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Abstract

As a result of global climate change, sea level has risen and will continue to rise throughout the 21st century. Sea level rise has been higher in Virginia than any other state over the past 100 years (US Climate Change Science Program 2009). Varied projections show that sea level could rise 1.2 to 5.5 feet above 1992 levels by 2100 (Boon et al. 2010; Ezer and Corlette 2012; Sallenger et al. 2012). Sea level rise threatens to drown intertidal wetlands (Craft et al. 2009; FitzGerald et al. 2010; Kirwan and Guntenspergen 2010; Menon et al. 2010). Wetlands are key biodiversity hotspots and provide a number of ecosystem services (Barbier et al. 2011). Wetlands have the ability to adapt to sea level rise by migrating inland as long as shoreline hardening, such as a bulkhead, is absent (Kirwan and Megonigal 2013). In Virginia, private landowners must be granted a permit by local citizen wetlands boards to alter or harden their shoreline. Although wetlands boards have been given sufficient guidance by government agencies, they have mostly failed to achieve Virginia's goal of preserving wetlands (VIMS 2012). If this practice continues, Virginia can expect a significant loss of wetlands, biodiversity and ecosystem services. To avoid losing wetlands, this paper proposes two changes to Virginia's current permit process. First, landowners should be required to consult with a Virginia Institute of Marine Science scientist to better understand the environmental impacts of and alternatives to shoreline hardening before submitting an application. Second, permit decisions should move from local wetlands boards to the Virginia Marine Resources Commission. These recommendations would serve to significantly limit future shoreline hardening and preserve wetlands and their associated biodiversity in the face of climate change.

Wetlands Threatened by Shoreline Hardening

- Measured sea level rise, caused by rising sea level and ground subsidence, has been higher in Virginia than any other state over the past 100 years, rising at a rate of 1.44 feet per century (US Climate Change Science Program 2009).
- Projections in Virginia vary from 1.2 to 5.5 feet above 1992 levels by 2100 (Boon et al. 2010; Ezer and Corlette 2012; Sallenger et al. 2012). Sea level rise is expected to cause a number of negative impacts for humans and ecosystems in coastal areas.
- Climate change and an increase in extreme weather events will likely be the strongest factors threatening tidal wetlands and their biodiversity (Craft et al. 2009; FitzGerald et al. 2008; Kirwan and Guntenspergen 2010; Menon et al. 2010).
- Coastal wetlands are highly productive areas and are some of the most economically important ecosystems on Earth (Barbier et al. 2011; Kirwan and Megonigal 2013). Marshes provide a number of ecosystem services such as protecting coastal areas from storms, carbon sequestration, and serve as a nursery ground for many commercially important fish (Barbier et al. 2011).
- Wetlands are adversely affected as sea level rises because the water depth rises above the optimal level for wetlands, drowning them. However, wetlands are able to mitigate the impacts of sea level rise by migrating inland if shoreline hardening is absent (figure 1 and 2) (Kirwan and Megonigal 2013).
- Typically, landowners harden shoreline to protect property from storms and erosion or aesthetics.
- Before shoreline construction begins, landowners must complete a lengthy, Joint Permit Application (JPA) that must be approved in a public hearing by a local wetlands board.
- Wetlands boards should evaluate proposals based on evolving, extensive guidelines provided by the Center for Coastal Resources Management (CCRM) at the Virginia Institute for Marine Science (VIMS 2012).

Permitting System Ineffective at Preserving Wetlands

Wetlands boards have consistently failed to follow the technical guidelines and have approved a proliferation of shoreline hardening projects. From 2009-2011, over 1200 JPAs were submitted to wetlands boards. During this time over 99% of JPAs that complied with guidelines in some form were approved. Additionally, 89% of JPAs that did not comply with guidelines in any way were approved (VIMS 2012). Wetlands boards overwhelmingly approved JPAs regardless of their conformity to the technical guidance.

The presence of shoreline hardening will have a strong negative effect of the future existence of critical tidal wetlands. In Virginia, 39% of coastal land is well-developed and 22% is less developed. 32% of land is undeveloped and 7% of land is in conservation (Titus et al. 2009). Meanwhile, 11.1% or 739km of shoreline has been hardened out of 7134km and it is estimated that 29km of shoreline is hardened each year (Bilkovic et al. 2009).

