



USGS Science in Response to Hurricane Sandy

NOAA Brown Bag Seminar

26 August 2014

John Haines, Michael Focazio, Matthew Andersen

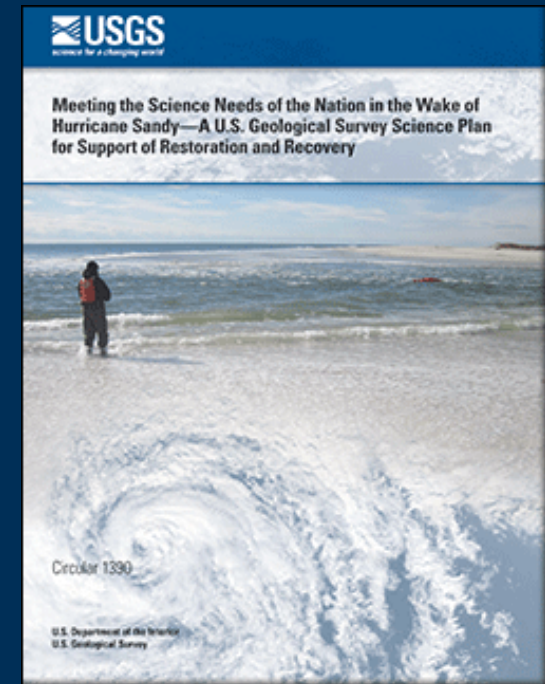
<http://www.usgs.gov/hurricane/sandy/>

(Chrome, mobile, Safari Not Explorer?)

USGS Science Plan for Support of Restoration and Recovery – 5 Themes

\$41.2 Million

- Coastal topographic and bathymetric data to support hurricane impact assessment & response.
- Impacts to coastal beaches and barriers.
- Impacts of storm surge, including disturbed estuarine and bay hydrology.
- Impacts on environmental quality, including exposure to chemical and microbial contaminants.
- Impacts to coastal ecosystems, habitats, and fish & wildlife, particularly for DOI lands and trust resources.



<http://pubs.er.usgs.gov/publication/cir1390>

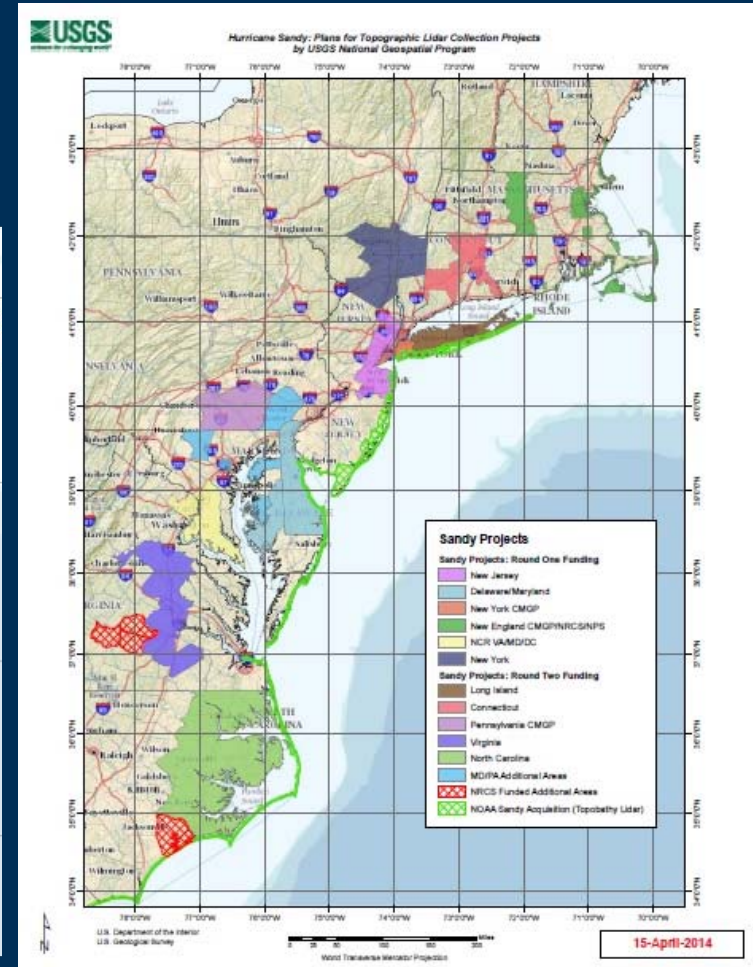
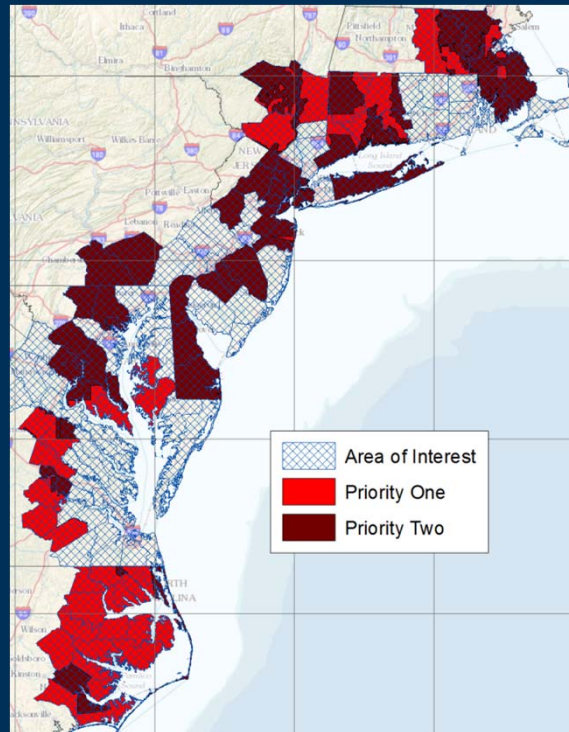


Coastal topographic and bathymetric data to support hurricane impact assessment & response

Teresa Dean

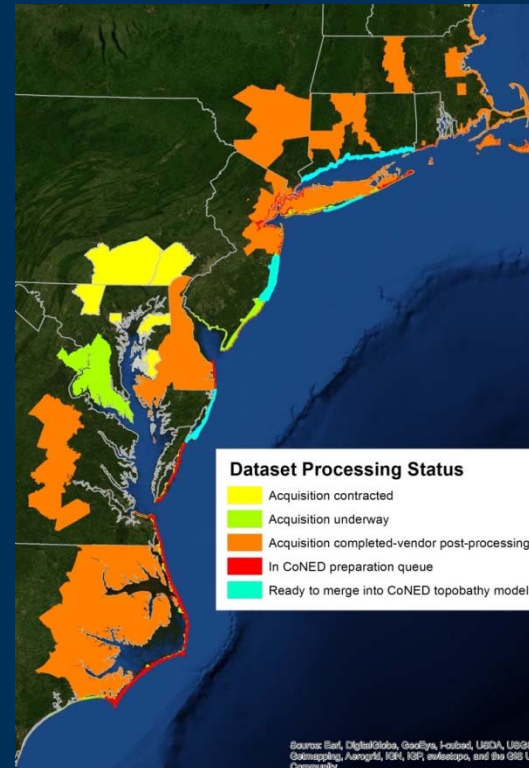
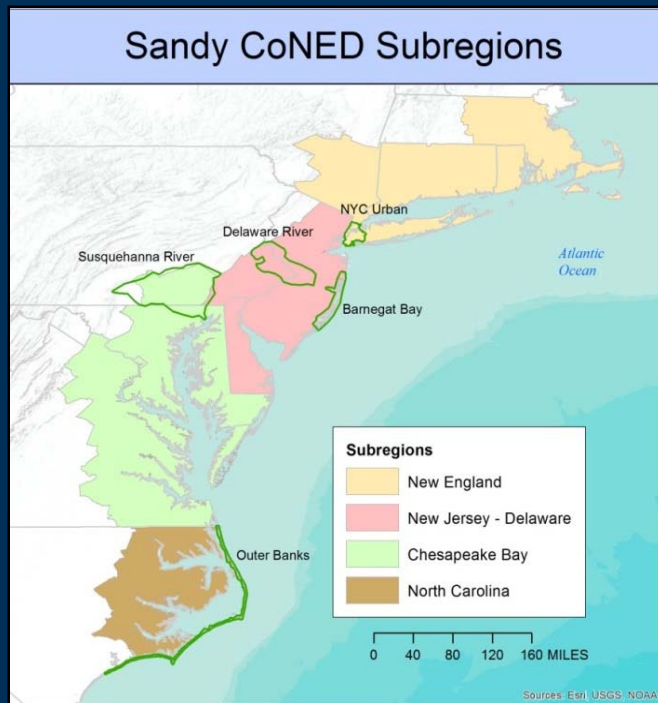
Coastal topographic and bathymetric data

- Acquire topographic lidar within the Hurricane Sandy impact area
- 12 acquisition projects
- More than 32,000 square miles of new lidar data
- \$2.17M in partner funding
- 3DEP – QL 2



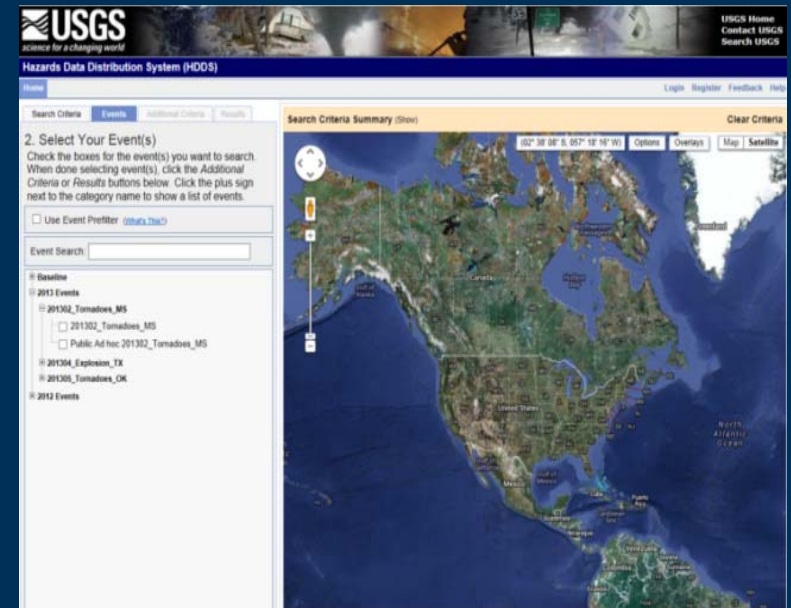
Coastal topographic and bathymetric data

