

Eastern Shore Coastal Resilience Assessment

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by Eastern Shore Land Conservancy

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Cover photograph provided by David Harp (www.ChesapeakePhotos.com).

Eastern Shore Land Conservancy is a private, nonprofit land conservation organization dedicated to the preservation of farmland and habitat on the Eastern Shore. A volunteer board of directors, chaired by Benjamin C. Tilghman, includes a diverse group of Eastern Shore landowners representing the agricultural and business communities as well as local governments.

Eastern Shore Land Conservancy is committed to preserving and sustaining the vibrant communities of the Eastern Shore and the lands and waters that connect them. Since its inception in 1990, ESLC, funded by member contributions, has helped landowners to protect more than 50,000 acres of farmland and important habitat.



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Executive Summary

This assessment seeks to understand the coastal hazards and vulnerabilities facing the Eastern Shore and to determine the capacity of town and county governments to prepare for and respond to long term coastal threats. The five major findings of the assessment are:

1. **The Eastern Shore is highly vulnerable to current and future coastal hazards.** Sea level rise will be at least 1.4 feet by 2050 and possibly over 5 feet by 2100. A Category 1 hurricane in 2050 could flood 12,000 homes in the six Mid-Shore counties and a land area equal to the size of Talbot County resulting in loss of life and property, impaired public health and services, and economic disruption. Slower moving impacts like shoreline erosion, wetland loss, and frequent or permanent inundation could cause ecosystems degradation, impairment of ecosystem services, and loss of property and livelihoods.
2. **There is less activity than anticipated in the form of concrete planning and projects for improving coastal resilience on the Eastern Shore.** Very few examples of long term resilience planning for climate change, sea level rise, or increases in extreme weather events exist at the town or county levels.
3. **Town and county planning efforts are focused on short-term preparedness for existing coastal hazards.** Hazard mitigation and emergency management planning consider currently expected flood or storm conditions but do not account for sea level rise or changes in temperature or precipitation patterns.
4. **At the town and county levels, neither the staffing capacity nor the resources exist for meaningful, comprehensive, resilience planning.** Despite this shortfall, a substantial appetite for education, leadership, and technical assistance on coastal hazards and resilience exists within the planning community.
5. **There is broad public support for action on long term coastal hazards on the Eastern Shore.** However, that support is not yet concentrated into strong demand for leadership by local elected officials.

Given these findings, the Eastern Shore has a clear need for coastal resilience planning. ESLC is well positioned to be a catalyst and a resource for communities that are looking to build resilience to shifting coastal hazards. With a history of being a trusted partner, ESLC's strengths are in convening stakeholders, fostering dialogue, and promoting sound planning principles. The Coastal Resilience Program's goals are 1) to create capacity and leadership, 2) foster public support and political will, and 3) to build resilience in vulnerable communities. In the long term, it is intended that public participation in resilience-building will strengthen civic processes and allow communities to confront other complex issues with respect and confidence. Furthermore, the Eastern Shore can become a national model for how to build resilience in rural coastal areas.

Introduction

This report is an assessment of the Eastern Shore’s vulnerability to coastal hazards and preparedness for the impacts of climate change on coastal communities. The area of focus is the Mid- and Upper Shore including Cecil, Kent, Queen Anne’s, Caroline, Talbot, and Dorchester counties. The Eastern Shore Land Conservancy (ESLC) conducted this assessment through the review of town and county planning documents, conversations, meetings, and secondary research of climate change impacts and projections. A summary of findings will be provided to counties and towns for use in long-range planning and for use by partners. For ESLC, the findings will guide a multi-year, organizational focus on building coastal resiliency on the Eastern Shore’s landscape and in communities. ESLC is grateful to the Town Creek Foundation for supporting this work and recognizing climate resiliency as an important component of vibrant towns and counties.

ESLC is committed to preserving and sustaining the vibrant communities of the Eastern Shore and the lands and waters that connect them. ESLC helps save land and promotes sound land use planning from the C&D Canal in Cecil County to the Nanticoke River in Dorchester County.

In combination with our partners, a quarter of the region’s rural lands are permanently conserved. ESLC currently protects 50,000 acres through conservation easements on the Eastern Shore. Nearly 11,000 acres – 22% of the land under ESLC’s protection – lie within the Chesapeake Bay Critical Area, designating lands within 1000 feet of tidal waters of the Chesapeake Bay and its tributaries. Protecting more than 83 miles of frontage on the Bay and tidal tributaries, ESLC has a clear interest in the future of the Eastern Shore’s coastline and coastal communities.

