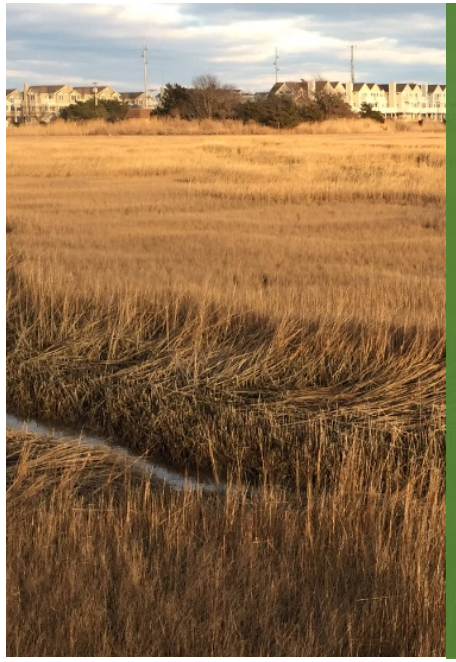

Building Ecological Solutions to Coastal Community Hazards

Guidance and NJ Coastal Community Assistance

Stacy Small-Lorenz, Ph.D.

National Wildlife Federation

BUILDING ECOLOGICAL SOLUTIONS TO COASTAL COMMUNITY HAZARDS (BESCCH)

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COMMENTARY:

Intact ecosystems provide best defence against climate change

Tara G. Martin and James E. M. Watson

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.

Climate change is affecting people and nature across every continent and ocean[1]. Changes in rainfall, snow and ice melt are impacting water resources in terms of quality and quantity. 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 deglaciation and range shifts of species on land and sea are leading to loss of ecosystems and creation of new and different ecological communities.

Table 1 | Examples of different human responses to pressures caused by climate change impacting natural ecosystems and their potential negative (bold) and positive long-term consequences.

	Different responses to climate pressure	Possible long-term consequences for local human communities
Erosion from sea-level rise and storm surges	**Destruction of coral reefs to build seawalls[1]**	**Loss of fisheries, loss of storm protection provided by functioning coral reef, loss of tourism and other livelihoods[7,16]**
	Coastal ecosystem (mangrove, salt marsh, estuary) protection and restoration[7,17]	Protection and restoration of a range of ecosystem services and goods with high economic value[7,17]
Increased seasonal variability	**Shifting large-scale agriculture to forested areas[1], over-reliance on crops with low tolerance for climate variability, that is, corn and soybeans[18]**	**Loss of intact native vegetation and the hazard protection it provides[7,19], lost carbon sequestration[6], change in local climate regulation leading to more extreme weather issues[4]**
	Adoption of ecologically sustainable agriculture practices such as agroforestry[11,12]	Increased crop resilience to climate change and increased yields[11]
Increased severity of drought	**Plant breeding and genetic modification for drought-tolerant pastures and crops[3]**	**Development of the next generation of invasive plant species[3]**
	Utilizing plant taxa where the risk of invading natural areas is low[3]	Increased food security with low risk of invasion[3]

In response, many local communities around the world are rapidly adjusting their livelihood practices to cope with climate change, sometimes with catastrophic implications for nature. In low-lying islands across Melanesia, the construction of seawalls out of coral by island communities hoping to slow down the impact of sea-level rise has amount of greenhouse gas emissions into the atmosphere. These are just a few of the human responses to climate change that, if left unchallenged, may leave us worse off in the future due to their impacts on nature.

Natural systems

The role of intact, functioning ecosystems most effective and inexpensive line of defence must be avoided[1,5].

