An Overview of Hurricane Sandy Resiliency Restoration at the John H. Chafee NWR, Rhode Island

Nick Emst, USFWS
Hurricane Sandy Resiliency Funding

$100 million awarded to federal agencies

- To promote natural resource enhancement / resiliency against storms
- Projects selected on a competitive basis

Fish and Wildlife Service in Rhode Island received $6 million

- Coastal Program (SNEP) $2 million
  - Aquatic habitat connectivity

- Rhode Island National Wildlife Refuge Complex $4 million
  - Saltmarsh habitat enhancement and resiliency
    - Sachuest Point NWR
    - John H. Chafee NWR
Developing the Narrow River Restoration Strategy

- Restoration team composed of experts from a variety of federal and state agencies, local municipalities, and conservation organizations.
- Development of an integrated set of actions designed to prevent and reduce the ongoing degradation of estuarine habitat.
  - Increase the ecological health of the Narrow River Estuary.
  - Improve the ability of the Narrow River ecosystem to adapt to changes brought about by sea level rise, climate.

Inter-Agency Team

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Project Area Boundaries

- Narrow River is a 9.5 mile long river/estuarine system
- 14 square mile watershed
- Located in the Towns of Narragansett, North Kingstown, and South Kingstown RI
- Diverse Habitat Types:
  - Depth: 2-12 feet
  - Bottoms range from coarse mud - fine silt
  - Eelgrass beds, estuarine channels and basins, shallow water habitats, intertidal shoals (tide flats), and extensive salt marshes
Environmental Issues

- Poor water quality
- Restricted Tidal Flows

- Shoreline Instability
  - Boat Wakes, wind driven waves
  - Increases sedimentation of channel (degrades eel grass and fish habitat)

- Saltmarsh Degradation
  - Poor Drainage/pooling of water on marsh surfaces
  - Limited areas for marsh migration/lack of elevation capital (sea level rise)
Water Quality

- Water Monitoring for over 20 years
- Excessive Nitrogen and fecal coliform inputs
- Closed to Shellfishing since 1997

NR-8: Middlebridge

NR-8: Bacteria - Fecal Coliform

Includes the calculated nitrogen load (SAIC 1994) from three sources: from rain that falls on the watershed and is not taken up by vegetation; from lawn fertilizer; and from septic systems.

Narrow River Preservation Association
Restricted Tidal Flow

- Tidal restrictions at Narrow River Inlet and at Sprague Bridge
  - Tide is greatly attenuated relative to Narragansett Bay. The high tide is slightly lower, low tide is higher
  - Marshes have less “elevational capital”
  - Avg. accretion rates 2.1mm/yr
  - Avg. sea level rise S. New England 3.5 mm/yr
Shoreline Erosion

- Undercut Banks
  - Throughout Narrow River
  - Sections of saltmarsh slump into river

Wind driven waves, boat wakes, green crabs
Vertical bank loss (now in undercut)
Saltmarsh Degradation:

- Increased pools and pans
  - 40% increase in pools and pans since 1939
  - Loss of 14 acres of saltmarsh

- Poor Drainage
  - 39% of saltmarsh degraded by waterlogging
  - Short-form S. alterniflora, loss of high marsh vegetation
  - Unstable peat/bog-like conditions
SW Pettaquamscutt Cove

- Ponded water adjacent to pool: unstable peat/bog-like conditions
- Clogged ditch leading to Phragmites
- Some revegetation of marsh surface
- Brackish marsh plants including Eleocharis rostellata, Ptilimnium
Mosquito breeding habitat

Trapped water in upper marsh

Mosquito larvae

South Middlebridge
Limited Marsh Migration Corridors

- Development along uplands
- Elevation gradients not conducive to migration
Channel Sedimentation

- Degraded eel grass habitat
The prevailing winds blow from the northwest in the winter and from the southwest in the summer.
**MATERIALS**

- Construction finished on the 21\textsuperscript{st} of April 2014

- **Applied materials**
  - **Coir logs** (20”φ & 16”φ)
    - white oak stakes, twine
  - **Bagged oyster shell** (barrier reef)

- **Sites**
  - Three ~100ft long experimental shore line section with 3 barrier reefs (2mx1m)
  - One control site

- Ultimately treat 3,000 ft of shoreline
Aerial View of Living Shoreline

Photo credit: Aron Katona
TNC MONITORING

- Monthly monitoring from May to October

- Fish and invertebrate diversity, abundance
  - Gee minnow traps
  - Shrimp traps
  - Seine nets

- Vegetation diversity, density and biomass
  - 3 random transects per site, 3 plots per transect

- New techniques were introduced recently to monitor erosion
  - Arial photography
Drainage Restoration/Runnels

- Excavate shallow channels (8-12” deep, 2’ wide)
  - Provide surface drainage
  - Restore growing conditions for marsh vegetation
  - Enhance habitat for small estuarine fish
  - Enhance high marsh nesting habitat for saltmarsh sparrow (Ammodramus caudacutus)
  - Reduce mosquito breeding habitat

Photo credit: Wenley Ferguson
Narrow River Proposed Runnel/Creek Restoration
North Middle Bridge
Star Drive
Proposed Beneficial Use of Dredge Material

- Dredging
  - 35,629 cubic yards of material (sandy with fines 2-60%)

- Eel Grass Enhancement
  - 7 acres excavated (-5 feet NAVD88)
  - Thermal refugia estuarine fish
  - 3 acres of upper tidal flat create shorebird foraging

- Low Marsh Creation
  - 1.2 acres of low marsh creation

- Elevation Capital and Restoration of Degraded Marsh
  - 14 acres enhanced with Thin Layer Deposition (TLD)
Conceptual TLD Unit Layout
Monitoring

- Fisheries
  - Seine Net Sampling, RIDEM
  - Nekton Sampling, USFWS
- Water Quality, NRPA
- Tidal Flow Volumes, USFWS
- Living Shorelines, TNC & USFWS
- Boat Wakes, USFWS
- Elevation Surveys, USFWS
- Saltmarsh Sparrow banding/nest monitoring, USFWS
- Saltmarsh Integrity (SMI), USFWS
- Vegetation/Pore Water, STB
- Eel grass surveys, USFWS
Acknowledgments

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- Aron Katona, TNC
- Wenley Ferguson, STB
- Ben Gaspar, USFWS