

Dynamic Living Shoreline Designs for Sea Level Rise

Donna Marie Bilkovic, Molly Mitchell, Pam Mason, Robert Isdell

Center for Coastal Resources Management
Virginia Institute of Marine Science
College of William & Mary, USA

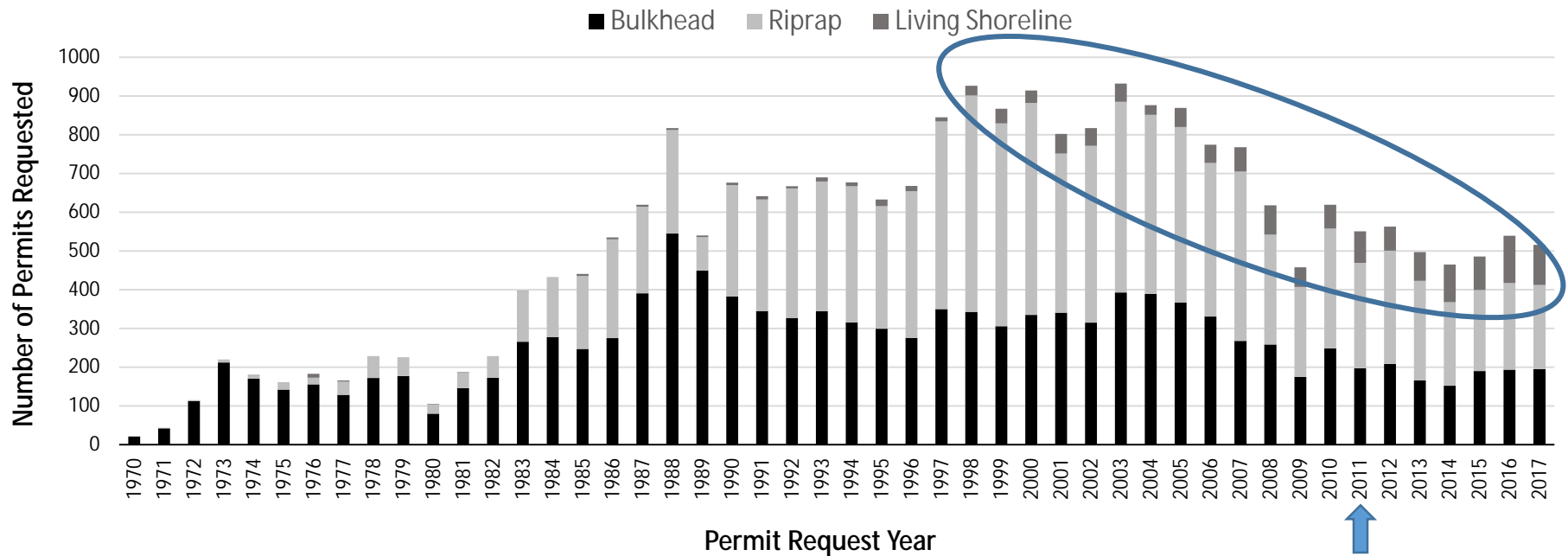


*donnab@vims.edu
<http://ccrm.vims.edu>

Living shorelines over time



Temporal Changes in Shoreline Permit Requests

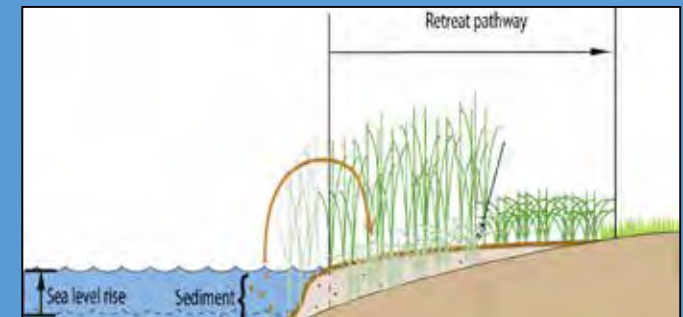


VA LS Act

Enhancing living shoreline long-term resilience

Pathways to Long term resilience

- **Siting** – areas with retreat opportunities likely to have enhanced longevity under sea level rise
- **Allow Dynamic Designs** that take advantage of natural processes that enhance sediment accretion, marsh surface elevation, marsh stability and adaptability
- **Maintenance** – for settings that need a boost – e.g.. raise elevations with sediment deposits



