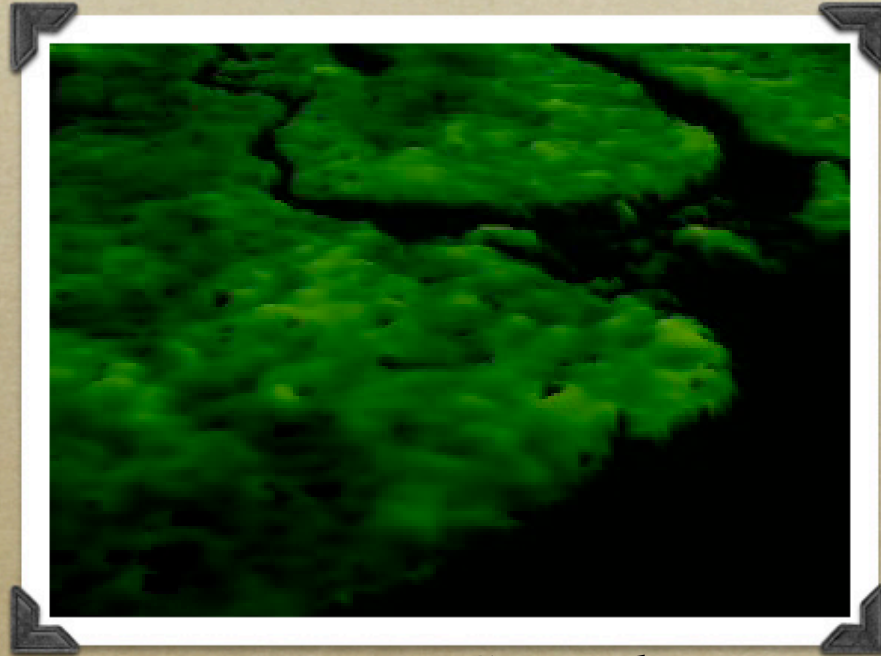


Landscape Scale Estimation of Mangrove Mean Tree Height and Biomass (IDS)



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Caltech/Jet Propulsion Laboratory

Victor H. Rivera-Monroy, Keqi Zhang, Mike Ross

Objectives

- *to use SRTM elevation data to estimate vegetation height in wetlands dominated by mangroves*
- *to estimate productivity within the complex mangrove mosaic and extend production models to regional scales.*

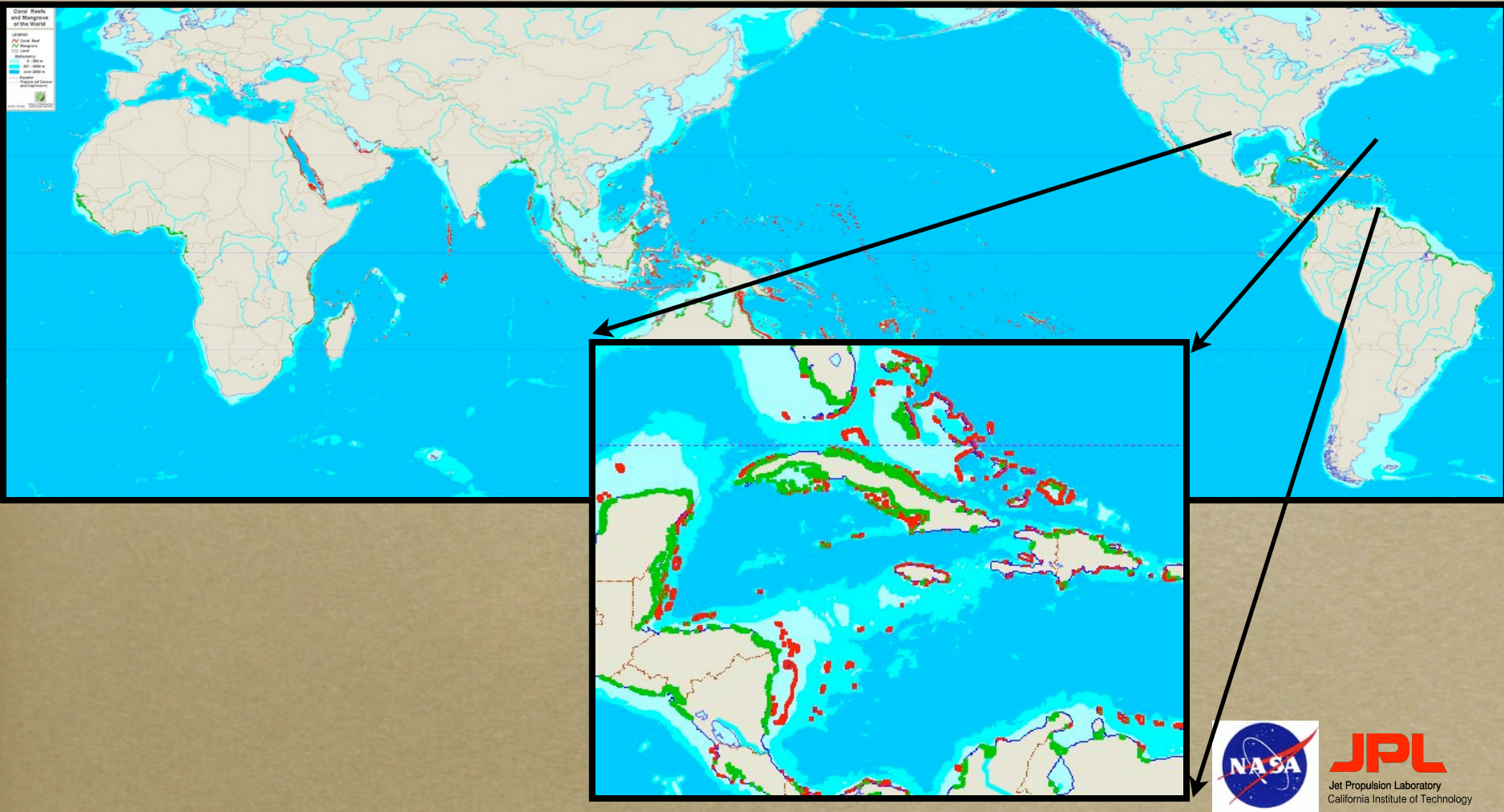


Relevance

- *NASA Carbon cycle and Ecosystem Roadmap*
 - *(T)Vegetation 3D structure (Biomass & Disturbance)*
 - *Coastal carbon*
- *Bridging scales, processes and disciplines*



Mangrove Distribution



Why Mangroves?

- *Biodiversity*

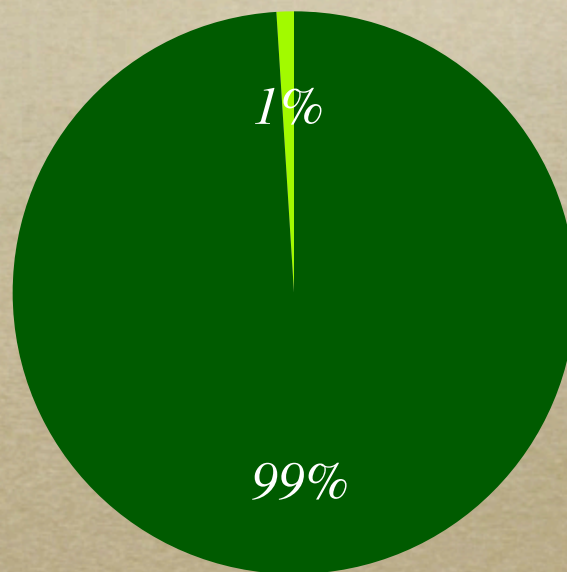
● Forests ● Mangroves

- *Habitats of 1300 species of animals*

- *628 mammals, birds, reptiles, fish and amphibians*

- *Among the most productive ecosystems on earth*

- *170k km² with mean 2.5g C m⁻² per day*



Why Mangroves?

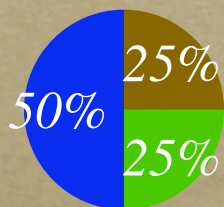
- *Biodiversity*

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- *Among the most productive ecosystems on earth*

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- Mangrove Sediment

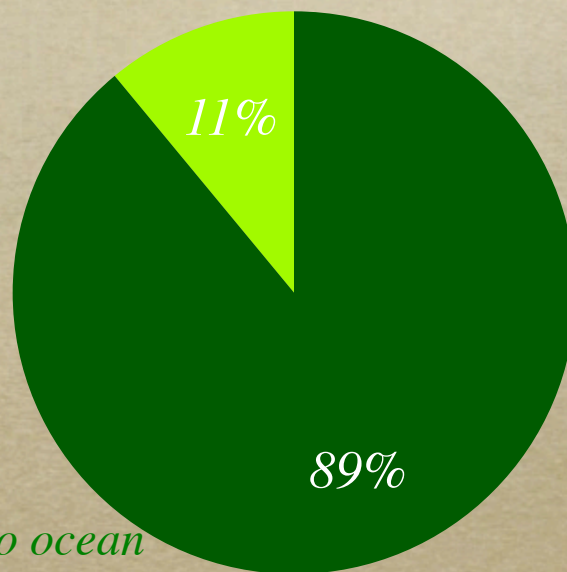
- Recycled

- Export to Ocean

- *Annual input into ocean 46×10^{12} g C*

- *Thus contributes 11% of global total export to ocean*

● Forests ● Mangroves



Why Mangroves?

