Abstract: This presentation will summarize several case studies of changes in littoral ecosystems on the Northern Gulf of Mexico and Southeastern Atlantic coasts, as captured with satellite and airborne imagery analysis. On the Georgia coast, 35 years of Landsat imagery revealed large scale (3 fold) inter-annual variation and a cumulative net loss of 16.5% in the aboveground biomass of the keystone salt marsh species, *Spartina alterniflora*. Spatial differences and temporal changes in 620 km^2 (about 680,000 pixels of *Spartina* habitat) were linked to climate variables, river hydrology, and sea level dynamics. In the same area, riparian brackish and freshwater wetlands are sensitive indicators of changes in salinity patterns. On the Texas coast, Black Mangrove vegetation is replacing salt marsh communities, as shown in analysis of high resolution WorldView satellite imagery. This "tropicalization" is well underway, but also reveals instabilities due to occasional winter incursions of arctic air. Finally, at multiple sites, we've used airborne hyperspectral and HICO Space Station imagery to document patterns of phytoplankton chlorophyll (including HABs) and CDOM in estuarine, inshore, and shelf waters.

The Dynamic Littoral Fringe – Spatial and Temporal Patterns in Community Structure and Productivity in North American Coastal Ecosystems

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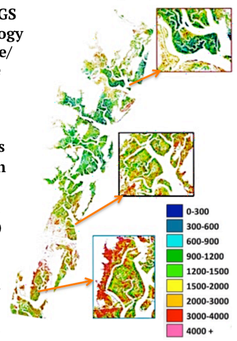
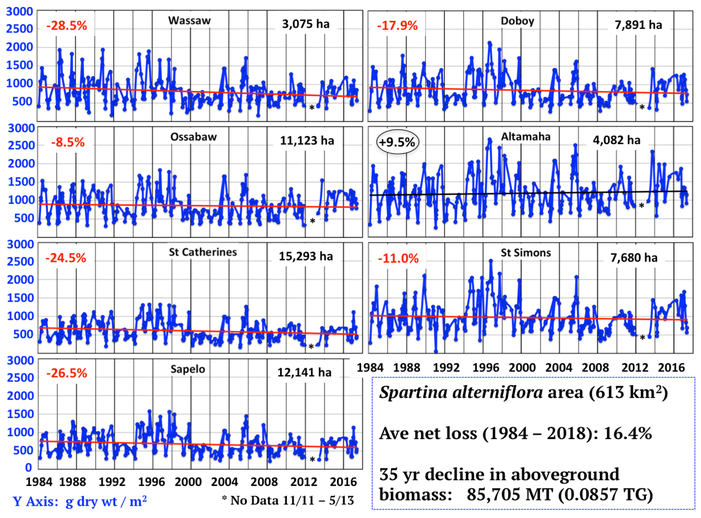
We undertook a large-scale, 35 year analysis of 612.8 km^2 (~680,000 pixels) of *Spartina* marshes in coastal Georgia (USA) based on new Hladik wetland mapping to produce 264 biomass maps (March, 1984 and April, 2018).

Methods:
- **We subdivided areas common to our Landsat scenes to 7 USGS coastal hydrology (HUC) drainage/ tidal exchange systems.**
- **A Landsat biomass algorithm* was applied to each *Spartina* pixel (*O'Donnell & Schalles, 2016)**
- **We then extracted the biomass pixels from each HUC drainage.**