The impacts of climate change, flooding being chief among them, are already being felt along these coastal properties. ESLC believes that a broad resilience to coastal hazards is critical to sustaining a high quality of life and the Eastern Shore’s rich heritage. ESLC seeks to be a resource for local and regional planning as well as convener for conversation and collaboration on coastal resilience and climate change issues.

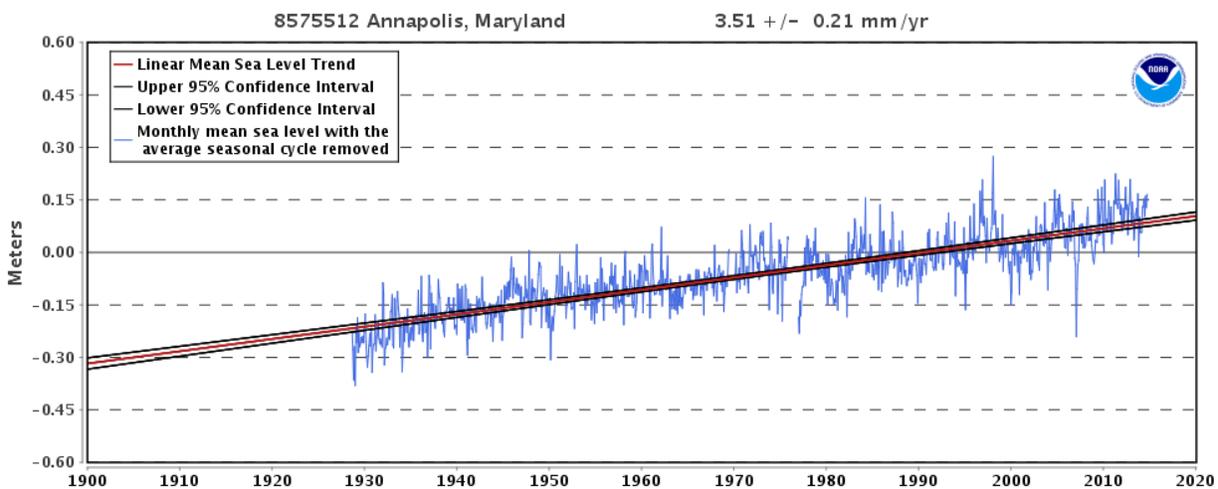
Climate Change Vulnerability on the Eastern Shore

In 2008 the State published its Comprehensive Assessment of Climate Change Impacts in Maryland.¹ The authors reiterate the Intergovernmental Panel on Climate Change 4th Assessment’s assertion that “warming of the climate system is unequivocal.” In 2013, the State of Maryland updated the sea level rise component of the assessment to include better understandings of the pace and impacts of melting land ice in Greenland and Antarctica. Rather than repeat the details of the assessment, the following section highlights the state’s major hazards, trends, and projections, supplementing them with information specific to the Eastern Shore, where available. We refer the reader to the state report for deeper discussions of the impacts of climate change.

Sea Level Rise

TREND – The Eastern Shore has experienced one foot of relative sea level rise over the past century due to thermal expansion, glacial melting, and local land subsidence. The rate of sea level rise is accelerating. Tide observations for Cambridge confirm a one-foot rise in sea level over the past one hundred years (Figure 1).

PROJECTION – Sea level will rise another 1.4 feet by 2050 and 3.7 feet by 2100. These are mid-range estimates that assume some level of carbon dioxide emission reductions on a global scale. High-end sea level rise projections of 2.1 feet by 2050 and 5.7 feet by 2100 are possible if carbon pollution continues on the current trend.



¹ Boesch, D.F. (editor). 2008. *Global Warming and the Free State: Comprehensive Assessment of Climate Change Impacts in Maryland*. Report of the Scientific and Technical Working Group of the Maryland Commission on Climate Change. University of Maryland Center for Environmental Science, Cambridge, Maryland. This report is a component of the Plan of Action of the Maryland Commission on Climate Change, submitted to the Governor and General Assembly pursuant to Executive Order 01.10.2007.07.

