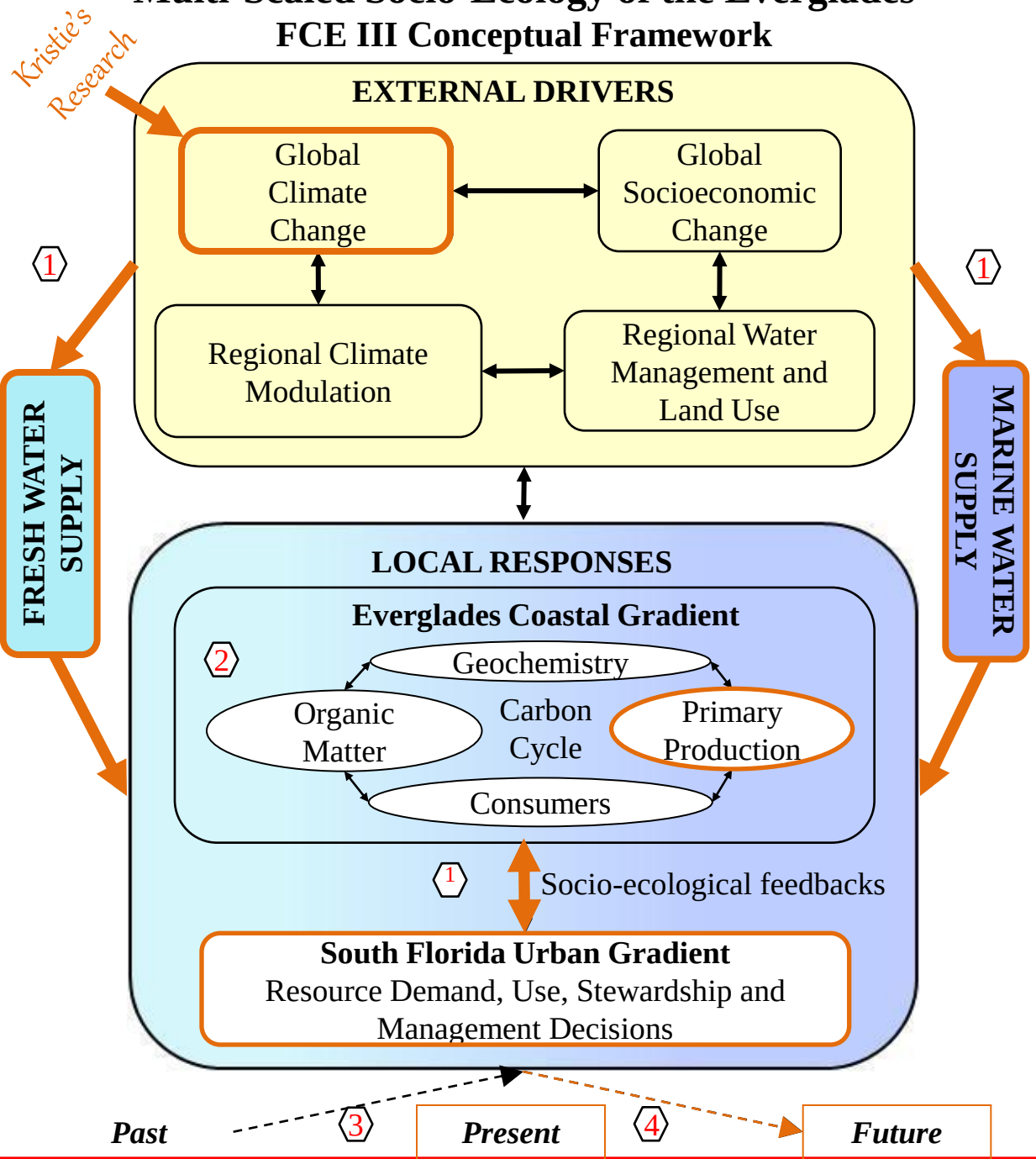
Detecting long-term community shifts in response to sea level rise and Everglades' restoration

Kristie S. Wendelberger[1], Jimi Sadle[2], Sonali Saha[3], Jennifer H. Richards[1]

[1]Florida International University, Miami, FL, USA
[2]Everglades National Park, Homestead, FL, USA
[3]The Institute for Regional Conservation, Miami, FL, USA

Multi-Scaled Socio-Ecology of the Everglades

FCE III Conceptual Framework



FCE III LTER Goals:

1 ***Water :*** How do water management decisions interact with climate change to determine freshwater distribution?

2 ***Carbon:*** How does the balance of fresh and marine water supplies regulate C uptake, storage, and fluxes by influencing water residence time, nutrient availability, and salinity?

3 ***Legacies:*** How does historic variability in the relative supply of fresh and marine water modify ecosystem sensitivity to further change?

