



Science and Coastal Resilience: *DOI Hurricane Sandy Response Program*

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**Department of Interior's Approach
to Science and Ecosystem Services
Following Hurricane Sandy**



Response to Hurricane Sandy

- To provide the knowledge needed to better anticipate and mitigate future damage from coastal storms and Sea Level Rise
- To establish the baseline of information and understanding essential to detect changes in coastal resilience both over time and as a result of our mitigation and restoration actions and,
- To develop monitoring and modeling strategies needed to track change, anticipate problems before they become chronic, verify and improve our models of environmental change, and develop best practices for sustaining or improving coastal resilience.





Examples of the Types of Science Funded



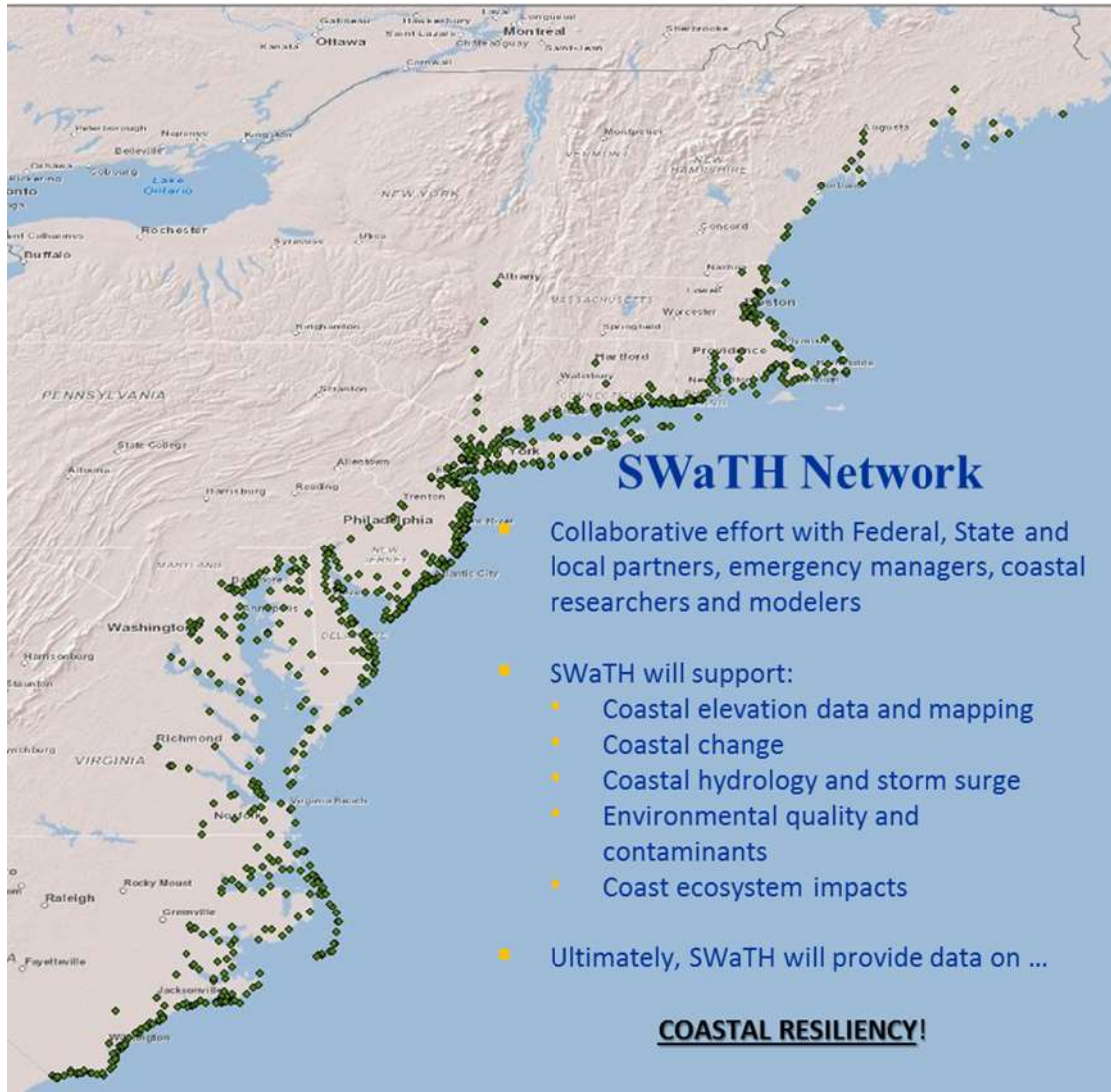
- *Beach, marsh and dune sustainability*
- *Surge and wave trends and vulnerabilities*
- *River connectivity assessment and restoration*
- *Marsh restoration, vulnerability, and migration*
- *Uplands and Watersheds dynamics*
- *Saltwater Intrusion in Maritime Forests*
- *Erosion/deposition in Estuaries*
- *Contaminants fate and transport*
- *Stability of the Built Environment: Grey infrastructure*
- *Stability of Green Infrastructure*

