Stick in the Mud
Mangrove Loss in South Florida

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Saltwater intrusion can lead to a rapid collapse of the soil surface.
Water levels in ENP have been rising more rapidly in recent years.

Lagomasino et al, *in prep*
Objectives

1. *Synthesize airborne and satellite remote sensing data* that are currently available for the Everglades in order to develop multi-sensor remote sensing techniques to identify spatiotemporal patterns related to spectral biophysical stress.

2. Investigate the ground, airborne, and spaceborne *foliar reflectance and fluorescence* in response to increased salinity and inundation.

3. Generate *ecosystem vulnerability maps* of areas susceptible to peat collapse or other rapid environmental changes.

4. Model the *fate and transport* of material and emissions from degrading areas into adjacent ecosystems and carbon pools.
**G-LiHT**: Goddard’s **Lidar**, Hyperspectral, and **Thermal** airborne imager

https://gliht.gsfc.nasa.gov/

*G-LiHT* is a portable, airborne imaging system that simultaneously *maps the composition, structure, and function of terrestrial ecosystems* using:

1) **lidar** to provide 3D information about the spatial distribution of canopy elements;

2) **imaging spectroscopy** to discern species composition and variations in biophysical variables (e.g., photosynthetic pigments); and

3) **thermal data** to quantify surface temperatures and detect heat and moisture stress.

*Loblolly pine plantation in lower coastal plan near Plymouth, NC*
G-LiHT v2.0 with FIREFLY

1. **LiDAR** – longer ranging, higher PRF and sampling density
2. **VNIR Imaging spectrometer** – 10x SNR, temp-controlled focal plane
3. **VNIR Irradiance spectrometer** – thermally stabilized detector
4. **Thermal camera** – 2x greater spatial resolution, 2x greater frame rate
5. **Fine-resolution RGB camera** – stereo images at ~4 cm GSD
6. **FIREFLY imaging spectrometer** (Headwall Photonics) and **fine-resolution irradiance spectrometer** (Ocean Optics QE Pro) for SIF retrievals
Lidar and high-resolution photos can provide information about the forest structure and terrain (surface, terrain, and canopy height models).
Structure-from-Motion can model the surface structures...
...and below canopy structures.
G-LiHT Spectra in FL Everglades

Mixing of Shark River and Gulf waters

Mouth of Shark River

Reflectance vs. Wavelength

Reflectance vs. Wavelength
Spectral reflectance can provide information about the conditions of the vegetation

Seasonal variability associated with salinity
Little variability when soils are perpetually saline

Lagomasino et al, 2014
Remote Sensing of Environment
Example of degraded mangrove areas

Areas Losing in NDVI

Vegetation

Water
Examples of gained mangrove areas
Spatio-temporal dynamics across ENP can be monitored through long-term (and continuous) satellite imagery.
Combining the forest function and structure can provide better details to the ever-changing coastline.

**Changes in NDVI**
- Complete Loss
- Degrading/Loss
- Regeneration

**Changes in Structure**
- Loss > 4 m
- Gain > 4 m
- No Change
NASA G-LiHT

Hi-Res Surface Structure

Forest Spectra

Structure Change

Areas Losing in NDVI

NDVI (Landsat 5 TM)
Mangrove Science
Protection, Sustenance, and Sequestration

Data Portal

Browse the Mangrove Science Data Portal to locate our research areas and to find our remote sensing datasets.

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South Florida is susceptible to SLR and saltwater intrusion

Chambers et al, 2014

Wanless, 2005
G-LiHT targeted key locations in ENP