Spatial patterns and environmental factors contributing to salt marsh stress in the Big Bend region of Florida

Stephanie Verhulst
Carrie Adams Lab
Restoration and Plant Ecology
Recent work in the region

- Plant focused research on ecosystem functions
- Genetic diversity of *Juncus roemerianus*
- Salinity and flooding stress thresholds of salt marsh plants
- Planting guidance for Living Shorelines
- Patterns of stress in *Juncus* marshes
Project motivations

• Observed death of coastal forest trees and reduced regeneration of seedlings
• Substantial marsh loss in the Northeastern US and Louisiana
• Current marsh conditions along Florida’s Gulf coast are understudied
Project Objectives

Examine patterns in Juncus response across environmental factors (soil, water, and herbivory) to determine within- and between-marsh variation.

Assess Juncus conditions across spatial locations within marsh systems.

Quantify Juncus roemerianus morphological and physiological conditions as possible indicators of stress leading to die-off in the Big Bend region.
Salt marsh study systems and project design
Salt marsh parameters

*Juncus* conditions
- Productivity (biomass)
- Stem height and density
- Tissue enzyme (proline) and ion accumulation
- Plant water conductance (stomate density)

Environmental factors
- Soil and groundwater salinity
- Soil nutrient levels (C and N)
- Herbivore presence (snail density)
Objective 1: Quantifying *Juncus* conditions

Evidence of stress present in 8 of the 15 measured response variables

- Physiological responses point to *Juncus* experiencing stress
- Productivity did not show strong indication of *Juncus* stress
Objective 2: Assess *Juncus* conditions across spatial locations.
Objective 3: Examine *Juncus* response to environmental variables to determine within- and between-marsh variation

- Plant stress varied considerably between marsh systems
  - Proximity to Suwannee River showed fewest signs of stress
- Soils varied in texture, organic matter, nutrients, and bulk density
- Groundwater salinity - seasonal trends across creek systems
  - Highest salinities in dry season
  - Lowest salinities in wet season
Project conclusions

• Physiological adaptations buffer *Juncus* from stressful environmental conditions

• Future marsh loss (conversion to open water) to occur at creek margins

• Florida’s Big Bend salt marshes are at various stages of threat to marsh die-off

• Fresh water river discharge and rain events likely reduce salinity stress
Thank you!

Special thanks:
Cher Nicholson      Dr. Carrie Adams
Sarah Tevlin        Dr. Bill Pine
Natalia Medina
Alex Matys