*** For rigorous assessment, different issues require different analysis**





Detecting Trends in Resilience Vulnerability





New LIDAR-Based Predictions of Sea Level Rise Vulnerability

Lentz et al, 2016



Data Visualization

Coastal Response Likelihood

The coastal response to sea-level rise is assessed for the northwestern U.S. using sea-level projections, vertical land movement rates and elevation and land-cover data. The landscape response to sea-level rise is presented on maps showing the likelihood of a dynamic landscape response. A higher dynamic response likelihood suggests the ability for a land cover type to adapt to rising sea-level, whereas a lower dynamic response likelihood (less than 50%) indicates the potential for inundation.

Overview

Legend

Dynamic Response Likelihood*

	Unlikely (0-25%)	About as likely as not (25-50%)	Likely (50-75%)	Very likely (75-100%)
Subaqueous	Light Blue	Medium Blue	Dark Blue	Black
Marsh	Light Green	Medium Green	Dark Green	Black
Beach	Light Yellow	Medium Yellow	Dark Yellow	Black
Rocky	Light Purple	Medium Purple	Dark Purple	Black
Forest	Light Green	Medium Green	Dark Green	Black
Developed	Light Red	Medium Red	Dark Red	Black

Land Class

Inundate Dynamic

Model Predictions

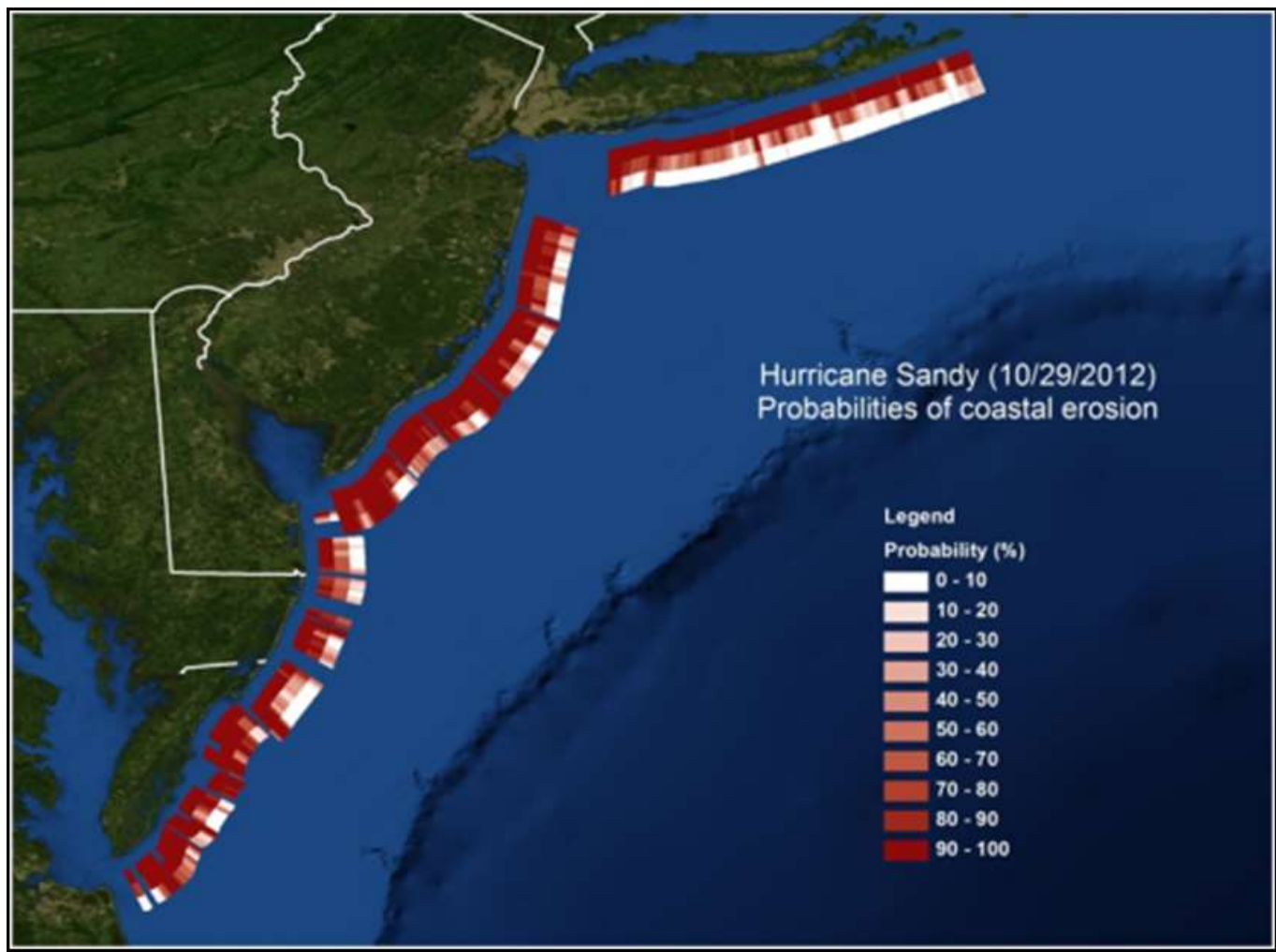
Additional Information

Decade: 2020s 2030s 2040s 2050s

Base layer



Real-time Forecast of Coastal Erosion During Hurricane Sandy

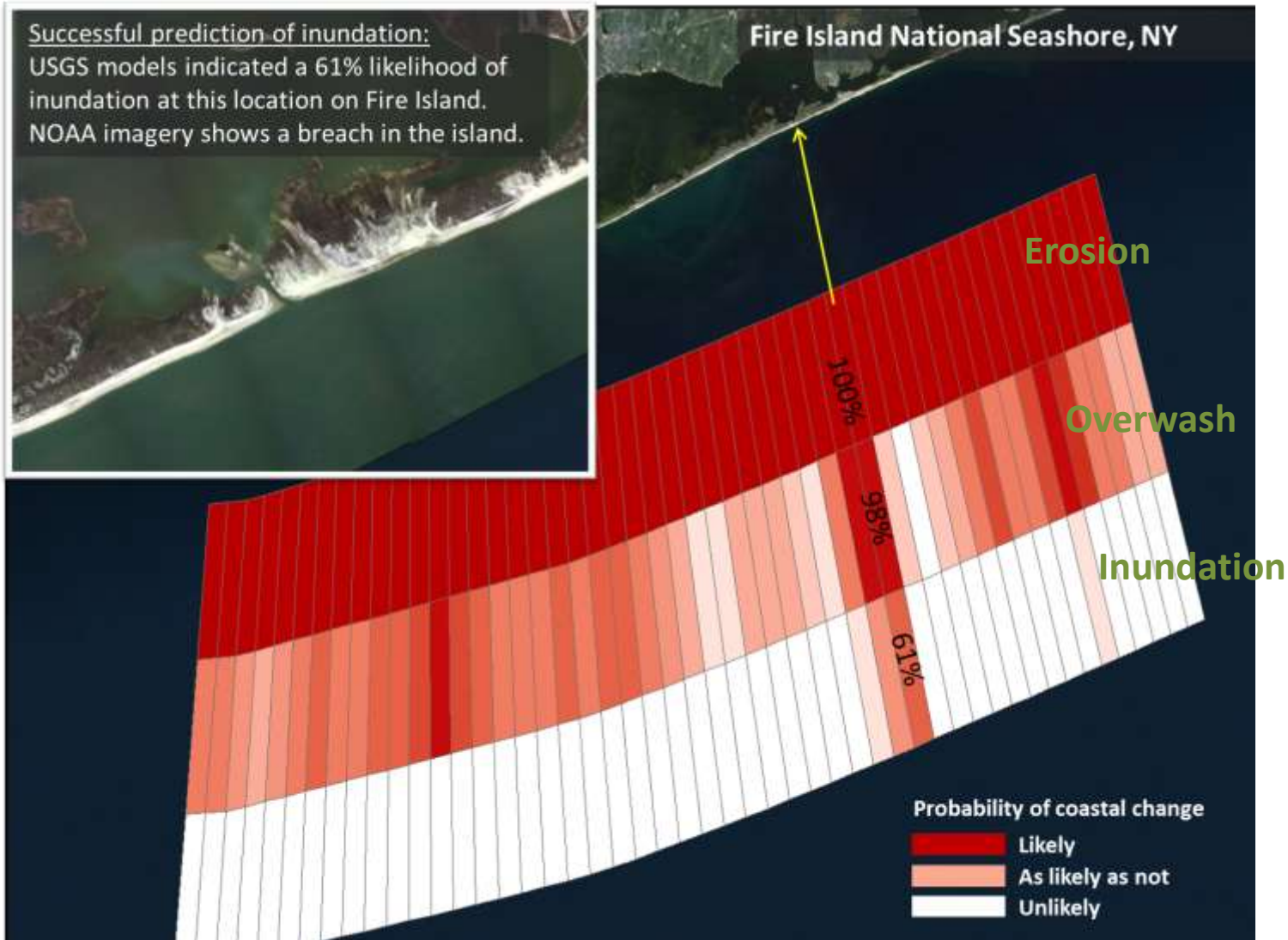




Real-time Forecast of Coastal Erosion During Hurricane Sandy

Successful prediction of inundation:
USGS models indicated a 61% likelihood of
inundation at this location on Fire Island.
NOAA imagery shows a breach in the island.