- Establish a Sandy Region Coastal National Elevation Dataset (CoNED)



Coastal topographic and bathymetric data

- Enhance data delivery systems for hazards, topographic and bathymetric elevation data & imagery
- Lidar
 - Increase storage and processing capacity
 - Improve quality assurance
 - Develop Bulk Download Tool
- Imagery
 - Migrate HDDS for imagery to Earth Explorer
 - Develop Collection Management Tool
 - Redesign Emergency Operations Portal





Coastal beaches and barriers

John Haines

U.S. Department of the Interior
U.S. Geological Survey

Coastal Beaches and Barriers

■ POB: National Assessment of Coastal Change Hazards

Goal: identify, quantify, and model the vulnerability of U.S. shoreline to coastal change hazards

Storms

Collision



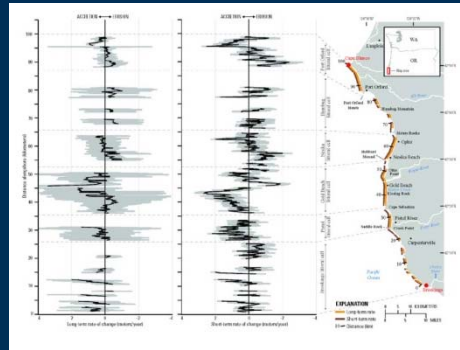
Overwash



Inundation



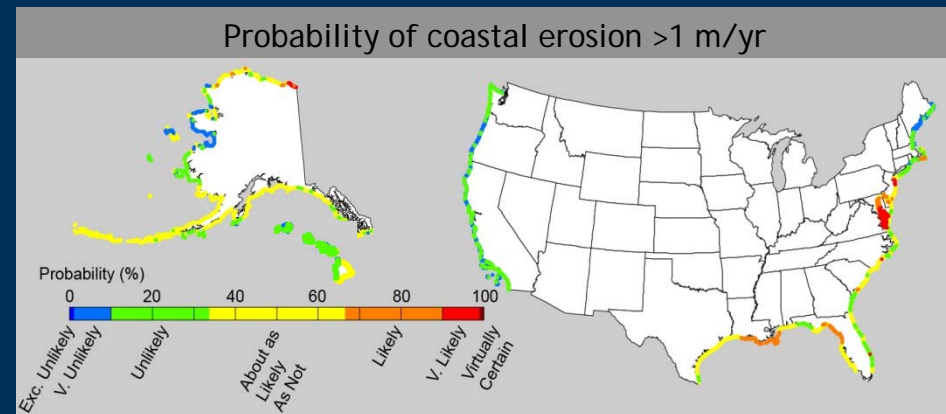
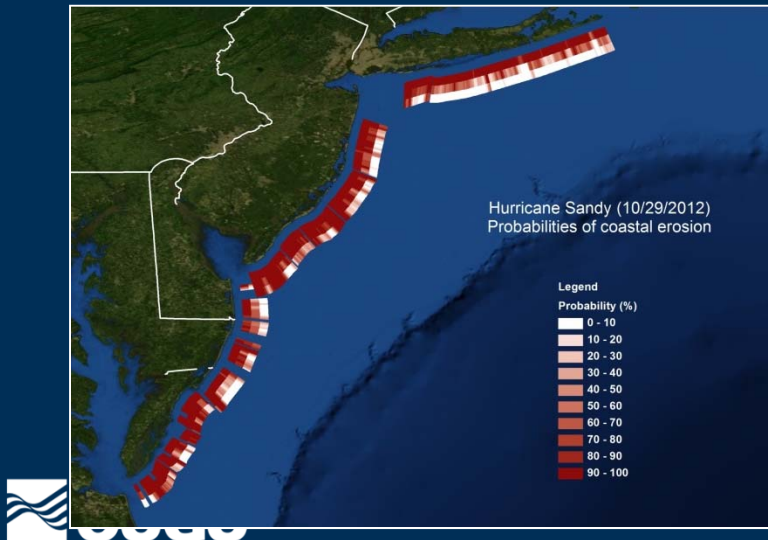
- Scenario-based approach for generalized storms
- Real-time mode for approaching storms



Long-term change



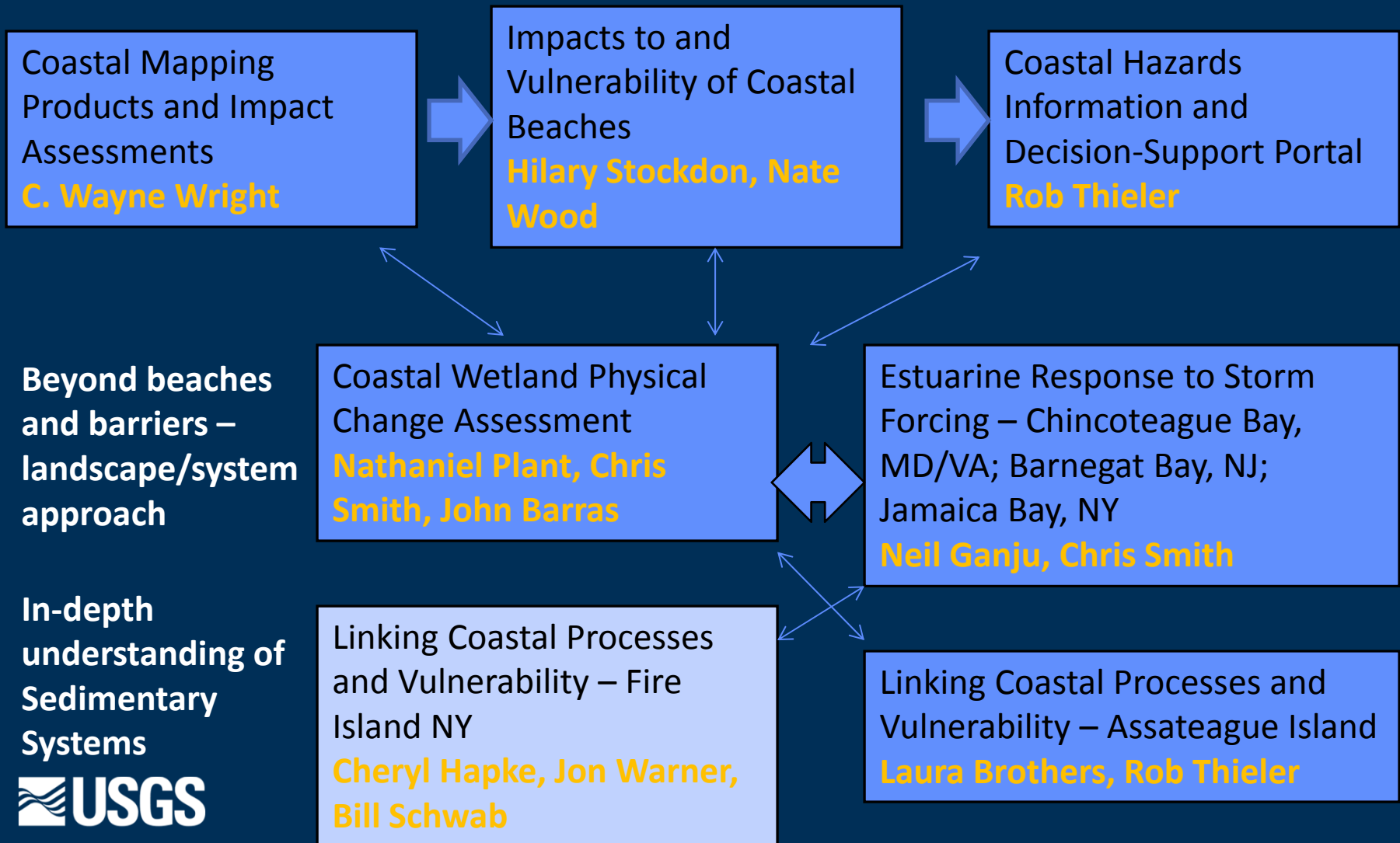
Sea-level rise



(Gutierrez et al., 2011; USGCRP NCADAC report, in press)

Coastal Beaches and Barriers

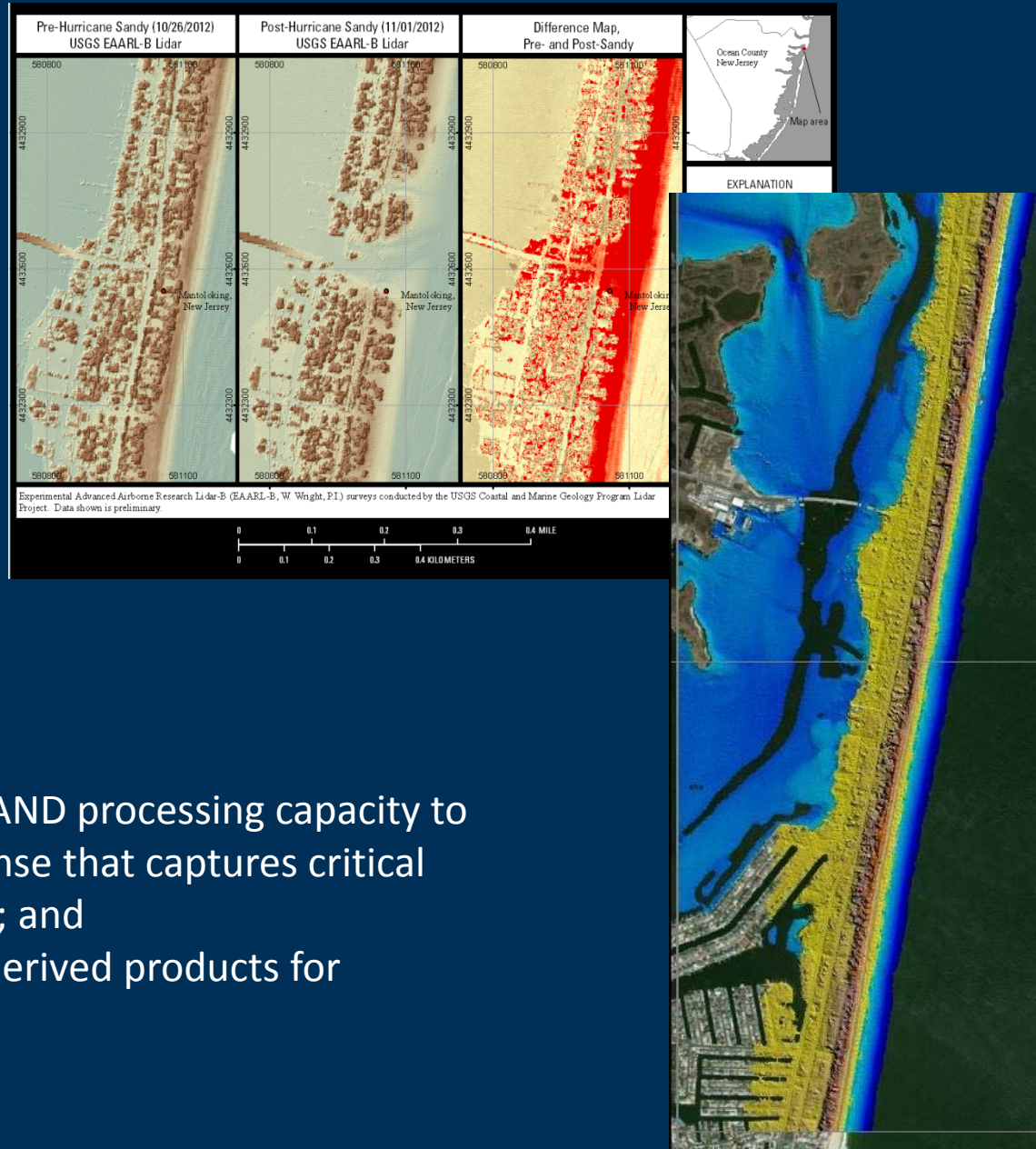
7 Projects – enhancing and expanding data, models, and forecasts