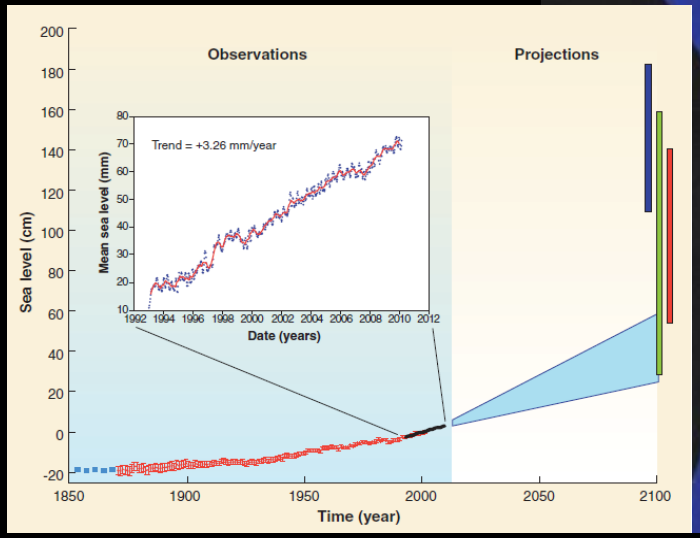
4 ***Scenarios:*** What are alternative socio-ecological futures for South Florida under contrasting climate change and water management scenarios?

Sea Level Rise

Globally, sea level has been rising and is predicted to continue to rise.

If sea level rise continues, it will produce major changes in the south Florida landscape and plant communities.

