Building Ecological Solutions to Coastal Community Hazards

Guidance and NJ Coastal Community Assistance

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Intact ecosystems provide best defence against climate change

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Humans are adapting to climate change, but often in ways that further compound our effects on nature, and in turn the impact of climate change on us. Drought, crop failure and poor yield, and human heat-related stress and mortality are increasing in frequency. Sea-level rise is displacing coastal and island communities through storm surges and saltwater incursion, and declination and range shifts of species on land and sea are leading to loss of ecosystems and creation of new and different ecological communities.

When functional and intact, natural systems provide our best protection against floods and storms

- Coastal ecosystems are the most cost-effective and ecologically sound storm buffers
- Without them, the cost of climate adaptation would be magnitudes higher
- Salt marsh vegetation has significant wave attenuation and shoreline stabilization benefits

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Climate-Smart Conservation Cycle
A Framework for Adaptation Planning and Implementation

1. Define planning purpose and objectives
2. Assess climate impacts and vulnerabilities
3. Review/revise conservation goals and objectives
4. Identify possible adaptation options
5. Evaluate and select adaptation actions
6. Implement priority adaptation actions
7. Track action effectiveness and ecological response

Revisit planning as needed
Re-assess vulnerability as needed
ECO SOLUTIONS
Principles

- Manage for change, embrace forward looking goals
- Include a range of projections in decision-making
- Link resilience actions to projected climate risks and known natural hazards
- Consider broader landscape context as part of your resilience strategy
ECO SOLUTIONS
Principles

- Seek solutions that are mutually beneficial to people and nature
- Ecological solutions offer additional co-benefits: fisheries, erosion control, pollination, eco-tourism, stormwater management, groundwater recharge, etc.
- Use the “softest” approach possible, based on site conditions
- Incorporate best science and ecological practices available into project siting & design
COASTAL HAZARDS

Sea Level Rise & Saltwater Intrusion

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COASTAL HAZARDS

Storms: Hurricanes & Nor’easters

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COASTAL HAZARDS
Heavy Precipitation Increasing

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ECO SOLUTIONS

Types of Ecological Solutions

- Conservation and restoration of ecosystems
- Hybrid green-gray infrastructure
- Landscaping with native plants
- Green storm water management
- Ecological mosquito control
- Restoring hydrology, groundwater conservation
- Development setbacks
- Open space
- BMPs for fish & wildlife
**GOAL: COMMUNITY PROTECTION**
Protect communities from storm surge, SLR impacts, flooding, & erosion

**GOAL: HABITAT CONSERVATION**
Conserve habitat for beach-nesting birds and migratory shorebirds

**Conserve, protect, create dune/swale complexes & beaches**

Conserve, Restore, Protect Breeding Habitat
- Protect open sand overwash fans, don’t overfence/overplant
- Protect native dune vegetation
- Avoid installing hard structures
- Avoid introduction & spread of invasive vegetation
- Plug gaps in dunes; build crossovers

Wider beaches with engineered, vegetated dune complexes and development setbacks may afford the greatest coastal storm protection. (Barone et al. 2014)

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Conserve, Restore, Protect Breeding Habitat

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GOAL: HABITAT CONSERVATION
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GOAL: COMMUNITY PROTECTION
Protect communities from storm surge, SLR impacts, flooding, & erosion

Conserve, protect, create dune/swale complexes & beaches

Minimize Disturbance to Nests & Chicks
• Avoid beach raking in breeding season
• Keep free-roaming pets off beaches in breeding season
• Reduce recreational impacts to nests
• Reduce human-associated predators

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Wider beaches with engineered, vegetated dune complexes and development setbacks may afford the greatest coastal storm protection. (Barone et al. 2014)
Conserve Coastal Stopover Habitats

- Avoid new development in/near key coastal habitats
- Establish development setbacks for habitat migration
- Prioritize living shorelines over hard stabilization

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**Conserve, protect, create dune/swale complexes & beaches**

*When Conducting Beach Nourishment:*
- Use clean, appropriate grain-sized sediment
- Prevent introduction of vegetation into red knot habitat
- Clean construction equipment off-site before use
- Schedule nourishment to avoid red knot disturbance

**BMPs**

*Building Ecological Solutions to Coastal Community Hazards*
Conserve Coastal Stopover Habitats

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• Establish development setbacks for habitat migration
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GOAL: HABITAT CONSERVATION
Conserve habitat for beach-nesting birds and migratory shorebirds