Coastal Beaches and Barriers

Coastal Mapping
Products and Impact
Assessments
C. Wayne Wright

- Mapping of pre- and post-Sandy coastal elevation and elevation change;
- Provision of post-Sandy elevation data for coastal characterization (beach width, dune height, shoreline position) required for forecasting coastal vulnerability;
- Development of Lidar collection AND processing capacity to ensure complete and timely response that captures critical “storm” signals from future events; and
- Ensure timely provision of Lidar derived products for research and applied users.



Coastal Beaches and Barriers

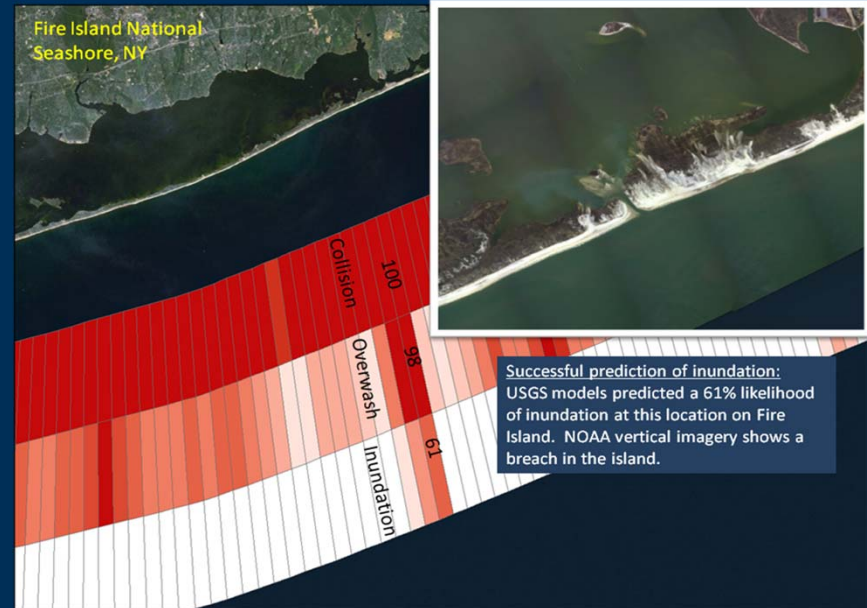
Impacts to and
Vulnerability of Coastal
Beaches

Hilary Stockdon, Nate
Wood



Shoreline vulnerability assessment – forecasting the probability of erosion, overwash and inundation to future storms.

- Complete coastal characterization (dune height, beach width, shoreline location) for the post-Sandy shoreline;
- Assessing extent of Sandy impacts (erosion, overwash, inundation) to validate and improve forecasts;
- ***NEW*** Enhance impact assessments and forecasts to include social vulnerability
- Provision of up-to-date vulnerability forecasts for model, scenario, and impending storms for the post-Sandy and “scenario” coastal configurations;
- Supporting research to improve forecasts in accuracy and description of impacts; and
- Enhancing delivery of data and products for research and application.



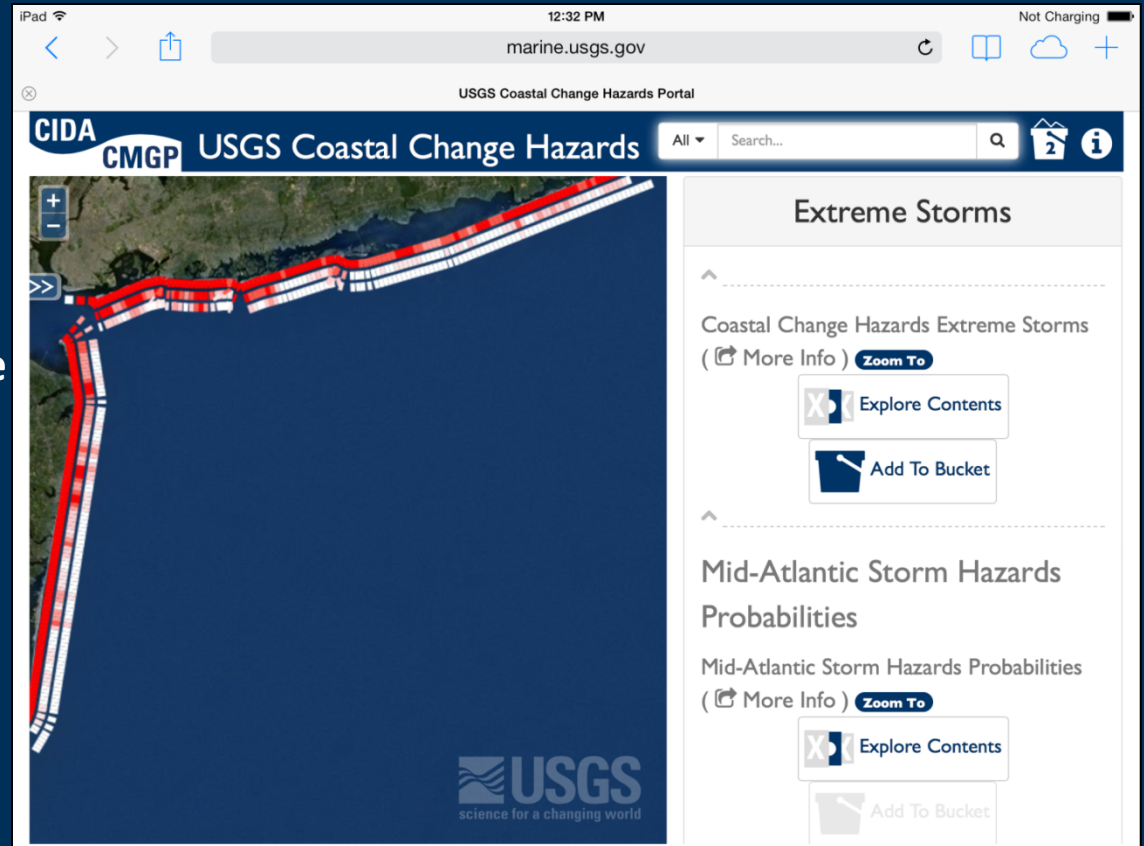
Coastal Beaches and Barriers

Coastal Hazards
Information and
Decision-Support Portal
Rob Thielers



Providing one-stop portal to facilitate access to and application of USGS Coastal Change data and products.

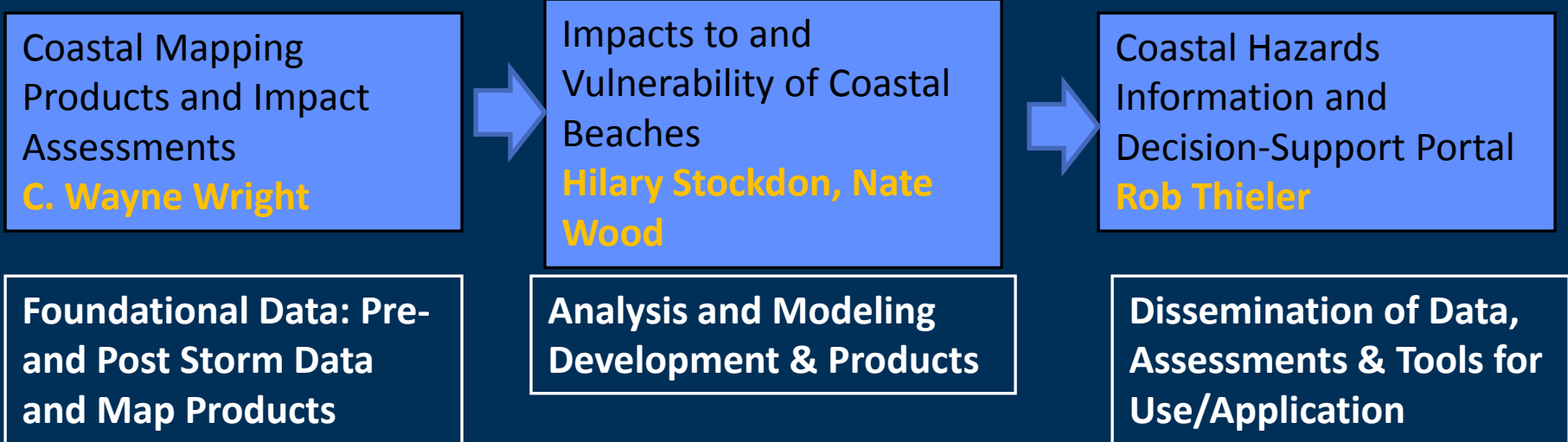
- Products are easily searchable and shareable
- Interactive tools integrate across time, space, and hazards
- Others can build products that support their particular requirements
- Designed to facilitate mobile access



<http://marine.usgs.gov/coastalchangehazardsportal/>

Now serving shoreline change, sea-level and storm vulnerability assessments
Platform for data, research and model output delivery

Coastal Beaches and Barriers



Developing Sandy Products and Capacity/Capabilities for more effective & sustained USGS response to coastal change over event, human, and climate time-scales.