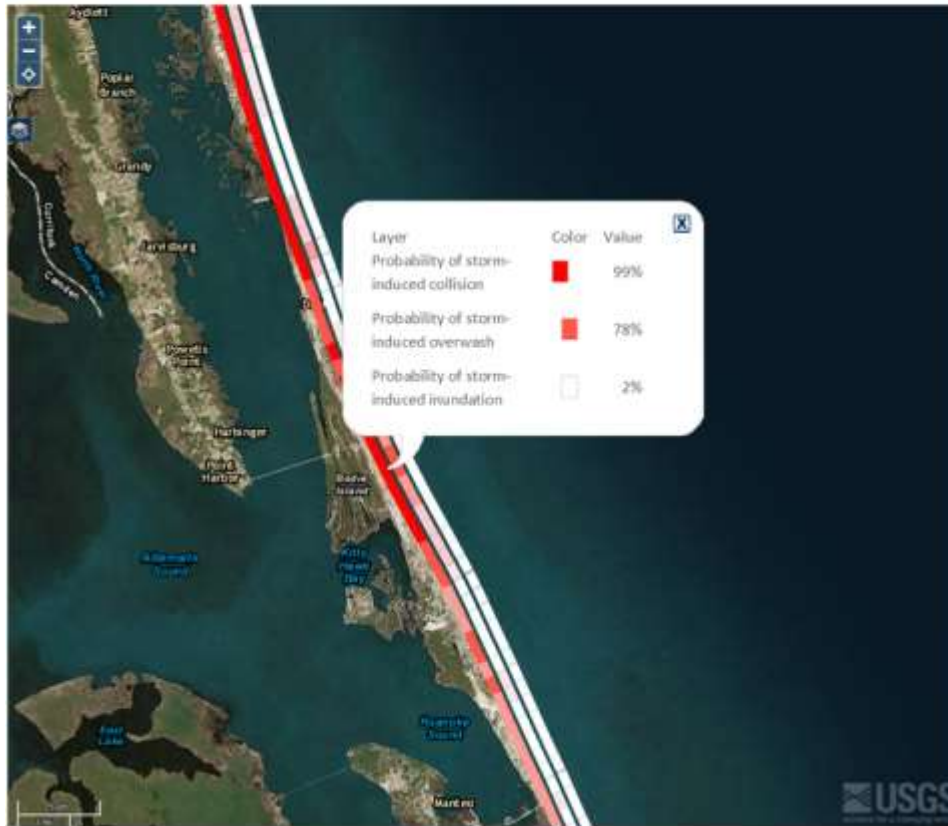
Fire Island National Seashore, NY





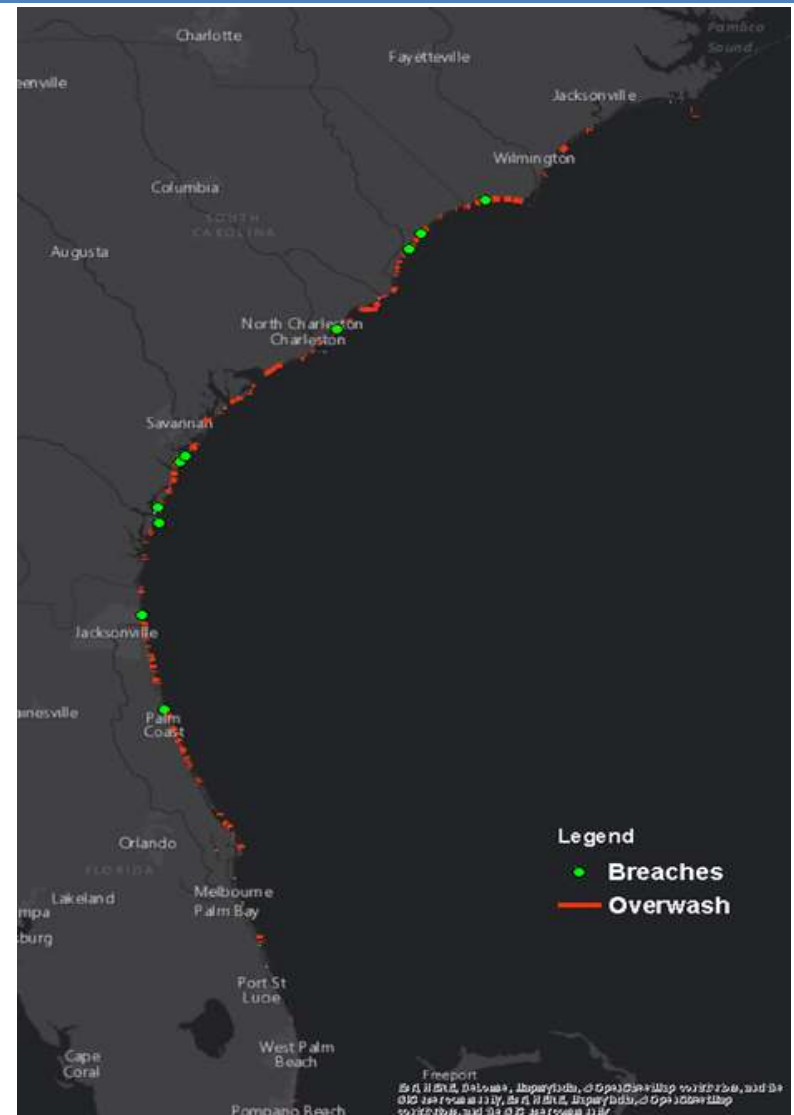
