Considerations for Designing Resilient Living Shorelines

Molly Mitchell
Donna Marie Bilkovic

Living Shorelines Tech Transfer Workshop, RAE
Beaufort, NC
Oct 2019
Sea level “report cards” for the US

Marshes are dynamic → resilient

To keep pace with sea level: a) Marshes migrate b) Marshes accrete

Controlled by:
- Plant production
- Sediment availability
- Sediment respiration

Δ Water Levels

Controlled by:
- SLR
- Land elevation

Δ CO₂
Δ Water Levels
Δ Temperature

Modified by human activities & decisions

Can living shorelines survive the rising seas?

https://appliedecologistsblog.com/2019/05/01/can-living-shorelines-survive-the-rising-seas/#comments
Can living shorelines survive the rising seas?

https://appliedecologistsblog.com/2019/05/01/can-living-shorelines-survive-the-rising-seas/#comments
Migration Prospects in Chesapeake Bay

- **Low** – marsh projected to decline over time due to typically high elevations in the surrounding lands
- **Medium** – opportunities for marsh migration are limited by development
- **Best** – Best likelihood for marsh migration

Conservation priorities for promoting marsh migration “DNH_marsh_conservation_2050” shapefile. Developed by Center for Coastal Resources Management, Virginia Institute of Marine Science. Nov 2018. Contact M. Mitchell (molly@vims.edu) or J. Herman (herman@vims.edu).
Migration potential in living shoreline design

- Focus planting in the upper elevations of the tidal range
  - *Dubois, K. 2017. Overcoming barriers of Living Shoreline Use and Success*

- Preserve riparian land where elevations are suitable for marsh migration
- Don’t mow!
Accretion potential, also affected by siting

- Sediment supply coming from
  - Plants (organic)
  - Watershed
  - Adjacent lands (via runoff or tidal waters)
  - Marsh front edge erosion

- Current CB management goals are to restrict sediment in waters

Enhancing accretion in living shoreline design

Marsh plant stem density, stem height, and aboveground biomass influence the marsh’s ability to trap sediments and attenuate wave energy

- Marsh-sill low marsh stem counts lower than natural fringing marshes; high marsh similar
- No evident trajectory across age of marsh sampled (1-11 yrs)

Bilkovic and Mitchell, 2017
Enhancing accretion in living shoreline design

Living sills add a dynamic component to wave energy attenuation

- Growth on structures reduces wave transmission as oysters grow
- Sills increase in height, width and density over time
When natural dynamic components are compromised...

Thin layer deposition artificially maintains elevations in the tidal frame

- Considered a beneficial use of dredge material and might help marshes stay within the tidal frame
- Might improve grass density leading to increased accretion
- Need more evidence of long-term usefulness
Dynamic designs are the path to resilience

- **Site**
  - allow for landward marsh migration with rising sea levels
  - don’t mow the marsh as it migrates

- **Enhance**
  - use sills (rock or oyster) *with windows* to encourage sediment accretion
  - encourage tall, dense plant growth
  - encourage mussel/oyster growth on marsh and sills

- **Maintain**
  - when marshes can’t migrate, and natural sediment supply is low, add thin layers of sediment to maintain elevations
  - remove invasive species

- **Communicate** — property owners need to know that living shorelines aren’t static
Thank you!
molly@vims.edu