Assessing the Effects of Eutrophication on Mangrove's Resiliency to Sea Level Rise

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Beneficial Mangroves

Mangroves provide a variety of ecosystem services

- **Carbon Sequestration**
- **Shoreline Protection**
- **Fisheries Nursery**
- **Wildlife Habitat**
- **Ecotourism**

Mangrove Threats

Mangroves are facing a variety of anthropogenic threats

- **Development and Urbanization**
- **Shrimp Farming**
- **Palm Oil Plantations**
- **Altered Hydrology**
- **Eutrophication**
- **Climate Change/SLR**

Mangroves & SLR Resiliency

Sea Level Rise is the greatest global threat to Coastal Wetlands.

Models predict significant loss of coastal wetlands around the globe over the next century

Vertical Land Movement

Mangroves can gain vertical elevation and compete with rising sea levels

Primary Drivers of Vertical Land Movement:

- **Sedimentation & Erosion**
- **Aboveground Productivity – litter and wood fall**
- **Belowground Productivity – root development**
- **Decomposition**

$$VLM_{(net)} = (S - E) + (AG + BG - D)$$

Mangrove Health & Resiliency

Mangrove resiliency to SLR is dependent upon their health

Healthy mangroves are more productive and can accrete more elevation and store more carbon

Stressors can result in reduced productivity and more vulnerability to SLR

Stressors:

- **Altered Hydrology**
- **High Sulfide Concentration**
- **Pollution**
- **Eutrophication**

