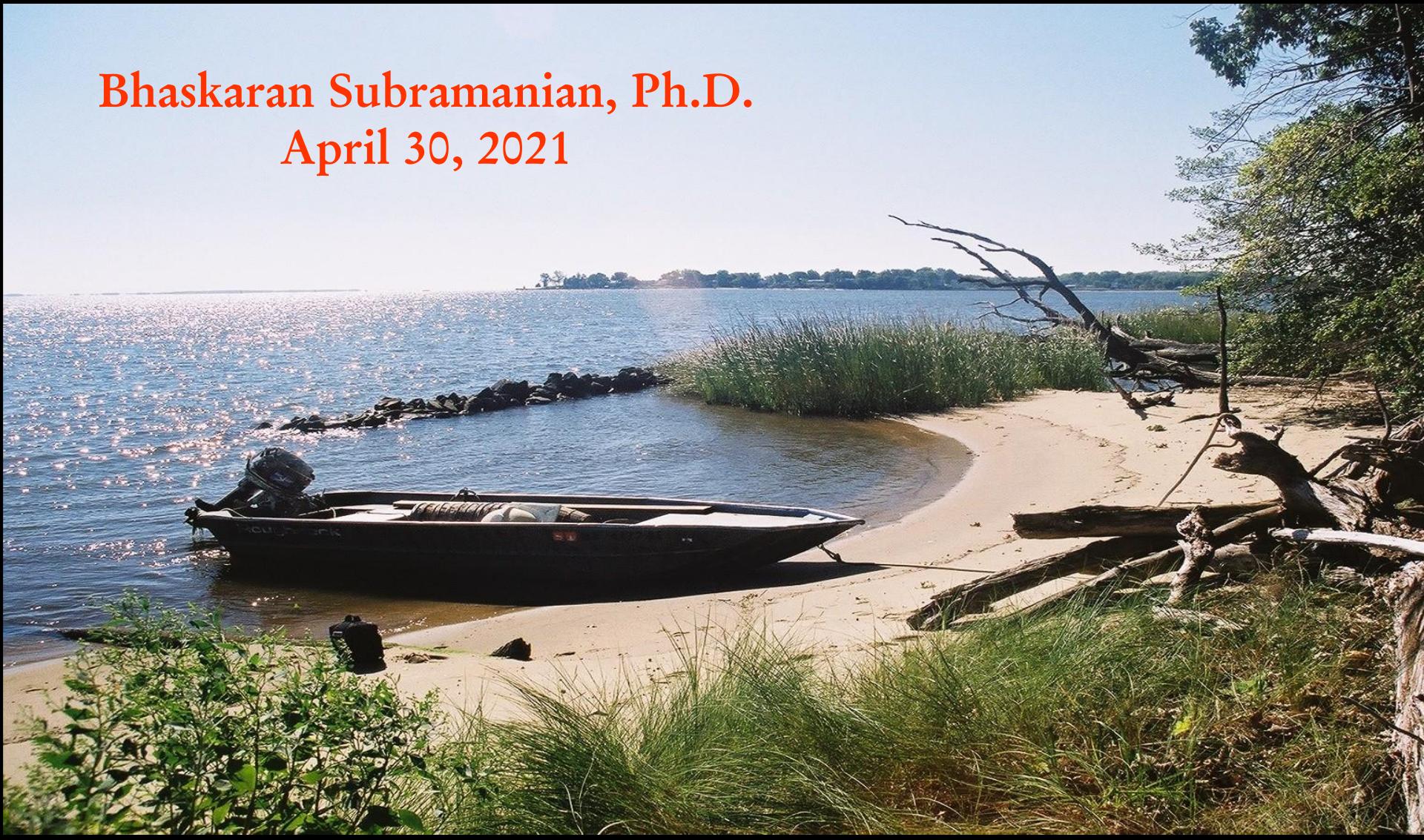


Building Resiliency through Restoration: The Maryland Story



Bhaskaran Subramanian, Ph.D.
April 30, 2021



Outline



1. Brief history of living shorelines in Maryland
2. Examples of MD shorelines- response to extreme events
3. Legislation supporting living shorelines
4. Funding- loans; grants; and others!!
5. Role of federal programs and partnerships
6. Natural and Nature-Based Features (NNBF) and mitigation benefits (blue carbon)

1. History of Living Shorelines

- MD's tidal shorelines = 6,659 miles



- Erosion affects all 16 coastal counties along the Chesapeake Bay and Coastal Bays watersheds.