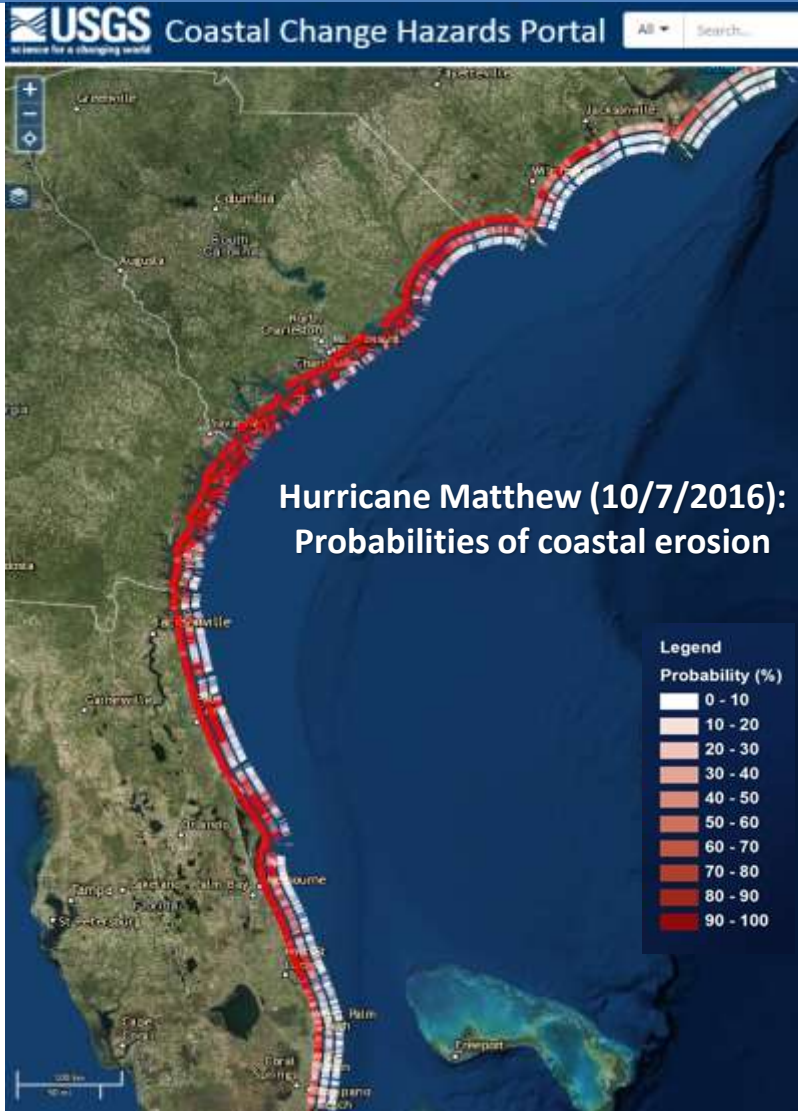
Real-time Forecast of Coastal Erosion During Hurricane Joaquin