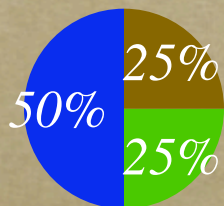
- *Biodiversity*

- *Habitats of 1300 species of animals*

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- *Among the most productive ecosystems on earth*

- *170k km² with mean 2.5g C m⁻² per day*



- Mangrove Sediment

- Recycled

- Export to Ocean

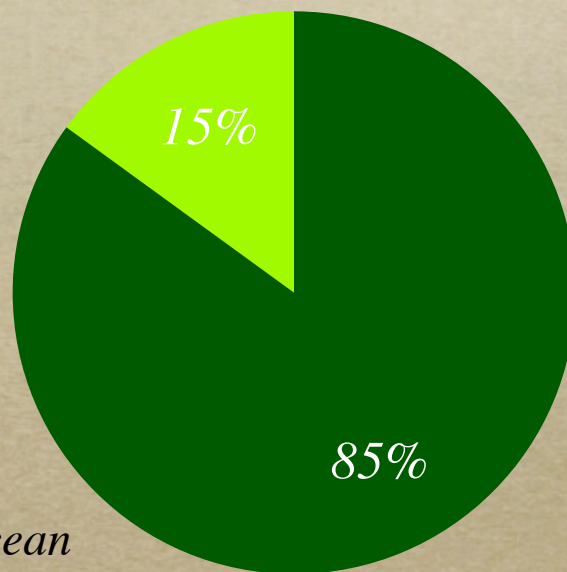
- *Annual input into ocean 46×10^{12} g C*

- *Contributing 11% of global total export to ocean*

- *Annual accumulation of carbon in modern sediments 23×10^{12} g C yr⁻¹*

- *Contributing 15% of carbon accumulation in modern sediments.*

● Forests ● Mangroves

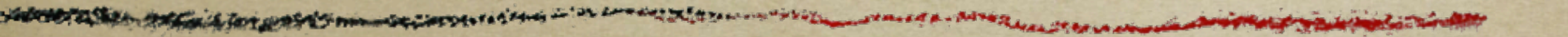


Mangroves Are Endangered

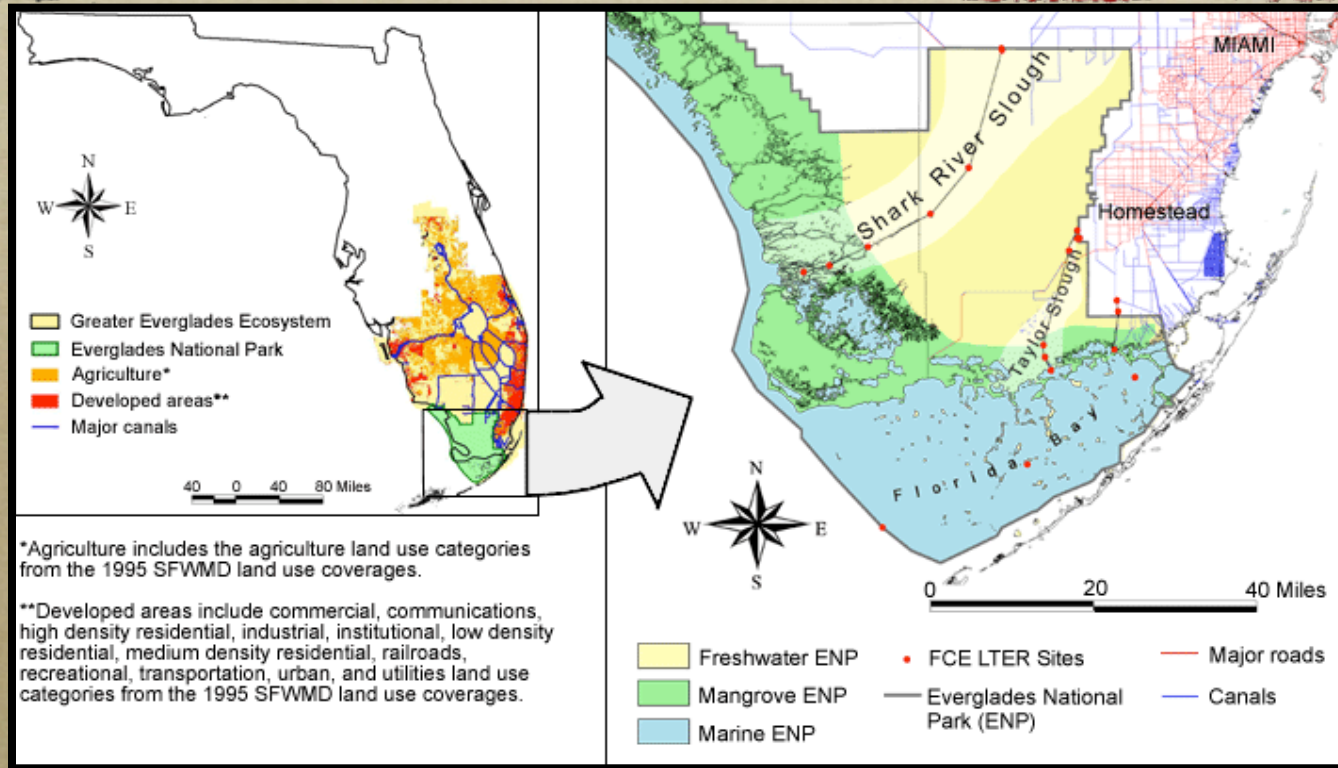
- *Endangered by Urbanization, exploitation and sea level rise*
- *Between 33 and 50% coverage loss over the last 50 years*



Everglades National Park, Florida



The Everglades National Park



Everglades National Park covers approximately 4300 km² in South Florida and is part of the greater Everglades ecosystem which extends north to Lake Okeechobee and the Kissimmee River.

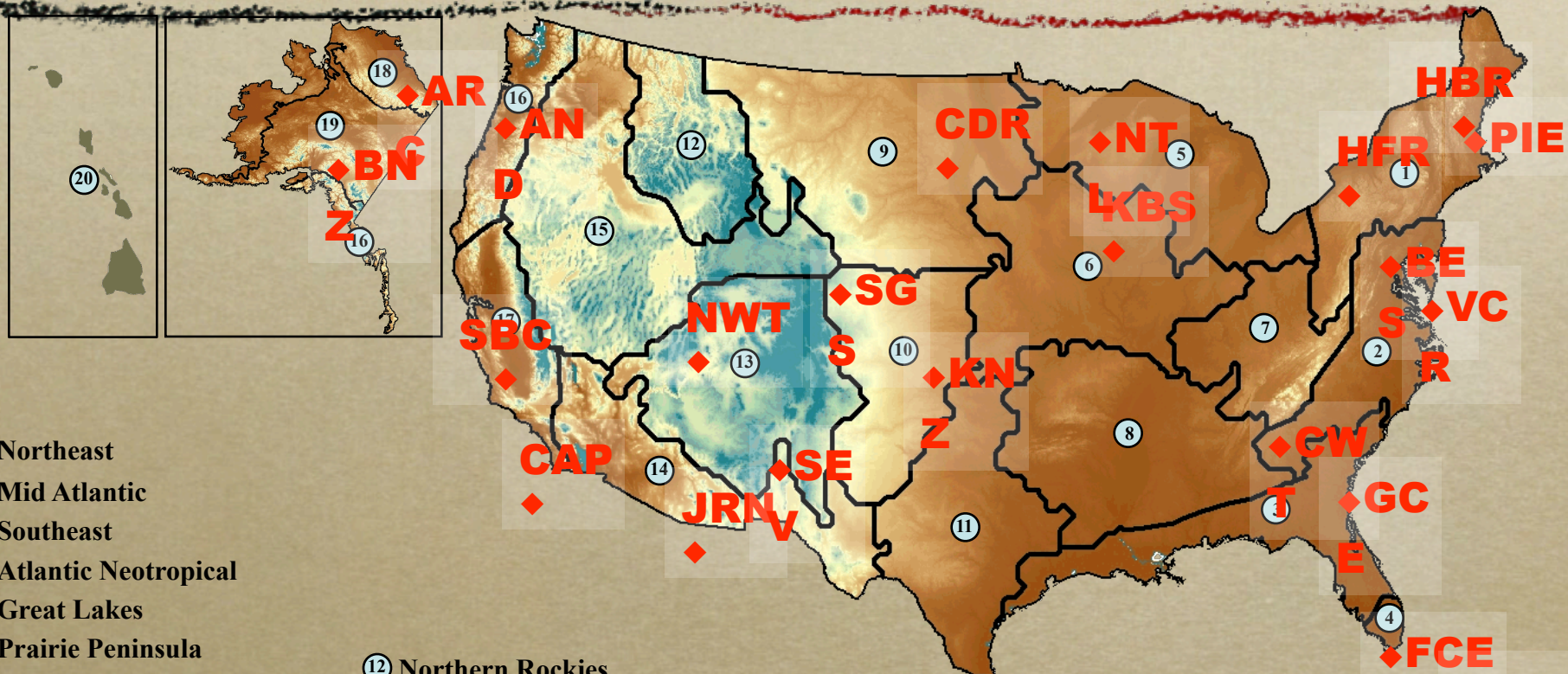
Everglades National Park

- *LTER (Long Term Ecological Research)*
 - *Founded by NSF in 1980*
 - *Network of 26 sites*
 - *Over 1800 scientists*
- *The majority of FCE LTER sites are located in freshwater marsh, estuarine mangroves, seagrass estuary ecosystems.*