Primer on Erosion

Erosion- Not necessarily bad

Necessary process- helps to maintain beach, marsh and offshore habitats.

Ecological health of the estuary depends on it.



Traditional Methods of Erosion Control Methods

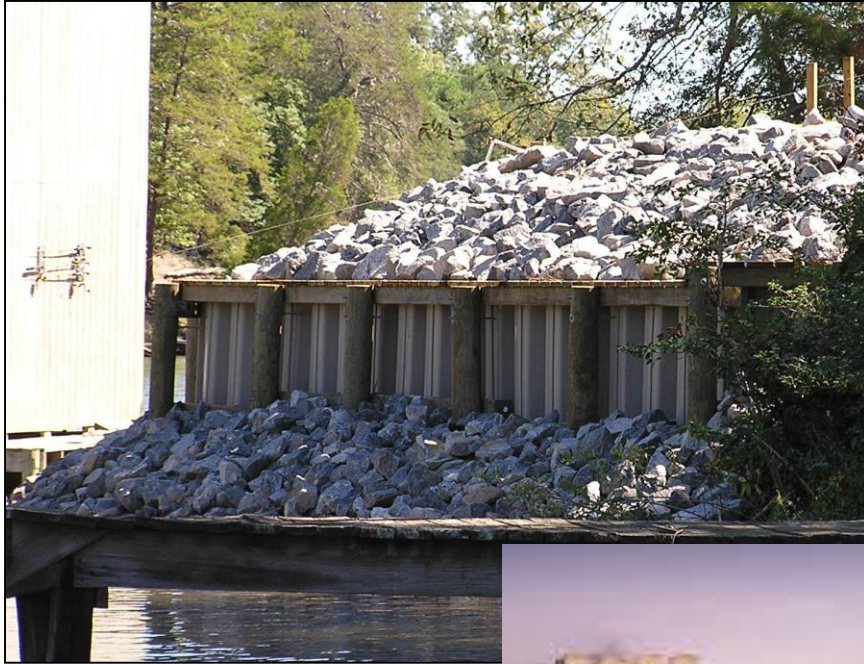


Rip-rap or Revetment



Wooden Bulkhead

Excessive ??



Misguided
efforts to
replicate the
Great Wall of
China!!!

Problems Associated with “Structural” Approach



Shoreline Erosion Rates in Maryland



Rate of change	Shoreline Length	
	Miles	%
Accretion	2,006	30
No Change	75	1
Slight erosion 0 to -2 feet/year	3,740	56
Low erosion -2 to -4 feet/year	618	9
Moderate erosion -4 to -8 feet/year	173	3
High erosion Over -8 feet/year	48	1
Total	6,659	100

87% of Maryland's shoreline experience "slight" to no erosion

Why Living Shorelines?

- Shoreline Protection
- Habitat
- Aesthetics
- Coastal Resilience



What Kind of Living Shoreline Project is the Best?



• One size **DOES NOT** fit all!!



- Energy Regime
- Project Objective(s)
- Site Conditions

2. Maryland's Share of Severe Storms



Name	Year	Surge above MLW (ft)
Chesapeake- Potomac Hurricane	August 23, 1933	7.3
Connie	August 13, 1955	6.0
Ash Wednesday Storm	March 8, 1962	3.6
TS Isabel	September 18, 2003	8.0

TS Isabel

- Isabel- major challenge to Maryland's capacity.
- Storm surge topped 8.0 feet above mean sea level.
- Some weak, insufficient or old shoreline protective devices did not survive.
- Nature-based projects survived unscathed.
- Most living shoreline projects survived without damage, blanketed by the surge of the storm.



