

WATERSHED SCIENCE BULLETIN



Journal of the Association of Watershed & Stormwater Professionals
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**Integrating Climate Change Science into
Watershed and Stormwater Management**

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This photo was taken along Young's Bay estuary in Astoria, OR. The Young's Bay estuary is a component of the Columbia River estuary, a nationally significant estuary in the northwest corner of Oregon that supports some of the largest anadromous fish runs in the world and provides unique habitat for sensitive and endangered species.



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Sea Level Rise Adaptation at the Local Government Level in Virginia

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Abstract

The tidal region of Virginia has the highest rate of sea level rise on the Atlantic Coast, threatening shoreline communities and the tidal ecosystem. Wetlands Watch has worked for nearly four years in this region to initiate local government sea level rise adaptation planning and to see those plans implemented through land use and other regulatory decisions. Early efforts, focused on protecting the tidal ecosystem from climate change impacts, produced insufficient responses. Current work, focused on protecting coastal communities and businesses from an increasing risk of storm surge inundation driven by sea level rise, have proven more effective. The goal of this shift is to use concerns about infrastructure and public safety to stimulate early adaptation work and insert shoreline ecosystem adaptation needs into the process once it has commenced. In the course of this work, Wetlands Watch has catalogued numerous existing, mandated planning efforts at the local and regional levels that serve as effective planning tools for climate change impacts. We are now developing these tools into a toolkit for local government policymakers.

Sea Level Rise Impacts in Virginia

Rates of relative sea level rise in Virginia are the highest along the Atlantic Coast, reaching 0.44 m (1.45 ft) over the last century at the Sewells Point tide gauge in Norfolk (Table 1; Williams et al. 2009). Future projections for rates of sea level rise in the Chesapeake Bay region (Pyke et al. 2008) show a significant increase, with the centennial rate predictions running from a minimum of 0.7 m (2.3 ft) to as much as 1.58 m (5.2 ft) in the coming century.

Table 1. Rates of relative sea level rise along the Atlantic Coast.

Tide Gauge Station	Rate of Sea Level Rise (mm year ⁻¹)
Portland, ME	2.12 ± 0.09
Boston, MA	2.65 ± 0.1
Providence, RI	2.57 ± 0.17
The Battery, NY	2.77 ± 0.05
Atlantic City, NJ	3.98 ± 0.11
Baltimore, MD	3.12 ± 0.16
Hampton Roads, VA	4.42 ± 0.16
Wilmington, NC	2.22 ± 0.25
Charleston, SC	3.28 ± 0.14
Miami, FL	2.39 ± 0.22

Source: Williams et al. 2009.

In the low-lying areas of Virginia's tidal region, these current and projected rates of sea level rise threaten natural ecosystems and developed areas alike. In the tidal ecosystem, the projected higher sea levels are expected to cause a range of impacts: a loss of primary coastal dunes to erosion; a loss of existing submerged aquatic vegetation (due to increased water depth, possible decreases in water clarity resulting from algal blooms and sediments, and increases in water temperature); and the inundation of vegetated wetlands in the intertidal zone (Pyke et al. 2008).

Tidal wetlands, if healthy and afforded adequate sediment, can accrete vertically and keep pace with the gradual rates of sea level rise observed over the last century. However, vegetated tidal wetland accretion rates, currently in the range of 3–4 mm year⁻¹ in the Chesapeake Bay (Stevenson et al. 1996) will probably not be sufficient to keep pace with the minimum predicted centennial rate of relative sea level rise of around 7 mm year⁻¹.

With rates of sea level rise higher than the ability of the coastal ecosystem to adapt *in situ*, the intertidal zone of the coastal ecosystem will move landward. When this shoreward movement encounters steep slopes, high banks, or hardened shoreline infrastructure, the wetlands will “drown” in place, unable to stay in the intertidal zone as that zone shifts (Titus et al. 1991).

Using the then-expected centennial rate of sea level rise of 60 cm, Wetlands Watch (2007) predicted tidal ecosystem impacts and estimated tidal wetland losses in the next century of 50% to 80%, depending on the type of wetland and on shoreline development and erosion control decisions. This range of estimates was confirmed by two subsequent studies, one by the National Wildlife Federation (2008) and the other by Cahoon et al. (2009).