NEON Climate Domains

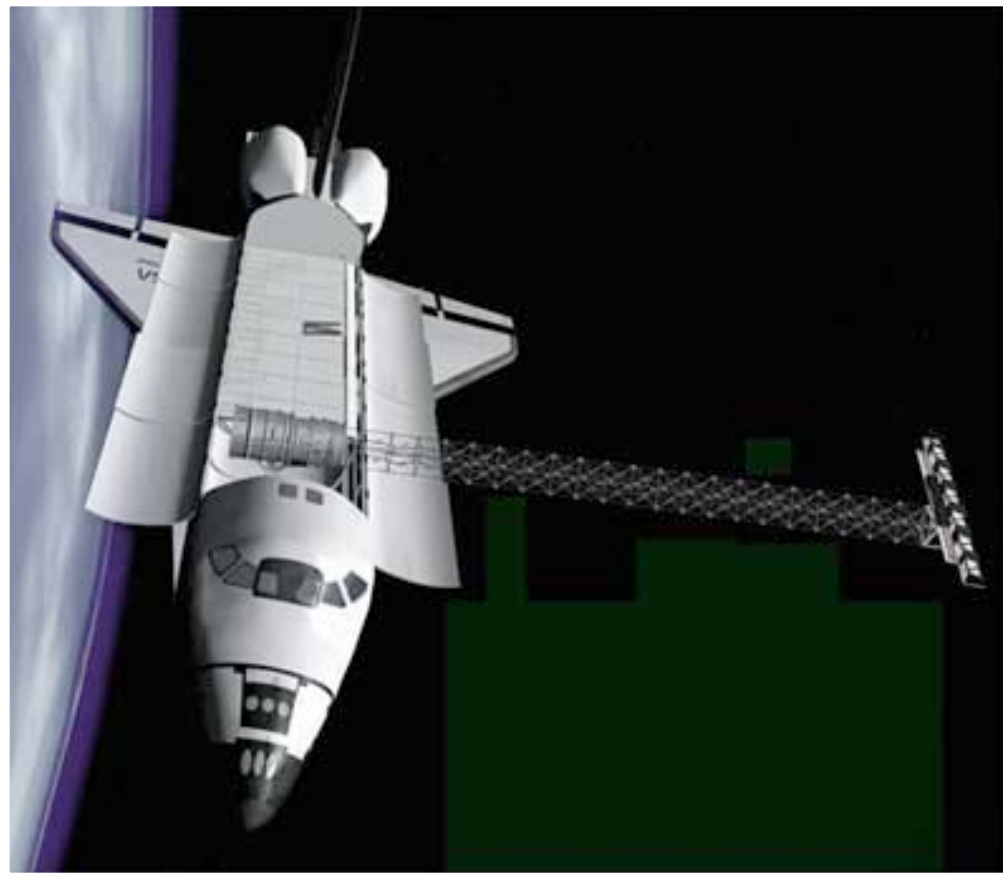
(National Ecological Observatory Network)



- ① Northeast
- ② Mid Atlantic
- ③ Southeast
- ④ Atlantic Neotropical
- ⑤ Great Lakes
- ⑥ Prairie Peninsula
- ⑦ Appalachians / Cumberland Plateau
- ⑧ Ozarks Complex
- ⑨ Northern Plains
- ⑩ Central Plains
- ⑪ Southern Plains
- ⑫ Northern Rockies
- ⑬ Southern Rockies / Colorado Plateau
- ⑭ Desert Southwest
- ⑮ Great Basin
- ⑯ Pacific Northwest
- ⑰ Pacific Southwest
- ⑱ Tundra
- ⑳ Taiga
- ㉑ Pacific Neotropical

◆ PAL ◆ MC
 ◆ MCM R CCE
 ◆

Shuttle Radar Topography Mission (SRTM)

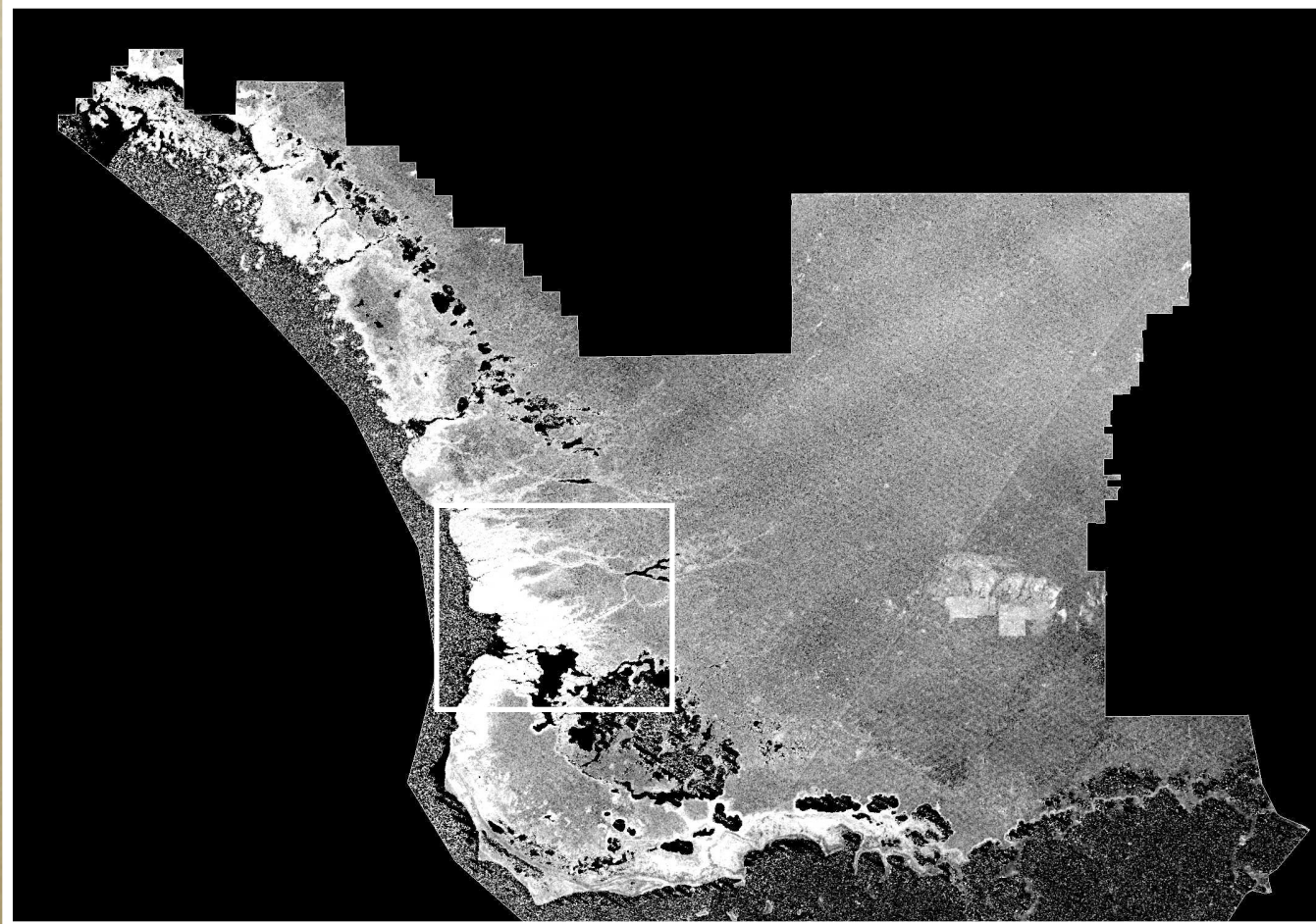


1. *Radar Interferometer*
2. *60m boom*
3. *C and X band*
4. *11 days in February 2000.*
5. *80% Earth Land*
6. *Latitude 56S to 60N*
7. *30m US and World 90m*

<http://www2.jpl.nasa.gov/srtm/>

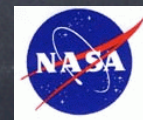
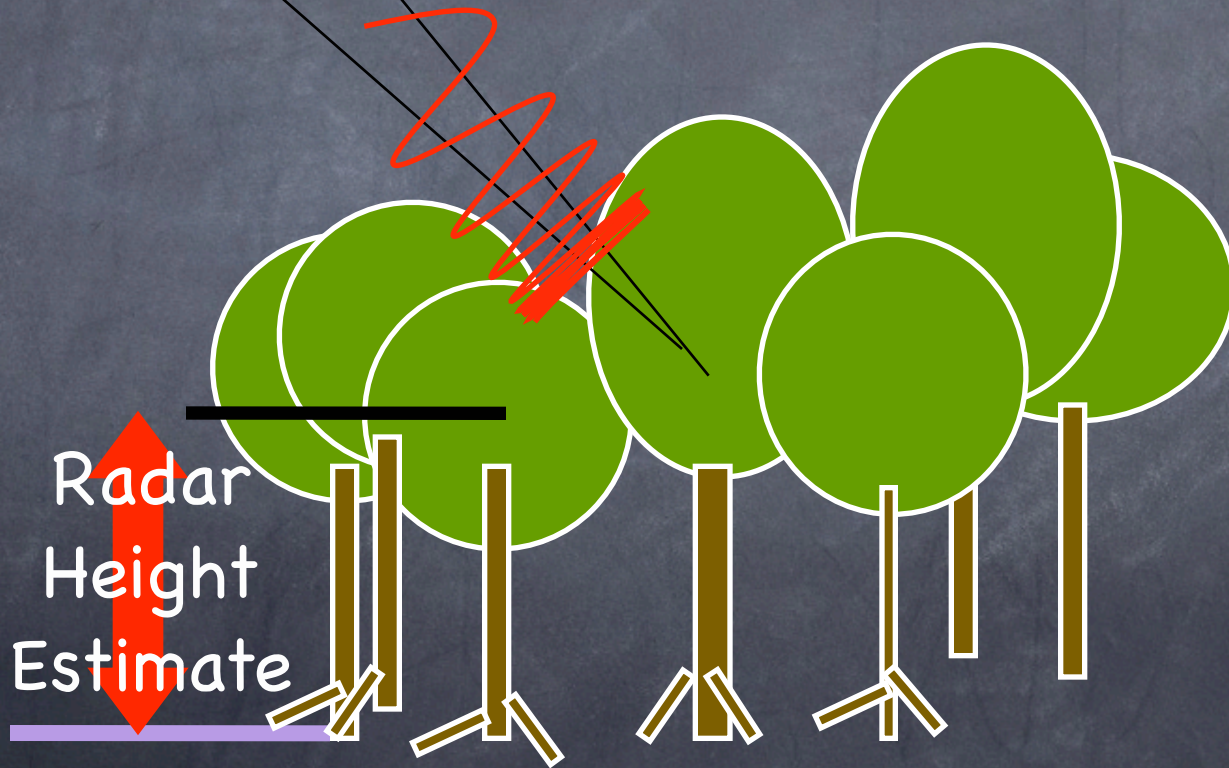