Further Goals: Build on comprehensive beach/barrier approach and capabilities to:

- Extend “physical” data, models and products to include linked offshore, estuarine and wetland, ecological, hydrologic and human components of the coastal system;
- Develop “in-depth” understanding at critical locations to respond to local needs and to enhance understanding of processes to develop models and assessments that reflect the complexity and diversity of coastal systems. Local Understanding ⇔ Regional/National

Coastal Beaches and Barriers

Need national-scale coastal “landscape” change assessments that include both marine and estuarine shorelines - wetlands, wildlife, lands, waters & communities

Sites:

Assateague/Chincoteague

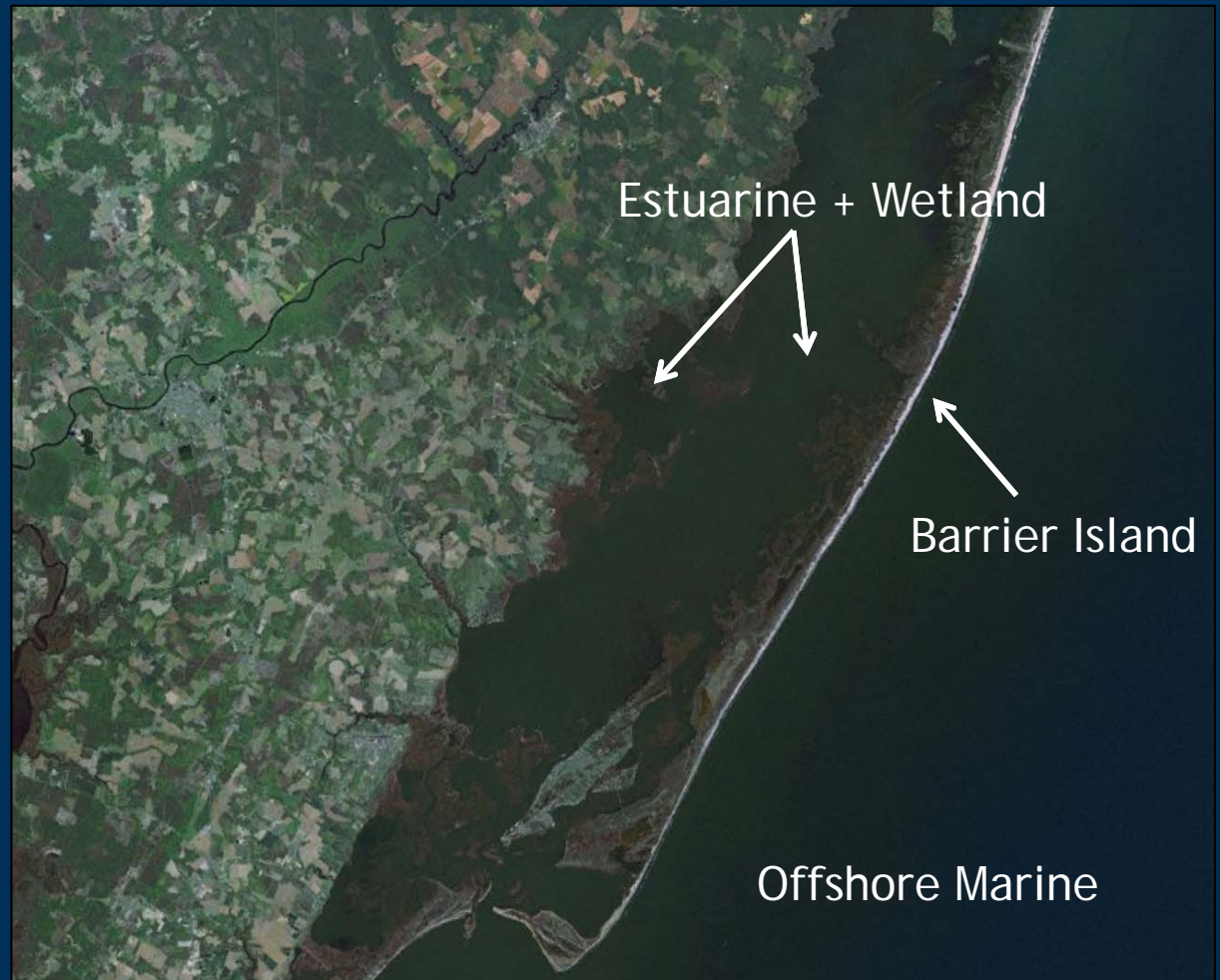
Barnegat Bay

Jamaica Bay

Fire Island/Great South

Bay

Goal: identify, quantify, and model the vulnerability of U.S. shoreline to coastal change hazards



Coastal Beaches and Barriers

Estuarine Response to Storm Forcing – Chincoteague Bay, MD/VA; Barnegat Bay, NJ; Jamaica Bay, NY

Neil Ganju, Chris Smith

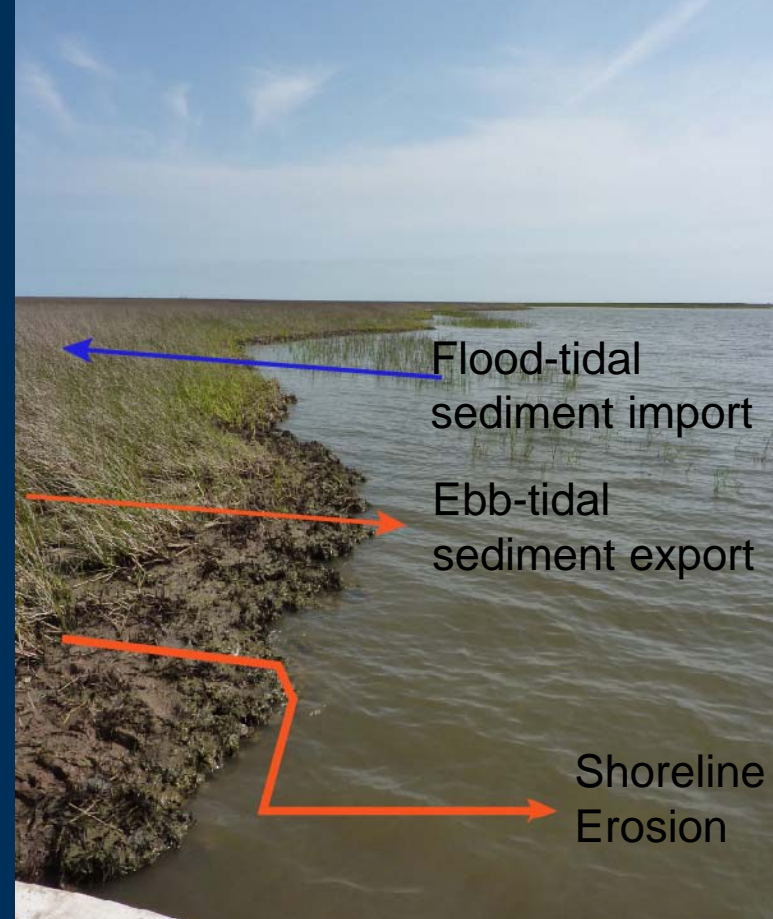


Storms

- Erosion / sediment generation
- Sediment export (ebb-tides and channelization)
- Sediment import (flood and surging tides)



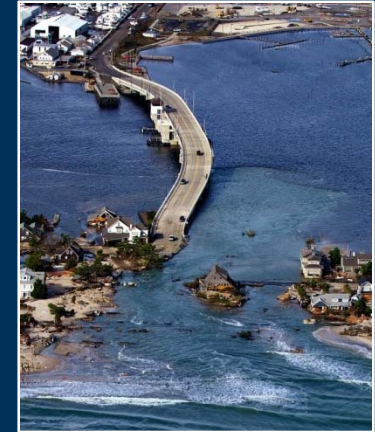
Recycling of coastal sediment



Coastal Beaches and Barriers

Estuarine Response to Storm Forcing – Chincoteague Bay, MD/VA; Barnegat Bay, NJ; Jamaica Bay, NY

Neil Ganju, Chris Smith



Objectives

- Model influence of storms on geomorphology, inundation, circulation, and water quality
- Developing new metrics and tools for estimating vulnerability of estuarine environments (e.g., wetlands, SAVs, estuarine-benthic)



Tasks

- Model development and implementation for fair-weather and storm scenarios
- Ground-truth and refine models with observations



Coastal Beaches and Barriers

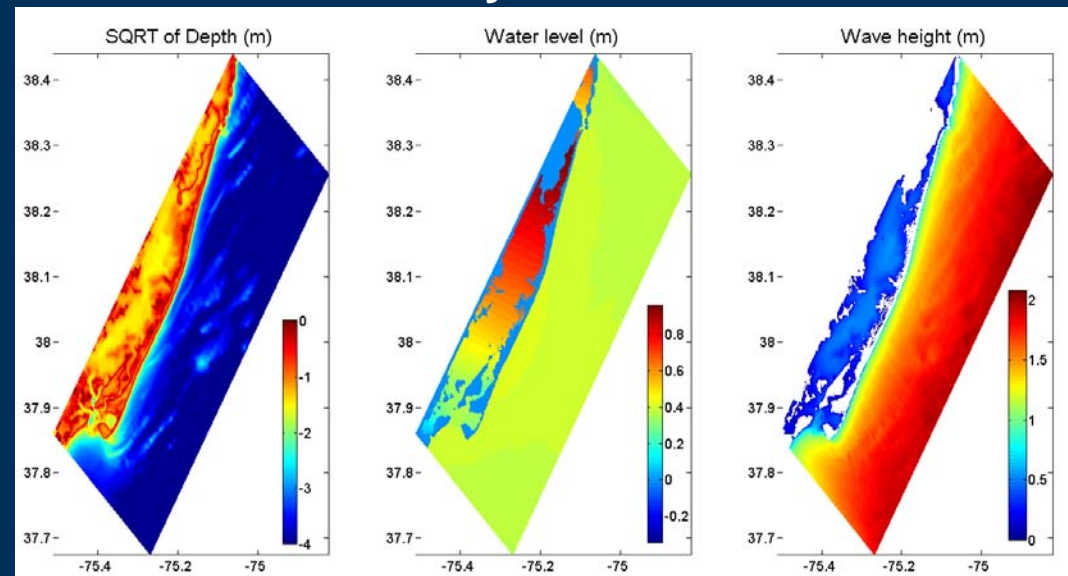
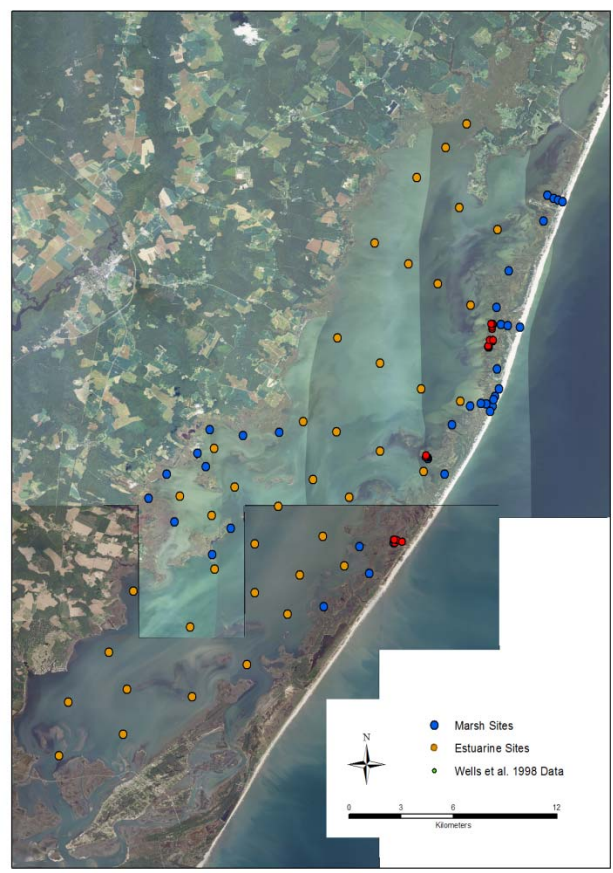
Estuarine Response to Storm Forcing – Chincoteague Bay, MD/VA; Barnegat Bay, NJ; Jamaica Bay, NY