Before Construction



CBEC LS Project



- Restored approx. 400 LF (linear feet) of shoreline to make it accessible to beach-nesting organisms.
- Created 600-foot oyster reef to provide fish and oyster habitat as well as serve as a break for wave energies.
- Created nearly 2 acres of tidal wetlands.
- Built “living breakwater” structures to protect the shoreline.
- Oyster reef located 600 ft from shore and is 600 ft long running parallel to the land.

After Construction



After Planting



After 3 years



Shoreline Conservation Service: 1968-2021

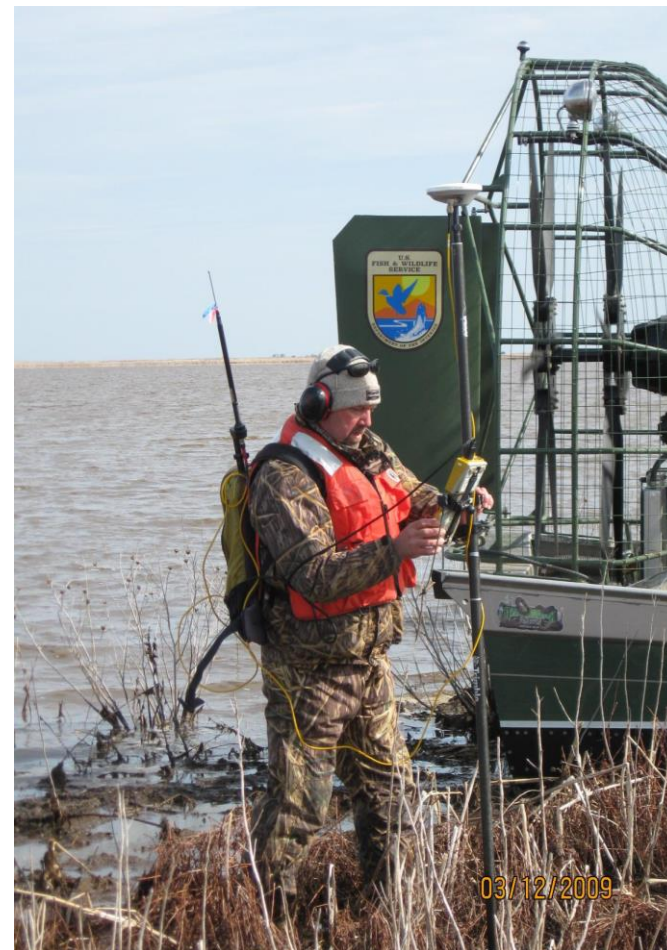


Items	Structural Projects	Living Shoreline Projects
# of Projects	484	485
LF of shoreline protected	201,649	203,550
Sq ft of marsh created	12,412	3,934,855
Amount of State loans	\$31,511,944	\$3,990,381

Assessment of Living Shorelines in MD



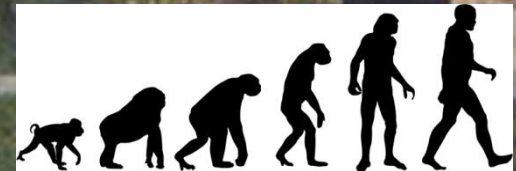
- Out of 177 projects, **131** of them were good or better.
- Investing in natural features like **wetlands, forest buffers, dunes, and living shorelines.**
- With natural buffers in place, communities will be better able to bounce back following climate-related events.



Evolution of Living Shorelines



High-profile sills with no gaps

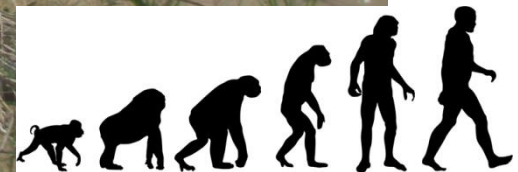


Fiber Glass Boat Analogy:

“Less is More”



Evolution of Living Shorelines



NextGen Project: Crucial Next Step in the Evolution of LS Projects



Conquest Preserve Living Shoreline Project



Before...