Although a significant amount of wetlands have been already lost, there is still an opportunity to preserve wetlands in the future. With almost 89% of the shoreline not hardened and 32% of coastal land undeveloped, Virginia has an opportunity to limit a substantial portion of wetlands by limiting future shoreline hardening.



Figure 1: Bulkheads (a) and riprap (b) are common methods of shoreline hardening. Both methods stabilize shoreline erosion, but also limit inland migration and accretion of wetlands. Source: VIMS.

Recommended Changes to the Current Permitting Process

In order to limit shoreline hardening and conserve tidal wetlands and their biodiversity in the face of climate change, Virginia should make two changes to the JPA process. First, landowners and permit agents should be required to consult with a VIMS wetland scientist on the property before the permit is submitted in order to discuss all the viable options for shoreline alteration and associated impacts of each option. Second, local wetlands boards should no longer evaluate permit applications. Instead, permits should be evaluated by VMRC.

Together, the recommendations would make a strong impact on limiting the amount of shoreline hardening and preserving wetlands and their associated biodiversity in the face of climate change, but they are not mutually exclusive. Individually, each recommendation would make a significant move toward achieving this same goal and would help pave the way for future policy changes.

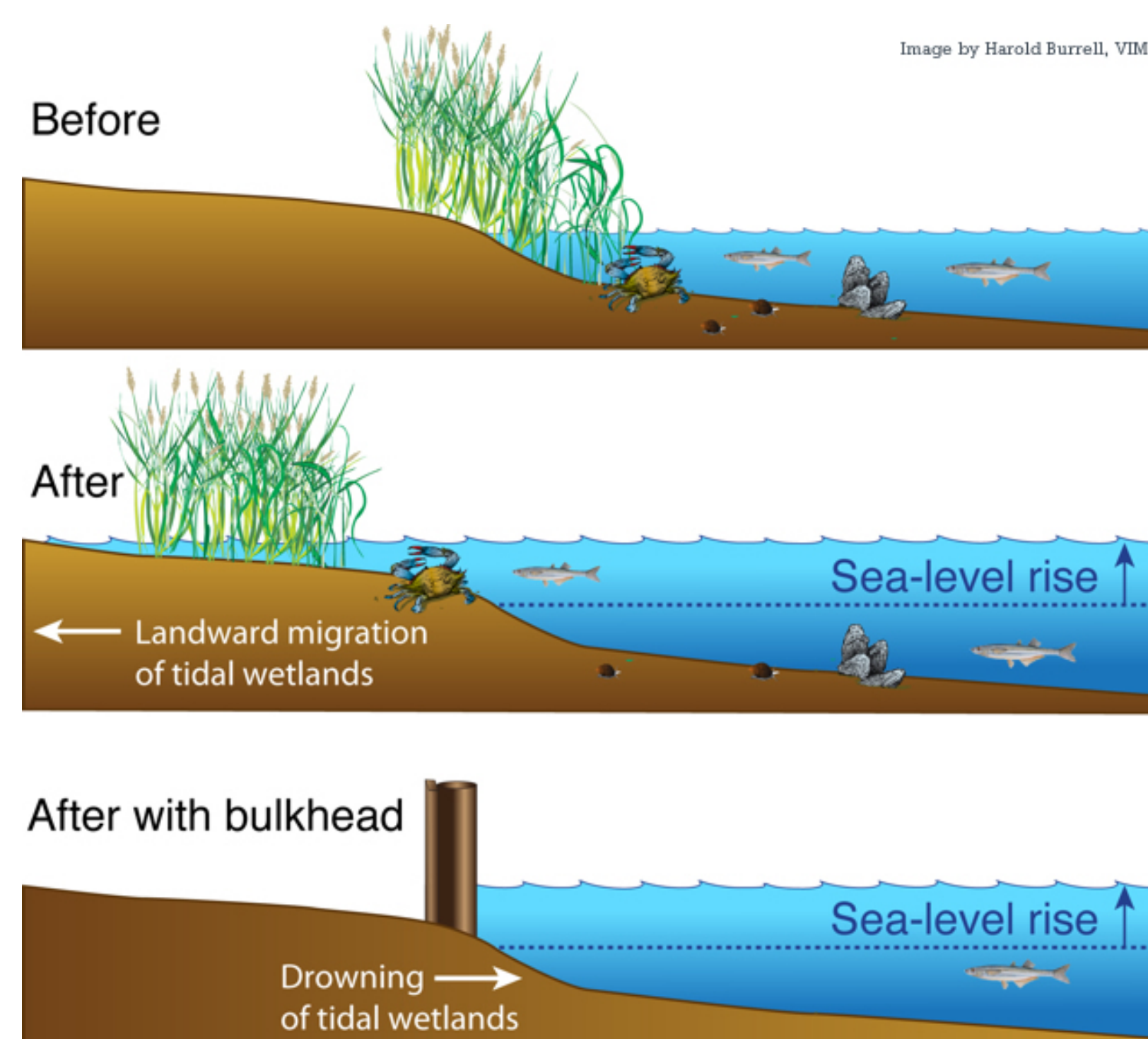


Figure 2: Shoreline hardening inhibits the landward migration of tidal wetlands, effectively drowning plants as sea level rises. Source: VIMS.



Figure 3: Living shorelines, created by planting marsh grasses slightly above mean high water, limit shoreline erosion and offer an alternative to bulkheads. Unlike bulkheads, living shorelines allow wetlands to migrate landward as sea level rises. Source: CCRM.

Requiring Landowners to Consult with VIMS

The JPA for shoreline alteration should require that landowners and agents consult with a VIMS official on the proposal site before the application is submitted. The goal of the consultation would be for the landowner to better understand the technical guidelines created by VIMS. The VIMS official would explain the guidelines and discuss all the viable options for shoreline stabilization at each site. Options would range from bulkheads and riprap to using vegetation and living shorelines (figure 3). VIMS officials would also discuss the environmental impacts of each option. The consultation would serve to educate landowners of the technical guidelines and all viable shoreline stabilization options and associated impacts. Requiring landowners to consult with a VIMS official would be effective at limiting shoreline hardening because:

- Currently, it appears that landowners do not generally understand the guidelines. From 2009-2011, 56% of JPAs did not meet the technical guidelines in any form (VIMS 2012).