Neil Ganju, Chris Smith



Chincoteague Bay, MD/VA

- Gauging wetland stability: Measuring cross-shore accretion from estuary to marsh
- Sedimentological characterization: frequency of storm depositional events
- Modeling influence of storms: geomorphic change, habitat quality, inundation risk, wetland vulnerability



Coastal Beaches and Barriers

Coastal Wetland Physical Change Assessment

Nathaniel Plant, Chris Smith, John Barras



| Mode of change | Examples | Impact Duration |
|----------------|--|------------------------|
| Burial | Overwash, dune formation (estuarine shoreline, open coast, barrier islands) | Ephemeral to permanent |
| Erosion | Undercutting, bank erosion, slumping (estuarine shoreline, open coast) | Permanent |
| Collapse | Conversion to open water (interior and marsh islands) | Permanent |

Objectives:

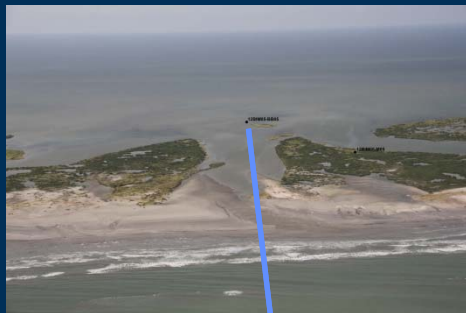
- Quantify the extent and evolution of wetlands and marshes to help assess their current and future resiliency,
- Assess the likelihood of coastal wetland change consistent with existing USGS coastal-change vulnerability assessments, and
- Develop, document, and provide tools to assess changing vulnerability due to future storm events, as well as proposed recovery and restoration projects.



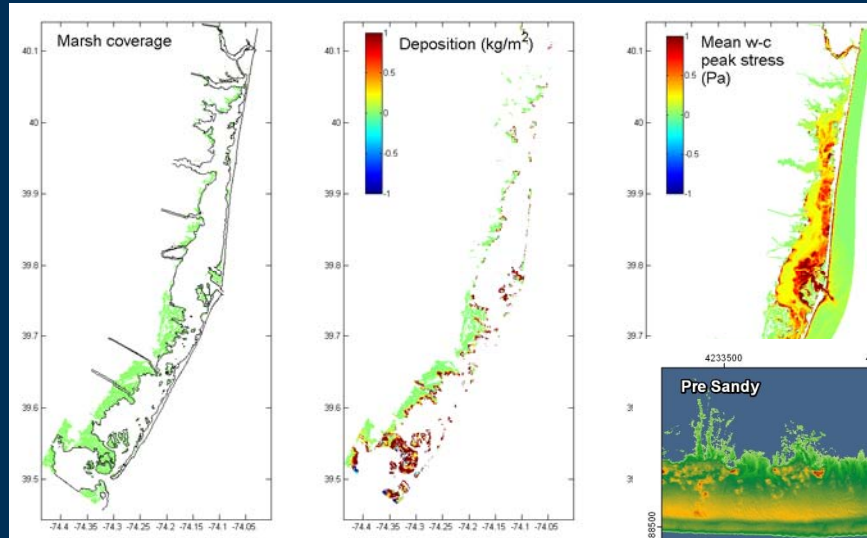
Tasks: Coastal change analysis, Sediment coring and ground truth, Assessment.

Coastal Beaches and Barriers

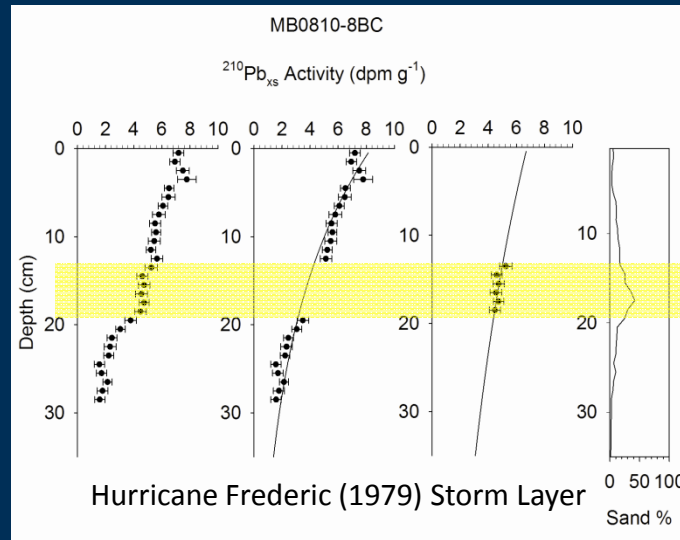
Coastal Wetland Physical Change Assessment
Nathaniel Plant, Chris Smith, John Barras



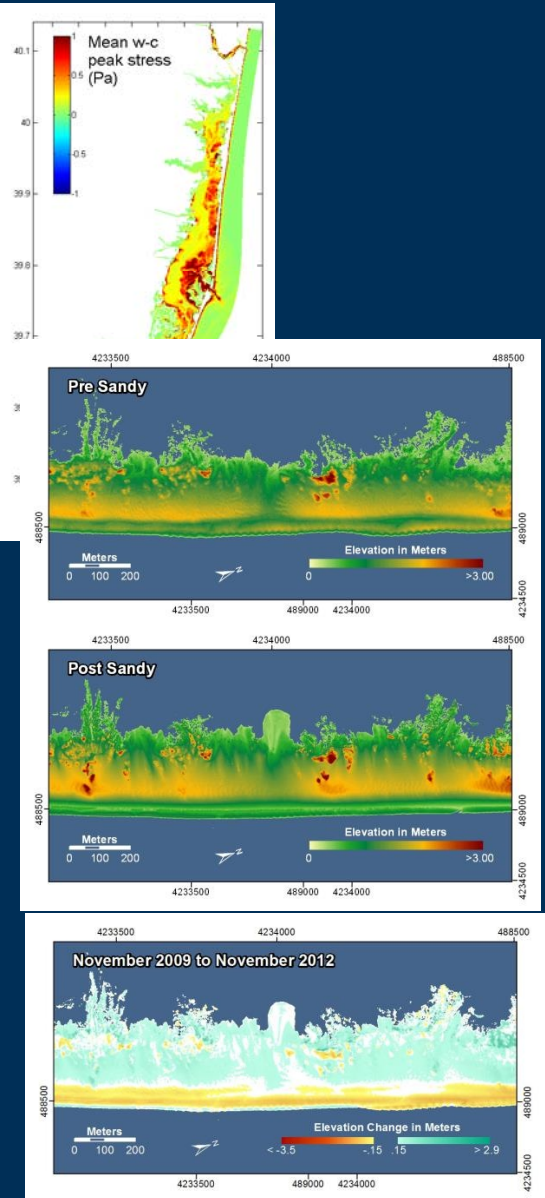
Ground Truthing



Hydrodynamic Modeling & Observations



Geologic Records



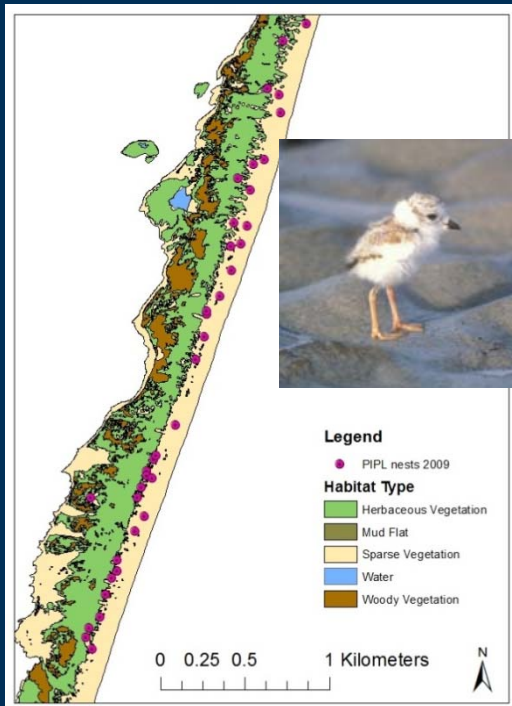
Repeat Remote Sensing

Coastal Beaches and Barriers

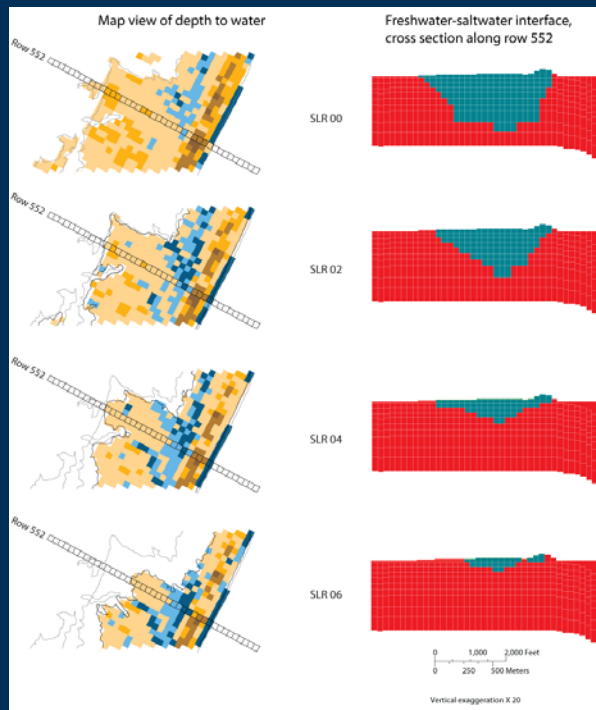
Linking Coastal Processes and Vulnerability – Assateague Island
Laura Brothers, Rob Thieler



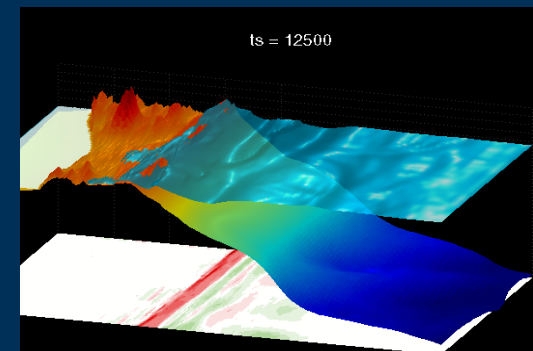
Integrate sea-level and storm history and processes with geology, biology, and hydrology to assess/forecast vulnerability and integrity over event and climate time-scales.