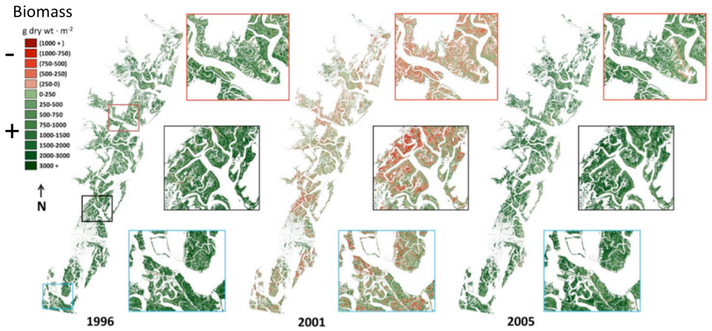




***Spartina alterniflora* area (613 km^2)**

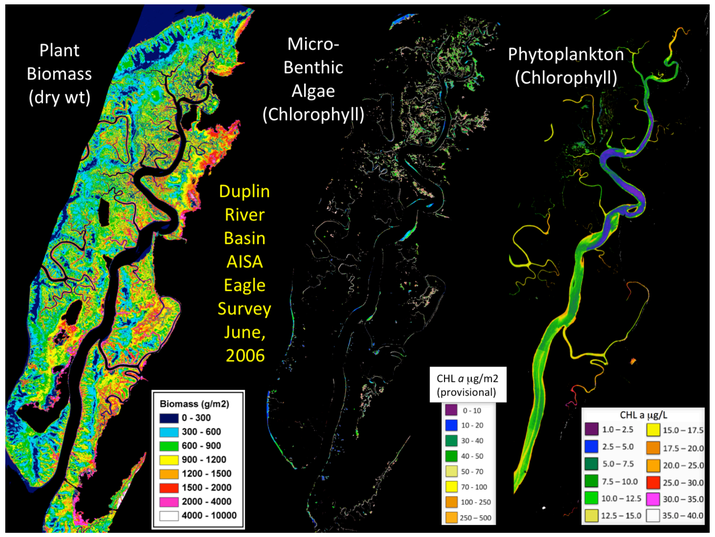
Ave net loss (1984 – 2018): 16.4%

35 yr decline in aboveground biomass: 85,705 MT (0.0857 TG)

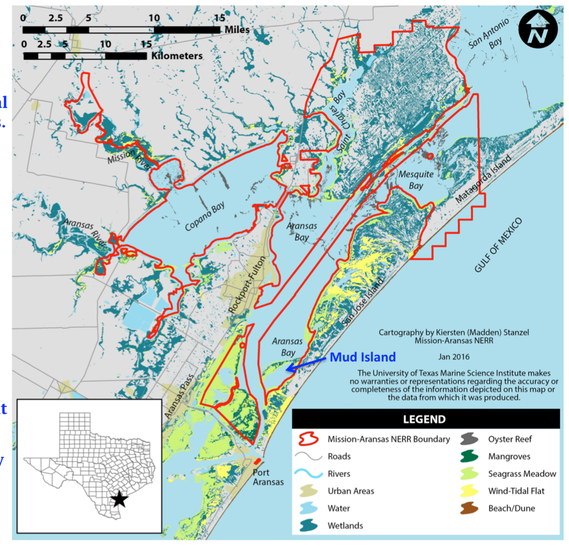


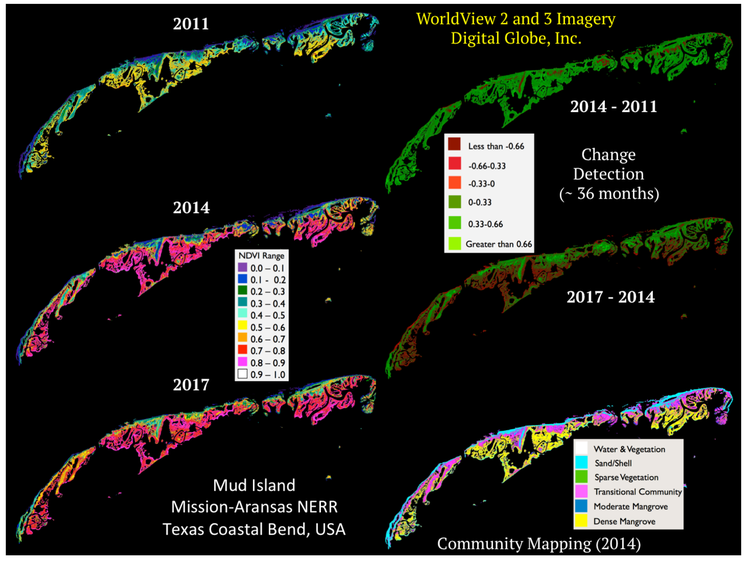
- Net difference maps and subscenes for early versus later growing seasons in two **above average moisture years (1996 and 2005)** compared to **2001 (impact of 4 years of severe drought**). (O'Donnell, Schalles, and Hladik – In Prep).
- **The 2001 difference map (late season – early season)** showed variable stress patterns. Areas further from freshwater flows more often showed net losses.
- **In 2005, Georgia marshes displayed resilience**. Growth rebounded to pre-drought levels. However, **growth was suppressed in the final 6 years of our analysis** (2006-11).