A recent analysis of future shoreline development and erosion control decisions (Titus et al. 2009, 1) illustrates the threat to shoreline ecosystems along the Atlantic Coast:

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“Almost 60% of the land below 1 m along the US Atlantic coast is expected to be developed and thus unavailable for the inland migration of wetlands. Less than 10% of the land below 1 m has been set aside for conservation.”

Developing Local Government Adaptation Strategies

After estimating wetland loss and tidal impacts, Wetlands Watch began work at the local government level in Virginia to initiate sea level adaptation strategy development. Because shoreline development conditions are a major factor in coastal ecosystem loss—with the vast majority of the tidal shoreline in Virginia privately owned¹—and because local governments control most private property development and erosion control decisions, local governments are central to sea level rise adaptation strategy development.

The main focus of our work was to place conditions on the development and redevelopment of shoreline parcels through the long-range comprehensive planning process required of each locality in Virginia, Code of Virginia (Va Code) § 15.2-2223 (2010). These plans usually have a 20-year horizon and are the logical places to start long-range climate change adaptation planning. In areas of the state with tidal waters, localities are also required to include water quality protection measures, including shoreline setbacks, in their long-range planning and zoning, Va Code § 10.1-2100 (2010). Local governments have additional planning, land use, and regulatory authorities that also may be useful in sea level rise adaptation strategies.

In 2008, Wetlands Watch secured funding from the National Fish and Wildlife Foundation (NFWF) to explore the development of a shoreline conservation strategy to protect the shoreline ecosystem from climate change impacts. This project involved examining the planning and regulatory tools available to the shoreline locality as well as investigating how to develop a social marketing strategy sufficient to

generate public support for climate change adaptation. Staff reviewed available literature on land use planning, zoning, and other authorities placing restrictions on the development of shoreline property. We reviewed state and federal natural resources regulatory authorities and conducted interviews with local government planning staff, as well as local and state regulatory staff, on the potential ability to include climate change impacts in their program decisions.

We undertook a similar process to develop a social marketing strategy, although a literature review revealed few practical examples of social marketing directed at climate change adaptation. General social marketing information provided some guidance and emphasized the need to (1) find issues of concern to the target audience, (2) put the issues into a local context, (3) make the impacts personal and real, and (4) show the immediate impact of the threat and the cost of inaction.

Wetlands Watch staff worked in Mathews County, Virginia (the target locality), as well as in numerous other localities in Virginia’s tidal region from 2008 to 2010. Our representatives spoke at numerous public meetings, testified and appeared before government bodies, consulted with local and regional planning staff, and offered comments on government land use and regulatory decisions. The focus of this work was to convince local governments of the need to plan for and act on projected climate change impacts.

We made some progress in the draft long-range land use plan for the target locality, which includes “possible climate changes and rising sea levels” in its comprehensive land use plan (County of Mathews, 93). Other localities along Virginia’s tidal shoreline have also begun including sea level rise impacts in their long-range land use plans. During this period, the Virginia Commission on Climate Change (2008) developed an outline of a state-level adaptation action plan.

Challenges to Local Government Adaptation Efforts

While these actions represent advances in state and local government public policy awareness, Wetlands Watch observed significant challenges to its initial, narrow focus on protecting the shoreline ecosystem from climate change impacts.

...use of the term climate change generated distracting debates about the source of the change... However, many of these participants accepted the reality of sea level rise...

¹ Many federal and Virginia State government documents indicate that 85% of the Chesapeake Bay shoreline is privately owned, although I am not aware of any peer-reviewed documentation for that claim. The percentage of ocean shoreline in Virginia that is privately owned has not been estimated.

First, the use of the term *climate change* generated distracting debates about the source of the change (anthropogenic or natural), its severity and certainty, the scientific basis for it, and a whole suite of issues that were fueled by the national debate over the need for greenhouse gas mitigation efforts. Wetlands Watch staff members encountered this at public information sessions and when they provided presentations across the tidal reaches of Virginia. Participants in these sessions raised issues to counter the evidence of anthropogenic climate change and to deny that climate change was a problem. However, many of these participants accepted the reality of sea level rise and provided anecdotal confirmation of worsening storm surges over time.

