greater Cape Floristic Region (GCFR)



Forest (up to ~40m)



Fynbos (0 to 5m)



## Veg height in The Greater Cape Floristic Region (GCFR)



Milkwood “Forest” (2-10m)



Fynbos (0 to 5m)



# Veg height in Fynbos (Cape Point)



Milkwood “Forest” (2-10m)



## Veg height in Fynbos (in Cape Point)



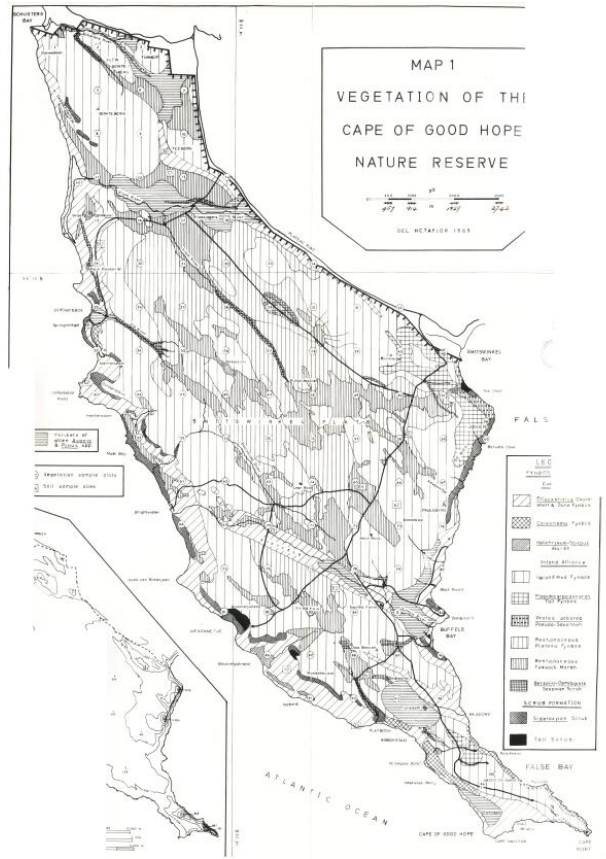
Sandstone fynbos (0-1m)



Sand dune fynbos (~3m)



# Veg height in Fynbos (in Cape Point)



Variation with vegetation type...



## Veg height in Fynbos



Fire!!!

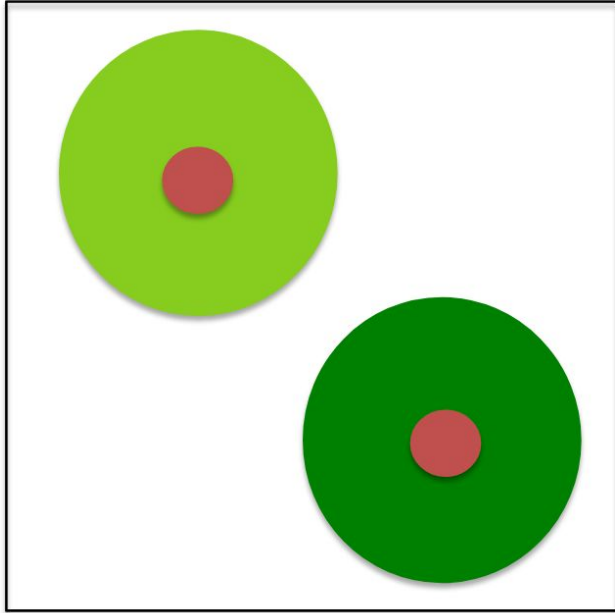


## Veg height in Fynbos

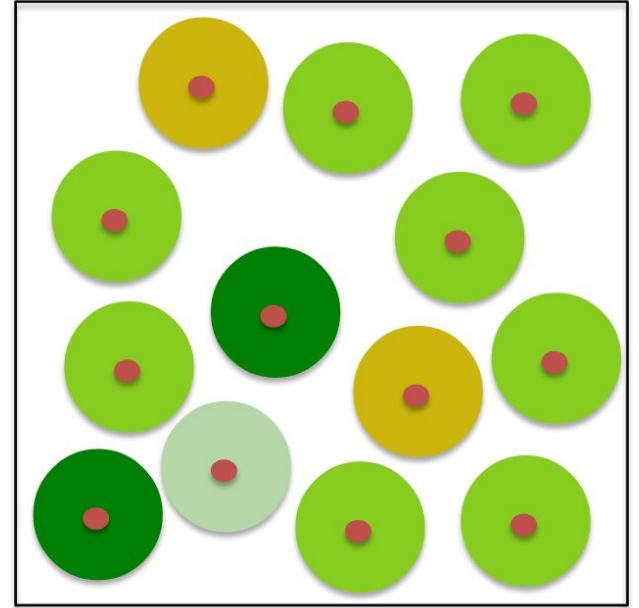
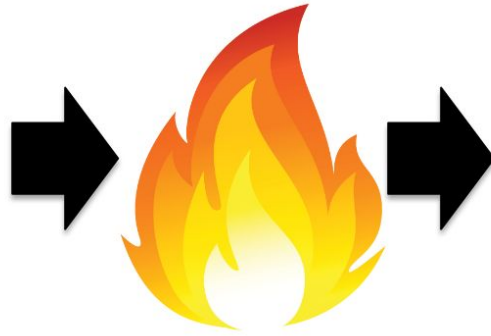


Post-fire vegetation growth...