Completed: August 24, 2016

Cost: \$271,473

Cost/Linear feet: \$232

After



3. Legislation Supporting LS



- Shore Erosion Control Program- established in 1968 Maryland's General Assembly.

- The Program provides technical and financial assistance to waterfront property owners who experience erosion.

- Living Shoreline projects- **preferred**, but structural projects are used in areas with high rates of erosion.

- Technical assistance is provided through site evaluations, problem assessments and recommended solutions.



Shore Erosion Control Law: 1968

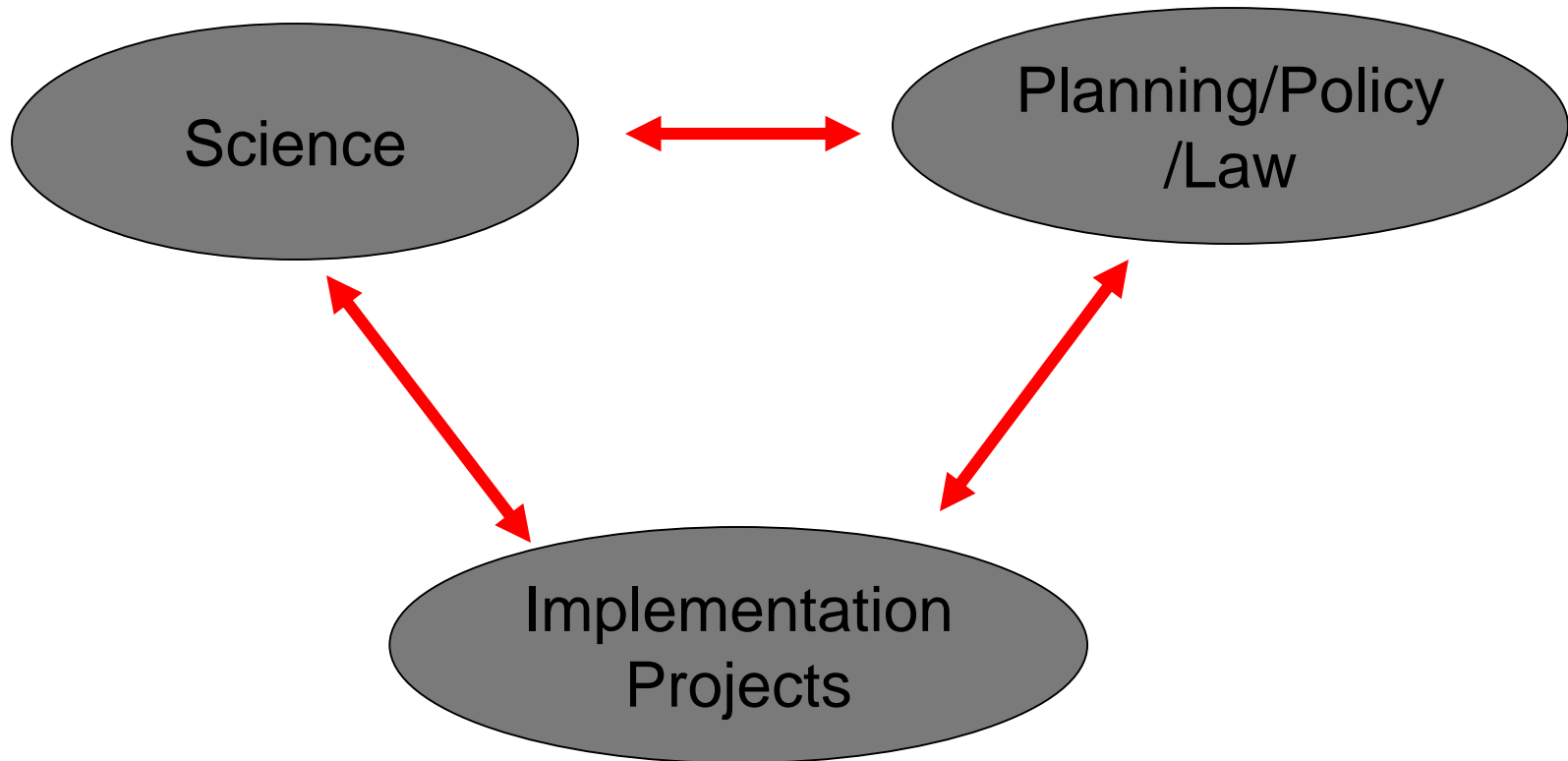
Living Shorelines Protection Act of 2008