GOAL: COMMUNITY PROTECTION
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Wider beaches with engineered, vegetated dune complexes and development setbacks may afford the greatest coastal storm protection. (Barone et al. 2014)

Conserve, protect, create dune/swale complexes & beaches

Manage Direct Disturbance & Predators

• Minimize & monitor human disturbances
• Avoid beach raking while red knots are present
• Minimize & monitor disturbance from predators and loose pets

Building Ecological Solutions to Coastal Community Hazards
Dunes Conservation

GOALS
- Stabilize Shoreline
- Build/Retain Land Mass
- Attenuate Storm Surge
- Provide Windbreaks
- Create Habitat

ACTIONS
- Conserve, protect and plant native dune vegetation
- Plug gaps in existing dune systems
- Establish and enforce local dune protection ordinances
- Consider neighbor impacts: erosion, sediment depletion
- Incorporate SLR into beach management plans
- Incorporate SLR and coastline migration into land use planning, zoning, and local ordinances
- Design beach access pathways to cross over, not cut through, dunes
- Use best management practices for beach and dune nesting wildlife species

COASTAL HAZARDS
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
Beach Conservation

**GOALS**
- Build/Retain Land Mass
- Stabilize Shoreline
- Attenuate Storm Surge
- Provide Windbreaks
- Create Habitat

**ACTIONS**
- Conduct beach profile surveys to identify points of vulnerability
- Manage for wider beach berms, vegetated dune complexes
- Avoid or remove hard structures that erode beaches
- Consider neighbor impacts of beach management
- Incorporate SLR into beach management and land use plans, zoning
- Incorporate projected coastline migration pathways into land use planning
- Use best management practices for beach and dune nesting wildlife species

**COASTAL HAZARDS**
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
Beach Conservation

**GOALS**
- Build/Retain Land Mass
- Stabilize Shoreline
- Attenuate Storm Surge
- Provide Windbreaks
- Create Habitat

**ACTIONS**
- Conserve groundwater to reduce land subsidence
- Design beach access pathways to cross over, not cut through, dunes
- Use BMP’s for beach and dune nesting wildlife species
  - Allow access to dunes for beach nesting wildlife
  - Prevent disturbance and nest predation by pets and wildlife
  - Allow sand overwash fans to remain
  - Don’t rake the wrack line
  - Minimize disturbance to beach nesting wildlife and migrating shorebirds
  - Match beach nourishment sand w native substrate

**COASTAL HAZARDS**
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
**Land Use Planning**

**GOALS**
- Build/Retain Land Mass
- Stabilize Shoreline
- Attenuate Storm Surge
- Provide Windbreaks
- Create Habitat

**ACTIONS**
- Inventory and map beach & dune systems in your community
- Incorporate SLR and coastline migration projections into all land use planning
- Establish ample development setbacks behind secondary dunes that take SLR projections and storm surge into account
- Cluster development in such a way that it is set back from the water’s edge with wide natural buffers
- Survey beach and dune profiles to identify points of vulnerability

**COASTAL HAZARDS**
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
Marsh Habitat BMPs

• Establish & enforce ample no wake zones
• Implement ecological BMPs for mosquito control
• Prioritize living shorelines over hard armoring for stabilization
• Establish development setbacks & designate wetland migration corridors

GOAL: COMMUNITY PROTECTION
Protect communities against erosion, land loss, SLR and coastal storm impacts

GOAL: HABITAT CONSERVATION
Conserve habitat for wetland dependent marsh birds

Wetlands are the overall most economically valuable ecosystem in New Jersey. (Costanza et al. 2006)

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**Land Use Planning & Zoning**

**GOALS**
- Stabilize Shoreline
- Build/Retain Land Mass
- Attenuate Storm Surge
- Create Habitat

**ACTIONS**
- Identify and assess condition of all tidal marshes on public & private lands
- Set and enforce a zero loss policy of existing tidal marshes
- Incorporate SLR marsh migration projections into land use zoning/open space planning

**COASTAL HAZARDS**
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
**GOALS**
- Stabilize Shoreline
- Build/Retain Land Mass
- Attenuate Storm Surge
- Create Habitat

