Monitoring Marsh Sediment Deposition at the GTMNERR During Hurricane Ian

Jacob Berna[1]
Jacob.Berna@FloridaDEP.gov
Pamela Marcum[1]
Scott F. Jones[2]
Scott.Jones@unf.edu
Nikki Dix[1,2]
Nikki.Dix@FloridaDEP.gov

[1]Florida Department of Environmental Protection, Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR), Ponte Vedra Beach, FL
[2]University of North Florida, Department of Biology, Jacksonville, FL

INTRODUCTION

- Sediment deposition, the laying down of sediment by wind or water currents, helps marshes build elevation and keep up with sea level rise.
- Measuring sediment deposition in GTMNERR marshes was previously attempted using feldspar clay marker horizons. This method was unsuccessful, however, due to many disruptions in the horizonal sediment layers. In 2022, we tried an alternative method using ceramic tiles set on the marsh surface.
- In September, Hurricane Ian provided an opportunity to test the ceramic tile method and identify how large storm events affect sediment deposition in marshes at the reserve.

METHODS

- Prior to Hurricane Ian, pairs of 4.25" (10.80 cm) tiles spaced 50 cm apart were deployed 2 m, 5 m and 15 m from the marsh edge at two sites (Figures 1 & 2, n = 24 total).
- After three weeks the tiles were collected and scraped into a pre-weighed Ziploc® bag. Bags were then dried and weighed.
- The tile pairs were re-deployed for another three weeks at the same distances and sites to collect non-storm sediment deposition data.
- Sediment accretion rates (g m^{-2} d^{-1}) were determined for each tile by dividing the accumulated weight by the number of deployment days and tile area.

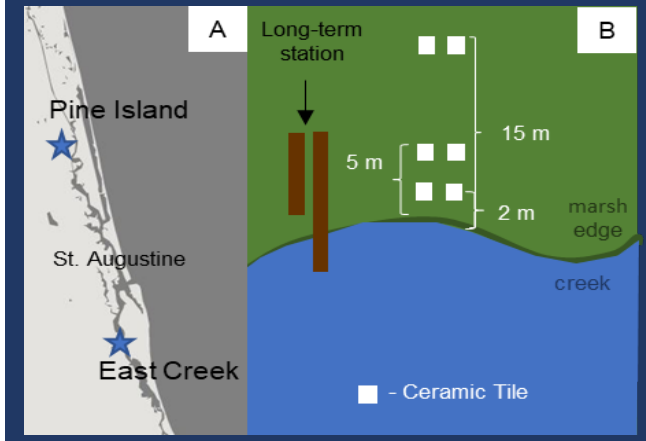

Figure 1. A) Site locations B) Schematic of tile deployment (not to scale).

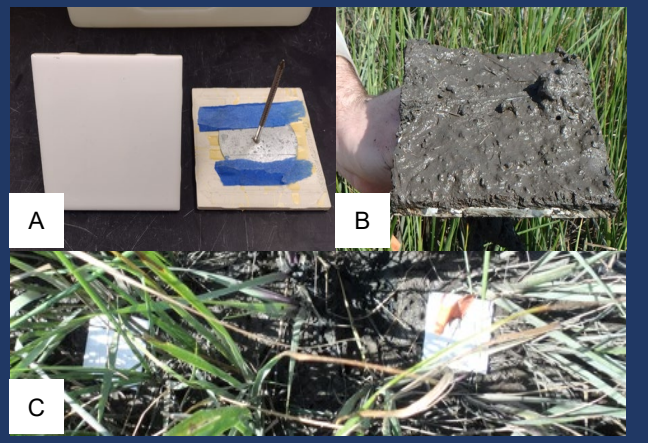

Figure 2. A) Ceramic tile assembly, B) Sediment on a ceramic tile after it was extracted from the ground at East Creek (5 m), C) Tile pair deployed at Pine Island.

Hurricane Ian increased sediment deposition at nearly all plots.

Marsh edges received more sediment than interiors.

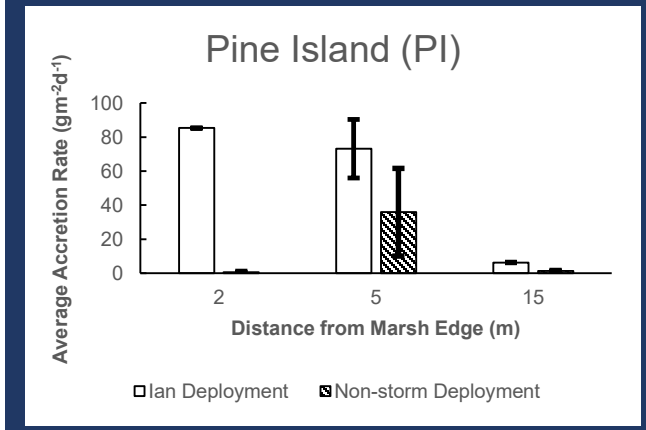

Figure 3. Average accretion rates (± SE) at Pine Island 2 m, 5 m and 15 m from creek edge during Ian and non-storm deployments.

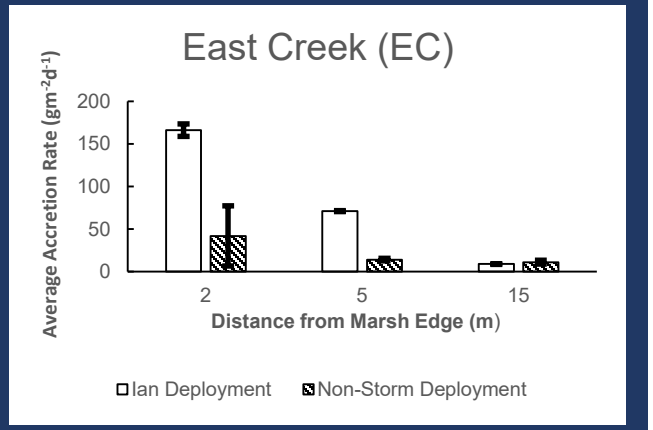

Figure 4. Average accretion rates (± SE) at East Creek 2 m, 5 m and 15 m from creek edge during Ian and non-storm deployments.

RESULTS

- 23 of 24 tiles collected sediment. One tile deployed during Ian at PI was tilted.
- At both sites and at all distances from the creek, except for PI at 5 m and EC at 15 m, there was significantly more sediment accretion during the Ian deployment than during the non-storm deployment (t-test p values < 0.05).
- During the storm deployment, tiles closer to the marsh edge at both sites had greater sediment deposition than interior tiles.
- During the non-storm deployment, tiles closer to the marsh edge at EC had greater sediment deposition than interior tiles.
- 2 – 40 times more sediment accumulated on tiles near the marsh edge at EC compared to PI. EC is closer to the St. Augustine Inlet and may also receive sediment from tributaries on the western side of Matanzas River.

WHAT CAN WE LEARN FROM THIS?

- This pilot project has shown that the tile method can be used to measure short-term sediment deposition at the reserve in the future.
- Storm events may play an important role in sediment deposition in marshes of the GTM. Most tiles deployed during the storm had greater soil deposition, especially close to the creek edges.
- Distance from the marsh edge may impact soil deposition. Tiles closer to the marsh edge during storm and non-storm deployments had greater deposition (excluding PI non-storm deployment).
- Since the project was a pilot trial, the sample sizes were small. More replication will be needed in future projects to have a better understanding of the effects of storms on sediment deposition and coastal wetland resilience to sea level rise.
- Next steps include analyzing sediment samples for organic vs mineral content (implications for soil building) and integrating water levels and surface elevation to understand how inundation varied across the two deployment periods.