Second, staff encountered challenges to moving public policy to better protect wetlands and the coastal ecosystem. According to the Virginia Department of Environmental Quality (2010), the State has yet to meet its commitment for “no net loss” of tidal wetlands, set in state law in 2000, Va Code § 62.1-44.15 (2010). In the 2008 annual report to the Chesapeake Bay Program, Virginia’s Secretary of Natural Resources (2008, 13) could not report on the acreage of wetlands restored toward its Chesapeake Bay 2000 Agreement goals because the State does not have a central wetlands tracking database. Given this inability to address conventional threats to Virginia’s wetlands, generating government policy and a management response to deal with additional, future threats to the coastal ecosystem proved very difficult.

Finally, while some local government planning documents acknowledge that climate change impacts exist, little concrete action was occurring. An informal survey of local and regional government elected officials and planning staff in Virginia’s tidal region contacted by Wetlands Watch could not find a single restriction on development that has occurred solely as a result of climate change and sea level rise impacts. The survey did find that some localities have imposed additional *freeboard*, or elevation of living space above the floodplains in tidal areas, because of concerns over rising sea levels, but development and redevelopment is still allowed with those conditions.

As Wetlands Watch staff reviewed initial approaches to climate change adaptation, we noted that local policymakers and the general public were less concerned about the shoreline ecosystem than more immediate concerns, such as emergency management, economic development, and transportation. Contacts with state, regional, and local government planners also revealed that many of the data needs

and policy tools for addressing inundation threats to communities generally were the same needed to address shoreline resilience and adaptation strategies for ecosystem protection: maps with high-resolution vertical accuracy, inundation models with storm surge built in, shoreline evaluations, and the like.

In response, we refined our social marketing approach to focus on the protection of shoreline communities and businesses from the present risk of storm surge inundation occurring along with accelerating rates of sea level rise. This new approach projected the distant, global issue of future climate change onto the present local landscape using images that people could understand: worsening tidal flooding events in their communities. This approach focused on impacts that were measurable and visible, such as new storm surge maps prepared by the map modernization program of the Federal Emergency Management Agency (FEMA) and resulting expansions in mandatory zones for federal flood insurance coverage. It replaced a lower-priority issue of wetlands protection with higher-priority issues of public safety, critical infrastructure protection, and threats to local economies.

Wetlands Watch reasoned that stimulated action along Virginia’s tidal shoreline to protect critical infrastructure and personal safety could generate an adaptation response more quickly than with a traditional shoreline ecosystem protection campaign. Once shoreline adaptation strategy planning began, we expected that some of the overlapping data and technical needs could be addressed. As the strategy developed, measures to restrict development along the tidal shoreline would keep the shoreline open and resilient, simultaneously providing tidal shoreline ecosystem benefits. Staff theorized that specific consideration of environmental services and protection of the shoreline ecosystem could be inserted back into the process later, but that an initial emphasis on emergency protection would accelerate the adaptation process.

Broadened Focus for Adaptation Efforts

Starting in mid-2009, Wetlands Watch activities commenced networking with shoreline businesses, local governments (including planning, regulatory, emergency and floodplain management, and economic development staff), public utilities, and economic development organizations in the tidal region of Virginia on the new target of infrastructure protection and public safety. Staff reviewed the legal authorities and requirements for planning among this set of partners, assessing data and technical needs, to identify overlap

with those needed for determining sea level rise impacts on the shoreline ecosystem.

Wetlands Watch's work in the early stages of the NFWF planning project focused mainly on land use and natural resources planning and regulatory programs. With our broader focus, staff began to examine other planning programs and documents in the emergency management, transportation infrastructure, and economic development fields. As a result, we discovered a wider array of policy tools with which to begin sea level rise adaptation planning. For example, many federal economic development, transportation infrastructure, and emergency management programs require local and regional governments to engage in long-range planning before federal funds can be obligated. FEMA requires a hazard mitigation plan before a community is eligible for most agency post-disaster mitigation programs (Title 42 United States Code [USC] Section 5165). And the US Department of Commerce requires a comprehensive economic development strategy (CEDS) prior to applying for Economic Development Administration funds (42 USC Section 3162). Periodic updates to these plans present opportunities to discuss local and regional climate change impacts and their emergency management and economic development consequences.