South Florida today

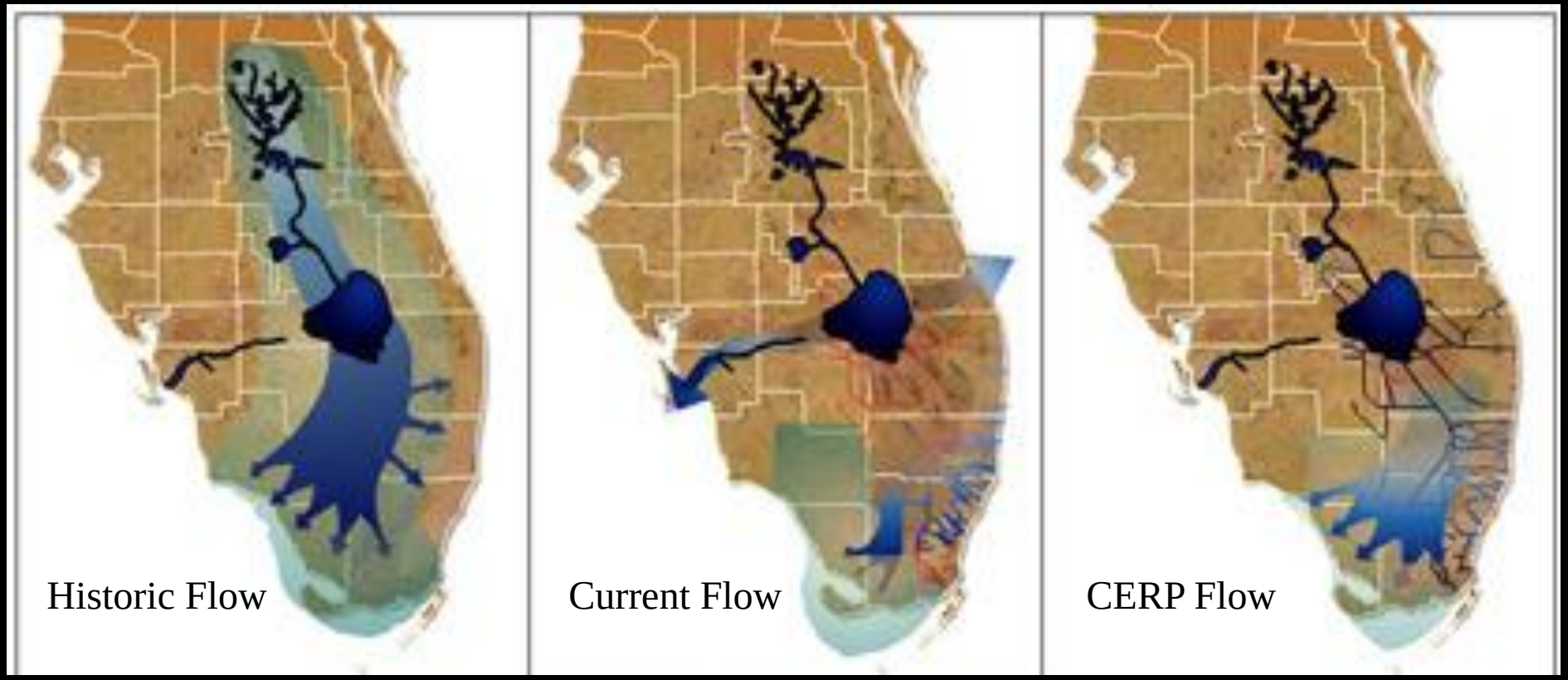


South Florida ~2060

+60 cm rise

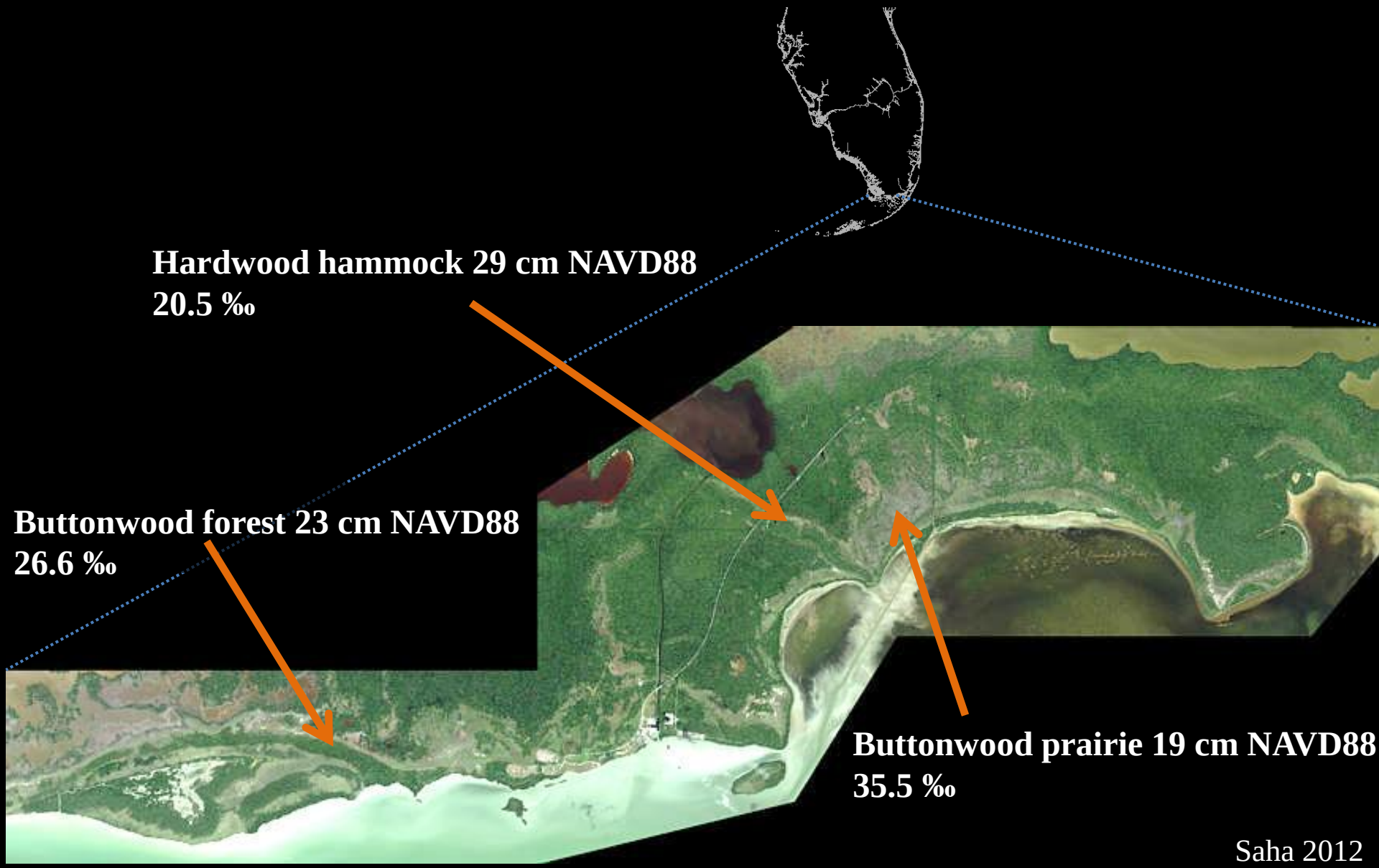
H. Wanless

Everglades restoration will also produce major changes in the south Florida landscape and plant communities.