- Bill passed into Law October 2008; regulations implemented in February 2013.
- Previously, Living Shorelines were “recommended” but not required.
- The law provides the regulatory agency with a strong foundation to promote alternate shoreline erosion control measures.
- The Law clearly states: “Improvements to protect a person’s property against erosion shall consist of non-structural shoreline stabilization measures (i.e. living shorelines) except where the person can demonstrate such measures are not feasible, or where mapping indicates areas that have been deemed appropriate for structural shoreline stabilization measures”.



MD-DNR's Coastal Adaptation Policy



Confluence of Science, Policy, Planning & Implementation!!



CHAPTER FIVE

Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change

Phase I: Sea-level rise and coastal storms



REPORT OF THE MARYLAND COMMISSION ON CLIMATE CHANGE
ADAPTATION AND RESPONSE WORKING GROUP

Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change

Phase II: Building societal, economic, and ecological resilience

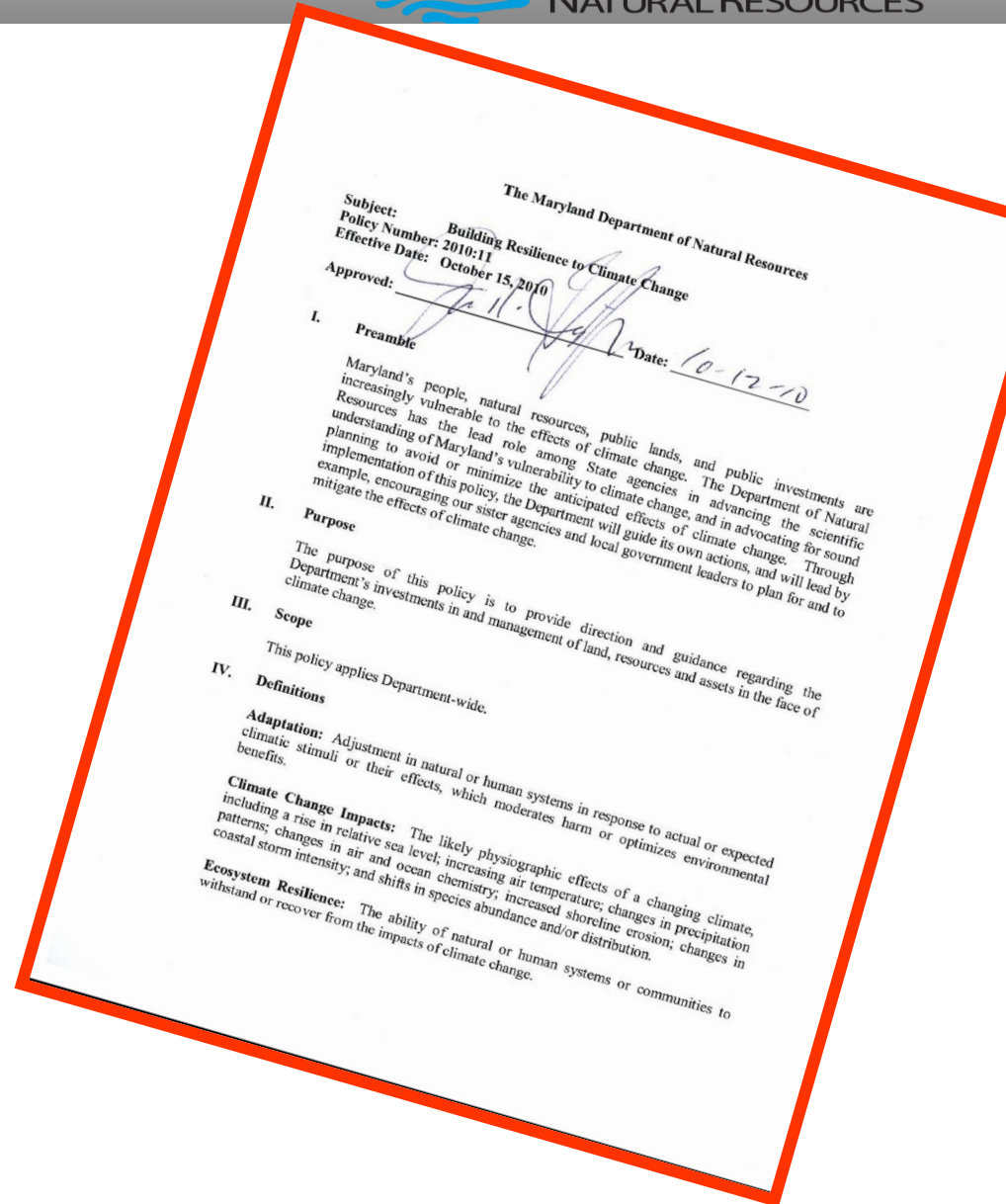


REPORT OF THE MARYLAND COMMISSION ON CLIMATE CHANGE
ADAPTATION AND RESPONSE AND SCIENTIFIC AND TECHNICAL WORKING GROUPS

Building Resilience to Climate Change: Investing in Nature



- Enhance the resilience of bay, aquatic and terrestrial ecosystems and/or increase on-site carbon sequestration.
- Incorporate factors associated with climate change in all phases of project.
- Compile a compendium (shortlist) of BMPs for habitat restoration project design.
- Conduct a GIS-based audit of DNR-owned lands to identify habitat restoration potential for enhancing ecosystem resilience and/or increasing carbon sequestration.



