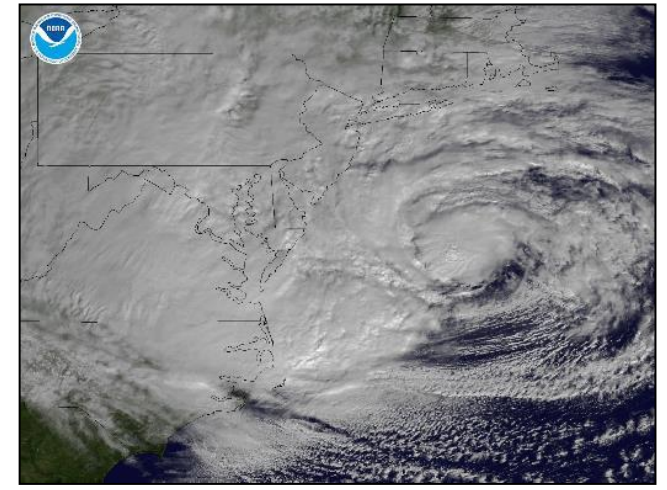
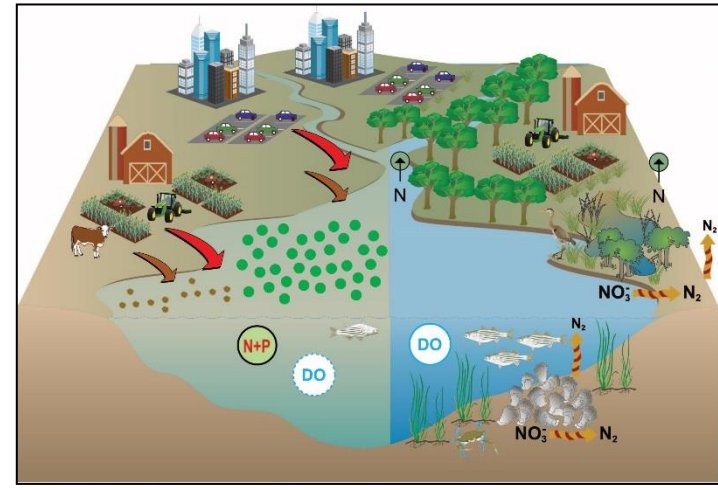
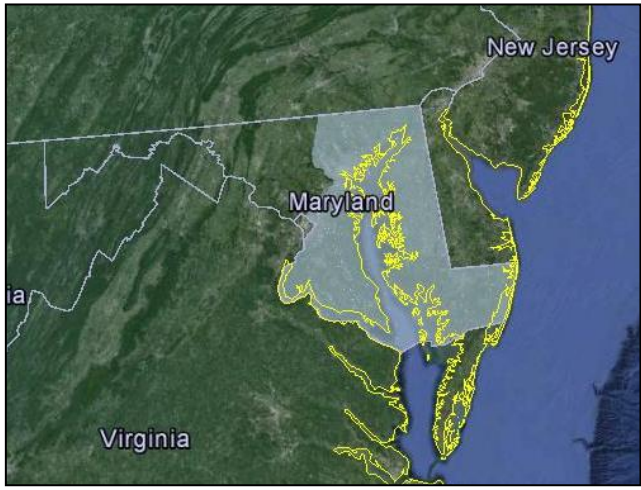


Guidance for Building Climate Resilience into Habitat Restoration



Nicole Carlozo

Chesapeake & Coastal Service

Maryland Department of Natural Resources

DNR Building Resilience to Climate Change Policy



“It is the policy of the Maryland Department of Natural Resources to make sound investments in land and facilities and to manage its assets and natural resources so as to better understand, mitigate and adapt to climate change.” (2010)