SRTM Elevation data





Relative Vegetation Height





Relative Vegetation Height

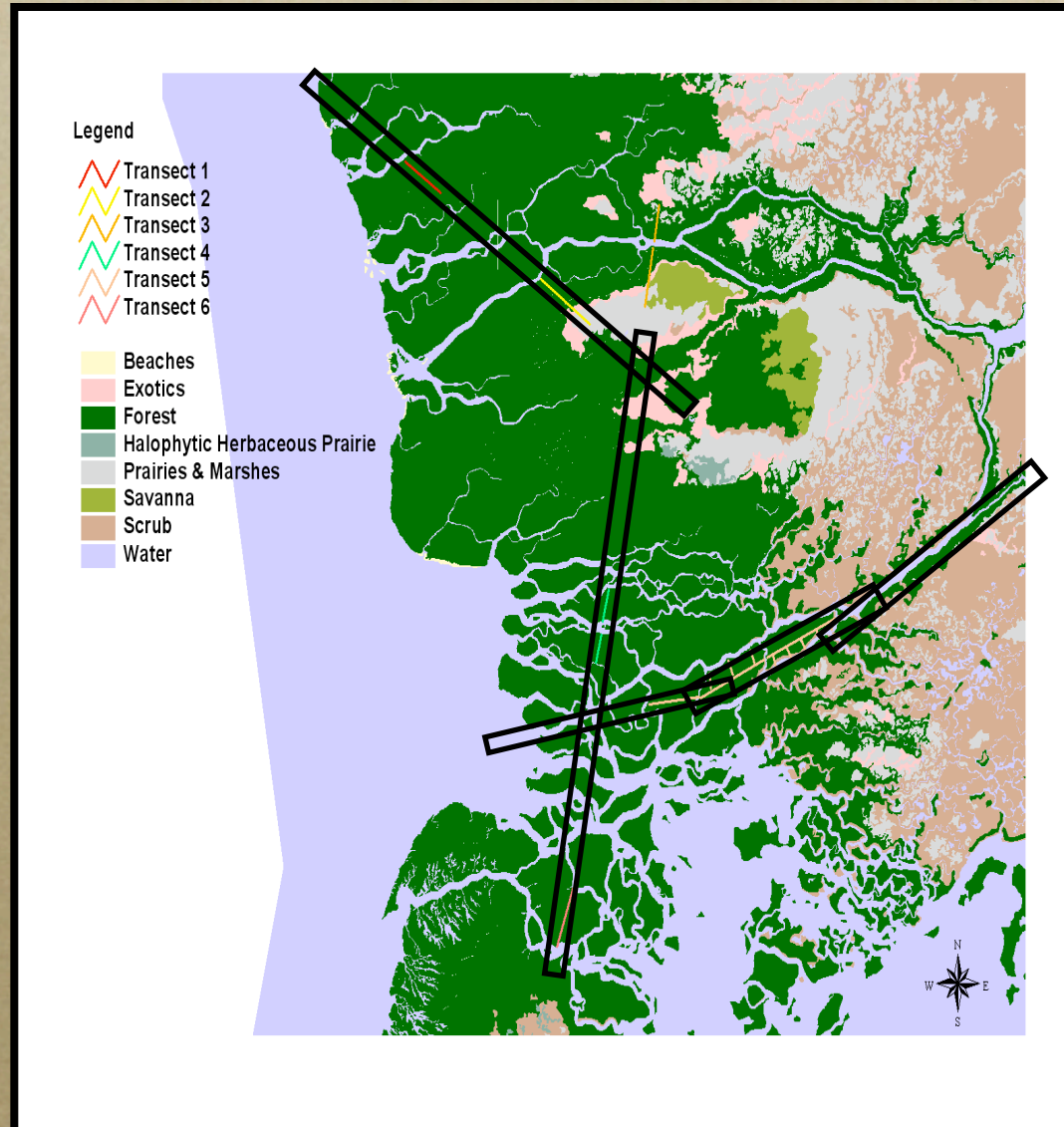


LIDAR Data

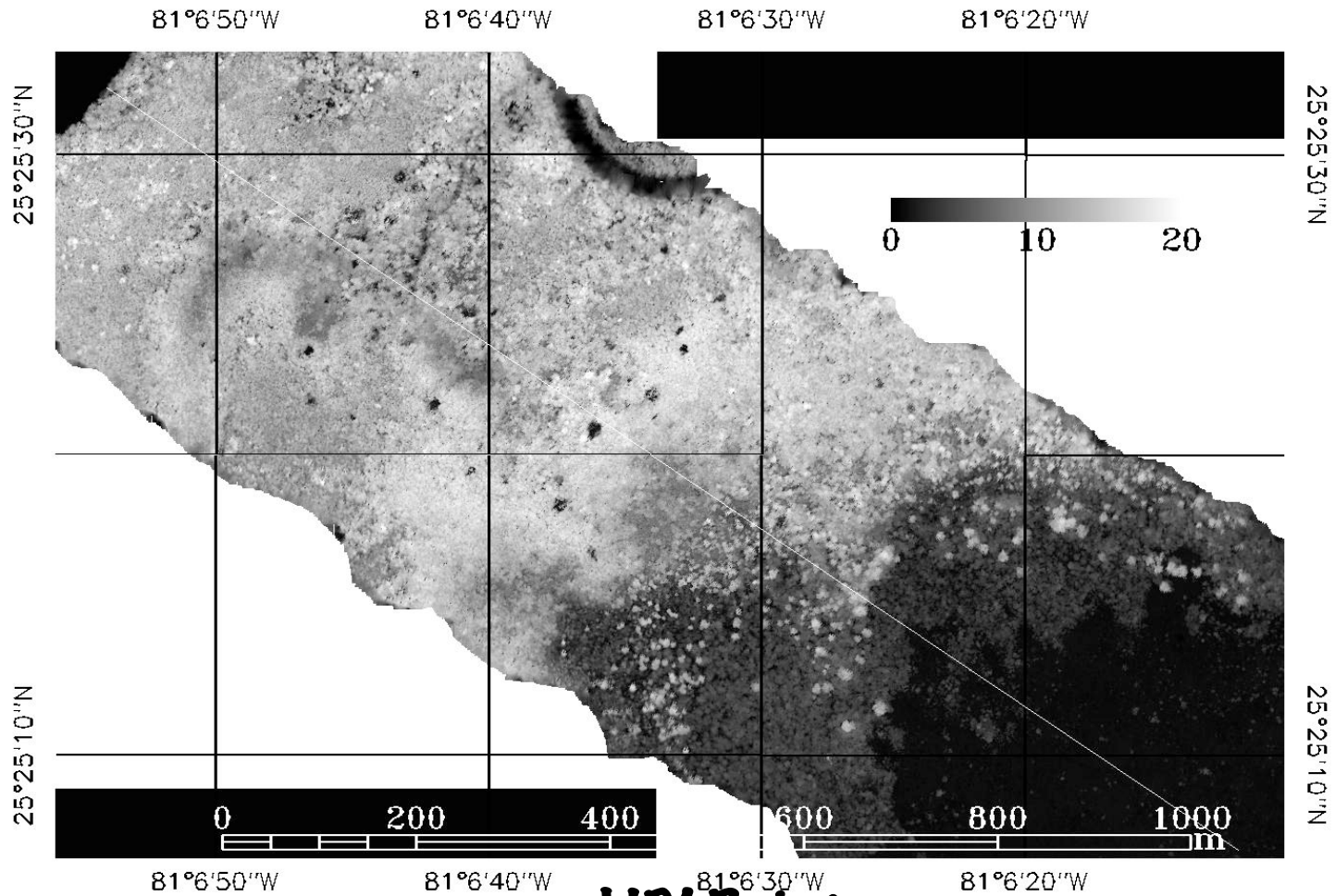
- *Optech 1233 Airborne Laser Terrain Mapper*
 - *Infrared 1.1um*
- *First and last reflection method (No Waveform)*
- *Nominal Altitude of 500m*
 - *360m swath*
- *May 13-15 2004*
- *1.5m spacing with 13cm laser footprint*
- *15 cm elevation accuracy*