Delineations of the primary production patterns of the 3 vegetation groups within the Duplin River tidal watershed at Sapelo Island, Georgia, USA (AISA Eagle imagery from June, 2006)

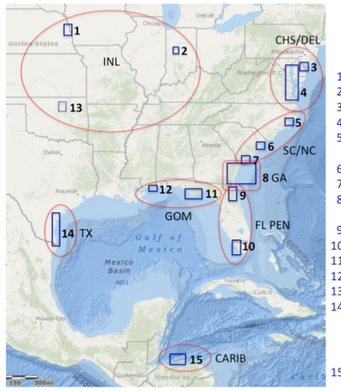


- **Tropical Black Mangrove Trees (*Avicennia germinans*) are rapidly expanding their range into the Coastal bend Region of Texas.**
- **We worked with the staff of the Mission-Aransas National Estuarine Research Reserve to survey vegetation in Aransas Bay, with recent attention focused on Mud Island, where mangroves have invaded in the last 2 decades and rapidly displaced existing salt marsh communities.**
- **Hard freezes in early 2011 and 2017 damaged mangroves (a sign of climate instability ?).**





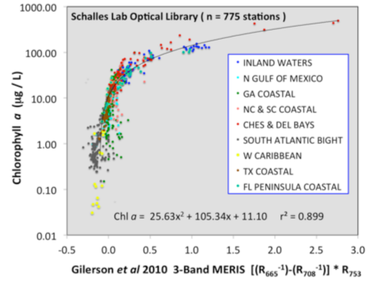
A consistent set of procedures was used to measure RS-0 water reflectance and water constituents at 775 stations with large variations in chlorophyll *a*, CDOM, and Total Suspended Matter. This data set provided a rigorous test of chlorophyll *a* algorithms. Algorithms using the red and NIR regions, with a "normalizing" denominator, performed best. The 3-band MERIS algorithm of Gilerson et al. (2010) was favored for robustness and satellite band availability. The band ratio approach greatly reduced, but did not eliminate CDOM & TSS interference.



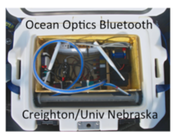
STUDY AREAS (775 total stations)

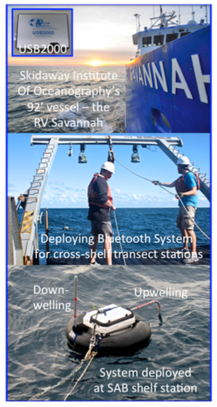
United States
1 Eastern NE / Western IA
2 Eagle Creek Reservoir, IN
3 Delaware Bay, DE
4 Chesapeake Bay, VA & MD
5 Neuse River and Pamlico Sound, NC
6 Winyah Bay, SC
7 Ace Basin NERR, SC
8 Georgia Rivers, Inshore, Coastal Shelf, & Gulf Stream
9 St. Johns River FL
10 Charlotte Harbor & Venice FL
11 Apalachicola & St. Joe. Bays, FL
12 Grand Bay NERR, MS
13 OK Red Clay Reservoirs
14 Mission-Aransas NERR, Nueces and Corpus Christi Bays, Bahia Grande Lagoon, TX

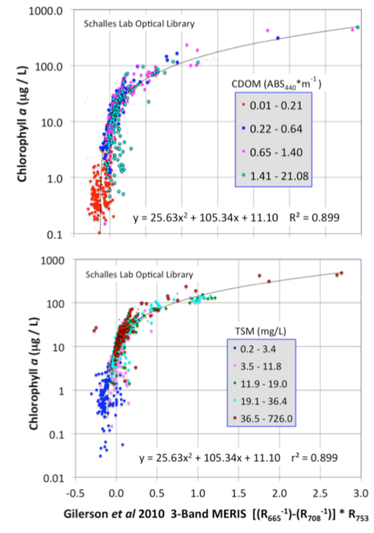
Honduras
15 Roatan Island and Offshore



A pair of Ocean Optics USB spectroradiometers, with 200 µ fiber optic inputs (solar downwelling and Calibration panel and target upwelling) were operated at each station with Univ. Nebraska CALMIT's CDAP software. An aluminum Jon Boat was used in 2002, a new Creighton 15' skiff was used between 2003 – 2015, and the RV Savannah in 2014.







CO photoproduction was vertically integrated to help elucidate the mechanisms regulating UV-driven photoproduction rates in the dynamic coastal environment of inshore and South Atlantic Bight waters of Central Georgia, USA. This work showed blended two ocean color algorithms to assess a UV dependent processes at high spatial resolution in an optically complex coastal environment

From Cao, Mishra, Schalles, & Miller.
Blending two ocean color algorithms to evaluate ultraviolet (UV) optics and photochemistry using the Hyperspectral Imager for the Coastal Ocean (HICO). *Geophys Res Lett* [In Revision]