USGS Coastal Change Hazards Portal





Real-time Forecast of Coastal Erosion During Hurricane Matthew





Fire Island Wilderness Breach

Understanding Breach Dynamics

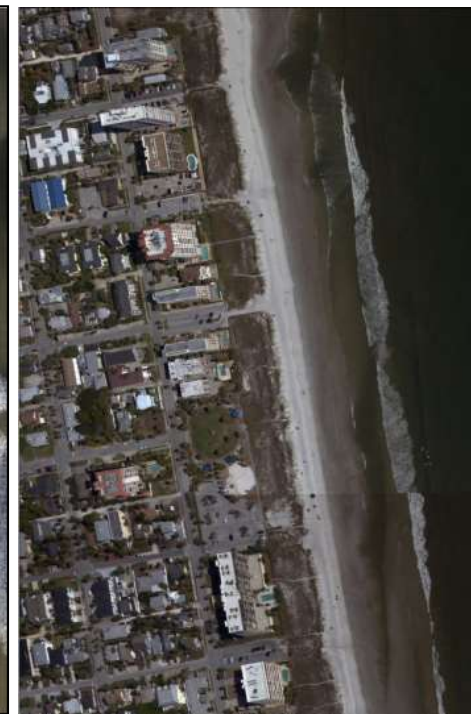
- Breach migration, morphology, modeling (NPS, USGS)
- Bay water levels (Stony Brook University, USGS)





Early Assessment of Coastal Change

- Spatial analysis to identify breaches, extent of overwash, and sand on roads or in marshes
- Visual identifications made by comparing pre- and post-storm NOAA imagery