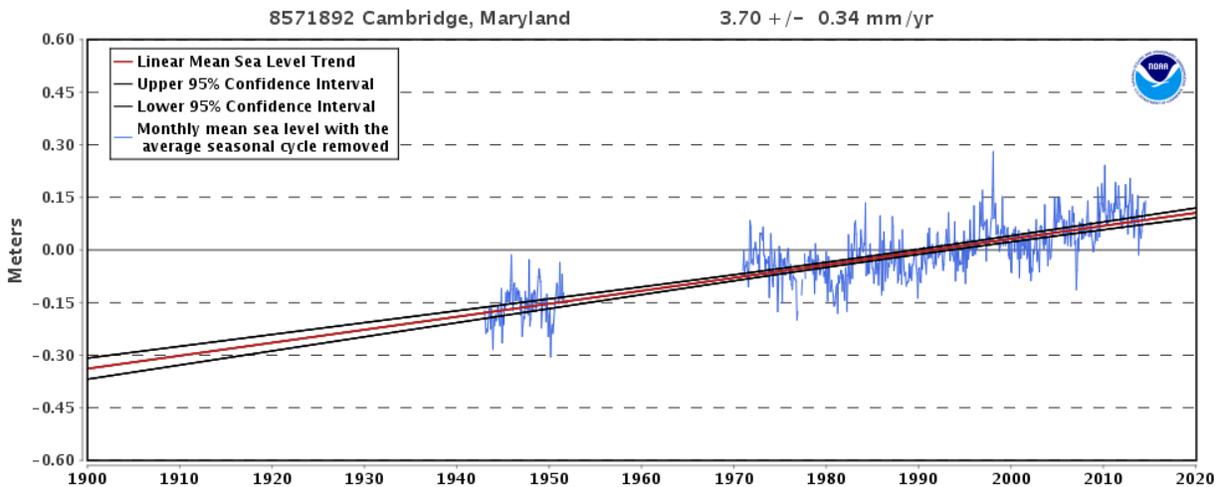


Figure 1. Tide observations and trendlines showing sea level rise in Annapolis² and Cambridge, MD.³

ISSUE – Shoreline inundation and erosion will affect significant parts of Dorchester, Talbot, and Queen Anne’s counties. Shoreline loss will vary locally with fetch, slope, soil characteristics, and structural protection.

ISSUE – Under the higher emission scenario, most tidal wetlands will be lost over the next century. Under a lower emission scenario, tidal wetlands may manage to keep pace with sea level rise in places where their ability to migrate upland is not impeded by roads and other obstacles.

Coastal Flooding & Inundation

TREND – The frequency of “nuisance” flooding events – minor flooding exceeding 1.5 feet above Mean Higher High Water (MHHW), which may occur during monthly spring tides and seasonal king tides – has increased 900% in Baltimore and Annapolis over the past 50 years. The duration of flooding has also increased. Cambridge saw fewer than 10 hours of nuisance flooding per year in the early 1980’s but has experienced 30 or more hours per year of flooding in recent years⁴ (Figure 2).

PROJECTION – Nuisance flooding will become daily inundation by 2050 as the current 1.5-foot nuisance threshold is surpassed by sea level rise. Regular *daily* high tides will inundate 62,045 acres of land and 2,154 homes on the Mid- and Upper Shore.⁵

ISSUE – Coastal floodwater management will become as important an issue for public works departments as stormwater management. Roads that currently flood a few times per year will be impassable for several hours each day. Low-lying infrastructure not designed for frequent saltwater immersion will corrode and degrade.

² http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8575512

³ http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8571892

⁴ Sweet, William et al. June 2104. Sea level rise and nuisance flood frequency changes around the United States. NOAA Technical Report NOS CO-OPS 073.

⁵ Strauss, Tebaldi, and Ziemlinski. 2012. Surging Seas: Sea level rise, storms and global warming’s threat to the US coast. A Climate Central Report. Projections generated by www.surgingseas.climatecentral.org.