Lidar Tansects

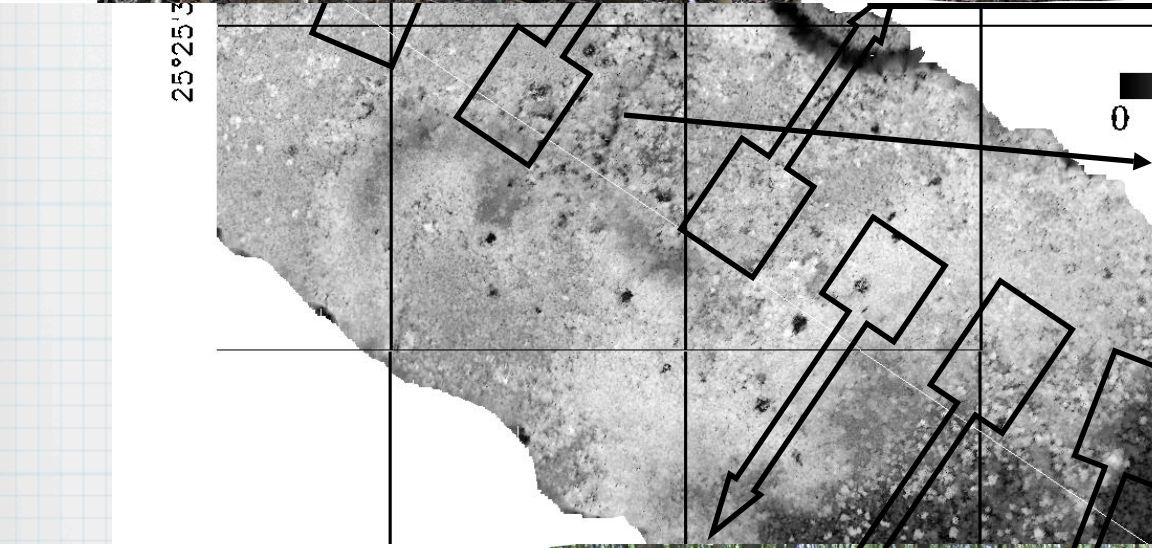


Transect Harney River

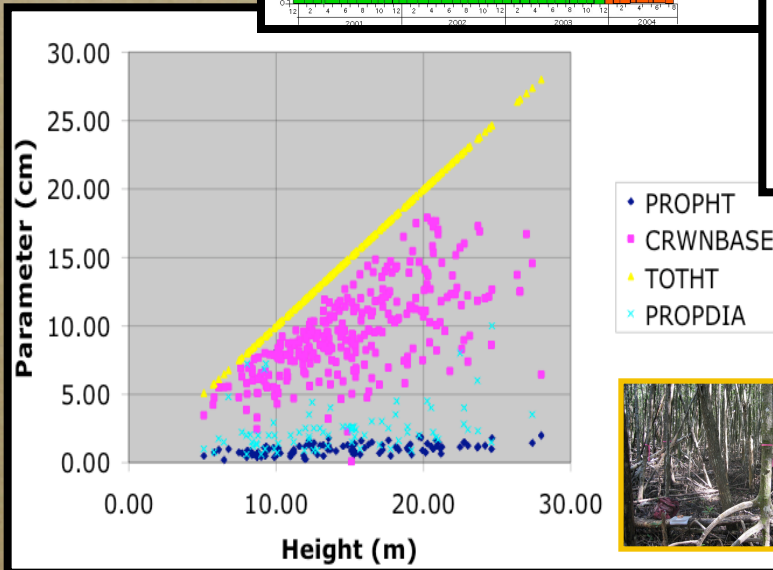
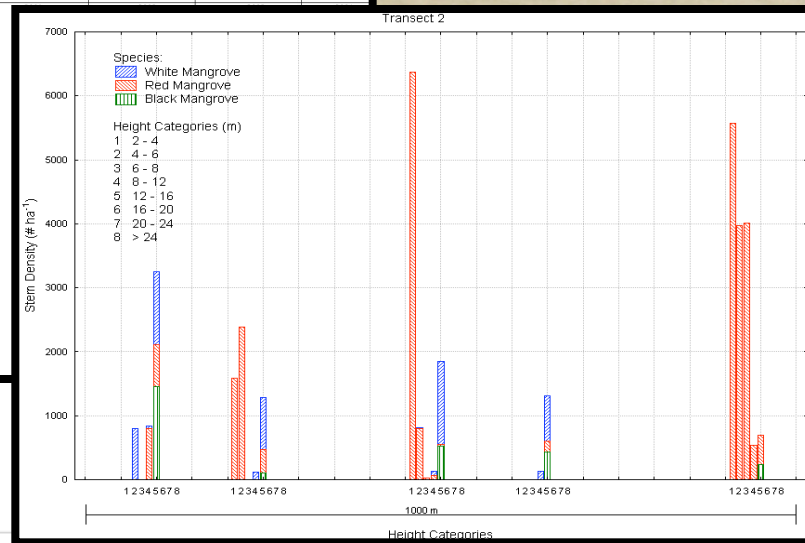
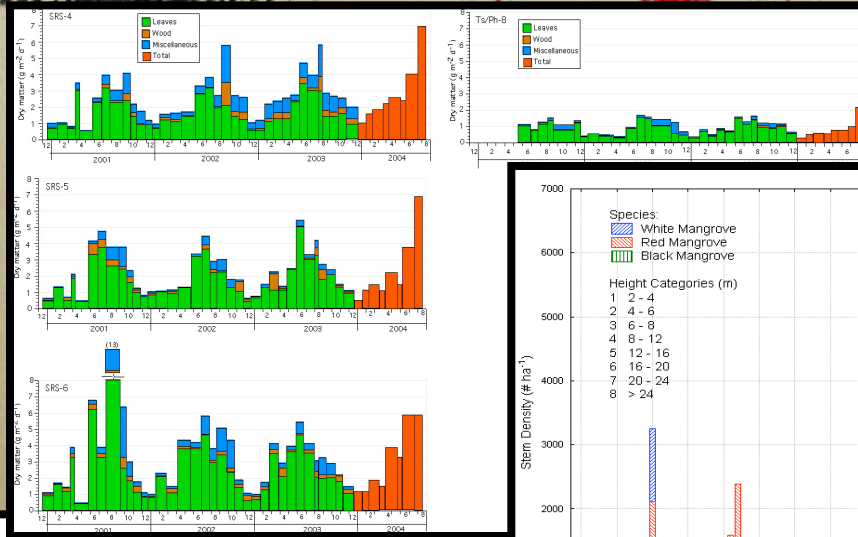


LIDAR data





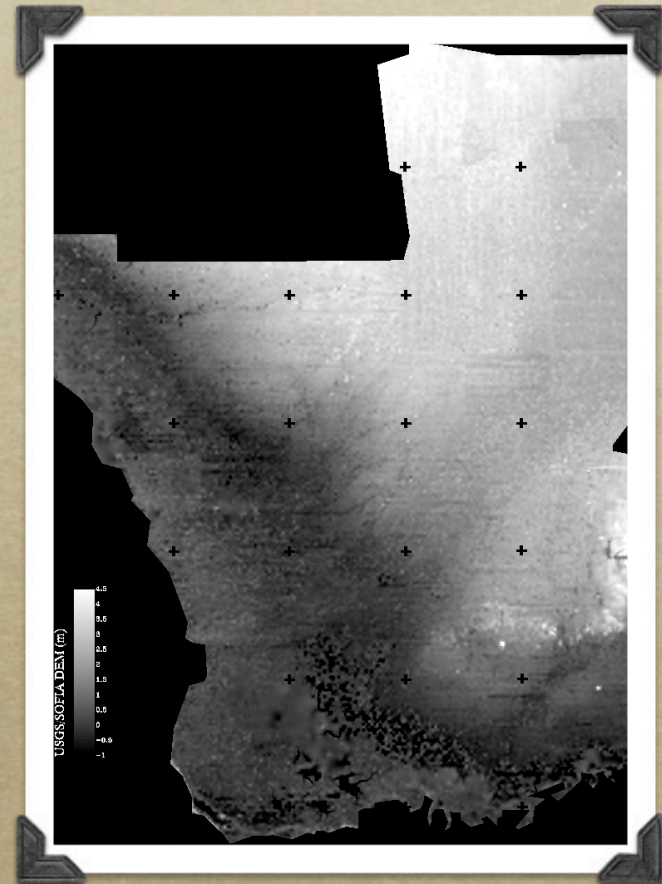
Field data: Tree and Forest Structure, Productivity



USGS DEM

South Florida Information Access(SOFIA)

- *DEM 15cm height Accuracy*
- *Grid with 400m sampling*

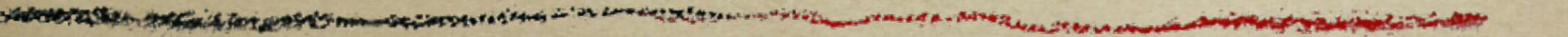


Land Cover Classification (University of Georgia Quads)