Climate Policy: Habitat Restoration

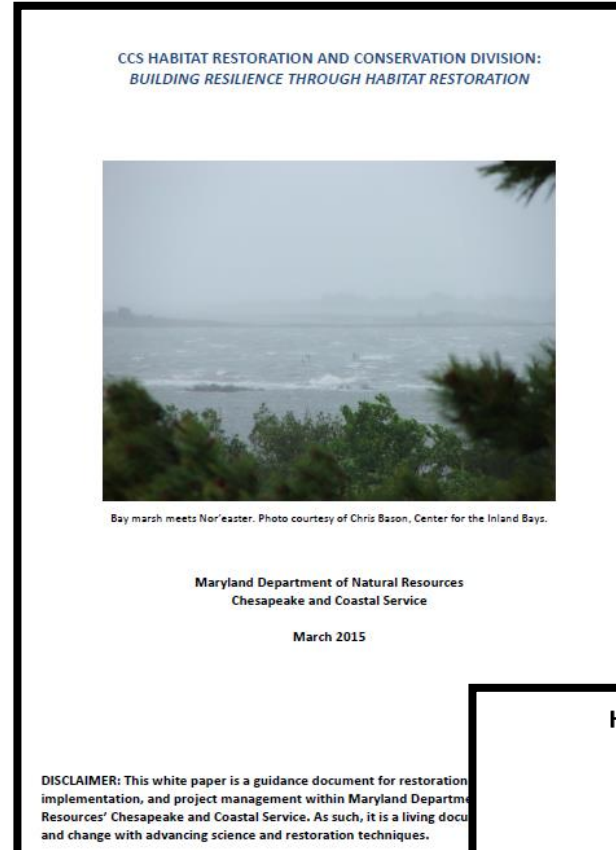


- **Practice:** Proactively pursue, design and construct habitat restoration projects to enhance the resilience of bay, aquatic and terrestrial ecosystems to the impacts of climate change and/or increase on-site carbon sequestration.
- **Procedure:** Address and incorporate factors associated with climate change during project planning and design processes, including maintenance and monitoring needs.
- **Implementation Guidance:** Compile a compendium of best management practices for habitat restoration project design...

Building Resilience Guidebook



1. Project Targeting and Prioritization
2. Project Selection
3. Site Analysis
4. Design
5. Review
6. Permitting
7. Construction
8. Monitoring