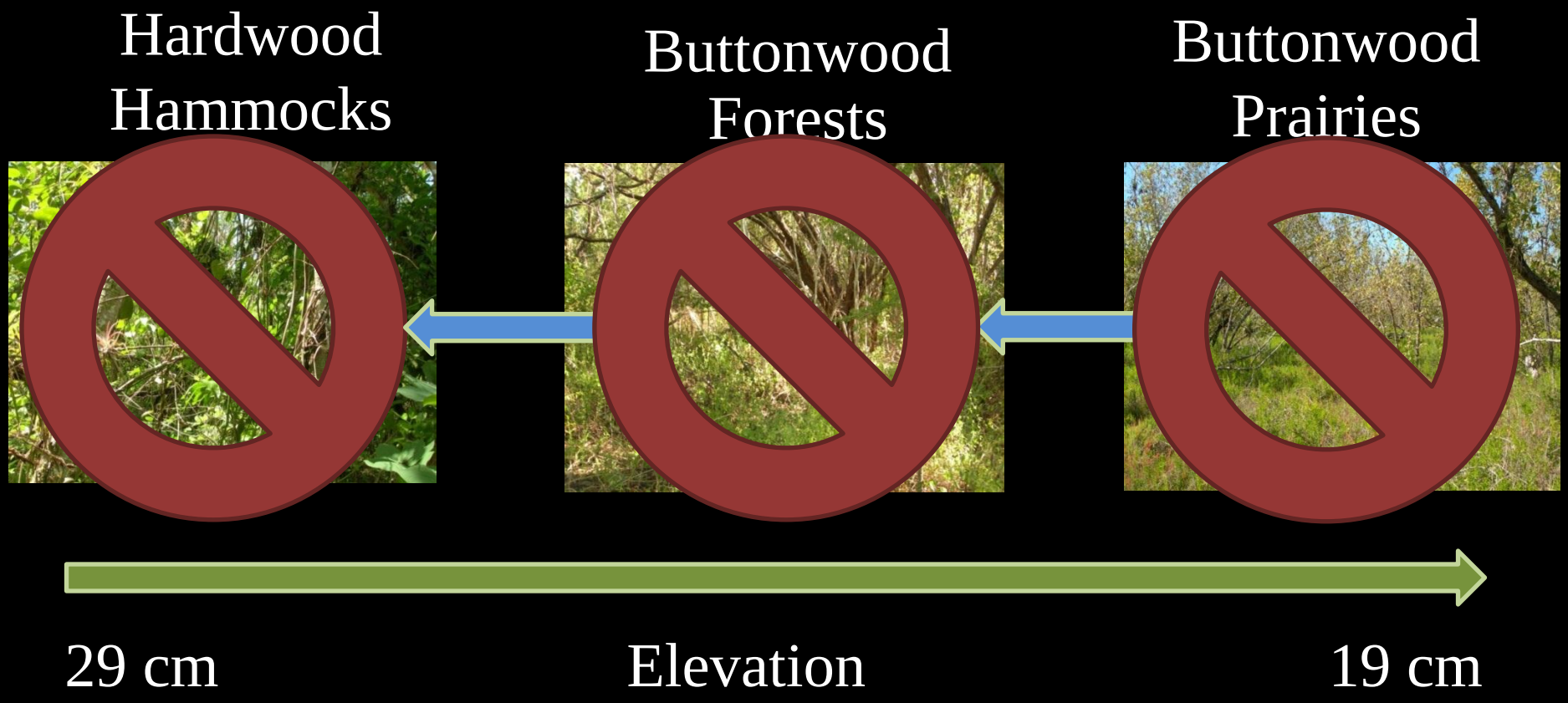
http://www.nps.gov/ever/naturescience/cerp.htm

Coastal communities have different distributions, elevations and salinities.



Saha 2012

Upland south Florida coastal plant communities affected by the interactions of SLR and CERP restoration.



Early life stages can be first responders to change.

Are seed germination and/or seedling establishment initiators of ecological change in response to salinity for coastal forest communities?

Effects of salinity on early life stage

Hypotheses

H1: Seed germination will ↓ with ↑ salinity.

H2: Seedling establishment will ↓ with ↑ salinity.

H3: Seedling establishment will be more vulnerable than germination to increases in salinity levels.