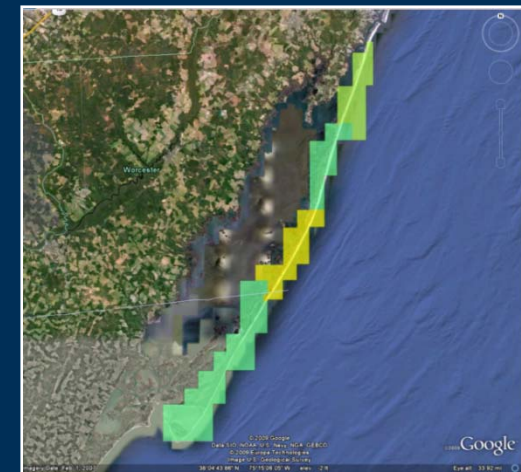
Impacts on habitat



Impacts on groundwater resources



Sea Level + Erosion



Storms

Coastal Beaches and Barriers

Linking Coastal Processes and Vulnerability – Assateague Island
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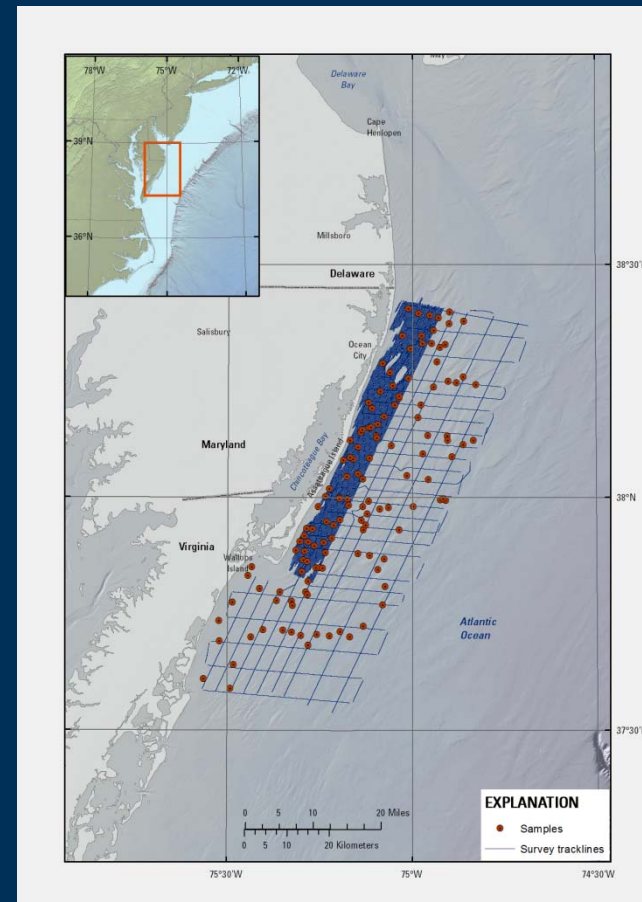
UNKNOWNNS: Regional scale sediment sources, transport pathways and deposition centers that support beaches and barrier islands in the region

Part of the solution: define the geologic framework of the Delmarva coastal system

- Antecedent geology
- Sediment type, distribution
- Deposit geometry and transport pathways

~40 days of ship time in 2014 and 2015

- Quality-controlled geophysical data
- Sidescan sonar mosaics and bathymetric maps
- Integration of sub-bottom data with other data types



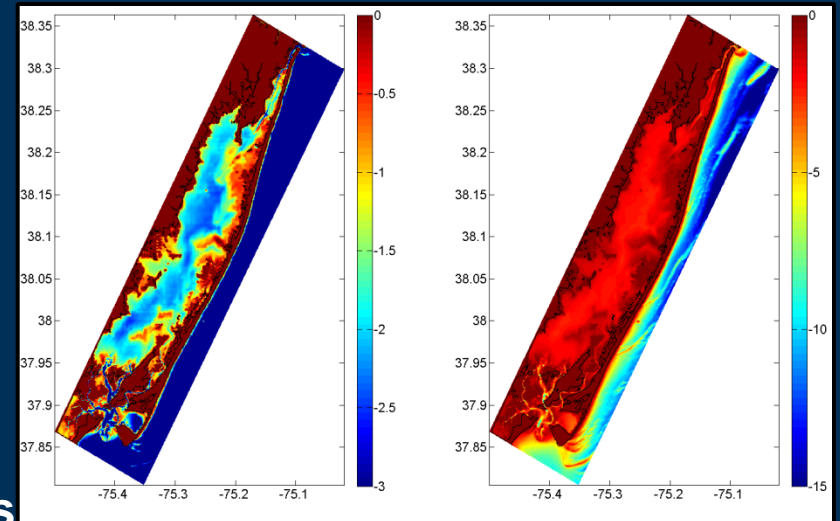
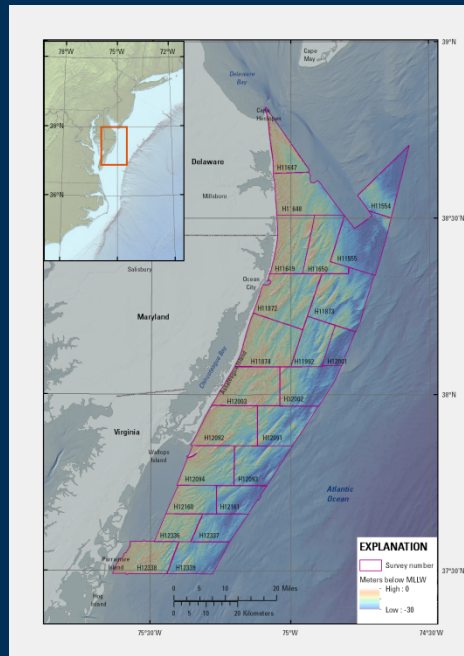
Coastal Beaches and Barriers

Linking Coastal Processes and Vulnerability – Assateague Island
Laura Brothers, Rob Thieler



Science goals: completing the picture;

- Integrate new offshore data with legacy nearshore datasets (Onshore and offshore boreholes, vibracores, Seismic surveys, and Bathymetric data for navigation and projects)



- Improve knowledge of geologic constraints
- Quantify spatial and temporal sediment mobility
- Integrate new offshore data with estuarine and shelf sediment transport, current and wave models, wetland change assessments, and



Future Direction: Integrate all data for a comprehensive coastal hazard assessment.

Coastal Beaches and Barriers Data & Product Generation and Output

Sedimentological data

- Generate spatial maps of sediment characteristics, Publish data in releases/OFRs
- Serve maps and underlying data through Coastal Change Hazards (CCH) portal

Hydrodynamic and time-series data

- Collect and process data under standard oceanographic database protocols, Publish data in releases/OFRs
- Serve time-series data through CCH portal (visualization) and existing USGS time-series database (download)

Numerical model code and output

- Source code freely available as part of USGS COAWST modeling system
 - Serve output through CCH portal (visualization) and existing USGS THREDDS servers (download)
 - Serve static maps of inundation, wetland vulnerability, geomorphic change and inner shelf surficial and subbottom geology.
- Connecting users with output
- Scientists: THREDDS and USGS database
 - Managers: CIDA portal, project website, meetings