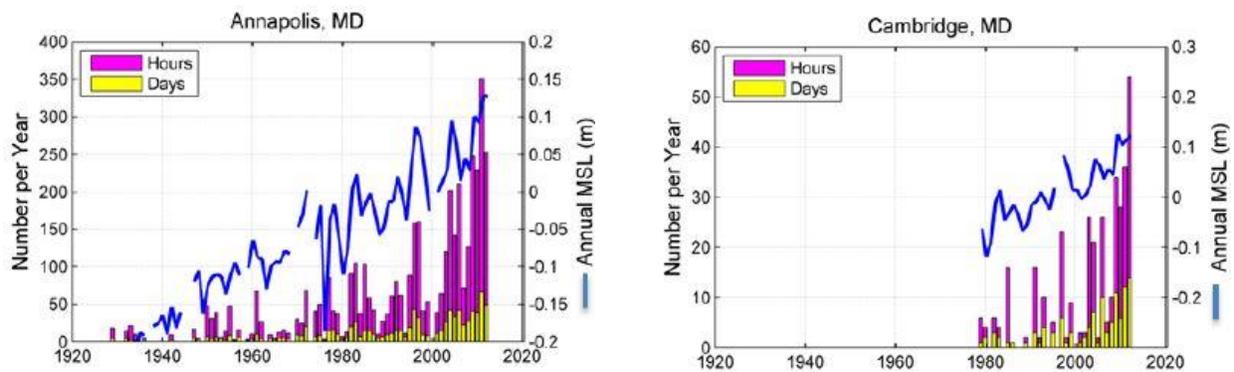


Figure 2. Increasing occurrences of nuisance flooding in Annapolis and Cambridge, MD.

Storms & Storm Surge

TREND – It is likely that the annual number of Atlantic tropical storms has increased over the past century fueled by a rise in sea surface temperatures.

PROJECTION – A decrease in the annual number of tropical storms is possible but an increase in storm intensity, storm surge, wind speed, and precipitation is expected for storms that do form.

PROJECTION – Greater storm surge will be on top of higher local sea levels. A Category 1 hurricane occurring in 2050 with 2 feet of sea level rise and 5 feet of storm surge would flood 171,248 acres of the Mid- and Upper Shore (equivalent to the total land area of Talbot County) and nearly 12,000 homes.⁶

PROJECTION – Winter storms and nor'easters will continue a trend of strengthening and becoming more frequent. Storm tracks may also continue a trend of shifting northward, increasing the likelihood of severe winter rain events.

Temperature

TREND – From 1977 to 1999, the state's average annual temperature rose by 2°F.

PROJECTION – A 3°F increase in average annual temperature is likely unavoidable by 2050. The number of 90°F days is expected to double to 60 from a current average of 30 by late century; 100°F days will increase to 10 per year from an average of 2 per year.

Precipitation

TREND – There are no statistically significant historical trends for precipitation.

PROJECTION – A slight increase in winter precipitation might be expected by 2050 but it is currently not possible to project precipitation totals for rest of the year. However, models do predict an increase in the intensity of rain events. The odds of experiencing 5 inches or more in a single rain event increase to 8-15% per year from a current chance of 5%.

PROJECTION – Under the higher emissions scenario, month-long droughts can be expected once every 8 years by late century, whereas today it is expected once in 40 years.

⁶ Strauss, Tebaldi, and Ziemlinski. 2012. Surging Seas: Sea level rise, storms and global warming's threat to the US coast. A Climate Central Report. Projections generated by www.surgingseas.climatecentral.org.

Chesapeake Bay Ecosystem

TREND – Chesapeake Bay water temperature has increased nearly 3°F since 1940. Warm water species such as Atlantic croaker are becoming more common while populations of cold water species like summer flounder are decreasing. The extent of eel grass beds, critical habitat for juvenile blue crabs, is decreasing, particularly in the northern half of the Bay.

PROJECTION – Water temperature is expected to increase 4°F by 2050 under the lower emissions scenario, resembling the intra-coastal sounds of North Carolina.

TREND – Ocean acidification has lowered the pH (i.e., increased the acidity) of the Chesapeake Bay by 0.1 units to 8.18 since pre-industrial times.

PROJECTION – A further reduction in pH (increase in acidity) of 0.3 to 0.5 units is possible by 2100, potentially decreasing shell production by mussels and oysters by 20 to 25 percent.

PROJECTION – More extreme rain events will increase rates of sedimentation and nutrient pollution in the Bay, which will impair water quality on shellfish beds and water clarity needed for eel grass health.

ISSUE – Species composition and abundance is very likely to change as warm water species replace cold water species with implications for water quality and fisheries. Chesapeake Bay restoration goals are likely to be more difficult to achieve. Higher water temperatures may also increase the likelihood of harmful bacteria and algal blooms.

Crop Production

PROJECTION – Initially, a longer growing season and increased atmospheric carbon dioxide are likely to increase crop production by modest levels. However, after several decades, heat stress and drought are expected to decrease productivity. Additionally, some regions may experience saltwater intrusion into groundwater as heat and drought necessitate greater drawdown of water tables coupled with a rise in sea level.