Coastal study species

Eugenia foetida

Piscidia piscipula

Capparis flexuosa

Conocarpus erectus

Swietenia mahagoni

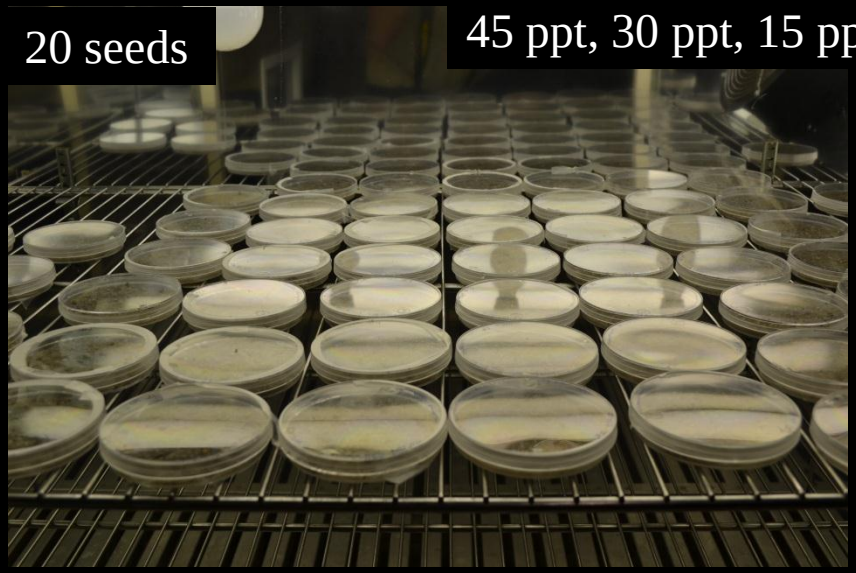
Chromolaena frustrata

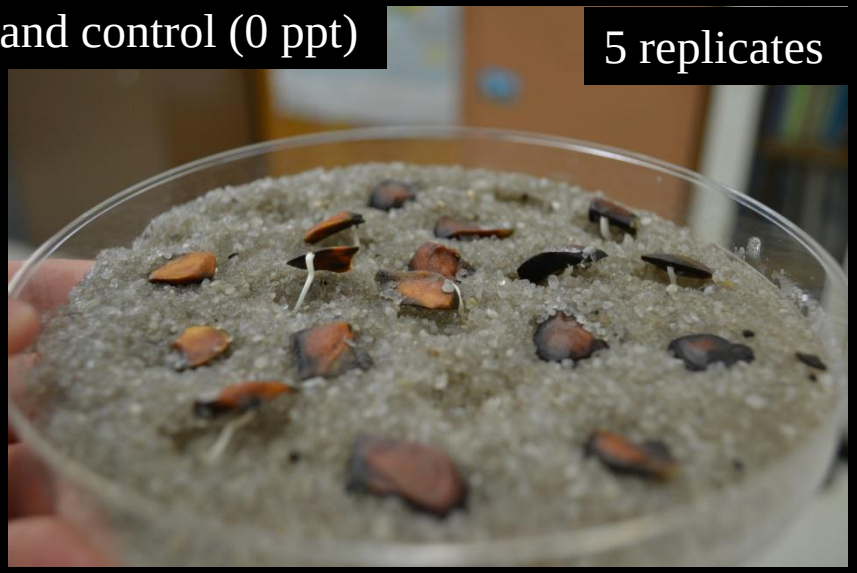
Seed germination in response to salinity: Methods

20 seeds

45 ppt, 30 ppt, 15 ppt, 5 ppt, and control (0 ppt)