Habitat Restoration and Conservation Divisions Climate Change Check List

March 23, 2015

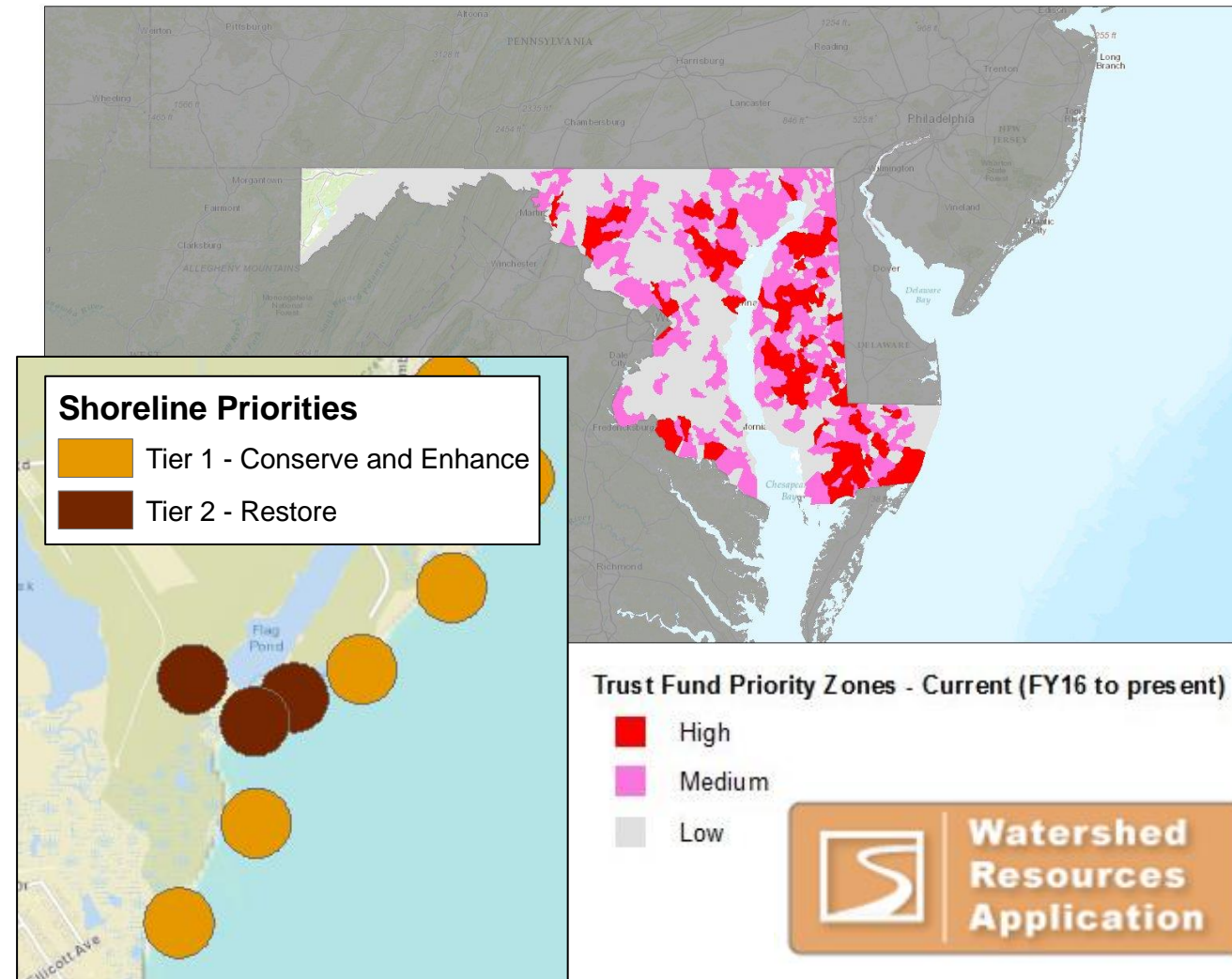
As an outcome of the *CCS Habitat Restoration and Conservation Division: Building Resilience through Habitat Restoration* white paper that was compiled by the Coastal Planning Division, this check list will serve as a way to ensure our division is planning for, selecting and accounting for enhancement and restoration sites that may address coastal sea level rise adaptation, and mitigation when possible. Determining proper site selection, proper design and construction of these projects is key to enhancing habitat and community resiliency.

Project Targeting / Prioritization



1. Invest in GIS-based targeting to identify watersheds and shorelines with impervious surface, habitat loss, nutrient and sediment runoff and other anthropogenic impacts (i.e. ditching).
2. Identify areas where restoration practices and their functionality are at greatest risk of impacts from climate change (sea level rise, precipitation, temperature, and stream flow changes).
3. Target sites that will be sustainable under future conditions or facilitate habitat migration.
4. Conduct an audit of state lands with habitat restoration potential to increase ecological resilience or carbon sequestration.

