Developing and Using Ecological Resilience Metrics to Measure Project Performance after Hurricane Sandy

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Photo: NOAA

DOI Metrics Expert Group Report provides Ecological Performance Metrics

Organized by Coastal Feature

- *Beach, Barrier Island, and Dunes*
- *Nearshore Shallow and Nearshore Deep*
- *Riverine and Riparian Zone*
- *Marshes and Wetlands*
- *Uplands and Watersheds*
- *Maritime Forests and Shrublands*
- *Estuaries and Ponds*
- *Grey infrastructure*
- *Green Infrastructure*

Identifies Abiotic, Biotic, and Structural Metrics

Ecological Monitoring:
Core Metrics

Marsh Restoration

- Nekton abundance, species richness

- Salt marsh plant community monitoring

- Water Quality

- Marsh surface elevation change trend

- Marsh accretion and erosion

- Groundwater dynamics

SET Installation

Aquatic Connectivity

- Fish migration rates and patterns

- Invasive species extent, mobility

- Fish assemblage/abundance

- Habitat availability

- Riparian plant communities, pre and post

- Water temperature, salinity

- Flooding extent and depth

- Sediment composition and contaminants

- River Flow and depth

Norton Dam, CT

Beach and Dune Restoration

- Fish, wildlife population, recruitment, overwintering, stopover weight
- Vegetation cover of dunes, pre and post
- Dune characterization
- Beach width, elevation, volume, shoreline position
- Post-storm volume of sand in active shoreface

Living Shorelines

- Oyster length/frequency
- Oyster coverage & population
- Vegetation cover
- Water temperature, salinity
- Vertical accretion rates
- Shoreline position

USFWS Conservation Design
Resilience Projects

Projects designed to provide ecosystem and community resilience to flooding, storm surge, SLR and increased storm events

- **Marsh Restoration**
- **Beach Restoration**
- **Aquatic Connectivity**
- **Science Support Tools**

http://www.fws.gov/hurricane/sandy/

Prime Hook NWR

- **On the western shore of the Delaware Bay, in southern DE**
- **Established in 1963**
- **10,132 acres, primarily wetlands**
- **Refuge divided into management units**
- **Dune breaches are in Units I & II**

Prime Hook NWR
Impoundment Management

- **~4000 acres of freshwater impoundments**

- **Tidal water restricted by water control structures**

- **Culverts between Unit II and Unit III**

- **Successful freshwater impoundment management for 20+ years**

Tidal Marsh and Barrier Beach Restoration at Prime Hook NWR

Issues

- **Freshwater impoundment management unsustainable**
- **Substantial historic accretion deficit**
- **Elevation deficit has led to peat collapse and conversion to open water**
- **Impacts to habitat, wildlife, and coastal communities**

Hurricane Sandy Disaster Relief Funds

- **$19 M in *Recovery Funds* - Fore beach, dune, back barrier platform**
- **$19.8 M in *Resilience Funds* - Marsh restoration**

Prime Hook NWR
Beach & Marsh Restoration

Restore a Barrier Beach & Salt Marsh Complex

- **Close breaches**
- **Dredge a network of tidal channels**
- **Eliminate water control structures**
- **Remove road and alterations to roads and/or culverts**
- **Use dredge material to augment marsh**

Prime Hook National Wildlife Refuge (Photos: USFWS)

The Result

- **Restored Hydrology**
  - **Establish tidal channels**
- **Restored ecosystem services**
  - **Storm surge and flood protection**
  - **Carbon Sequestration**
  - **Habitat**
- **Increased public support**

Sand Pumping to Close Breaches (Tim Boyle, USACE)

Restoring hydrology, recreating channels (Photo: USFWS)

Replanting saltmarsh vegetation (Photo: USFWS)

Abiotic & Biotic Monitoring

- **Water Monitoring**
- **Sediment Monitoring**
- **Marsh Elevation, Accretion**
- **Groundwater Influence**

- **Vegetation Communities**
- **Bird Communities**
- **Fish Communities**

Measuring Success
Are Resilience Projects Effective?

Program Assessment:

- **Identify ecological system performance metrics**

- **Identify socio-economic performance metrics**

- **Link ecological performance metrics with the socio-economic metrics**

- **Enhanced data collection (performance metrics), modeling, and analysis in targeted geographies**

- **Provide results to evaluation/assessment of DOI project contributions to coastal resilience (5-10 year timeframe)**

Subbottom profiles in nearshore (Photo: USGS) **Saltmarsh Bird Survey (Photo: FWS)** **Fish Survey (Photo: NFWF)** **SET Installation (Photo: USGS)**

Thank you!