Pre-Matthew

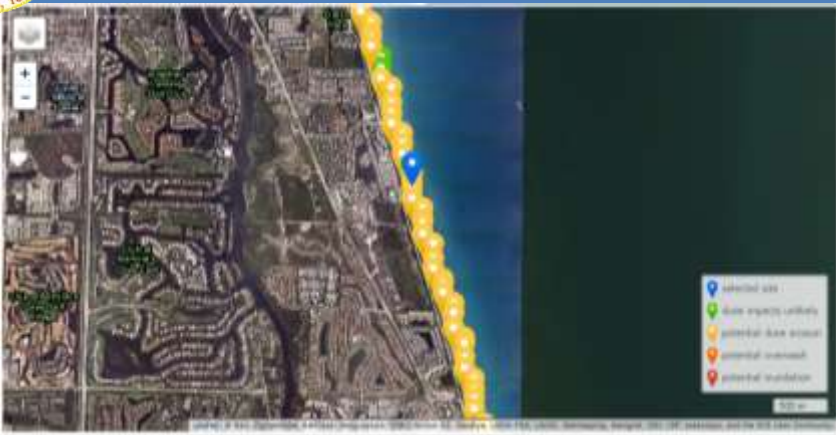
Post-Matthew

Pre-Matthew

Post-Matthew



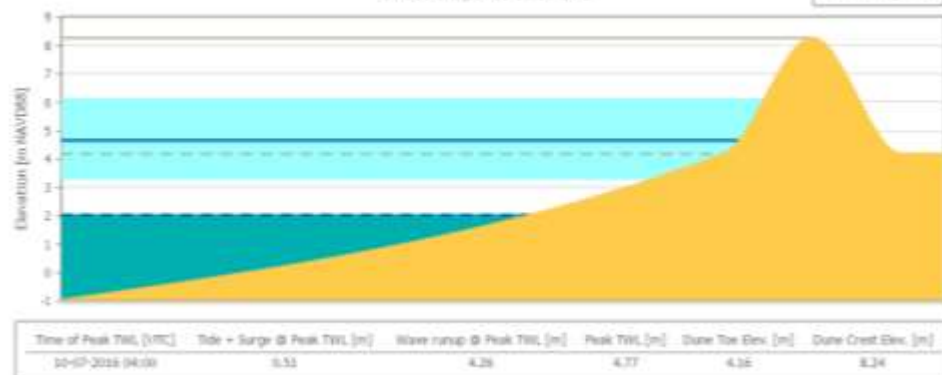
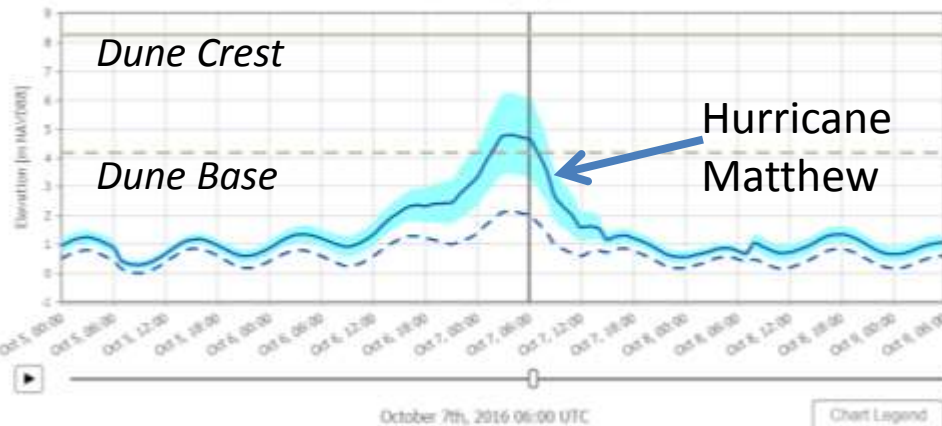
Total Water Level and Coastal Change Forecast Viewer



Carlin Park - Jupiter, FL

USGS/NOAA/NWS Wave Runup Forecasts

- An interagency effort that provides forecasts every 300-500 meters along the coast
- Forecasts include combination of tides, wind surge, and wave runup
- **Predicts the magnitude, timing, and duration of water level impacts**
- **Provides operational predictions that can trigger local coastal change warnings for all storm events**
- It is fully operational at four pilot sites and the methodology is designed to scale nationally