Maryland Trust Fund Priority Zones

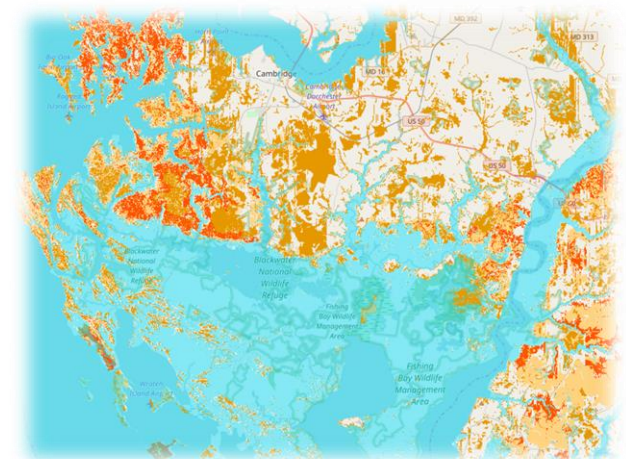
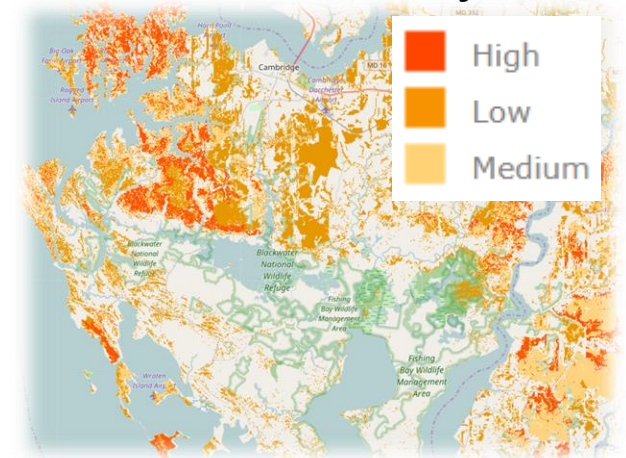


Project Selection



- Foster partnerships with wetland conservation organizations, watershed groups, local governments and others to identify potential projects.
- Review properties under consideration for state purchase or easement to align restoration and conservation activities.
- Select sites that may facilitate inland wetland migration
- Investigate the costs and benefits of restoration opportunities at the land-water interface on a project-by-project basis.

***Wetland Adaptation Areas
and Sea Level Rise Projections***

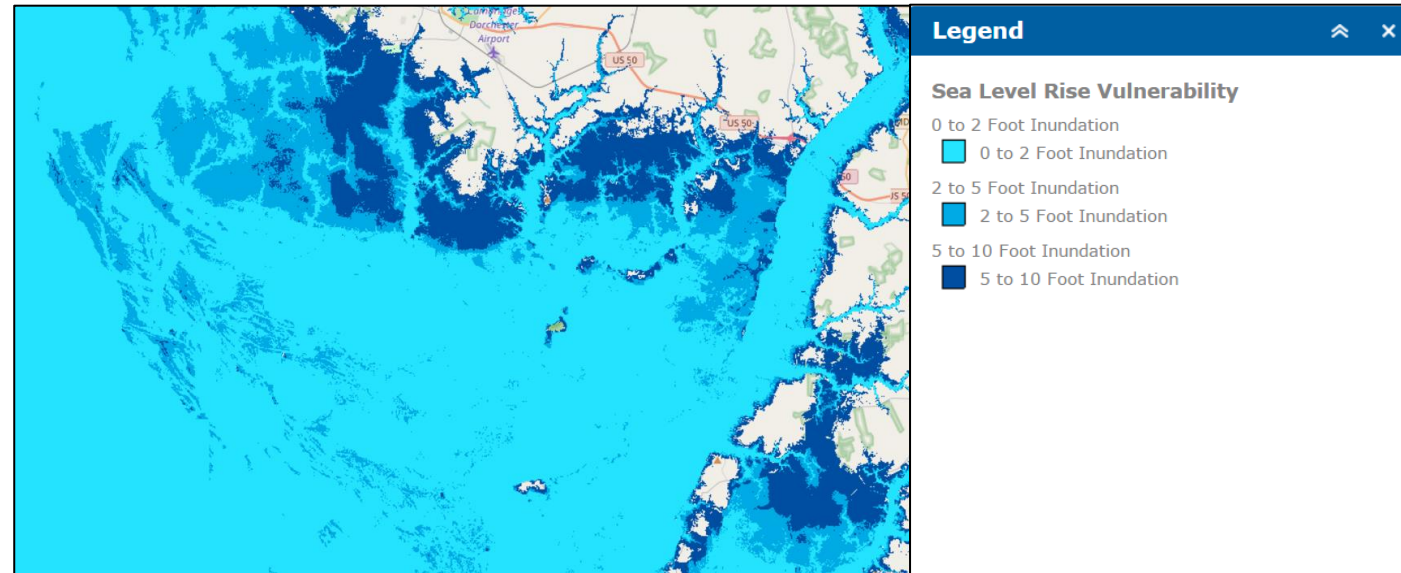


Site Analysis: Desk and Field Assessments



- Desk Audits

- Consider “predicted conditions” in desk audits for tidally influenced projects (i.e. sea level rise, erosion vulnerability, floodplains, wetland migration, etc.).
- Increase understanding of future hydrologic conditions for upstream and non-tidal areas.