5 replicates



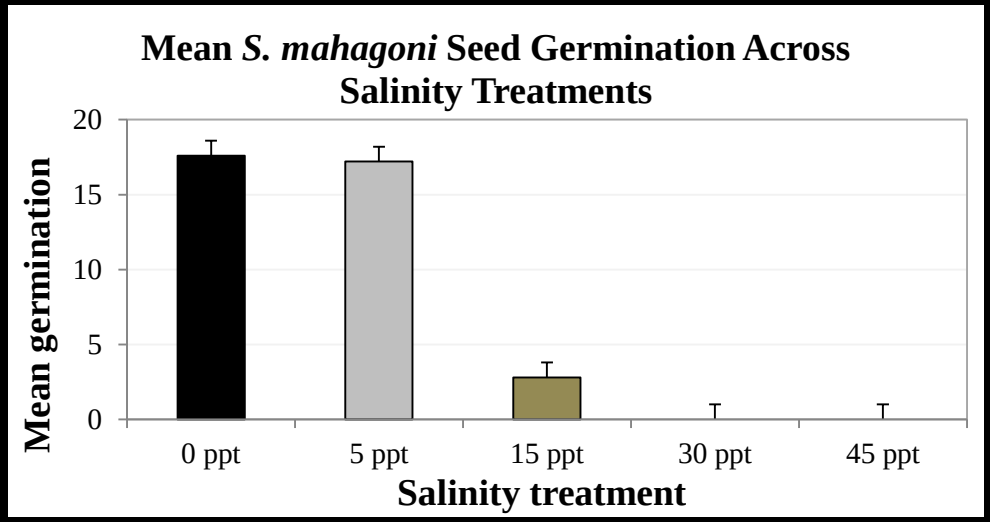


12 hour day/night light regime, 70% humidity, and 26°C

6 weeks

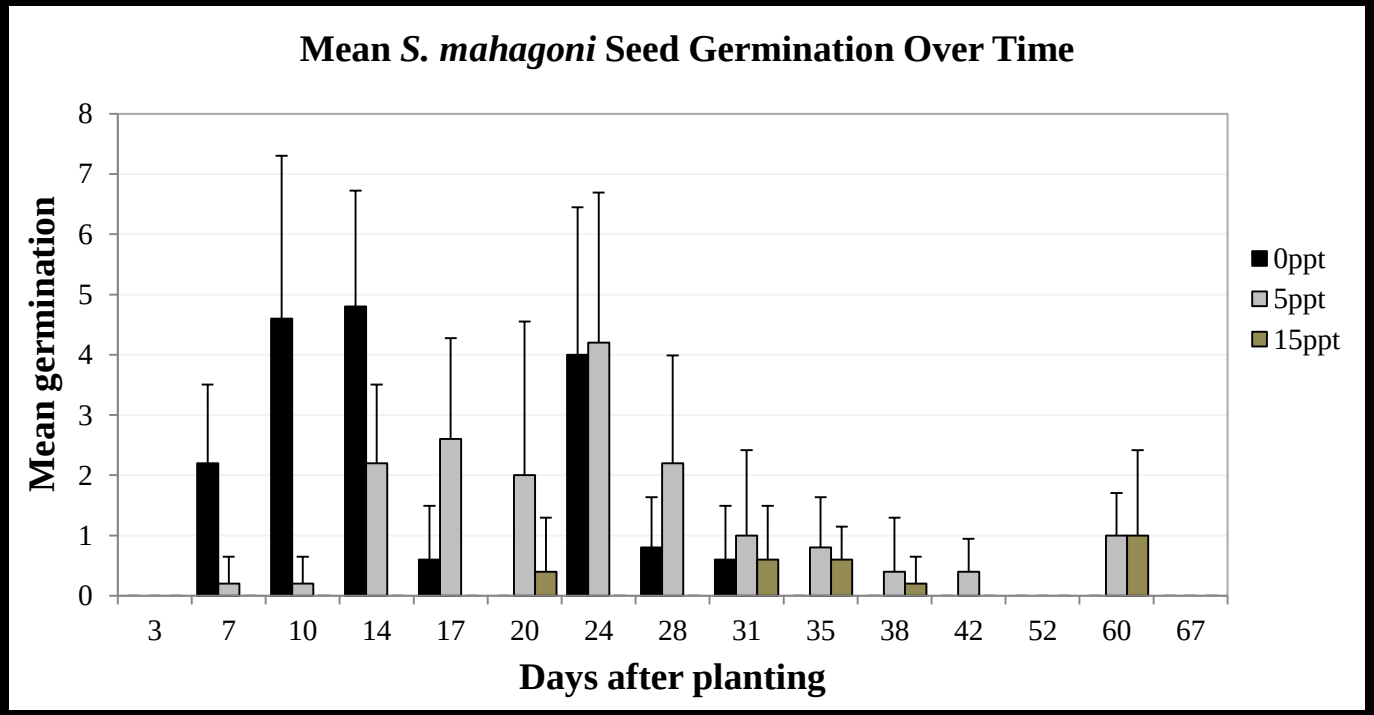
0 ppt at the end

Seed germination in response to salinity: Results

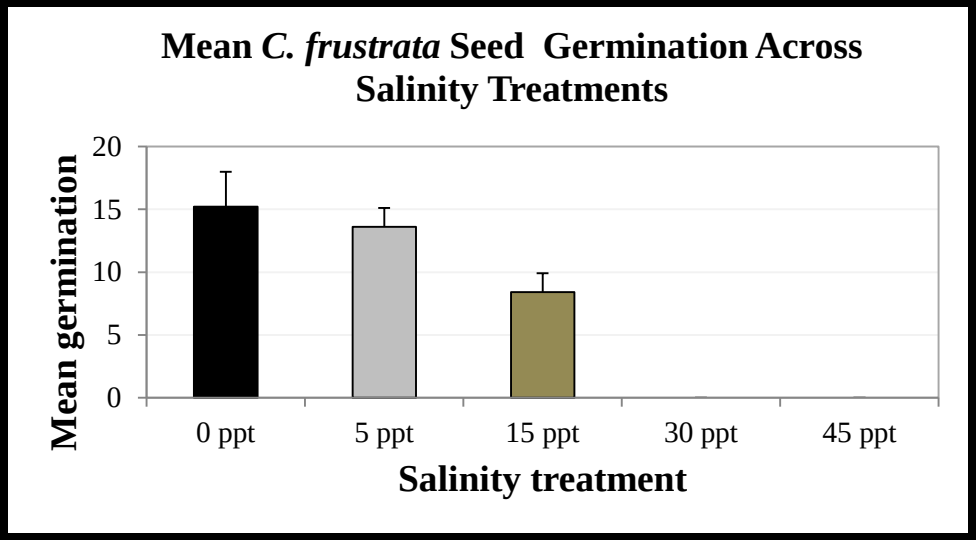


Swietenia mahagoni

H1: Seed germination will ↓ with ↑ salinity.



Seed germination in response to salinity: Results



Chromolaena frustrata

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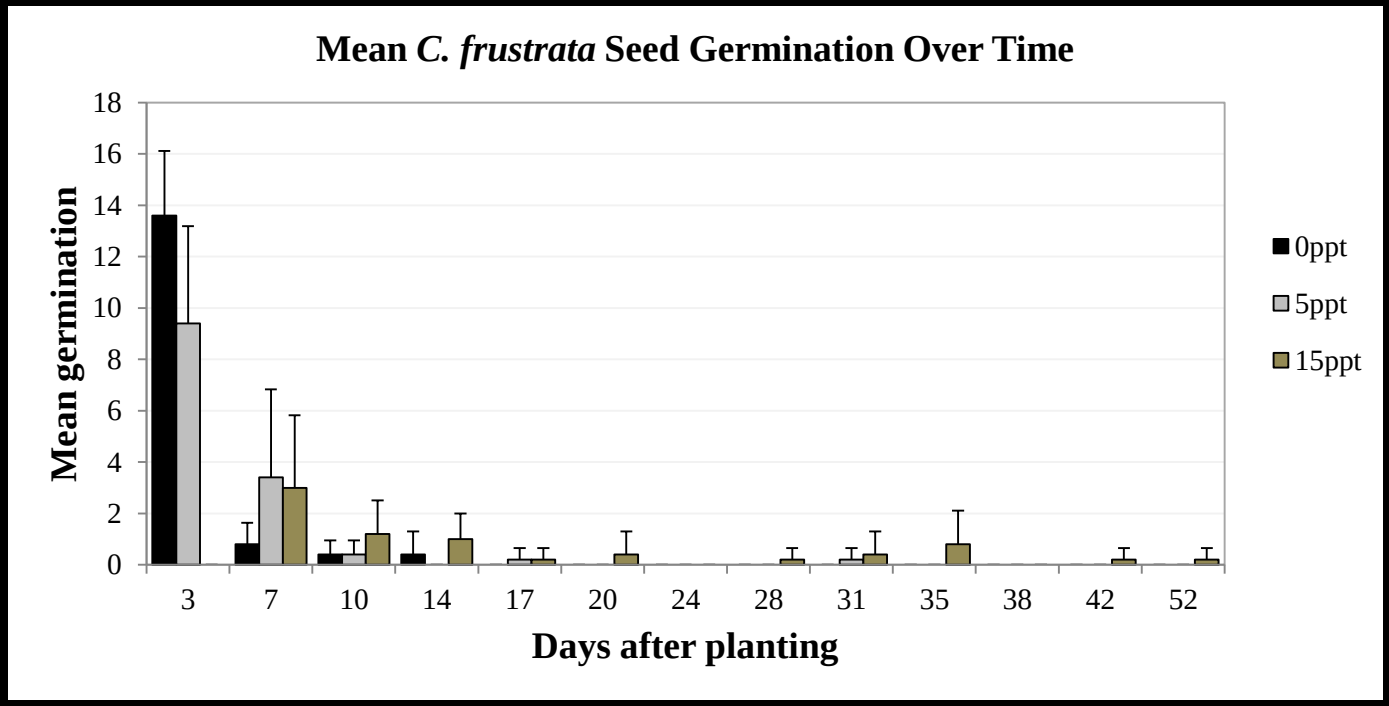