Mitchell & Bilkovic, J. Applied Ecology, 2019



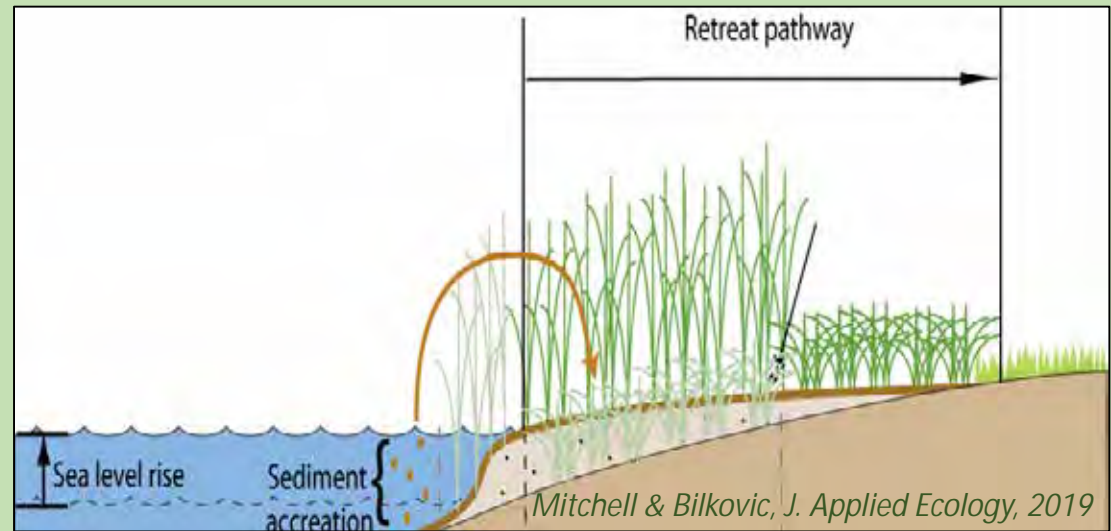
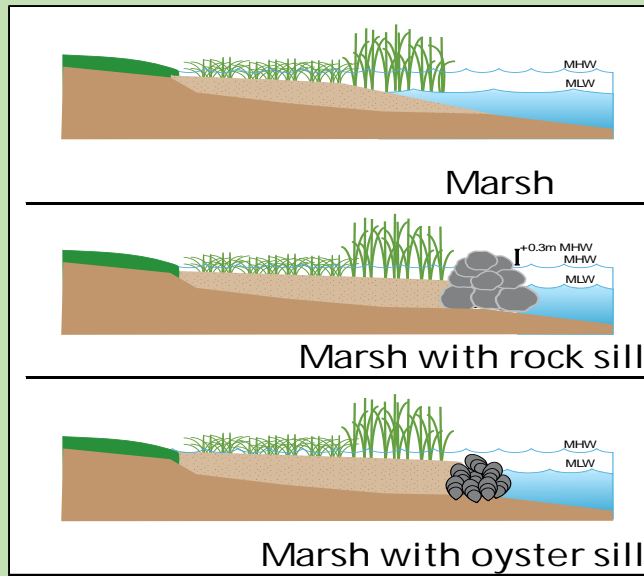
Siting – retreat potential



Retreat potential

- About 70% of VA shorelines may require some shoreline protection (11,000 km)
- A living shoreline is suitable on 86% of those shorelines
- With expected SLR by 2050, **14% of those living shorelines may not be able to retreat.**
 - 2% with impervious surface barriers
 - 2% with agriculture barriers
 - 10% will intersect turf/grass (yards, parks, golf courses)