Old: Few, large, tall(er)



Young: Many, small, short(er)







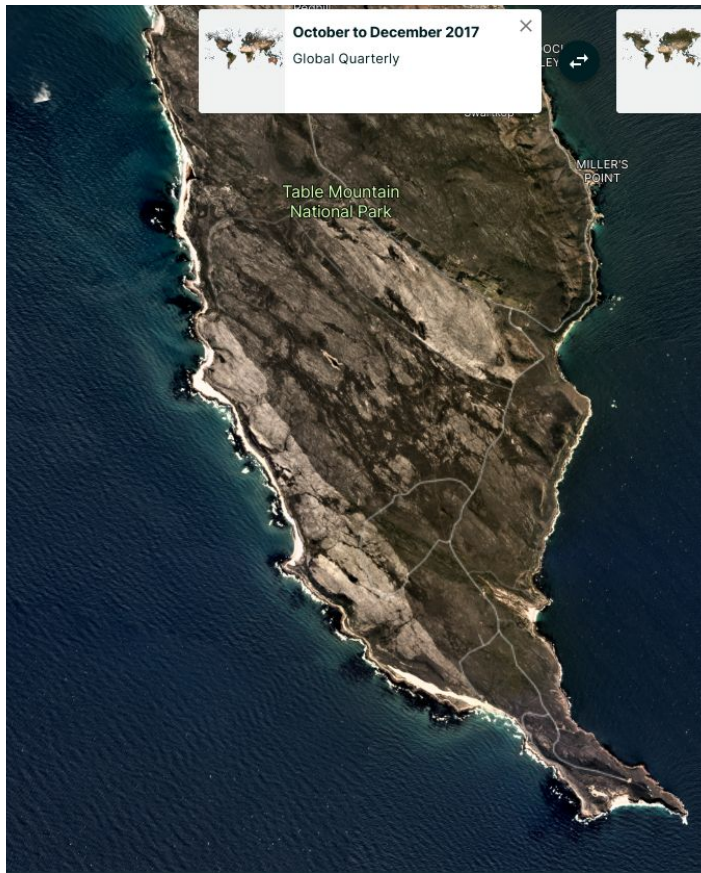
Old: Few, large, tall(er)



Nothing or Young: Many, small, short(er)

Also note small forest patch in fire refuge (hard to map with imaging!)





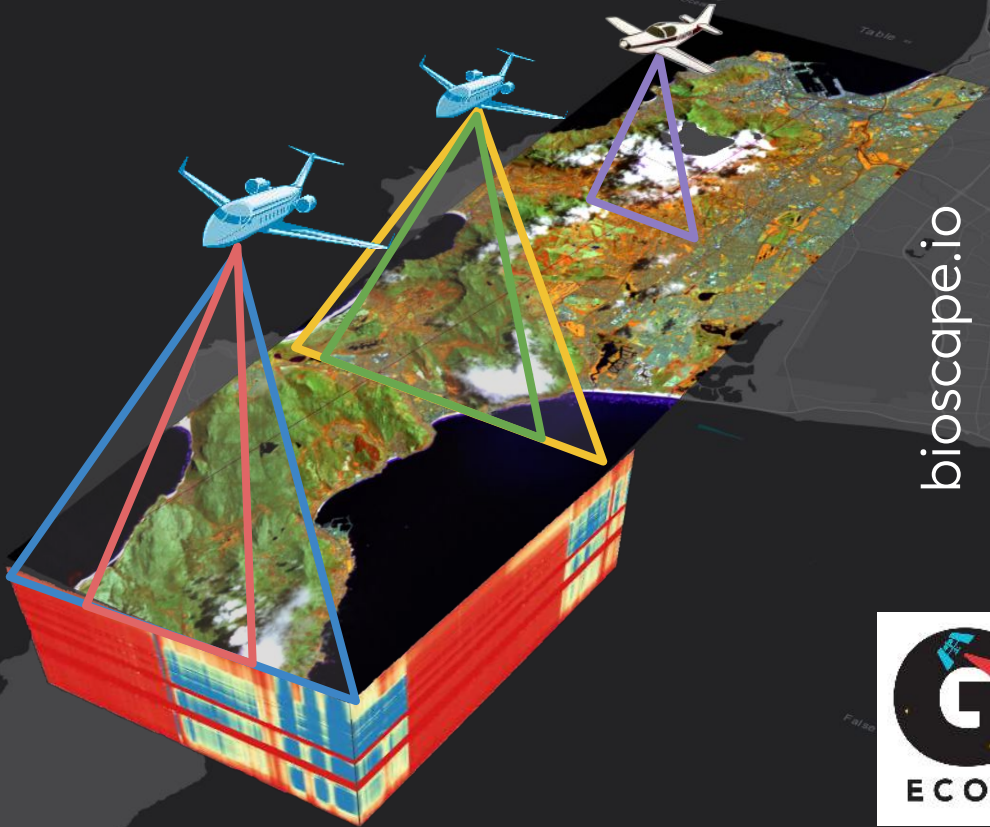
## Veg height in Fynbos (in Cape Point)



Variation with fire...



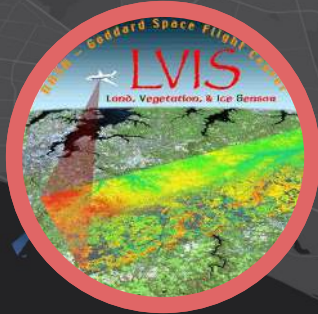
# Fire and veg type create much variation in height distribution in the GCFR



**NRF**  
National Research Foundation

**SAEON**  
South African Environmental Observation Network

Discrete return  
airborne lidar  
(for small areas)



Full waveform  
airborne lidar

Full waveform  
orbital (ISS) lidar  
(not operational during  
BioScape, but close enough for  
many applications)