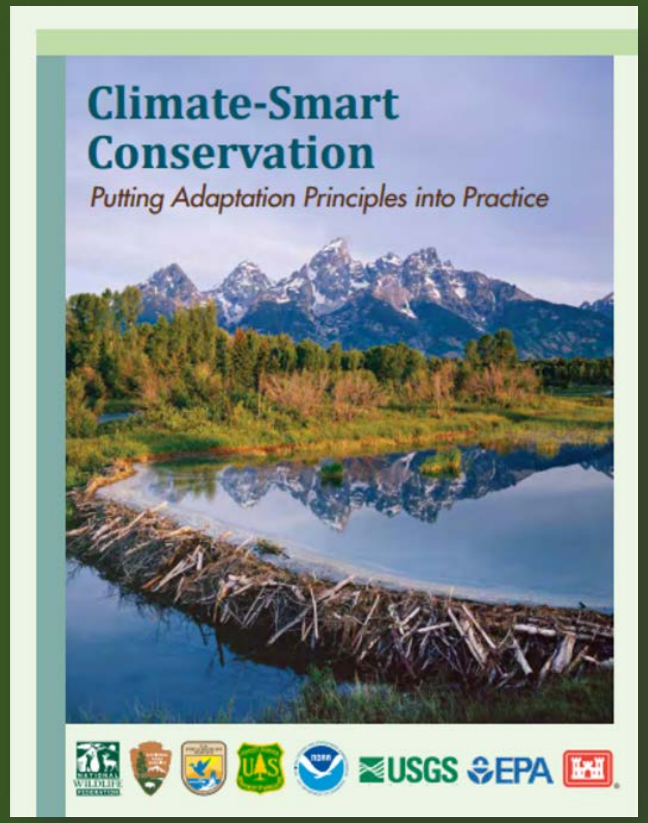
Thoughtful policy is urgently needed to ensure adaptation leads us in the right direction, and away from perverse outcomes that exacerbate our current environmental and climate crisis. The role of natural ecosystems in sustaining the complex

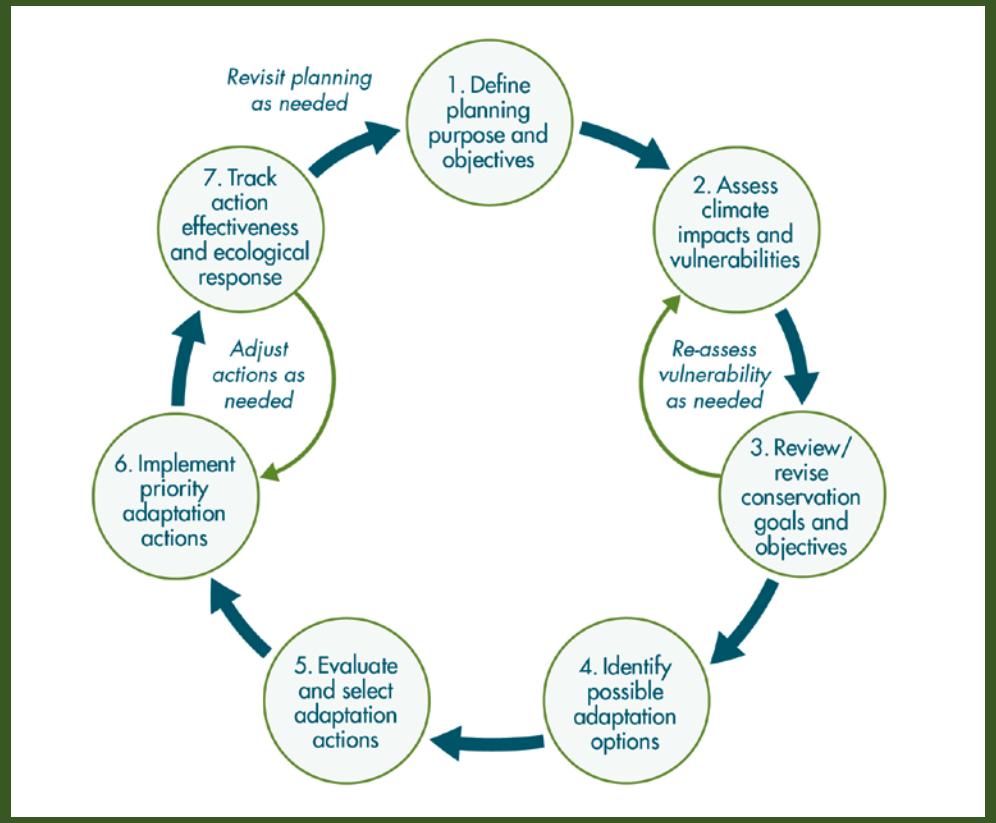
When functional and intact, natural systems provide our best protection against floods and storms