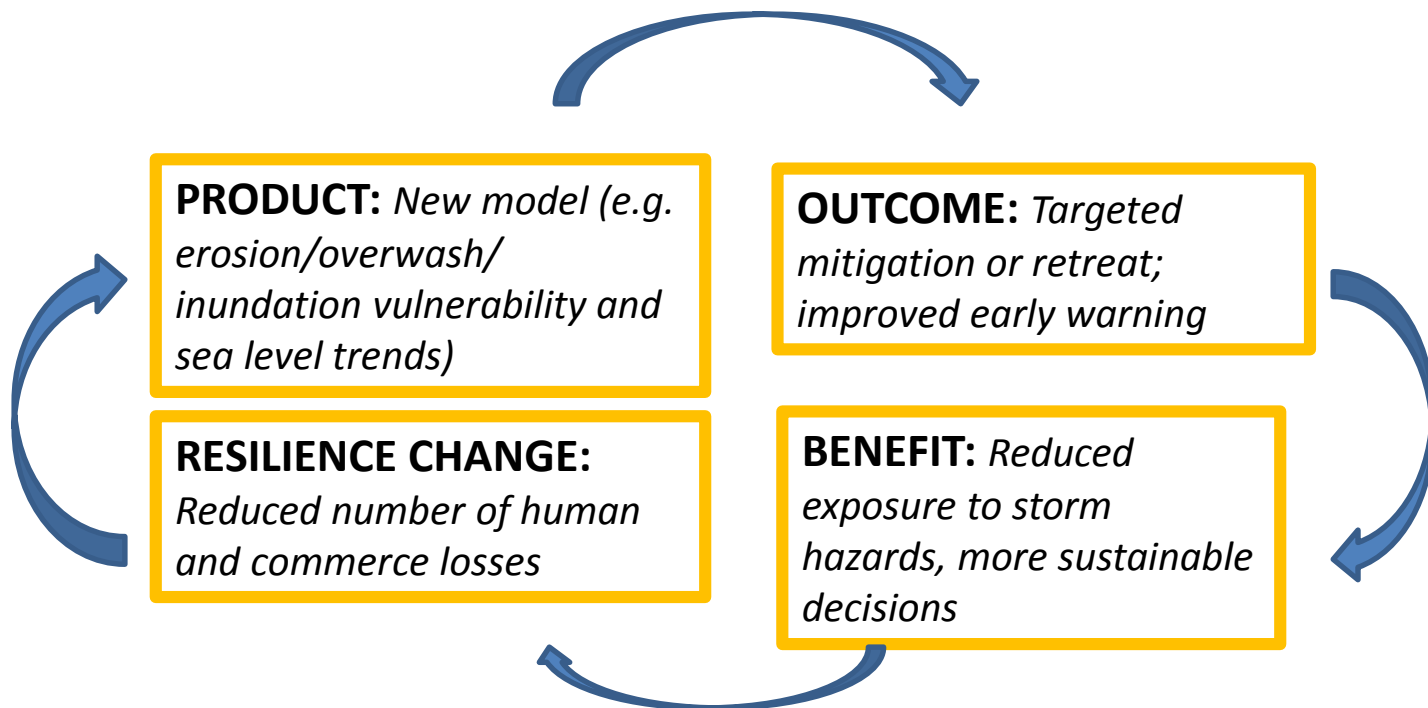
coastal.er.usgs.gov/hurricanes/research/twlvviewer



DOI Science: Putting it All Together

GOAL: Predict and reduce coastal erosion for different scales/trajectories of storms

APPROACH: Start with science product and work toward a resilience solution





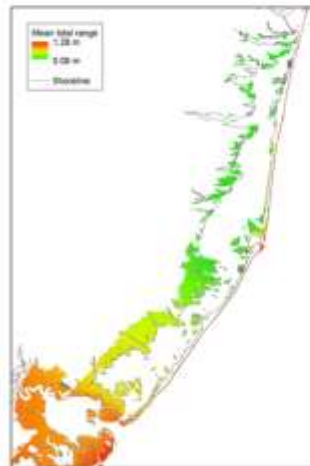
Synthesis: Wetland Classification



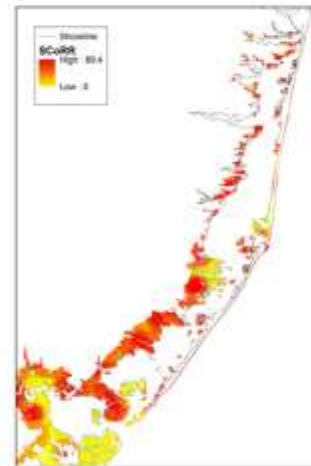
E.B. Forsythe National Wildlife Refuge: Wetland Synthesis

**A First Step to a National Assessment
of Wetland Physical Change**

Tide range (driver)



Contaminant
exposure (driver)



Bird density (service)



Thank You!