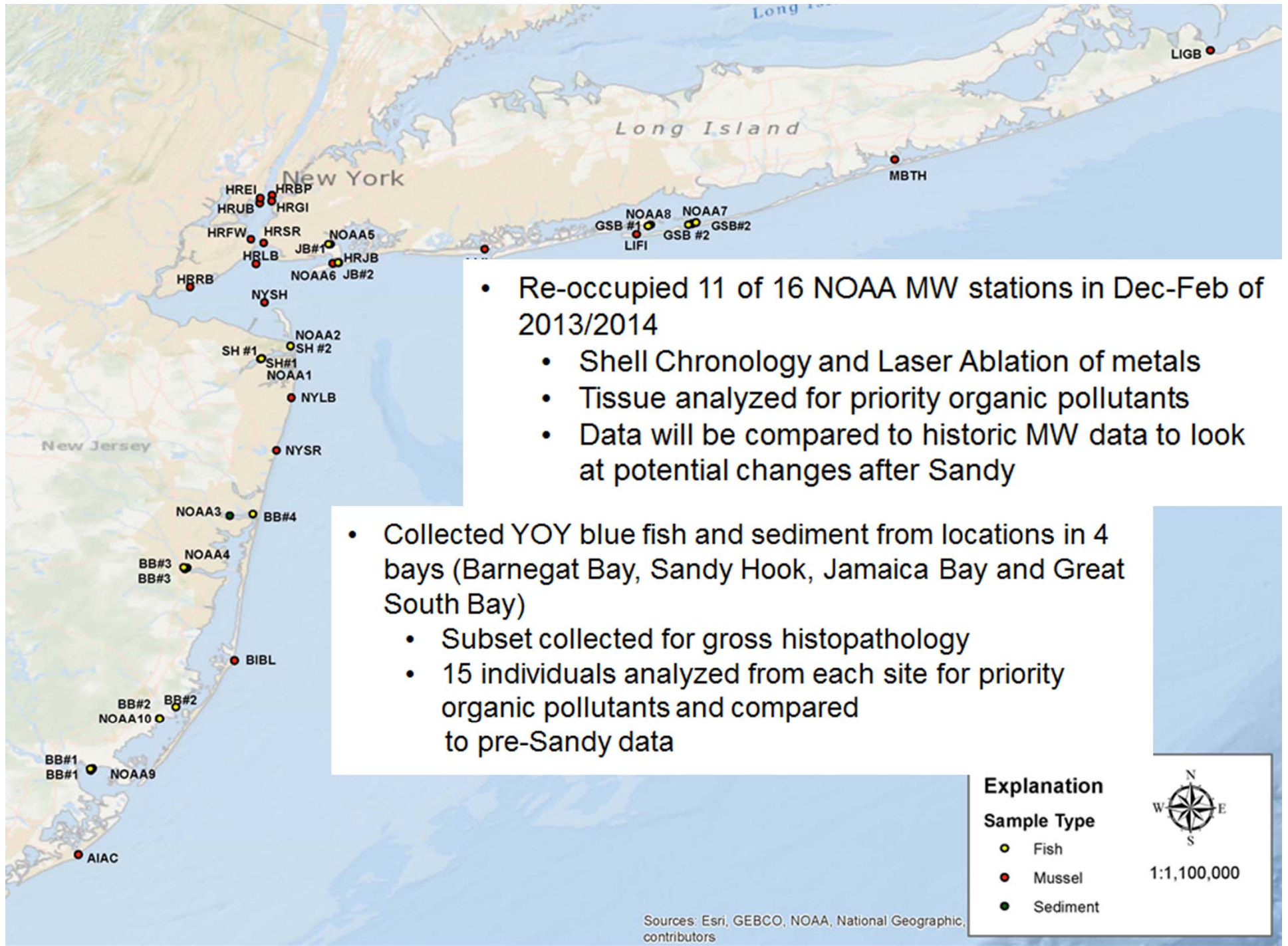


Environmental Quality and Persistent Contaminant Exposures

Michael Focazio

Contaminant Exposures

- Investigating the impacts released pollutants may have had on animals, specifically **mussels**, **bluefish**, and **sea turtles**.
- Mussels were collected at NOAA **Mussel Watch** sites after Sandy and are being analyzed for a range of contaminants.
- Young-of-year bluefish were collected after Sandy and are being analyzed for contaminants and histopathology.



- Re-occupied 11 of 16 NOAA MW stations in Dec-Feb of 2013/2014
 - Shell Chronology and Laser Ablation of metals
 - Tissue analyzed for priority organic pollutants
 - Data will be compared to historic MW data to look at potential changes after Sandy

- Collected YOY blue fish and sediment from locations in 4 bays (Barnegat Bay, Sandy Hook, Jamaica Bay and Great South Bay)
 - Subset collected for gross histopathology
 - 15 individuals analyzed from each site for priority organic pollutants and compared to pre-Sandy data

Explanation

Sample Type

- Fish
- Mussel
- Sediment



1:1,100,000

Contaminant Vulnerability Network

- Developing a **Sediment Contaminant Resiliency and Response (SCoRR)** network.
- Will provide baseline and post-event sediment chemistry.
- Will be co-located with the USGS **SWaTH** network where possible and appropriate
- Priority sites: sensitive ecosystems (wetlands, estuaries, marshes), parks/beaches, and trust resources in proximity to potential contaminant sources identified via geospatial analysis.

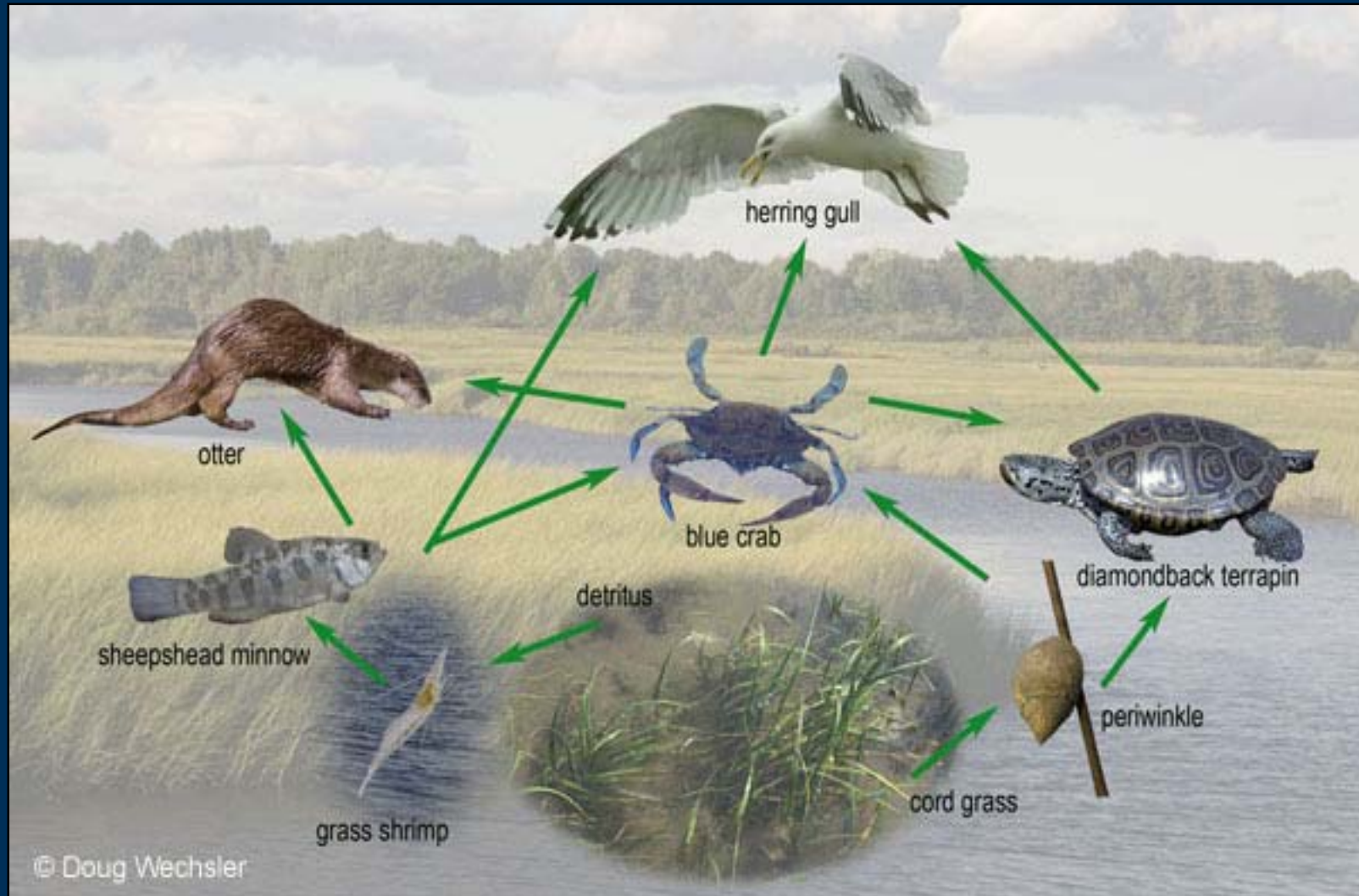


Coastal Ecosystems, Habitats, and Fish and Wildlife

Matthew Andersen

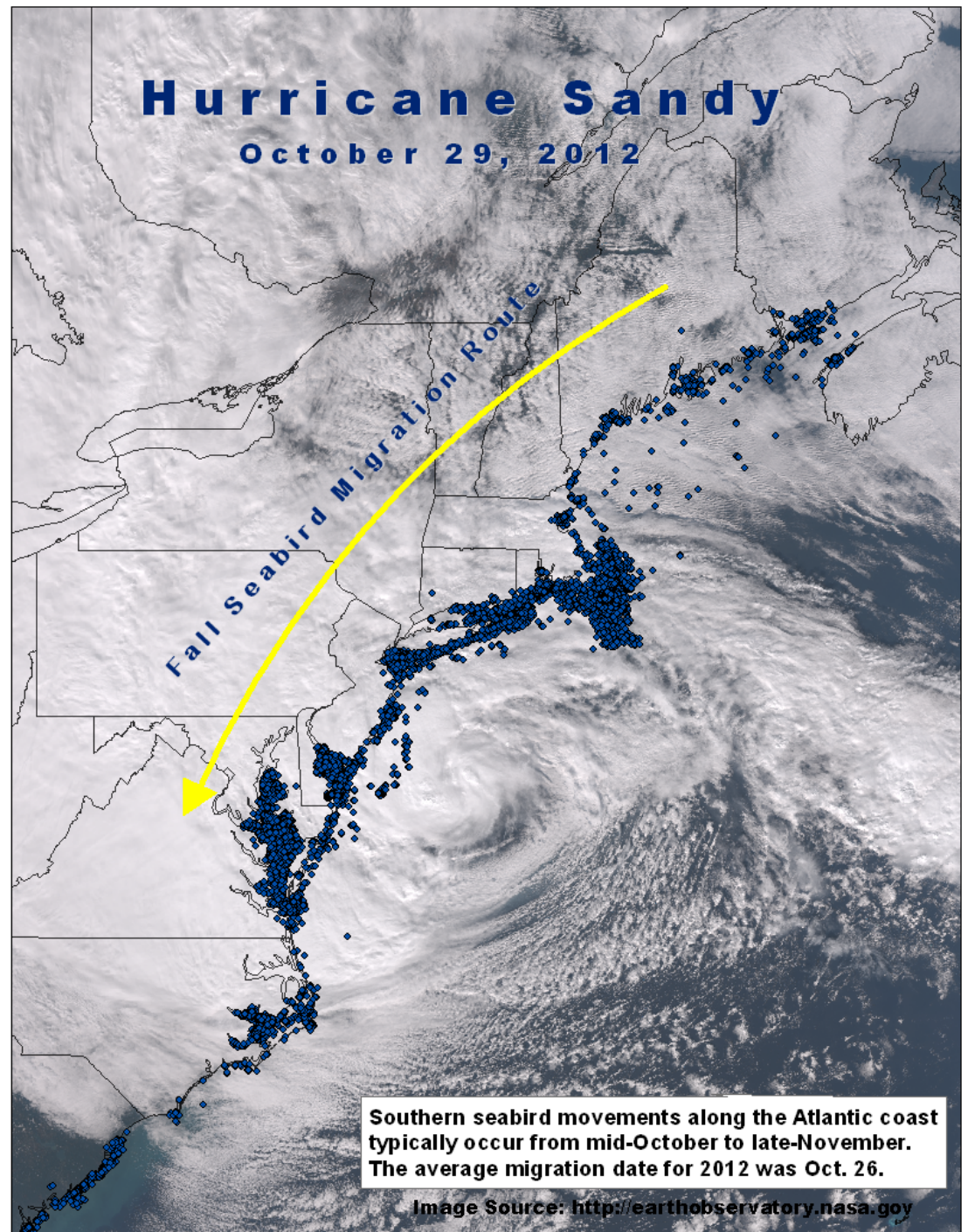
U.S. Department of the Interior
U.S. Geological Survey