- 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

Climate-Smart Conservation Cycle

A Framework for Adaptation Planning and Implementation





Building Ecological Solutions to Coastal Community Hazards

ECO SOLUTIONS
Principles

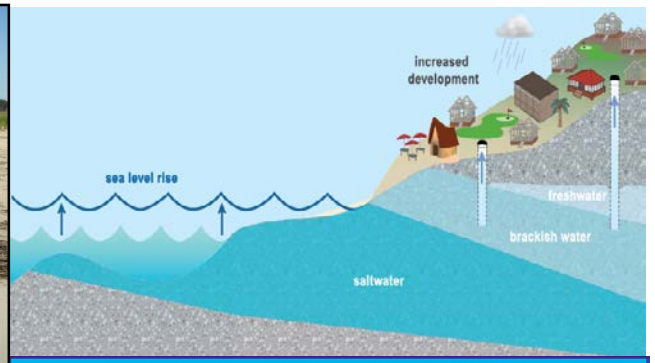
- Manage for change, embrace forward looking goals
- Include a range of projections in decision-making
- Link resilience actions to projected climate risks and known natural hazards
- Consider broader landscape context as part of your resilience strategy

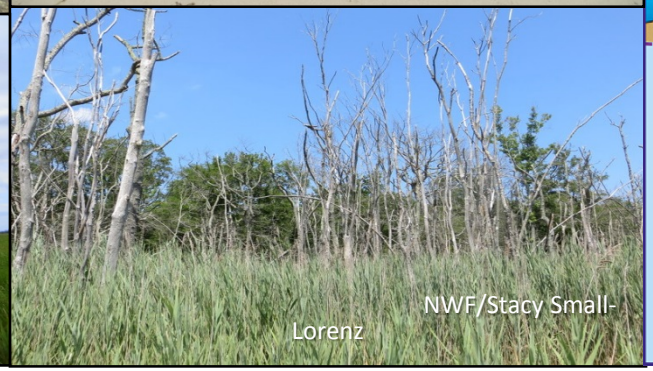
ECO SOLUTIONS
Principles

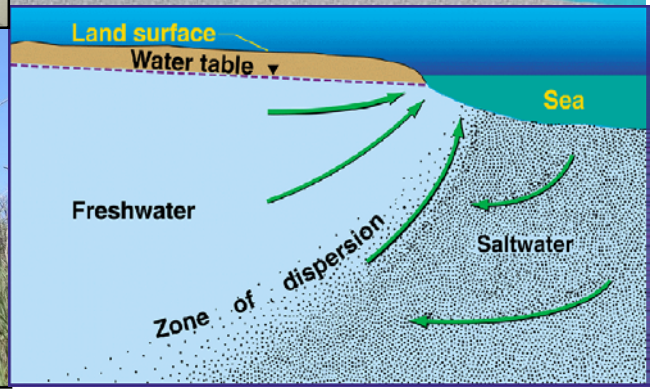
- Seek solutions that are mutually beneficial to people and nature
- Ecological solutions offer additional co-benefits: fisheries, erosion control, pollination, eco-tourism, stormwater management, groundwater recharge, etc.
- Use the “softest” approach possible, based on site conditions
- Incorporate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