ISSUE – Farmers may be forced to switch to crop varieties that are more tolerant of heat, drought, and, in some areas, saltwater (both from flooding and groundwater intrusion). A more tolerant crop portfolio may include a greater proportion of genetically modified varieties.

Human Health

TREND – From 1961 to 1990 an average of 20 to 30 days per year saw temperatures rise above 90°F.

PROJECTION – By 2050, the number of days over 90°F doubles to 40 to 60 days per year. Toward the end of the century under the high emissions scenario, it would be a rare summer day when the high temperature did not top 90°F and there will be nearly a month where daily temperatures reach 100°F.

Population Growth & Land Use Change

Coastal hazards become more worrisome when people live and work in risk-prone areas. The Eastern Shore has struggled for decades with the questions and challenges of population

growth and development. The opening and expansion of the Bay Bridge has made the Eastern Shore more accessible to the population centers of Annapolis, Baltimore, and Washington, D.C. Recently, population growth rates for the upper Eastern Shore averaged 18% for the period from 2000 to 2015. However, that growth has not been uniform across all counties – Dorchester County grew at just 8% while Queen Anne’s County grew at 24%. Changes in local industry and proximity to the Western Shore via the Bay Bridge, respectively, are important drivers of population trends in these two counties.

	Recent Population Growth 2000 - 2015	Projected Population Growth 2015 - 2030
Maryland	13%	10%
Upper Eastern Shore	18%	18%
Caroline County	14%	19%
Cecil County	21%	21%
Kent County	7%	10%
Queen Anne's County	24%	20%
Talbot County	16%	10%
Dorchester County	8%	14%

Table 1. Population growth trends and projections. Maryland Department of Planning.

Overall, population growth is expected to continue at 18% for the next fifteen years, with a somewhat tighter range of values for the counties. Queen Anne’s and Cecil counties will experience the highest growth as they continue to become suburbs of the Philadelphia-Wilmington-Baltimore-Washington, D.C. corridor. Kent and Talbot counties expect slower – but not insignificant – growth of 10%.

Land use change is a frequent consequence of population growth, particularly in rural areas. The Eastern Shore is no exception. From 1973 to 2002, the acreage of developed land increased by 80% per decade. Since 2002, the growth in developed land has slowed dramatically to a relatively uniform 10% per decade across the six counties.

One need only look at Kent Island to see that coastal areas were not immune to the growth trends. To manage development of the shoreline, the Critical Area Commission regulates development and activities within 1,000 feet of the shoreline. The Commission is currently updating its rules governing state and local agency activities in the critical area to account for sea level rise, coastal hazards, wetland migration, and other climate change impacts.

Exposure: What is at risk?

Following devastation by Hurricane Betsy in 1965, New Orleans developed an extensive defense system of levees and flood control structures. Forty years later, Hurricane Katrina revealed the consequences of failing to plan adequately and *continuously* for sea level rise, subsidence, and increasingly severe storms. In Miami, it no longer takes a hurricane to point out the threats

associated with climate change. Sea level has already risen enough that the high tide pushes Biscayne Bay right up the storm drains or over seawalls. Streets and yards can flood on sunny days. Both cities have now embarked upon ambitious efforts to build protection and increase resilience against the hazards posed by climate change.

Maryland's Eastern Shore is the nation's third most vulnerable region to climate change after the Mississippi Delta and South Florida.⁷ Like these two regions, the Eastern Shore is already experiencing the impacts of climate change. Even a decade ago, the accumulated one foot of sea level rise enabled Hurricane Isabel to achieve a level of flooding equal to or exceeding the great 1933 Chesapeake-Potomac hurricane, despite Isabel's smaller storm surge and weaker intensity. This is an example of how sea level rise is literally changing the equation for flooding in coastal communities. Weaker hurricanes and tropical storms now have the same potential for flooding as the strongest hurricanes experienced during the twentieth century. Moderate and strong hurricanes in the future will present the region with levels of flooding that have never been experienced on the Eastern Shore.