**ACTIONS**
- Establish a goal of protecting/restoring all tidal marshes in your municipality
- Reduce, soften, eliminate rigid vertical structures along wetlands
- Prioritize ‘living shorelines’ practices for shoreline stabilization in estuary communities, over hard armoring
- Involve hunters/anglers/birders in marsh monitoring
- Refocus mosquito control efforts to be ecologically sound
- Reverse wetland damages from mosquito control practices
- Control human-associated predators, such as feral cats
- Establish, observe, and strictly enforce ample “no wake zones” to prevent shoreline erosion
- Restore tidal flow where it has been severed

**COASTAL HAZARDS**
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
Reduce Pollution Runoff

GOALS
- Stabilize Shoreline
- Build/Retain Land Mass
- Attenuate Storm Surge
- Create Habitat

ACTIONS
- Promote a culture shift away from grass turf and towards native vegetation in uplands
- Promote landscaping with native plants and leaf mulching that improves soil condition
- Reduce impervious surface cover
- Promote low-impact-development practices, e.g. capturing and using rainwater where it falls

COASTAL HAZARDS
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
Public Outreach

**GOALS**
- Stabilize Shoreline
- Build/Retain Land Mass
- Attenuate Storm Surge
- Create Habitat

**ACTIONS**
- Publicly declare the importance of tidal marshes to community resilience and commit to excellent wetlands stewardship
- Recognize and reward private landowners who demonstrate excellent stewardship of tidal marshes & adjacent uplands
- Reduce pressure on marshes from mosquito control by publicly promoting ecologically sound practices
  - Marsh v. container-breeding mosquitoes
  - Natural mosquito predators
  - Targeted spraying

**COASTAL HAZARDS**
- Coastal Storms (Hurricanes and Nor’easters)
- Erosion
- Flooding
- Sea Level Rise
Conserve, Restore, Protect Scrub-Shrub Cover

- Map & protect scrub-shrub patches where they exist
- Control or remove Phragmites wherever possible and ecologically appropriate
- Manage human-associated nest predator populations

GOAL: COMMUNITY PROTECTION
Protect communities from storm surge, SLR impacts, flooding, & erosion

GOAL: HABITAT CONSERVATION
Conserve habitat for shrub-nesting birds and migratory songbirds

Conserve, protect, create maritime forest & scrub-shrub habitat

BMPs

Development of scarce remaining maritime scrub-shrub & forest reduces critical habitat for migratory species.

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Development of scarce remaining maritime scrub-shrub & forest reduces critical habitat for migratory species. (NJWAP 2008)

**GOAL: COMMUNITY PROTECTION**
Protect communities from storm surge, SLR impacts, flooding, & erosion

**GOAL: HABITAT CONSERVATION**
Conserve habitat for shrub-nesting birds and migratory songbirds

**Conserves, protect, create maritime forest & scrub-shrub habitat**

- Conserve, Restore, Protect Maritime Forest Cover
  - Incorporate maritime forest tree canopy into public & private landscaping
  - Conserve groundwater, manage aquifers to reduce saltwater intrusion

*BMPs*
GOAL: COMMUNITY PROTECTION
Protect communities from storm surge, SLR impacts, flooding, & erosion

GOAL: HABITAT CONSERVATION
Conserve and create habitat for wildlife movement and migration

Ecological Solutions for Coastal Developed Areas
- Incorporate SLR into land use planning, zoning
- Install rain gardens & bio-swales to improve infiltration/groundwater recharge
- Establish native-vegetated buffer zones
- Prioritize natural infrastructure over hard armoring shorelines
- Reduce impervious cover

Designs inspired by nature enhance the benefits of traditional built infrastructure. (Sutton-Grier 2015)

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ECO SOLUTIONS
Considerations

- Factor in SLR and precipitation trends
- Know the ecosystems in your community and surrounding landscape
- Evaluate site conditions: tides, wave energy, sediment transport, erosion, plant communities, wildlife, flood risk, etc.
- What is the project’s life expectancy, long-term maintenance requirements?
- Can your project self-repair after storm damage?
ECO SOLUTIONS

Considerations

- Is your project beneficial, neutral, or detrimental to fish & wildlife?
- Does it transfer risks to neighbors or downstream?
- Can it be done with natural materials? Use native plants wherever possible.
- Conserve groundwater
- Reduce impervious cover
- Leave room for nature to move
- Maximize eco-tourism potential
Building Ecological Solutions to Coastal Community Hazards
Web Design Underway

- NJDEP OCLUP
- Multiple entry points
- Links to technical resources
- May 2017 release
- Companion Guide

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