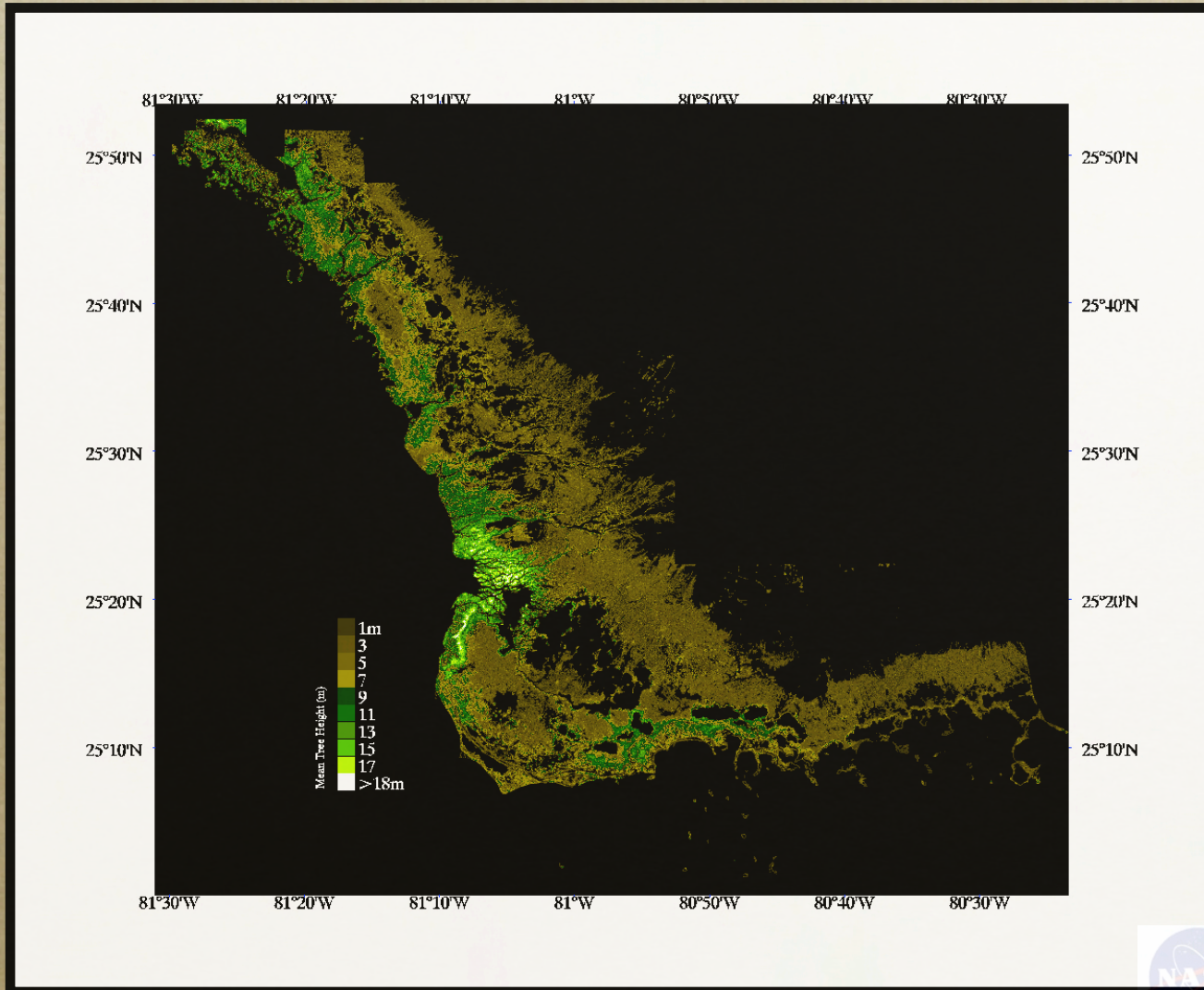
- *Land Cover Classification*
- *Mangrove Forests*
 - *by specie dominance*
 - *scrub vs tall*