LAND & ECOSYSTEMS – On the Mid- and Upper Shore, sea level rise threatens to inundate (submerge on a daily basis) over 62,000 acres of land and wetlands by 2050.⁸ The fate of thousands of acres of wetlands will be defined by which global carbon emission scenario unfolds. Under a lower emissions scenario with a slower rate of sea level rise, wetlands may be able to survive by accreting sediment at a rate equal to sea level rise. Under a higher emission scenario and faster rise, however, wetlands cannot accrete sediment fast enough and will drown under rising seas. Coastal wetlands can also migrate inland and upland over time, if the path is not obstructed by roads or other structures. Statewide, the upland area available and accessible for marsh migration is equal to only 10% of the existing wetland area.⁹ This loss of wetlands will impair ecosystem services like coastal floodwater storage, wave attenuation, and control of erosion and excess nutrients from runoff. Biodiversity losses will arise from the loss of wetland habitat for waterfowl, shellfish, and finfish spawning.

INFRASTRUCTURE – Statewide, one foot of sea level rise will inundate 264 miles of road, 226 miles of railway, and 31% of the state's port facilities. In Kent County, the following critical facilities are located in the 100-year floodplain: two higher education buildings, eight sanitary facilities, one dam, and one food distribution center.¹⁰ In Talbot County, the 100-year floodplain contains: eight school buildings, one emergency facility, two medical facilities, eleven municipal buildings, and fifteen utility facilities.¹¹

⁷ Maryland Commission on Climate Change Adaptation and Response Working Group. 2008. *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change. Phase I: Sea level rise and coastal storms*. This report is a component of the Governor's Commission on Climate Change, *Climate Action Plan* (August 2008).

⁸ Strauss, Tebaldi, and Ziemlinski. 2012. *Surging Seas: Sea level rise, storms and global warming's threat to the US coast*. A Climate Central Report. Projections generated by www.surgingseas.climatecentral.org.

⁹ Boesch, D.F. (editor). 2008. *Global Warming and the Free State: Comprehensive Assessment of Climate Change Impacts in Maryland*.

¹⁰ Kent County 2013 Hazard Mitigation Plan

¹¹ Talbot County 2011 Hazard Mitigation Plan

Many coastal areas are accessible by only one road. Emergency response and recovery efforts in these areas will be limited during a storm event. Eventually, the state and local governments will need to decide whether to elevate or abandon roads when they become inundated on a regular basis due to sea level rise.

SOCIAL WELL-BEING – Sea level rise will cause high tides to inundate over 2,100 homes *daily* on the Mid- and Upper Shore by 2050. A Category 1 hurricane with 5 feet of storm surge on top of sea level rise will flood 12,000 homes and a land area equivalent to Talbot County. This type of event would not be considered extreme by 2050 yet still has the potential to disrupt lives, livelihoods, public health, and economic vitality on the Eastern Shore. The effects of flooding are already having financial impacts in Kent County where five repetitive loss structures have received a total of \$350,000 in recovery payments for second incidences of flood damage.¹² By the end of the century, 5 feet of sea level rise will have permanently inundated 7,700 homes and displaced nearly 12,000 people currently living on the Mid- and Upper Shore.¹³

As heat waves become commonplace, heat-related illnesses are very likely to increase. Respiratory illness is also likely to increase as higher temperatures lead to unhealthy levels of ground-level ozone. Increased reliance on air conditioning will raise peak demand for energy leading to further greenhouse gas emissions and diminished air quality.

Reducing vulnerability to today's threats

Climate hazards come in two forms. Short-lived, episodic, extreme weather events such as hurricanes, rainstorms, and floods can have severe local or regional impacts. These events are typically handled as emergencies by disaster response agencies. In contrast, long-term, slow-moving changes like inundation from sea level rise or extended, recurring heat waves will threaten populations and critical systems on local, regional, and national scales. These impacts generally will not rise to the level of an emergency or disaster but will nonetheless place enormous strain on planning agencies, public works departments, healthcare systems, and natural resource managers at all levels of government.

Policies and practices that reduce susceptibility include land conservation, hazard mitigation planning, and specific zoning requirements like floodplain ordinances. Land conservation can reduce exposure to hazards by preventing new development in high-risk locations. Conservation in combination with land stewardship improves natural resilience by protecting and strengthening ecosystems. Healthy ecosystems can sustain beneficial services like wave attenuation and storm water absorption.

HAZARD MITIGATION PLANNING entails identifying specific hazards and existing exposures within a community and undertaking specific projects to reduce those vulnerabilities. All six Mid- and Upper Shore counties have developed hazard mitigation plans as a prerequisite to receiving federal disaster recovery assistance. Many towns, including Chestertown, Oxford, and St.