Mangroves & SLR Resiliency

Coastal wetland loss will not be uniform across the landscape

West: Eutrophication

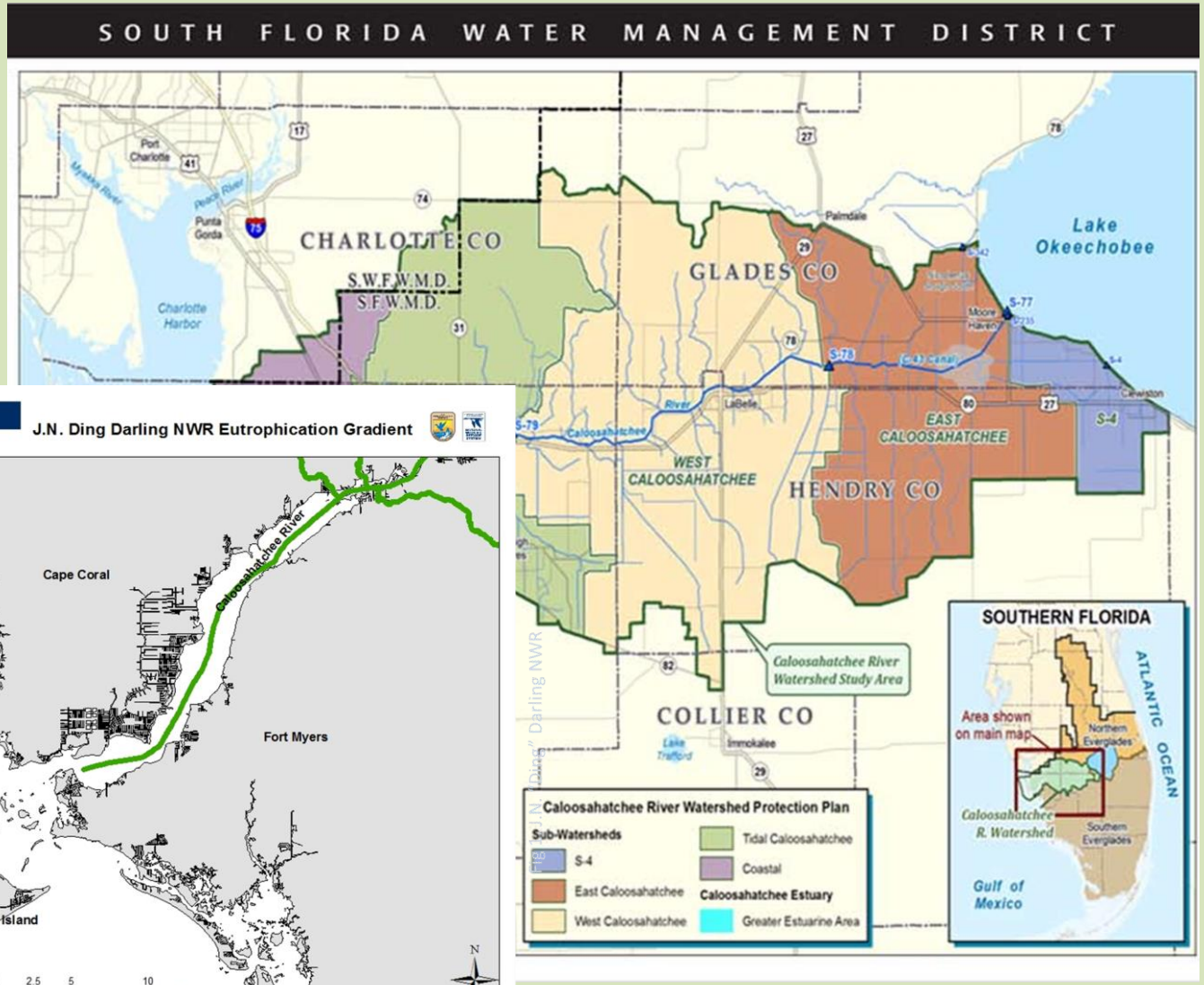
East: Impounded

South: Altered Hydrology

Models & Monitoring

Lake O & Nutrients

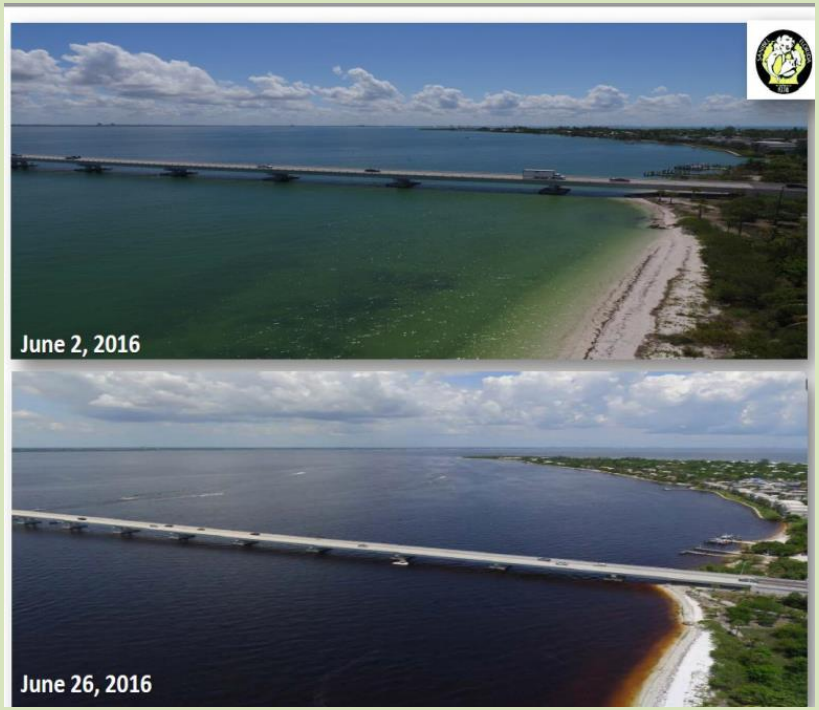
Lake O to Ding



Lake O & Nutrients

Eutrophic fresh water releases from Lake Okeechobee:

- **Destroyed 1,000s acres of seagrass**
- **Destroyed nearly 90% of oyster reefs**
- **Exacerbated Red Tide events – fish kills & manatee deaths**
- **Cost Millions**
- **What about mangroves?**



Mangroves & Nutrients

The effects of eutrophication on mangrove health is mixed

Pros:

- **Short Term - Increased productivity** (Onuf et al. 1977, McKee et al. 2007)
- **Short Term - Increased carbon burial** (Chmura et al. 2003).

Cons:

- **Increased belowground decomposition & herbivory** (Feller et al. 1999)
- **Tree mortality** (Lovelock et al. 2009)
- **Vulnerability to storm damage** (Feller et al. 2015)

Research Design

Goal: Assess how nutrient inputs effect primary processes of vertical land movement across a hydro-geomorphic gradient (Fringe and Basin)

- **18 Experimental Plots – SET MH**
- **3 Treatments (C, P, N) – Fertilize P & N plots**
- **Aboveground productivity – Litterfall & woody debris**
- **Belowground productivity – Root development**
- **Decomposition – Loss of known quantity of organic material**
- **Rate of Sedimentation**
- **Determine net change in Vertical Land Movement**

Predicted Outcomes

Short Term Increase in Productivity + **Long Term Increase in Decomposition** = **Net Change in Elevation???**

Questions