Confluence of Science, Policy, Planning & Implementation!!



SHORE PROTECTION

A Guide for Engineers and Marine Contractors
Working in the Chesapeake Bay Region



2013



U.S. Army Corps of Engineers
Maryland Department of Natural Resources

This information is presented as a public service. Inclusion of any shore protection device or method does not necessarily constitute a government recommendation or endorsement, nor is it guaranteed that any particular method will be successful for a specific application.

CCS HABITAT RESTORATION AND CONSERVATION DIVISION:
BUILDING RESILIENCE THROUGH HABITAT RESTORATION



Bay marsh meets Nor'easter. Photo courtesy of Chris Bason, Center for the Inland Bays.

Maryland Department of Natural Resources
Chesapeake and Coastal Service

October 2014

DISCLAIMER: This white paper is a guidance document for restoration planning, implementation, and project management within Maryland Department of Natural Resources' Chesapeake and Coastal Service. As such, it is a living document which will grow and change with advancing science and restoration techniques.

Building resiliency through restoration... was born!!

Components of RtR

Targeting using Coastal Resiliency Assessment

- Identify vulnerable coastal communities
- Identify locations where nature can help reduce risk

Community Resiliency Grant Program

- Technical and financial assistance
- Protect residents, economies, infrastructure and public resources.

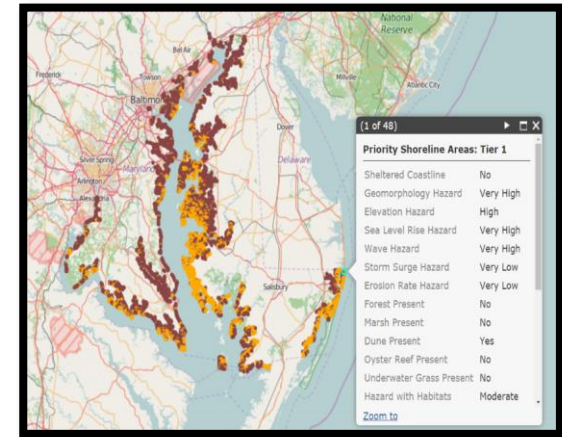
Innovative Climate-Resilient Designs

- Tidally influenced sites (SLR, marsh migration, storm surge, etc.)
- Non-tidal/inland sites (Precipitation, streamwater flow, etc.)