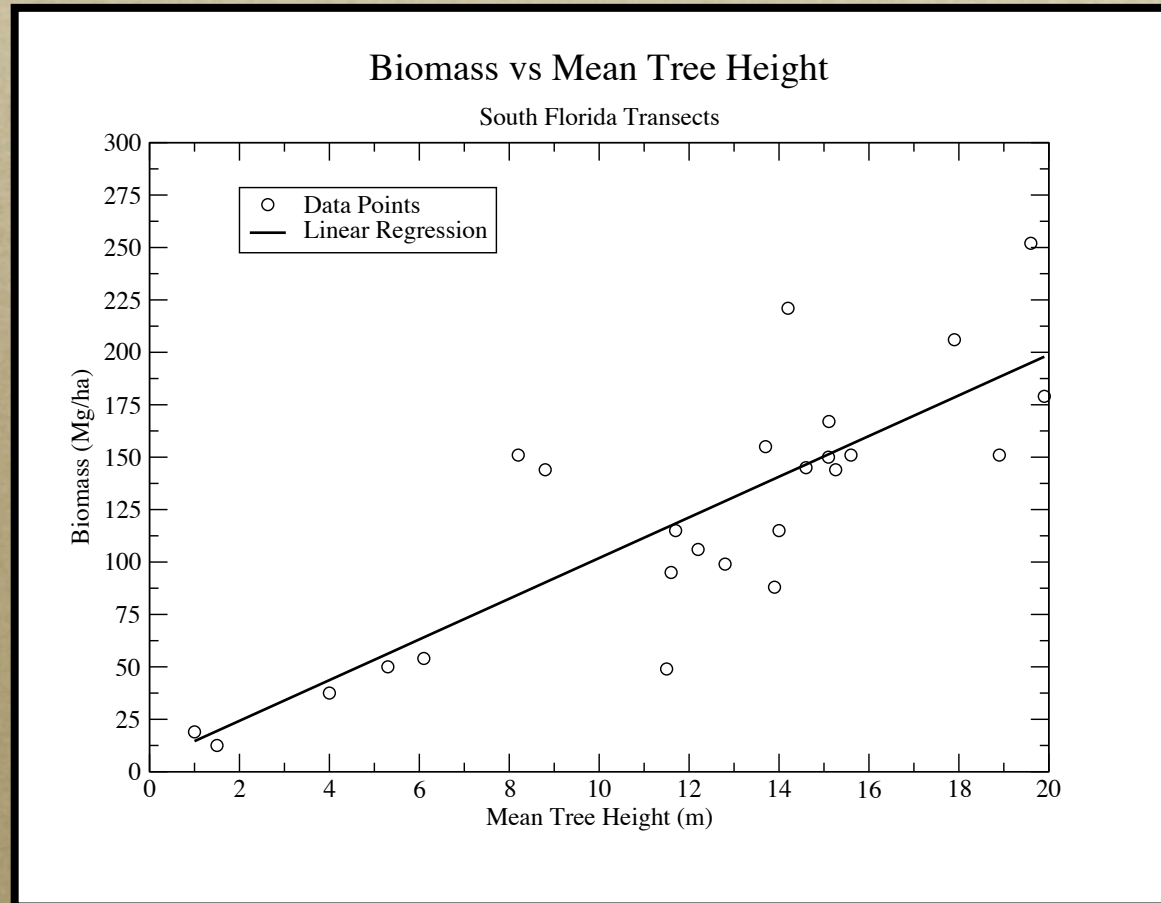
Results



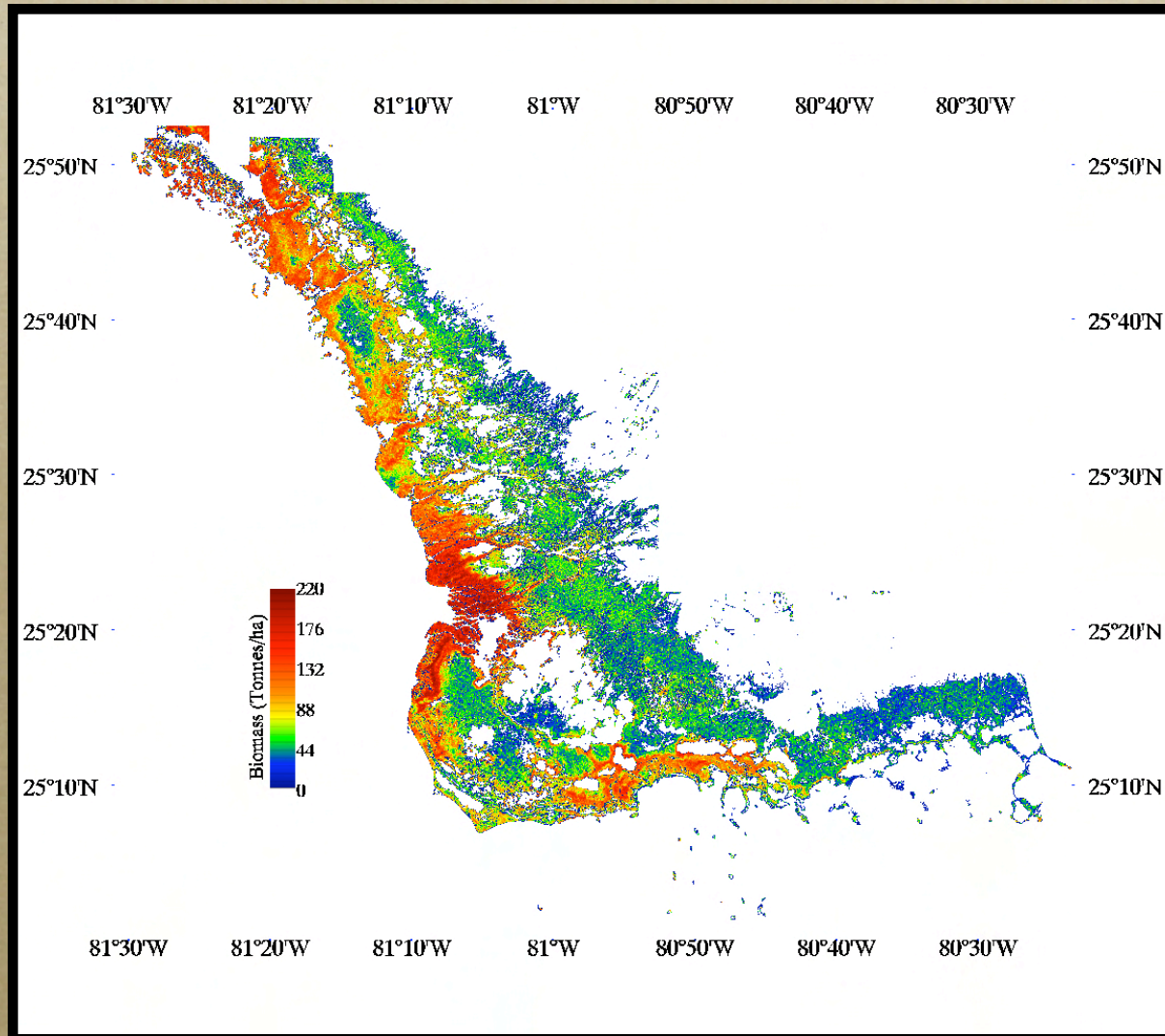
Mean Tree Height



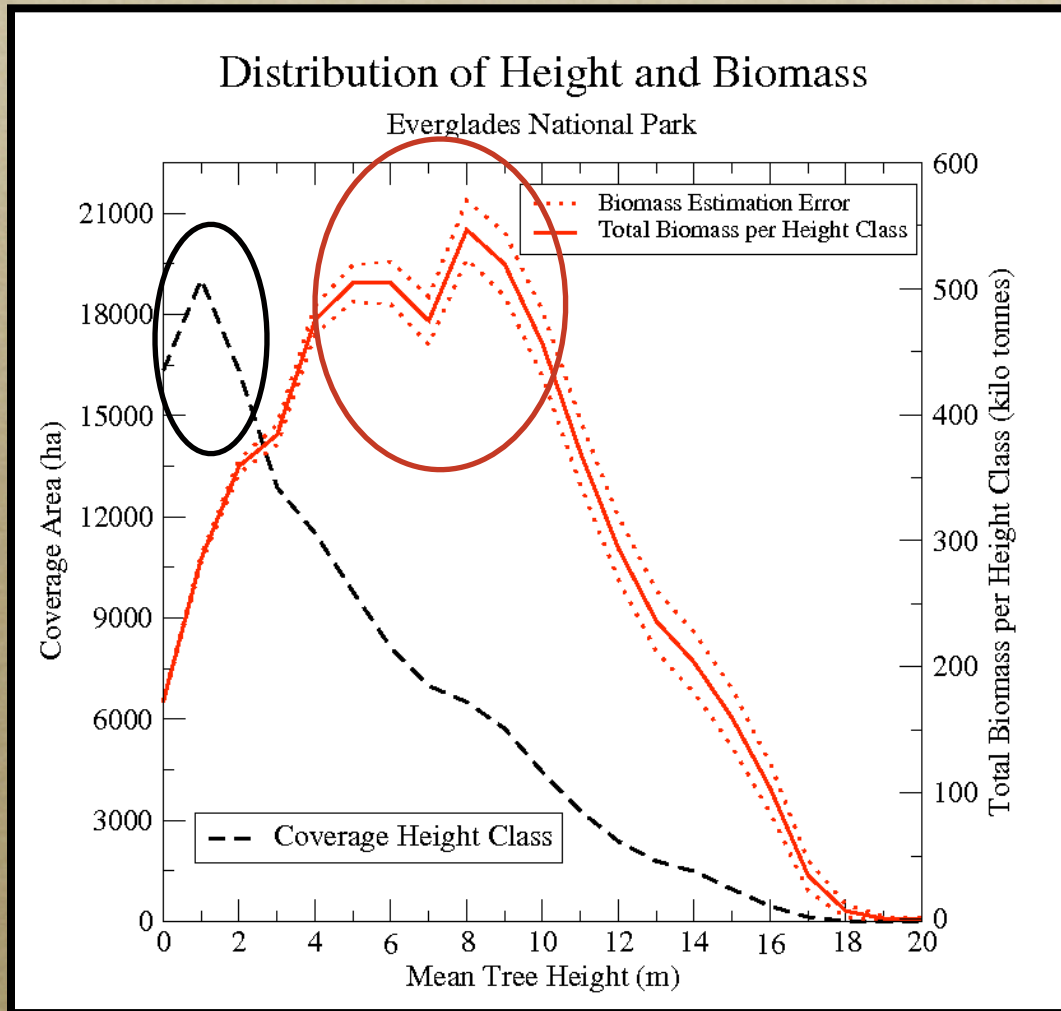
Biomass Estimation



Biomass Spatial Distribution

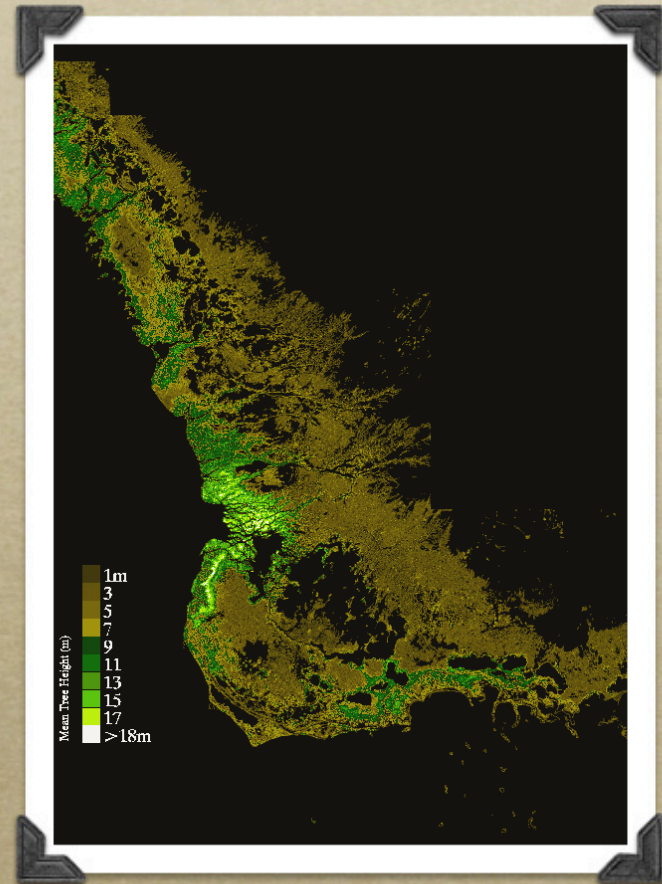


Histogram Distribution

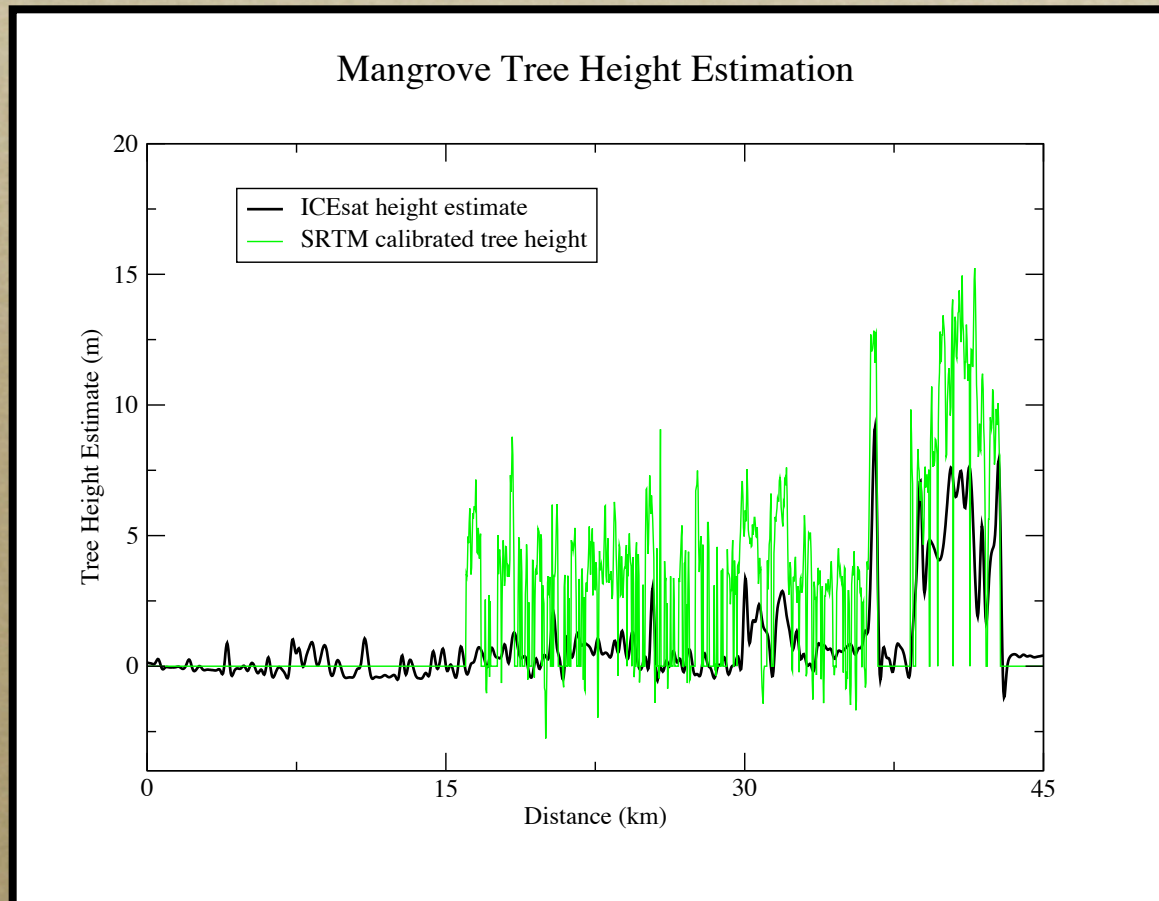


Plans

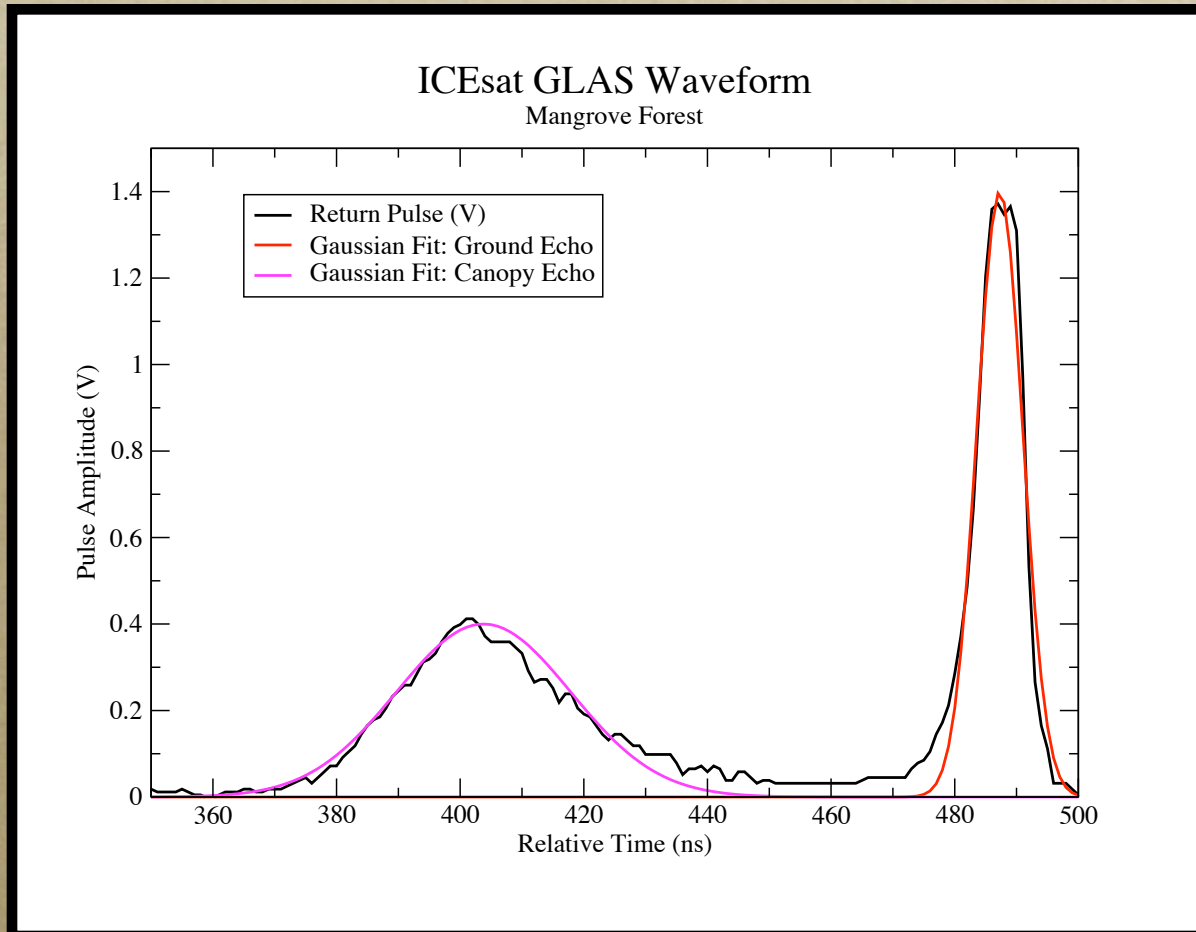
- *Landscape Scale Productivity*