COASTAL HAZARDS

Sea Level Rise & Saltwater Intrusion



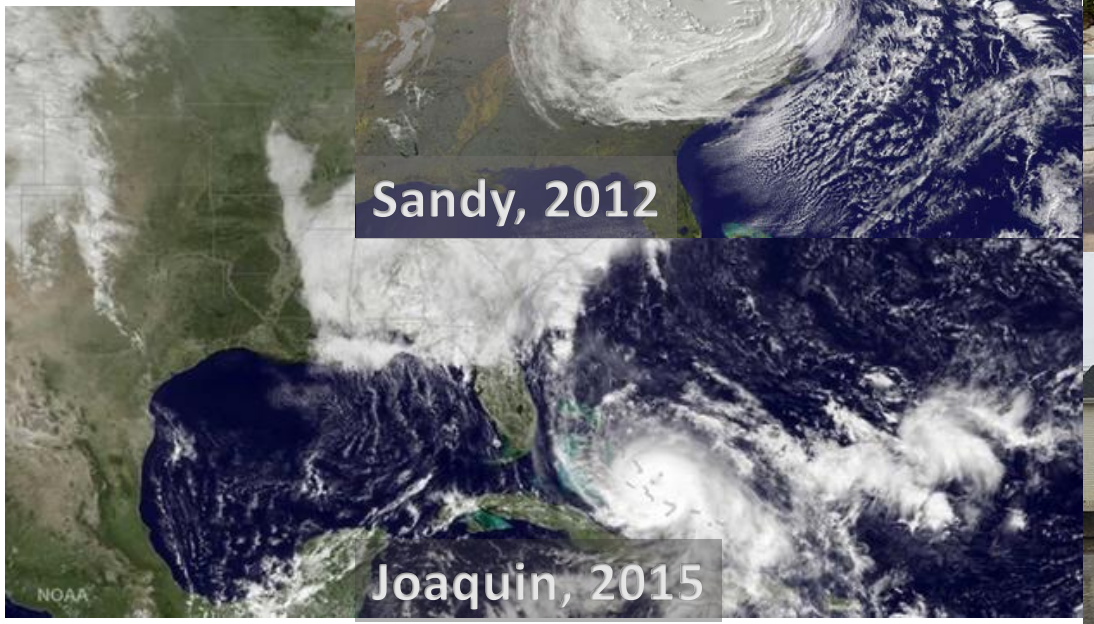




Building Ecological Solutions to Coastal Community Hazards

COASTAL HAZARDS

Storms: Hurricanes & Nor'easters



Building Ecological Solutions to Coastal Community Hazards

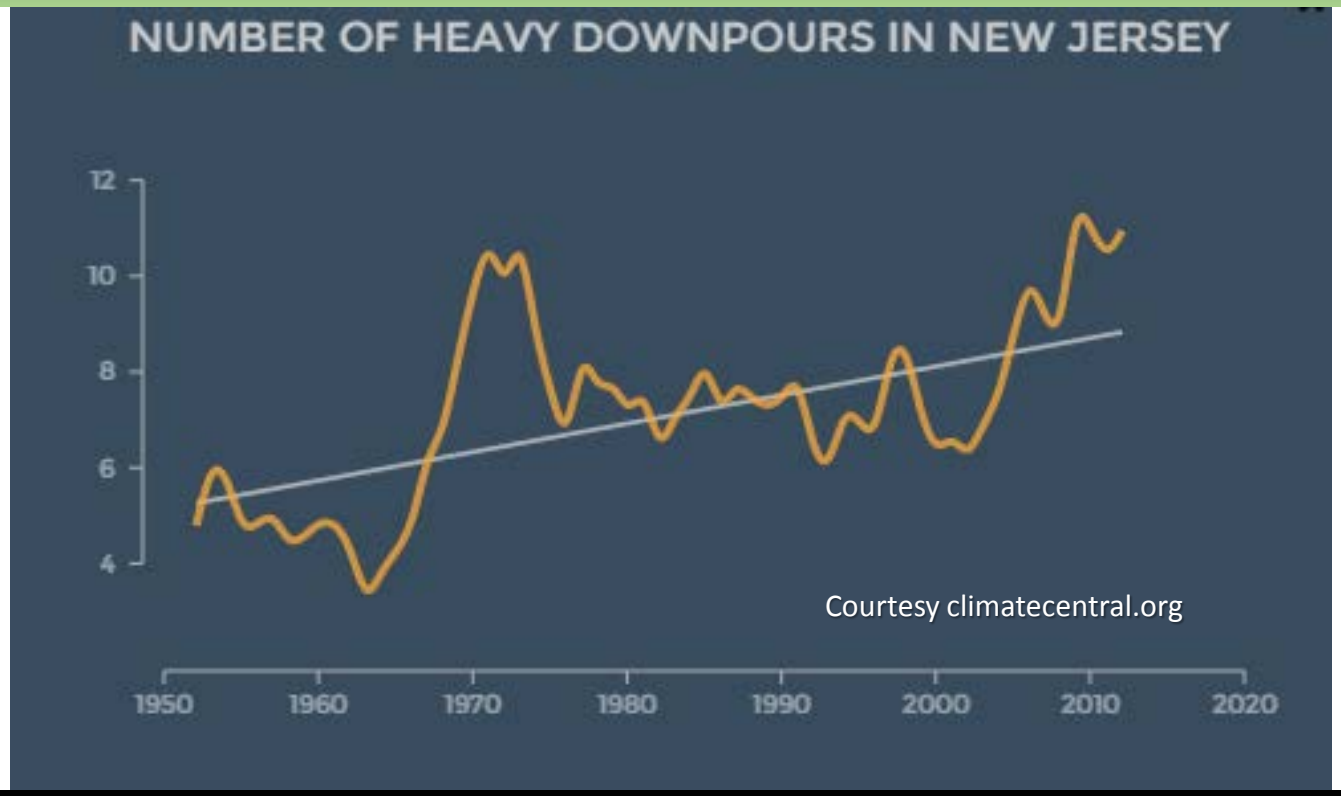
COASTAL HAZARDS

Storms: Hurricanes & Nor'easters

Building Ecological Solutions to Coastal Community Hazards

COASTAL HAZARDS

Heavy Precipitation Increasing



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

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

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

BMPs

Building Ecological Solutions to Coastal Community Hazards

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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)

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

BMPs

Building Ecological Solutions to Coastal Community Hazards

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Conserve Coastal Stopover Habitats

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

BMPs

Building Ecological Solutions to Coastal Community Hazards

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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

BMPs

Building Ecological Solutions to Coastal Community Hazards

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Conserve, protect, create dune/swale complexes & beaches

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

Manage Direct Disturbance & Predators

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

BMPs

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 ordinaces
- 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

GOAL : COMMUNITY PROTECTION

Protect communities against erosion, land loss, SLR and coastal storm impacts

GOAL : HABITAT CONSERVATION

Conserve habitat for wetland dependent marsh birds

Conserve, protect, manage for intact tidal marshes

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

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

BMPs

Building Ecological Solutions to Coastal Community Hazards

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

Ecosystem Management

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

GOAL : COMMUNITY PROTECTION

Protect communities from storm surge, SLR impacts , flooding, & erosion

GOAL : HABITAT CONSERVATION

Conserve habitat for shrub-nesting birds and migratory songbirds

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

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

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

BMPs

Building Ecological Solutions to Coastal Community Hazards

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

Conserve, Restore, Protect Maritime Forest Cover

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

BMPs

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

Building Ecological Solutions to Coastal Community Hazards

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)

BMPs

Building Ecological Solutions to Coastal Community Hazards

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

ECO SOLUTIONS
In Action






Building Ecological Solutions to Coastal Community Hazards

Web Design Underway

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

Questions: smalls@nwf.org

BUILDING ECOLOGICAL SOLUTIONS TO COASTAL COMMUNITY HAZARDS (BESCCH)