- Through simply educating landowners, viable alternatives to shoreline hardening would be more widely utilized. In many cases, alternatives to traditional shoreline hardening exist, but only 10-14% of JPAs each year use alternatives to shoreline hardening (VIMS 2012). Alternatives include planting vegetation or marsh and building living shorelines (figure 3).
- Landowners and agents also often meet with contractors to survey their land and offer recommendations for erosion problems, but most contractors are not knowledgeable in installing vegetation or living shoreline. Landowners who hardened shorelines used contractors for advice more than any other source of information (CCRM 2013). By meeting with a VIMS official and a contractor, landowners will be informed of all construction options and the impacts of their decisions.

Moving Permit System from Wetlands Boards to VMRC

Local wetlands boards have appeared to show they are not appropriate groups to evaluate JPAs and they should be evaluated by VMRC instead. This would likely limit the number of permits granted because:

- VMRC has the technical knowledge to properly evaluate applications based on the technical guidance developed by VIMS. Wetlands boards are typically comprised of unpaid volunteers with varying levels of technical knowledge. The VMRC has staff dedicated to habitat management that could more effectively evaluate applications.
- As a state-level agency, VMRC is better able to understand the cumulative impacts of shoreline hardening compared to local wetlands boards. A state-level agency should evaluate permits because shoreline hardening has cumulative environmental impacts and may even be a breach of the Clean Water Act (Titus et al. 2009). Local wetlands boards often do not consider the cumulative impacts of shoreline hardening. Projects that impacted small amount of wetland were generally approved (VIMS 2012). If one agency reviewed all applications, they would be able to see the cumulative and significant impacts of over 500 applications per year and better balance the preservation and use of wetlands.
- VMRC would be able to make more impartial decisions because they are not intimately connected to applicants like wetlands boards are. Members of wetlands boards are community members and often have close ties with applicants. Wetlands boards frequently do not grant permits based on the technical guidelines (VIMS 2012). Having close relationships with applicants can cloud judgment in decision making. Being empathetic to neighbors, colleagues and friends is understandable and board members likely want to avoid conflict with close community members. VMRC lacks the close relationship with applicants and will be able to evaluate permits in a logical manner and follow the technical guidelines.

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