- *Expand to Honduras, Colombia, Venezuela, Mexico.*
- *Forest Structure Model vs. Radar Elevation and Correlation*
- *LIDAR Waveforms (ICESat)*



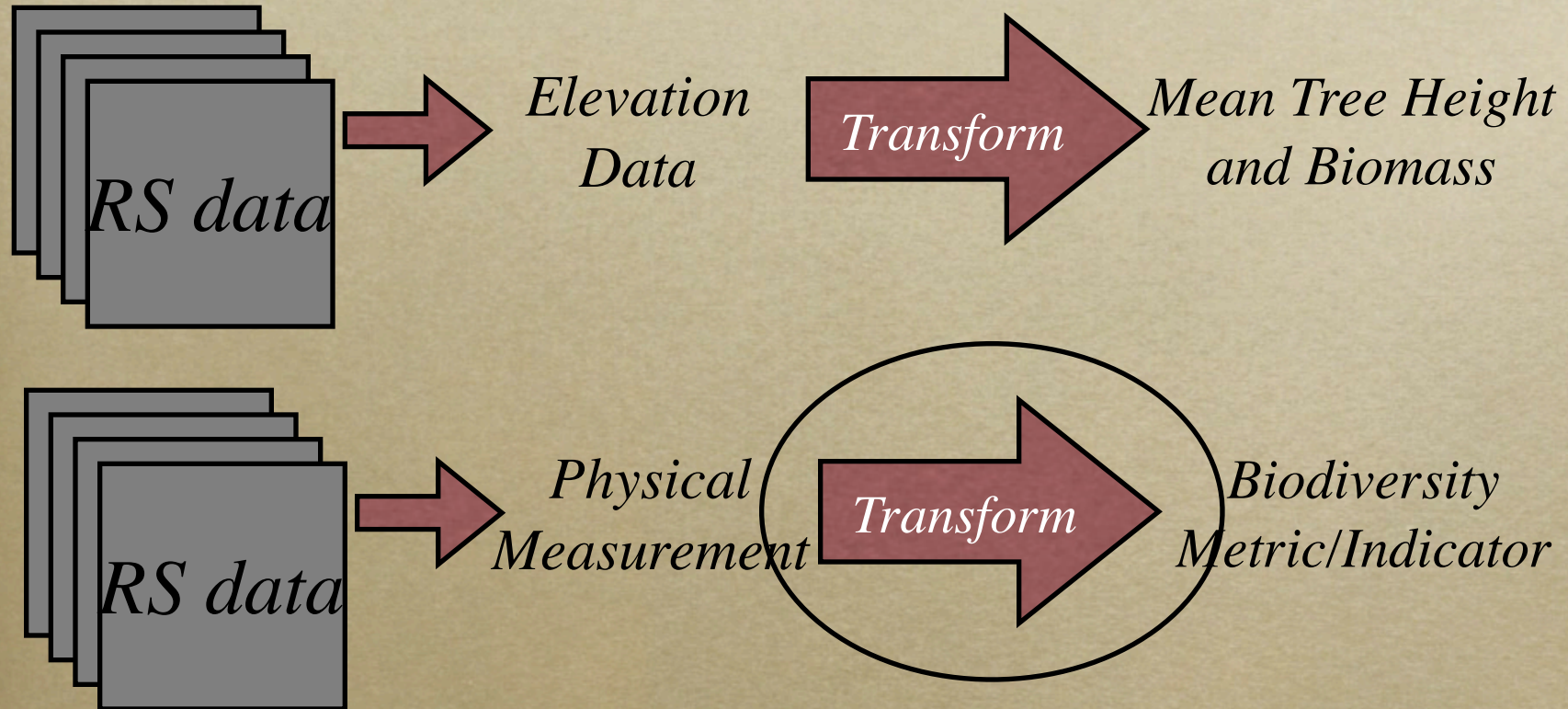
ICESat Elevation vs SRTM



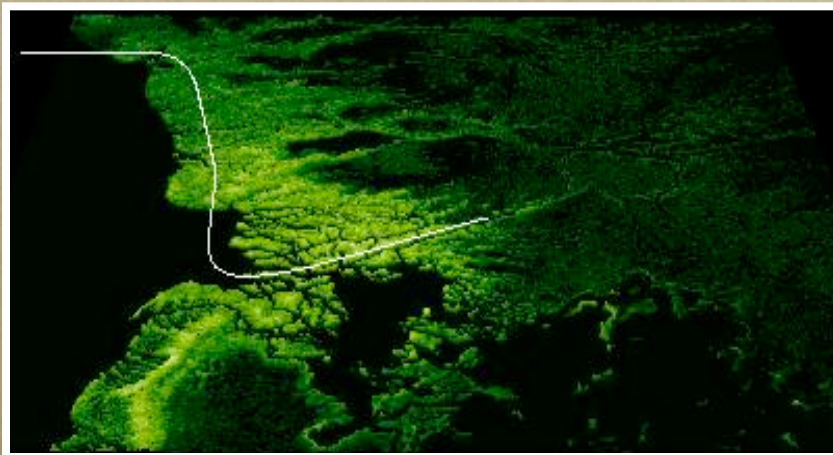
ICESat Elevation vs SRTM



From Remote Sensing to Relevant Metrics



Flight Simulation



From Lostman River to Shark River

