Marsh Restoration Using Dredged Material for Coastal Resilience

UCONN | COLLEGE OF LIBERAL ARTS AND SCIENCES
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Why restore wetlands to protect our coasts?

What's wrong with traditional coastal protections?

Shorelines have traditionally been protected against natural processes such as coastal erosion and storm surge through the construction of seawalls, bulkheads, groins and revetments. While these structures provide varying degrees of protection to upland property, they have been shown to cause unintended consequences such as increased coastal erosion and loss of habitat for shore birds and important commercial and recreational fish species.

In some areas, over 50% of the shoreline is protected with manmade structures. Hardened coastal protection may lead property owners or even entire communities into a false sense of protection from storm surge and wave action, resulting in devastating consequences in the event of structure failure.

Increasing understanding of the adverse impacts of hard structures has resulted in the development of shoreline stabilization approaches that preserve coastal habitats, or at least minimize the destructive effects of traditional shoreline protection.

Tidal Wetlands Living Shorelines for Coastal Resilience

Tidal marshes increase coastal resilience by providing a number of ecosystem services:

Regulating Services:
- Mitigate the impact of storm surges and associated erosion from wind waves
- Reduce impact of flooding by storing water and conveying surface water runoff
- Improve water quality through groundwater filtration of nutrients and toxins in surface runoff

Cultural Services:
- Provide psychological, cultural, and health benefits to local residents
- Reduce urban heat island effect and improve air quality
- Reduce stress and improve physical and mental health
- Enhance social cohesion by providing gathering space, increasing social trust
- Increase aesthetic value by enhancing appearance of the shoreline
- Improve shoreline access
- provide opportunities for recreation

Supporting Services:
- One of the most productive ecosystems in the world, and provide critical ecological functions and
- Provide critical year round habitat for economically and ecologically important fish, shellfish, shorebirds and other wildlife and marine plants Provide nursery habitat for aquatic species
- Rest stops for migrating birds
- Improves biodiversity, which makes ecosystem resilient to change.

Provisioning Services:
- Source of food, fiber, and fuel

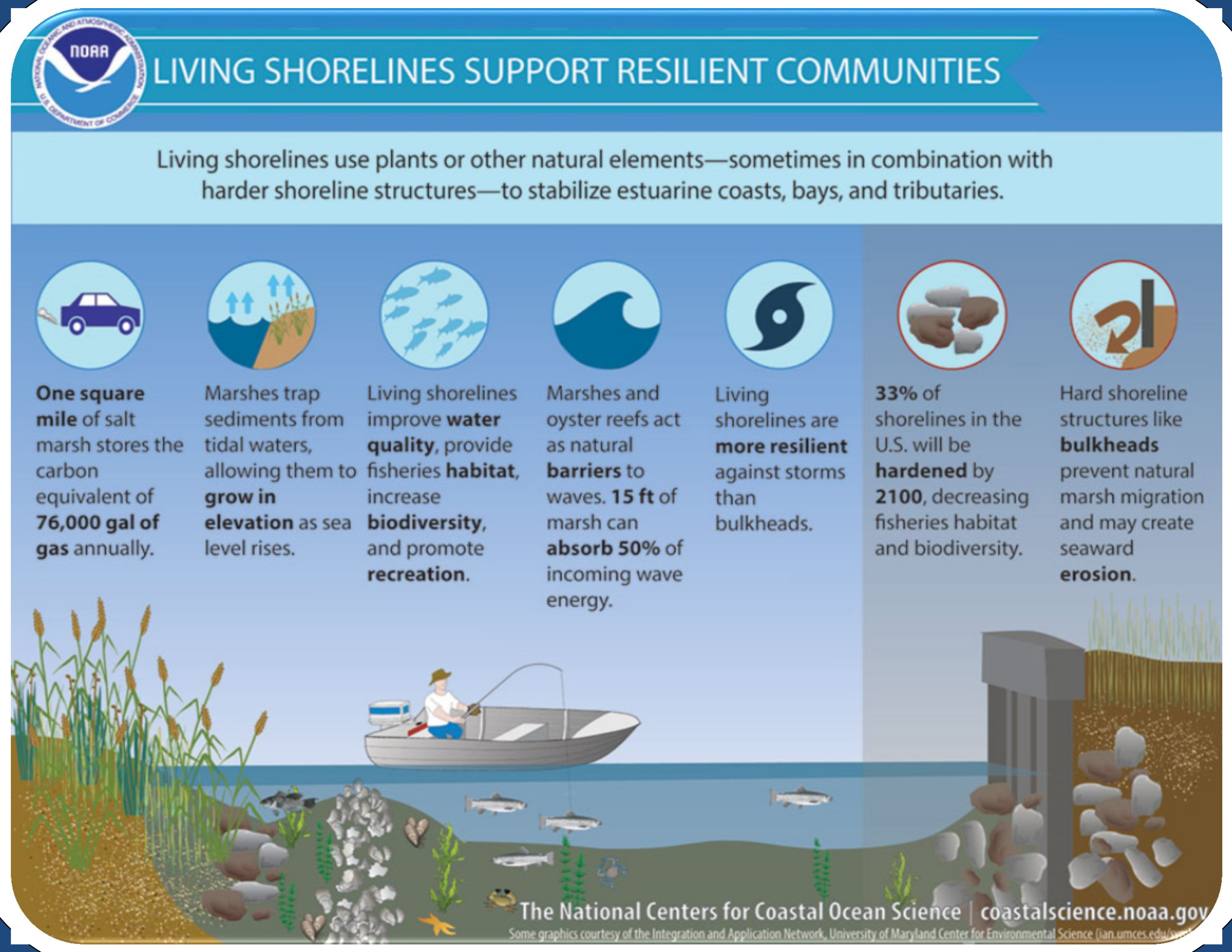
Value of Tidal Wetlands: $9k-$79k/acre with storm protection estimated at around $13k /acre

