SEA LEVEL RISE, SALTWATER INTRUSION AND MANGROVE MIGRATION: INITIATING AN ECOSYSTEM RESTORATION PROJECT

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PROJECT PURPOSE:

 This project will explore the potential to beneficially use dredged material from federal channels for ecosystem restoration and include consideration of findings to advance Natural and Nature-Based Features coastal storm risk management efforts.

CHALLENGES TO ADDRESS:

- Viability of thin-layer placement (TLP) as a method to maintain ecosystem function of mangrove wetlands
- Improved understanding of TLP applications in mangrove wetlands
- Methods/logistics involved with TLP in mangrove wetlands
- Options to beneficially use dredged material as well as other sediment sources





WHAT IS REGIONAL SEDIMENT **MANAGEMENT (RSM)?**



A systems approach using best management practices for more efficient and effective use of sediments in coastal, estuarine, and inland environments.

Question: Is thin-layer placement a viable method to maintain ecosystem function of mangrove wetlands?



This is the Engineer Design & Research Center Website for Thin Layer Placement: https://tlp.el.erdc.dren.mil/ and a slide show is located here: https://tlp.el.erdc.dren.mil/what-is-tlp/







CONNECTION TO BISCAYNE BAY AND SOUTHEASTERN EVERGLADES RESTORATION (BBSEER) PROJECT





BBSEER Project Objectives:

RESTORE ECOLOGICAL AND HYDROLOGICAL CONNECTIVITY

Restore connectivity and habitat gradients in areas compartmentalized by federal and state canal system in Southern Everglades, Model Lands, Biscayne Bay Coastal Wetlands

SEA LEVEL CHANGE RESILIENCY

Increase and restore ecological resilience in coastal habitats in southeastern Miami-Dade County

Can TLP be scaled up and included as a management measure in BBSEER?





THE EVERGLADES MANGROVE MIGRATION ASSESSMENT STUDY (EMMA)



EMMA follows the BBSEER-RSM Project. EMMA is a Resiliency pilot study to enhance the foundational vegetation's ability to adapt to sea level rise (SLR) by building soil/sediment elevation and adding phosphorus.

Key Background to EMMA

- Sawgrass is physiologically stressed by salt every 1 ppt increase in salinity results in a 5% decline in production, reducing C storage as saltwater intrudes.
- Increases in SLR rate and saltwater intrusion has been found to cause marsh peat collapse and hinder the landward migration of mangroves.
- Building mangrove elevations is both biotic (roots) and abiotic (deposition)
- Modeling indicates a transition to open water by 2070 if accretion rates are not enhanced.



Enhanced Habitat resilience has huge ecological impacts. Young Wood Storks (pink bills) foraging in ENP mangroves (July 25, 2021)

U.S.ARMY

MODELING THE IMPACTS OF SLR

SKLAR, FH, C. CARLSON, C, CORONADO-MOLINA AND A.C. MARAN. 2021. COASTAL ECOSYSTEM VULNERABILITY AND SEA LEVEL RISE (SLR) IN SOUTH FLORIDA: A MANGROVE TRANSITION PROJECTION. FRONT. ECOL. EVOL. 9:646083. DOI: 10.3389/FEVO.2021.646083





The Surface Elevation Table (SET) measures ELEVATION CHANGE that incorporates both Surface and Subsurface Processes. Marker Horizons measure VERTICAL ACCRETION

6



60

0 15 30

90 120

THE MODEL ALLOWS MANGROVES TO MIGRATE INTO FRESH MARSH

Habitat Transition with an Accretion Rate of 4.2 mm yr-1 (0.211 m by 2070).

Agriculture Palustrine Marsh Barren Land Estuarine Water Mangrove Swamp Marine Terrestrial



EMMA PURPOSE: TO INCREASE COASTAL

EMMA assumes that wetland loss due to SLR is a net reduction in ecosystem services, such as nutrient and carbon sequestration and that despite the ecological value of an estuary, a transition to an open water habitat is a significant decline in biodiversity, resilience and coastal zone functionality.





Inundation Map Representing USACE SLC Intermediate and High Curves Assuming 50year Planning Horizon to Year 2080, Absolute Elevations of 0.67 ft. and 2.85 ft. NAVD88, Respectively. Coastal Structures with Bypass Elevation (ft. NAVD88) for Reference.



EMMA is built upon the concept of Adaptive Foundational Resilience (AFR): AFR is the ability of the vegetation to <u>adapt</u> to sea level rise by building elevation as a function of water depth, salinity and flow.





A CLOSER LOOK AT POSSIBLE EMMA SITES







DESIRED RESTORATION CONDITION WITH THIN LAYER PLACEMENT



Photo Dr. Mike Ross



Fresh Marsh



Building Resilience

Building Resilience



HOPE FOR THE FUTURE?







THANK YOU