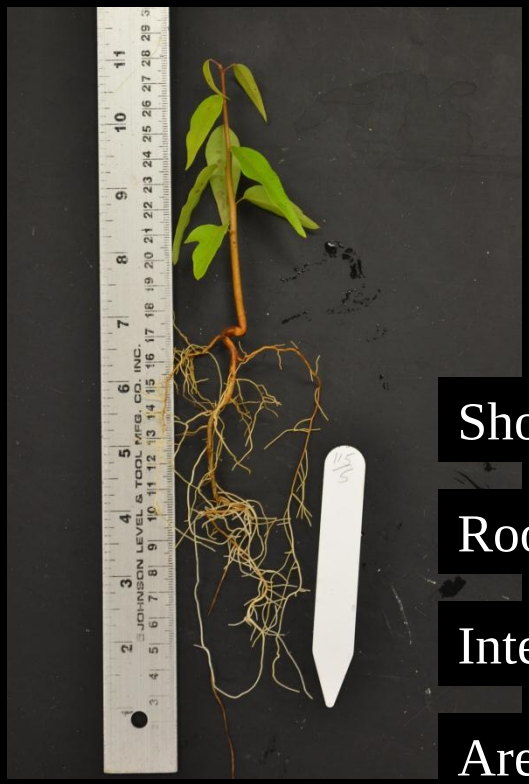
Effects of salinity on seedling establishment: Methods

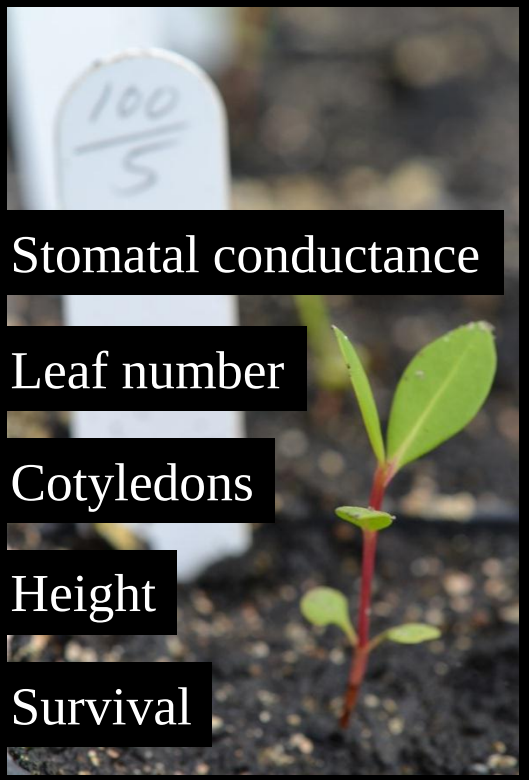
16 seedlings/tray.
4 trays/treatment.
1 week acclimation.
45 ppt, 30 ppt, 15 ppt,
5 ppt, and control (0 ppt).