<http://dnr.maryland.gov/ccs/coastalatlus/>

- Field Assessments

- Note site-specific factors that may indicate the location of future wetlands, water, and floodplains (i.e. elevation, ditches, distance to tidal waters, etc.)
- Identify opportunities to remove migration barriers
- Align data collection with post-project monitoring metrics

Site-Specific Design



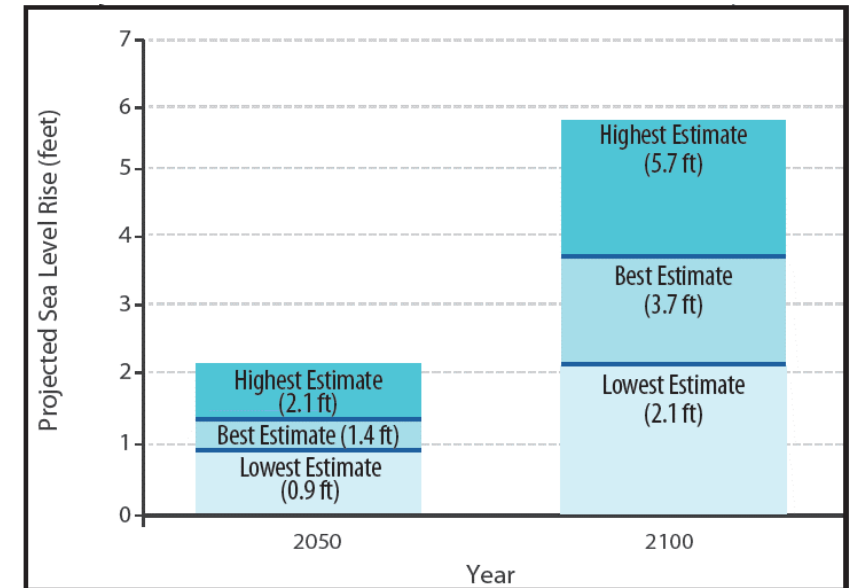
- Address site-specific conditions and climate impacts:
 - Tidally influenced sites (SLR, marsh migration, storm surge, floodplain, fetch, accretion rate, depth, etc.)
 - Non-tidal/inland sites (Precipitation, streamwater flow, upland land use, channel structure)
 - Capacity, inflow and outflow
 - Assess for potential fresh or saltwater intrusion
- Restore hydrologic conditions, facilitate infiltration and select appropriate vegetation:
 - Reconnect Floodplains
 - Maximize wetland area
 - Expand riparian buffers at potential high-flow areas
 - Utilize a diversity of native species
 - Manage invasive species



Review / Permitting / Construction



- Reference state-accepted climate data during review for projects with long expected lifespans (15+ years)
- Hold pre-application permit meetings
- Improve adaptive management techniques, planning for possible storm-related delays or construction impacts



Source: Boesch et al., 2013



Monitoring for Maintenance and Adaptive Management



- Identify physical, chemical and biological metrics based on project-by-project goals
- Monitor vegetation and structural stability to address project failures and improve design as conditions change
- Align monitoring with baseline field assessments
- Adapt monitoring protocols to capture changing conditions (ex. timing for monitoring activities may be impacted by changes to migration patterns, max spring flows, rainfall patterns, etc.)
- Use predictive models to identify targeted areas for monitoring