Simplified salt marsh food web



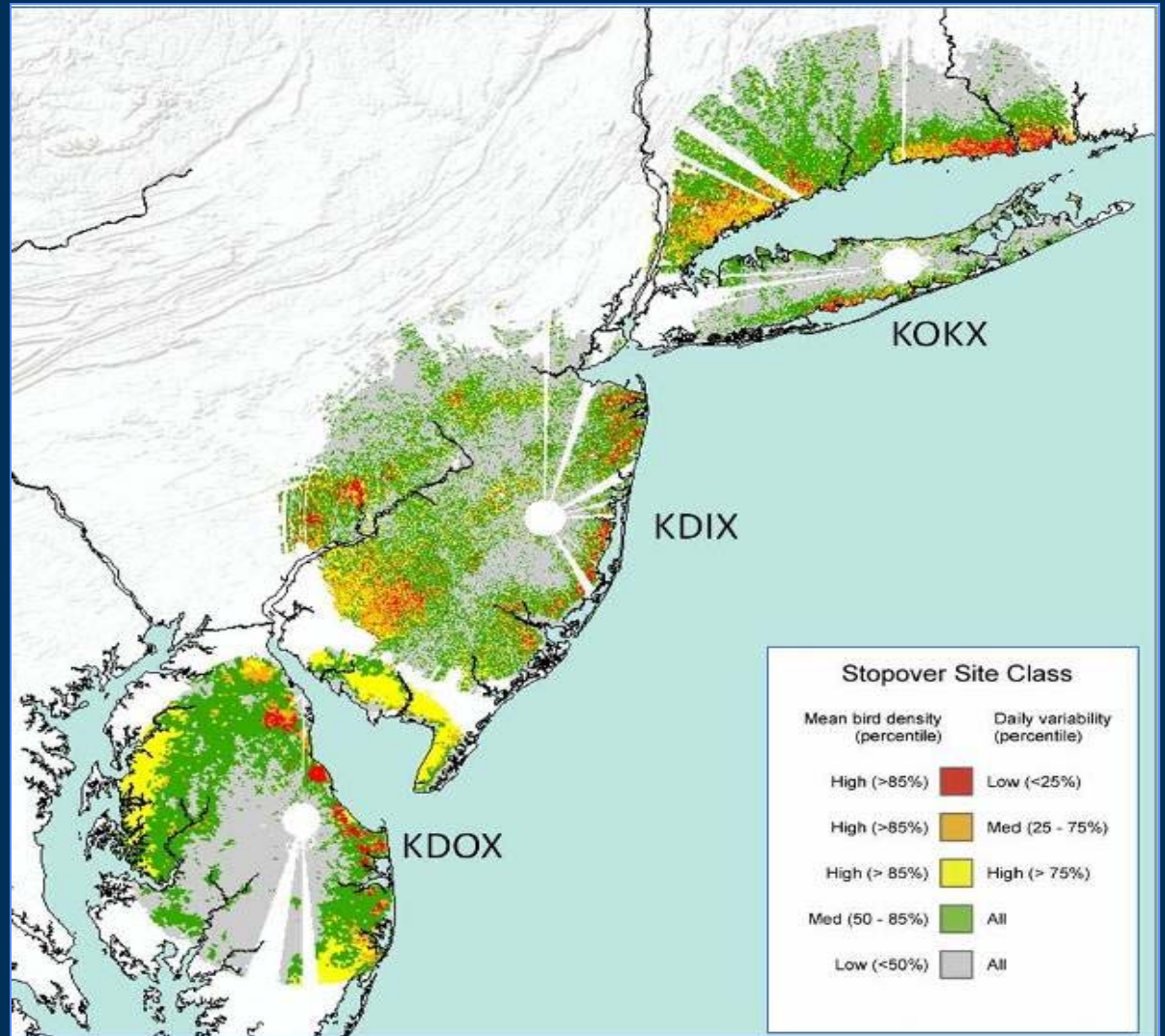
Assessing Extreme Meteorological Events on Habitat Utilization and Migration of Seabirds

- meteorological parameters (temperature, humidity, pressure, wind speed and direction)
- migration characteristics (flight speed, direction, timing of arrival and departure, daily distance, stopover location)



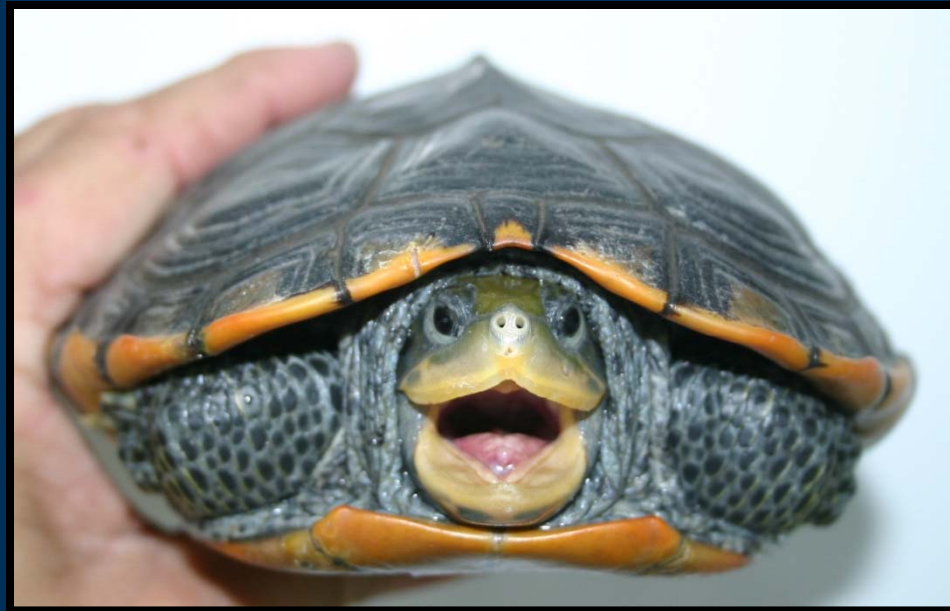
Assessing Extreme Weather Events on Bird Migration and Habitat Using NEXRAD Radar Technologies

- ID and evaluate storm damage to stop-over sites important in bird migration
- Offer insight into species displacement



Effect of Hurricane Sandy on the vertebrate fauna and wetlands of the New Jersey coast

Diamondback terrapin case study



State-listed species (special concern), only exclusively
brackish-water turtle in North America

Coastal Vulnerability and Wetlands Impacts: Goals and Objectives

- **Goal 1: Document change to Northeast U. S. coastal marshes impacted by Hurricane Sandy**

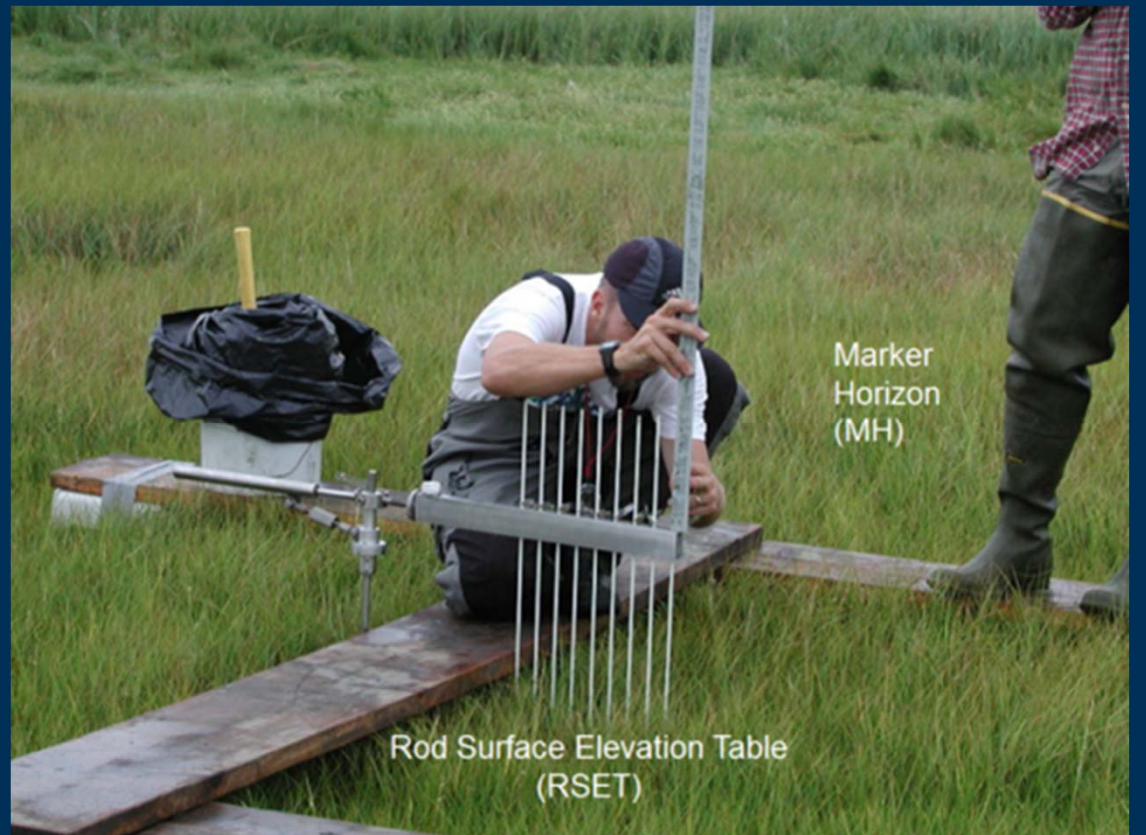
Objectives:

1. Use a collection of elevation and accretion data and related environmental data from study sites within the path of Hurricane Sandy to assess coastal wetland responses to this storm
2. Build a database that includes metadata for each coastal wetland used in the analyses
3. Use data and syntheses to estimate the long-term impact of Hurricane Sandy on marsh sustainability and the potential impact of similar future storms.

- **Goal 2: Develop a plan for a strategic monitoring network for northeast U. S coastal marshes**

Rod Surface Elevation Table – Marker Horizon method (RSET-MH)

- Expand SET network with more monitoring stations to assess long-term vulnerability and develop strategies to increase resilience of coastal wetlands



SET-MH geographic locations: March 2014

