ISLAND RESTORATION TO MEET 'TRIPLE-WIN' ENGINEERING WITH NATURE® OUTCOMES

Paula Whitfield, Jenny Davis, National Oceanic and Atmospheric Administration, paula.whitfield@noaa.gov, jenny.davis@noaa.gov
Danielle Szimanski, US Army Corp of Engineers Baltimore District, Danielle.M.Szimanski@usace.army.mil
Jeffrey King, Joe Gailani, Brook Herman, Amanda Tritinger, Todd Swannack, Catie Dillon, US Army Corp of Engineers, Engineer Research and Development Center, Jeffrey.K.King@usace.army.mil, Joe.Z.Gailani@usace.army.mil, Brook.D.Herman@usace.army.mil, Amanda.S.Tritinger@usace.army.mil, Todd.M.Swannack@usace.army.mil, Sally.C.Dillon@erdc.dren.mil.
Rebecca Golden Maryland Department of Natural Resources, rebecca.golden@maryland.gov.
Matt Whitbeck, US Fish and Wildlife Service, matt_whitbeck@fws.gov

ABSTRACT

The coastal islands and marshes of Chesapeake Bay USA, are disappearing along with the ecosystem services and infrastructure/shoreline protection they provide. Within the last half century, cumulative effects of shoreline erosion, subsidence, inadequate sediment supply and sea level rise, have accelerated the rate of island submergence. For example, the Smith Island complex, of which Swan Island is a part, has been experiencing erosion rates of up to 3 m per year over the past 75 yrs. To counter such losses, the USACE Baltimore District is restoring historic island footprints using dredged sediments. Islands constitute an important natural and nature-based feature (NNBF) that meet the 'triple win outcomes' of USACE's Engineering With Nature® (EWN®) initiative, by providing economic, social and environmental benefits. Here we highlight the restoration and monitoring of Swan Island using 61,000 cubic yards of dredged sediment. The creation/expansion of Swan Island, is expected to produce significant benefits in terms of ecosystem services, increased resilience to future sea level rise, and abatement of erosive losses to an adjacent coastal community. The pre- and post-restoration monitoring and model development by project partners will serve to quantify the benefits and efficacy of the island restoration thereby facilitating island restoration as a viable NNBF option in the future.

METHODOLOGY

To quantify and assess restoration outcomes for Swan Island, the collaborative team conducted pre- and post-restoration monitoring of primary hydrodynamic, topographic and ecological components. In turn, the data is being used to develop an integrated hydrodynamic and ecological model to predict ecosystem responses under "action" (i.e., placement of dredged sediment) and "no action" (i.e., no placement of dredged sediment) scenarios. In September 2018, we conducted pre-restoration monitoring of the vegetation (subtidal, intertidal), ascertained elevation profiles, and determined sediment characteristics on Swan Island. At that time, the team also installed three, acoustic Doppler velocimeters around the island to characterize site hydrodynamics prior to sediment placement. From October 2018 to April 2019, the Baltimore District dredged nearby navigation channels (Figure 1) and placed approximately 61,000 cubic yards of dredged sediments on Swan Island. In June/July 2019 approximately 200,000 high/low marsh and dune plants were installed. Post-restoration monitoring began in August 2019 and will be conducted annually for at least two more years.

THE INTEGRATED HYDRODYNAMIC AND ECOLOGICAL MODEL

To quantify and compare ecosystem service provisions, we developed a simplified conceptual model that included three 'measured' system parameters: wave height, biomass and island profiles (i.e., elevations). Once validated, we will apply the model, under "action" and "no action" scenarios using sea level rise projections to quantify island performance and benefits) over time.

Figure 1. Swan Island post-restoration, looking south toward Town of Ewell on Smith Island, Chesapeake Bay.

ANTICIPATED OUTCOMES

The results will demonstrate how restoring these islands, by leveraging natural and engineered processes, can achieve 'triple win' benefits making these projects common practice in the future.

REFERENCES

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