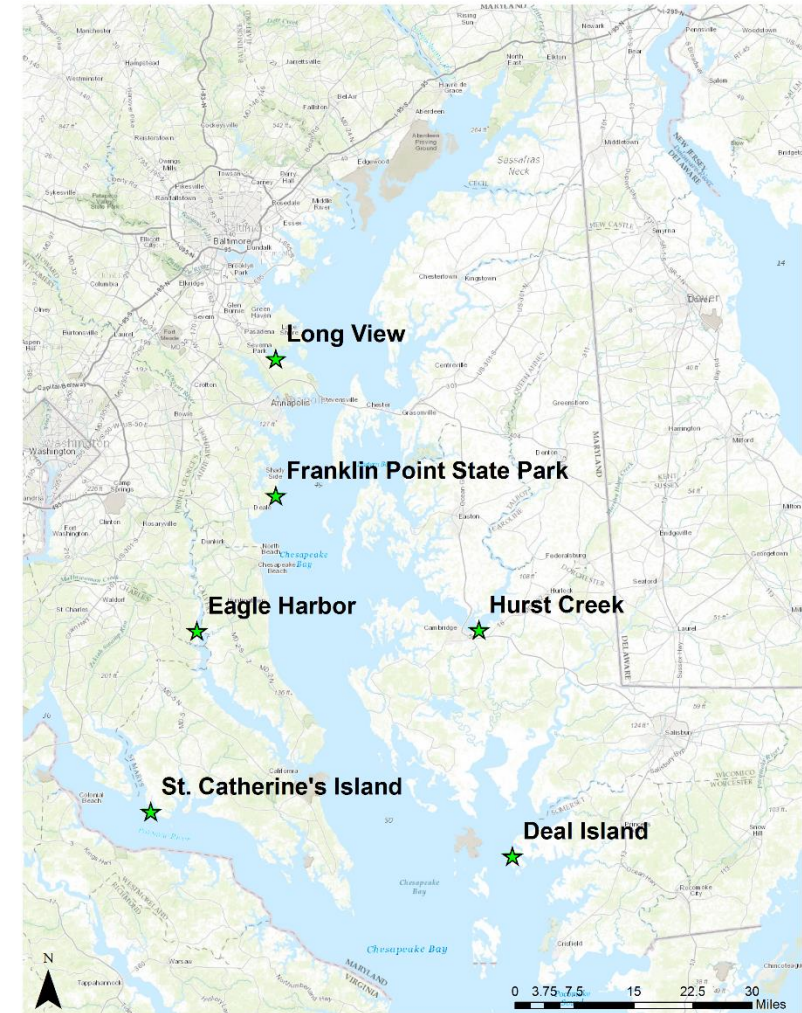
(Kreeger and Moody, 2014)

Type	Attribute	Feature	Metric
Core	Physical	Shoreline Stabilization	Elevation Change at Marsh Edge
			Elevation Change Interior Platform
			Shoreline Slope/Contours
			Position of Contiguous Vegetated Shoreline
			Sediment Capture (Volume)
	Physical	Structural Integrity of Materials	Coir Logs, Mats
			Shell Bags
			Wave Attenuation Structures
			Bivalve Recruitment Structures
			Other
	Chemical	Environmental Conditions	Temperature
			Salinity
	Biological	Ecological Enhancement	Vegetation Robustness
Vegetation Integrity			
Extent of Bivalve Community			
Inhibition of Fauna Movement			

Guidance into Practice



- **Resiliency through Restoration Initiative**
 - FY18 – FY 22 Capital Budget supporting a Coastal Resiliency Grant Program
 - Design, construction, and adaptive management of 15 priority projects
 - Natural and nature-based solutions to climate impacts with climate-resilient features
 - FY18: Design and permit acquisition for 6 living shoreline Projects in 5 jurisdictions
 - FY19: Construction of FY18 projects; and release of RFP for identification of 4-5 additional projects



For more information...



Email: nicole.carlozo@maryland.gov

Report:

http://dnr.maryland.gov/ccs/Documents/NF_CCS-HRC_Climate_2015.pdf

Fact Sheet:

http://dnr.maryland.gov/ccs/Documents/NF_HabitatRestorationCC_FactSheet.pdf