Monitoring for Maintenance & Adaptive Management

- Identify physical, chemical and biological metrics
- Improve design with changing conditions

Outreach, Communication & Education



4. Financing Options in MD



Program	Organization	Contact Information
Shoreline Conservation Service	Maryland Department of Natural Resources (DNR)	Chesapeake and Coastal Service/ Shoreline Conservation Service Phone: (443) 454-1638 Website: https://dnr.maryland.gov/ccs/Pages/livingshorelines.aspx
Resiliency Through Restoration		Chesapeake and Coastal Service Phone: (410) 260-8726 Website: https://dnr.maryland.gov/ccs/Pages/funding/grantsgateway.aspx
Maryland Linked Deposit	Maryland Department of the Environment	Maryland Water Quality Financing Administration Phone: (410) 537-3119 Website: https://mde.maryland.gov/programs/water/wqfa/pages/linked_deposit.aspx
Restoration and Science	Chesapeake Bay Trust	Chesapeake Bay Trust Phone: (410) 974-2941 Website: https://cbtrust.org/grants
National Coastal Resilience Fund	National Fish and Wildlife Foundation	National Fish and Wildlife Foundation Phone: (202) 857-0166 Website: https://www.nfwf.org/programs/national-coastal-resilience-fund
Resilient Communities Program		Website: https://www.nfwf.org/programs/resilient-communities-program

Shoreline Conservation Service Loan Program



MARYLAND DEPARTMENT OF NATURAL RESOURCES
ECOSYSTEM RESTORATION SERVICES
SHORELINE CONSERVATION AND MANAGEMENT SERVICE
(410) 260-8523

FINANCIAL ASSISTANCE FOR SHORE EROSION CONTROL PROJECTS*

TYPE OF PROJECT	TYPE I	TYPE II	TYPE III
TYPE OF FUNDS USED	STATE	STATE	STATE
TYPE OF ASSISTANCE**	LOAN	LOAN	LOAN
LOAN INTEREST	0%	0%	0%
LOAN TERM	5 YEARS	15 YEARS	20 YEARS

Type I Projects: Marsh creation/protection using natural/living materials

Type II Projects: Marsh creation/protection with stone edging, stone sills and/or stone groins, with sand fill and marsh plantings

Type III Projects: Marsh creation/protection with stone breakwaters, with sand fill & marsh plantings

APPLICANT	EXTENT OF ASSISTANCE****		
COMMUNITY ASSOCIATIONS/NON-PROFIT ORGANIZATIONS/SERVICE ORGANIZATIONS	75% NTE \$20,000	100%	100%
MUNICIPALITY - PUBLIC LANDS	75% NTE \$20,000	100%	100%
MUNICIPALITY - SPONSORING PRIVATE OWNERS/BUSINESSES	75% NTE \$20,000	LOAN FORMULA ***	LOAN FORMULA ***
COUNTY - PUBLIC LANDS	75% NTE \$20,000	100%	100%
COUNTY - SPONSORING PRIVATE OWNERS/BUSINESSES	75% NTE \$20,000	LOAN FORMULA ***	LOAN FORMULA ***
COUNTY - SPONSORING COMMUNITIES/NON-PROFIT ORGANIZATIONS/SERVICE ORGANIZATIONS	75% NTE \$20,000	100%	100%

* Financial Assistance provided based on project priority and availability of funds

** Matching grants are not available

*** Loan Formula as established in Natural Resources Article, Section 8-1005 of the Annotated Code of Maryland

Loan Formula:

Project cost	\$0 to \$60,000	100% loan	\$60,000 loan	\$0 Property owner's cash
Next	\$20,000	50/50%	\$10,000	\$10,000
Next	\$20,000	25/75%	\$ 5,000	\$15,000
Above	\$100,000	10/90%		

No financial assistance provided for structural/barrier type projects

5. Federal Support



- State CZM Programs have effectively tackled the country's most pressing and emergent coastal issues for nearly 50 years.
- Support the congressionally recognized priority-effective management, beneficial use, protection, and development of the nation's coastal zone.
- Healthy coastal resources = support economic drivers and conservation
- In FY 2022, the CZM Programs will build on efforts to enhance the preparedness and resiliency of coastal communities and their capacity to mitigate the impacts of coastal hazards.