Benefits of Coastal Wetlands Living Shorelines

Traditional coastal structures are most effective on completion.

- Lower initial and maintenance costs
- Even narrow fringe marsh provides protection from waves
- Living shorelines increase protective function with time

Even narrow fringe marsh provides protection from waves



https://oceanservice.noaa.gov/facts/living-shoreline.html

Beneficial Use of Dredged Material to Restore Tidal Wetlands

https://circa.uconn.edu/wp-content/uploads/sites/1618/2017/08/Brian-Thompson_September-28-2017.pdf

Is objective a dredging project seeking site for disposal or marsh restoration project seeking sediment source?
Distinction greatly impacts remainder of design project but in either case, choice of alternatives may be limited and less than optimum.

Need to View Dredged Material as a Resource
Bring together challenges of dredged material management and deteriorating tidal wetlands to create opportunities

Challenges of using dredged material

Motivations
- dredge disposal option
- shoreline stability
- nutrient management
- carbon storage
- habitat, endangered species
- food webs / fin/shellfish

Technical Challenges
- clean dredge, how clean is clean?, grain size
- siting, wave energy, habitat conversion
- competing management agendas (SAV, shellfish, etc.)
- post restoration maintenance, leaching, mortality
- quantifying 'success' / meeting restoration goal

Social Challenges
- the stigma of dredge
- perceived mosquito-borne illness
- NIMBY, exacerbated by high population density
- historical disconnection from coastal wetlands

The success of beneficial use of dredged material for tidal wetlands restoration or creation to increase coastal resilience is likely not a physical science or engineering issue - it hinges on making the case that this is worth doing to an often skeptical public.

Site Selection Criteria

Logistical Considerations	• **Availability for marsh restoration/creation** • **Dredging volume versus beneficial use requirements** • **Jurisdiction concerns** • **Proximity to dredging area** • **Site accessibility** • **Equipment compatibility**	• **Scheduling of dredging operations with marsh construction** • **Public acceptability** • **Costs** • **Presence of cultural or archeological resources** • **Material rehandling requirements**
Physical Considerations	• Topography: tide elevation determines suitable plant species • Shape and orientation of shoreline • Wave climate, currents, boat wakes and storm surge: susceptibility to erosion and potential necessity of protective structures • Hydrology (i.e., circulation and sedimentation)	• Salinity: influences plant species composition • Slope, tidal range and water depth: affect size of intertidal zone, suitable plant species, drainage and susceptibility to erosion
Environmental Impact on Existing Habitat	• Potential impacts on water quality • Presence of contaminants at the site • Relative value of existing and proposed habitats	• Presence of domestic or wildlife animals, and foot or vehicular traffic
Geotechnical Considerations	• Existing soil chemical properties • Soil physical properties: sediment type and characteristics, and potential for consolidation and instability	• Sediment supply and littoral drift • Foundation characteristics: site's ability to support construction activities or structures
Habitat Development Potential	• feasibility and level of effort to create or restore sustainable marsh	

Design Criteria

Location ♦ Orientation and Shape ♦
Size ♦ Configuration ♦ Elevation ♦
Protection ♦ Retention

Biological Criteria	Hydrologic	Criteria	Geotechnical Criteria
•Water depth •Inundation frequency •Nutrient requirements •Shoreline slope	•Hydrologic setting •Flooding duration & timing •Hydraulic retention time •Flow resistance	•Storage capacity •Surface area •Wave conditions •Flooding depth •Flow velocities	•Geologic setting •Geomorphic setting •Wetland form & size •Soil characteristics •Hydrogeologic processes •Geomorphic processes •Geomorphic trends

10 Policy Recommendations

1. Dredged material to increase marsh resilience should not be considered as fill
2. If appropriate, projects should be done as a wetlands restoration with co-benefits of flood and erosion control
3. Wetlands creation should be permitted as living shoreline for floodplain management
4. Habitat tradeoffs should be balanced against flood and erosion control benefits
5. Water Quality Standards should include flood and erosion control/mitigation and sea level rise resiliency as benefits
6. Create criteria for testing and beneficial use of dredged materials
7. The CT Water Quality Certificate should not further limit the size of projects with minimal environmental impacts under the Programmatic General Permit
8. Economic and social co-benefits should be evaluated when considering cost-effectiveness and permitting.
9. Community engagement should be required at all stages of a project.
10. Project monitoring should be required to improved flood and erosion control and water quality improvement are verified.

Blackwater National Wildlife Refuge – Dredge America

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