Monitor once a month

Linear mixed effects model

Cox survival analysis





Stomatal conductance

Leaf number

Cotyledons

Height

Survival

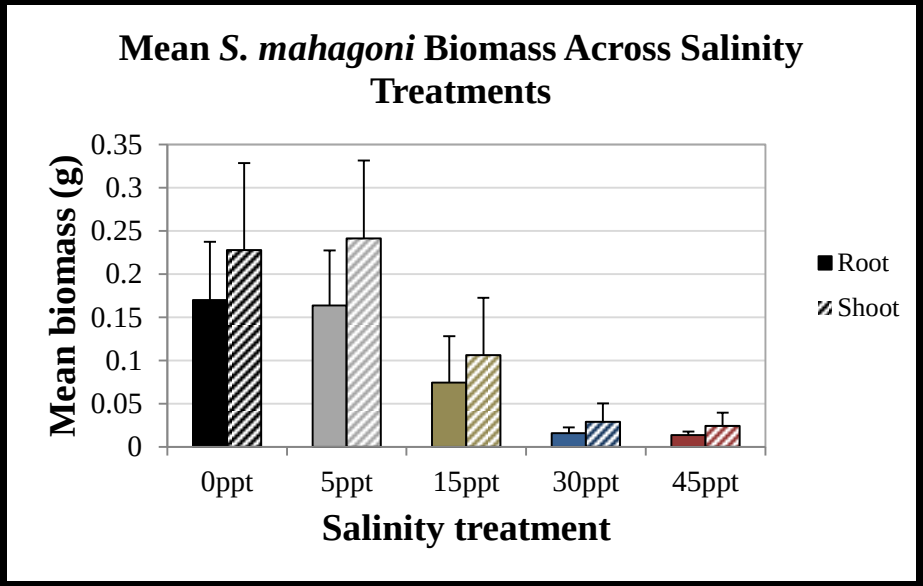
Shoot/root biomass

Root length

Internode length

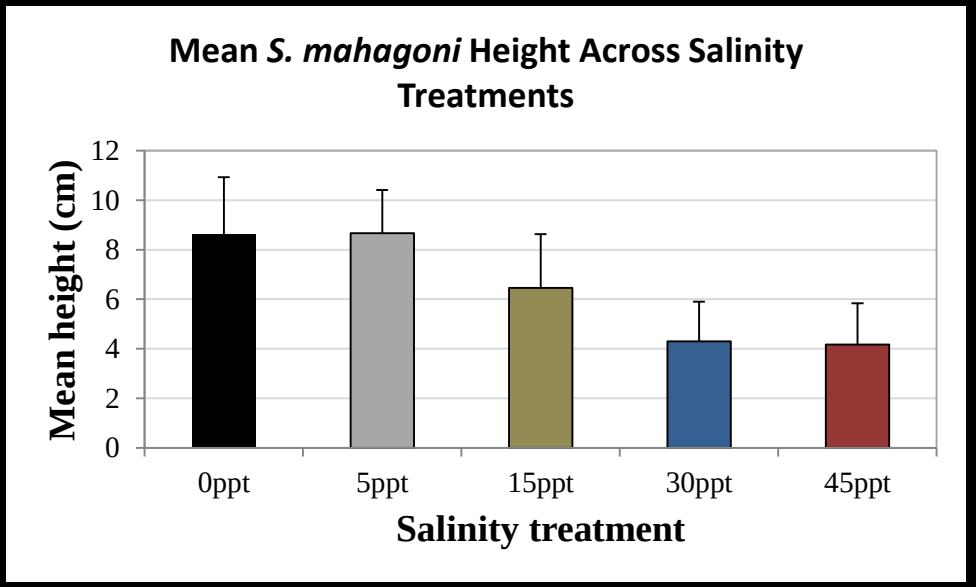
Area of newest mature leaf

Effects of salinity on seedling establishment: Results



Swietenia mahagoni

H2: Seedling establishment will ↓ with ↑ salinity.



Effects of salinity on seedling establishment: Results

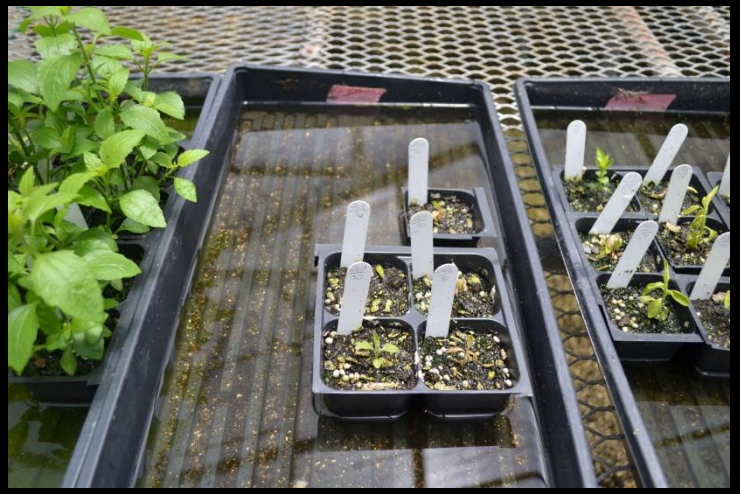
Chromolaena frustrata

0 ppt

5 ppt

34 days after treatment

15 ppt



30 ppt

FCE Contributions

Biogeochemical Cycling

Trophic Dynamics

Organic Matter Dynamics

Primary Production: How does the balance of fresh and marine water supply to the oligohaline ecotone influence the composition, distribution, and productivity of primary producers?

Hydrology

Carbon Cycling

Climate & Disturbance Legacies

Scenarios & Modeling

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Questions?