When Wetlands Watch examined some of those plans for localities in Virginia, we discovered that climate change impacts—at least sea level rise and increasing coastal storm surge inundation—were already being included in these planning processes. For example, the Hampton Roads Partnership (2010) produced a regional CEDS that lists sea level rise as a potential threat to the regional economy. And the current hazard mitigation plan for the City of Poquoson (2009), a low-lying city in southeastern Virginia, contained a discussion of the inundation threats driven by sea level rise. Other localities in the tidal regions of Virginia were similarly addressing sea level rise impacts in emergency management and economic development documents.

This new social marketing focus allows us to more readily engage nontraditional partners in Wetlands Watch's work, especially those in the private sector. It also enables us to leverage for a broader set of events to drive adaptation work.

For example, concerns over financial risk in tidal shoreline communities have caused a withdrawal of private wind and personal property insurance availability. Fleishman (2006) reported on this trend, and Wetlands Watch, through interviews with representatives from insurance providers, has documented the withdrawal of more than 50% of the private insurance market for primary residence and business coverage along Virginia's Atlantic Ocean and Chesapeake Bay shorelines. Efforts to reduce risk along Virginia's tidal shoreline can address the concerns of private insurers and lead to a potential partnership among homeowners and the private sector in Wetlands Watch's refocused work to initiate adaptation planning for storm surge and sea level rise.

In May, 2010, Wetlands Watch held a half-day, mediated workshop with coastal planners at the annual meeting of the Virginia Chapter of the American Planning Association. At that session, we presented our draft toolkit of planning and regulatory authorities identified during the NFWF planning process as useful in sea level rise adaptation and discussed social marketing approaches. Planners at that workshop helped refine the adaptation approaches and tools being used; Wetlands Watch is currently using this information to create a toolkit and social marketing package for use at the local and regional levels in Virginia to promote adaptation to sea level rise. Wetlands Watch will continue to collaborate with this community of planners going forward.

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Summary and Next Steps

Adaptation to climate change impacts in coastal Virginia has proven difficult using a traditional natural resources-based approach. Distant impacts, indifference toward ecosystem protection, and conflicts with the present economic goals of local governments and individual landowners conspire to limit the effectiveness of adaptation efforts focused solely on the shoreline ecosystem.

Once such adaptation work is reframed and focused on an immediate impact—such as increasingly serious storm surges—and responses are framed in terms of the protection of public safety, critical infrastructure, and local economies, more support can be gained for early adaptation. Since the

early technical needs for any shoreline adaptation effort are similar (e.g., maps with high vertical resolution, modeling of shoreline inundation, and shoreline situation surveys), much of the initial work for shoreline ecosystem adaptation can be accomplished using this approach.

Virginia still lags its neighboring states in supporting sea level rise adaptation efforts. Unlike Maryland and North Carolina, detailed digital elevation maps have yet to be produced, state agencies are not being tasked to support this work, and state political leaders are not visibly promoting adaptation efforts. Unfortunately, efforts to address the federal budget deficit, combined with the end of federal stimulus funding, also threaten to curtail federal support for climate change adaptation work. This increases the importance of efforts by Wetlands Watch and others to work with

local governments to find ways to insert sea level rise adaptation planning and action strategies into ongoing local government programs. Wetlands Watch is expanding its collaboration with the community of professional planners in Virginia and is adding floodplain and emergency managers, municipal government organizations, and the private sector to this network of partners.

Our next steps will involve securing foundation funding to develop a pilot sea level rise adaptation strategy in an example community along a reach of tidal shoreline. This effort will test both the toolkit of policy options and our social marketing approaches. Wetlands Watch plans to then use this experience to further refine both tools and social marketing efforts and to replicate its work elsewhere along the tidal shoreline in Virginia.

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