Allow Dynamic Designs



- Design projects for marsh productivity and sediment retention
- Allow plants to move and settle into the optimal tide elevations – *this will enhance sediment capture (horizontally and vertically)*
- Encourage plant growth – *Tall, dense canopies reduce more wave energy (and capture more sediment)*
- Allow movement landward with rising seas (*don't mow!*)
- Encourage the settlement of marsh mussels on *Spartina* – *enhance sediment capture and marsh stability*



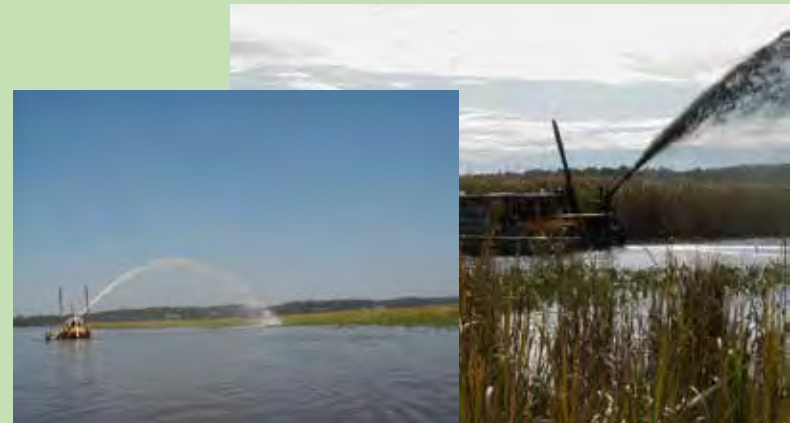
Plan for Maintenance

Some settings are likely to need assistance

- Extreme sea level rise
- Low natural sediment input
- Vegetation stress: exposed to invasive plants or high rates of herbivory

Options include

- Periodic sediment addition, thin-layer spray dredging
- Continued invasive removal
- A maintenance plan with contractors so costs are understood up front



Priority next steps

- **Identify areas with high long term resilience potential** to help prioritize restoration activities (e.g. areas with sediment sources for marsh maintenance, retreat potential)
- **Promotion and branding** should encourage the acceptance of the dynamic nature of living shorelines for maximum benefits and longevity
- **Continued research on project designs** that may enhance longevity and minimize maintenance costs

Resources & ongoing efforts about shorelines

New publications:

- [The application of oyster reefs in shoreline protection: are we over-engineering for an ecosystem engineer?](#) (Morris et al. 2019, *Journal of Applied Ecology*, open access)
- [Embracing dynamic design for climate-resilient living shorelines](#) (Mitchell & Bilkovic 2019, *Journal of Applied Ecology*, open access)
- [Living Shorelines: The Science and Management of Nature-based Coastal Protection](#) (book) compiles, synthesizes and interprets the current state of the knowledge on the science and practice of nature-based shoreline protection.
- [Review of boat wake wave impacts on shoreline erosion and potential solutions for the Chesapeake Bay](#). *STAC Publication Number 17-002*, Edgewater, MD. 68 pp. (see poster)



Resources & ongoing efforts about shorelines

Ongoing efforts:

- [AdaptVA.org web portal](#): Continuously updated web portal to convey risk & adaptation solutions for all VA coastal communities
- [Natural & nature-based features to build resilience](#): Assessment of the flood resilience benefits of NNBFs. We are working with our project partners to identify criteria for NNBF co-benefit values in three areas: stormwater, TMDLs and CRS credits
- [Sustainability in Chesapeake Bay shorescapes](#): Quantifying how natural factors, socioeconomic conditions, and public policies interact to drive marsh evolution and shoreline management decisions
- [Fish and shorelines](#): Assessing the effects of shorescape development on forage fish production in the York River
- [Response of marshes to sea level rise](#): Projecting marsh change with a Tidal Marsh Migration model
- [Sea Level Rise Report Cards](#): Annually updated analysis of trends in tide gauge records throughout the coastal US
- [Impact of sea level rise on septic failures](#): Predicting septic failures along coastal zones
- [Road network flooding](#): Spatially predicting the influence of road flooding on coastal community access
- [Shoreline Management BMP credits \(Ches Bay Program\)](#): establishes nutrient and sediment reduction values for shoreline practices

Questions?