- Coastal communities are facing steadily increasing coastal hazards
- Coastal Management Grants enable states to:
 - increase their efforts to effectively prepare for,
 - mitigate impacts of, and
 - quickly recover from these hazards.

- States do this through priority investments in:
 - **Supporting technical assistance, planning, and implementation** necessary to strengthen coastal hazard preparedness, mitigation, and recovery capacity of communities, and
 - **Planning, assessment, design, and implementation of resilient coastal infrastructure**, including both natural (green) infrastructure and hard (grey) infrastructure"
 - In the wake of COVID-19 recovery, these types of resilient projects help to ensure **safe public access to coastal areas** and invest in coastal infrastructure habitat restoration projects which **drive local job creation**

6. Blue Carbon

- ❑ Carbon storage and sequestration in the estuarine or marine environment
 - Coastal wetlands
 - Submerged Aquatic Vegetation (sea grasses)

- ❑ Blue carbon is complicated
 - Highly variable rates of sequestration
 - Must account for changing rates of accretion and possible loss due to sea level rise/erosion
 - Must account for methane emissions



Blue Carbon



- ❑ Blue Carbon Initiative with UMCES, Restore America's Estuaries and COMPASS
 - Identify research needs
 - Highlight ongoing work
 - Identify co-benefits- flood prevention, nitrogen processing, wildlife habitat, etc.
 - Clarify how blue carbon fits into Maryland GHG reduction plan (currently a minor piece)

- ❑ US Climate Alliance Blue Carbon Modelling Project
 - Led by Duke University
 - Partnership of MD, NC, VA, DE, NJ, NY
 - Models impact of wetland change out to 2120 on blue carbon in coastal wetlands
 - Preliminary results show a wide range of outcomes dependent on emissions scenario but significant loss of blue carbon is likely by 2075

Blue Carbon in 2030 Maryland Greenhouse Gas Reduction Act

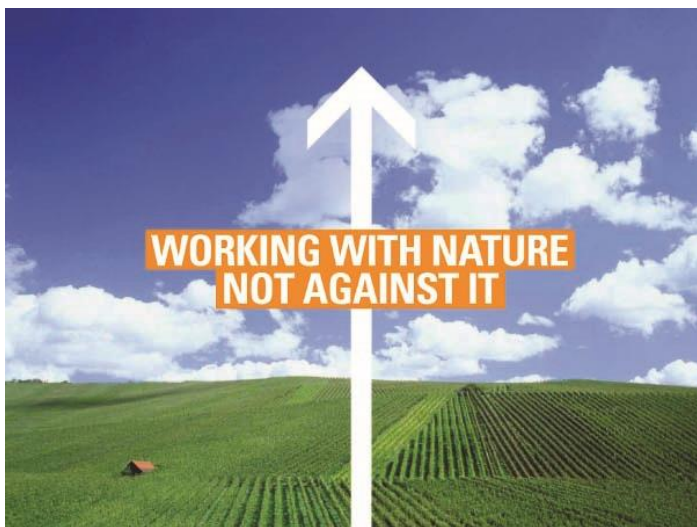


Funding Source	Coastal Wetland Acres Restored 2006-2020	Carbon Sequestration MT CO ₂ e per year	Estimate for additional acres by 2030
Coastal Wetland Initiative	505.6	1,095.3	500
DNR Trust Fund	3.8	8.2	0
Federal Partners	2096.9	4,542.8	2,500
Total	2,606.3	5,646.4	3,000
Estimate of Annual Carbon Sequestration in 2030=		11,062.5	We use RAE/Verra default carbon sequestration rate for created coastal wetlands- 2.16 MT CO ₂ e/ac/yr

Blue Carbon a minor piece of the over 25 million MT of CO₂ reductions needed by 2030 to meet 50% GHG reduction goal...

...but comes with significant co-benefits

Take-Home Message



<http://dnr.maryland.gov/ccs/Pages/livingshorelines.aspx>



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