¹² Kent County 2013 Hazard Mitigation Plan

¹³ Strauss, Tebaldi, and Ziemlinski. 2012. *Surging Seas: Sea level rise, storms and global warming's threat to the US coast*. A Climate Central Report. Projections generated by www.surgingseas.climatecentral.org.

Michael’s, are under county plans. The counties’ plans are all- or multi-hazard mitigation plans addressing threats from hurricanes and flooding to heat, fires, earthquakes, and tornados. None of the counties, however, make recommendations pertaining to future hazards or changing risks associated with climate change or sea level rise. Kent County’s 2014 draft hazard mitigation plan, in fact, makes no mention of climate-change-related projections or impacts in its “Future Trends” section. Likewise, Talbot County mentions sea level rise in its official 2011 plan but makes no recommendations.

FEMA’S COMMUNITY RATING SYSTEM (CRS) is a federal program that encourages local flood hazard mitigation. The CRS lists specific flood mitigation activities that earn credits for the community. Credit totals determine the community’s discount on individual flood insurance premiums. CRS status and insurance discounts for the six counties are given in the table below.

County	CRS Level	Flood Insurance Discount
Cecil	8	10%
Dorchester	8	10%
Talbot	8	10%
Caroline	9	5%
Kent	Not enrolled but CRS is recommended in hazard mitigation plan.	
Queen Anne’s	Not enrolled	

Table 2. Enrollment in the Community Rating System. FEMA.

While the flood protection measures reflect currently expected 100- or 500-year flood conditions, the 2013 revision to the CRS includes credits for considering future flooding conditions. However, FEMA’s new digital flood insurance rate maps (DFIRMs) do not attempt to project future flooding conditions that will be influenced by sea level rise or changes in precipitation.

FLOODPLAIN ORDINANCES govern building construction within the 100- and 500-year floodplains. An important element of floodplain management is the “freeboard” required between the 100-year base flood elevation and the first floor of a building. All six counties, as well as Oxford and St. Michaels, require 2 feet of freeboard elevation above the base flood level. Cambridge requires 1.5 feet of freeboard; Chestertown requires one foot. Climate change is mentioned in several county and town floodplain ordinances as a reason for requiring freeboard. Freeboard will provide structures with 20 or 30 years of protection against sea level rise but, unless the base flood elevation is continuously updated to reflect sea level rise, it is not a long term substitute for limiting development in coastal flood zones.

Coping with extreme events

The previous section addressed policies and practices for reducing exposure to hazards before they occur. This section examines factors that improve a community’s response to short-lived, episodic, extreme hazard events. Whereas the previous section was largely about locating or relocating threatened facilities and systems out of harm’s way, the coping capacities in this section

are about protecting natural or community elements that cannot be relocated. The most effective coping capacities for improving survivability are the result of careful planning and action taken before an extreme event occurs. Emergency operations planning, stormwater management projects, and shoreline erosion control measures (structural hardening, and non-structural or living shorelines) are all practices that municipalities can undertake to prepare their communities for the onset of extreme conditions and the immediate recovery process.

Extreme events on the Eastern Shore could range from a surprise torrential rainfall that causes locally severe flooding to a well-forecasted hurricane or nor'easter that visits multiple hazards across a wide geographical area. These events are not a direct result of climate change; however, the frequency, intensity, or baseline conditions on top of which the extreme event occurs will likely be influenced by climate change. Therefore, planning efforts must reasonably anticipate future conditions in order to adequately prepare a community and minimize the danger to lives, livelihoods, and property. Emergency management plans should consider long-term threats from climate change, including the exposure of shelters and access roads to flooding or erosion. Stormwater management plans should anticipate larger rainfall amounts that will require greater storage and treatment capacity. Shoreline erosion control measures should account for sea level rise by giving living shorelines space to move inland and upland and by designing seawalls to avoid overtopping. Currently, the planning documents that are available from the counties and towns are concerned with present day hazards and exposures; they do not demonstrate long-term consideration of climate change.

Community networks can play an important role in planning for and recovering from extreme events. Church groups, business or trade organizations, schools, and libraries can be useful for communicating risk to the public, soliciting input for planning exercises, and coordinating emergency response efforts. Emergency plans should include contact information for these groups and should identify each group's special needs or unique capacities they can provide before, during, and after an emergency.

Adaptive capacity

Communities make decisions every day that will have impacts and legacies twenty, fifty, and a hundred years hence. Each of the counties and towns studied in this assessment have a long-range planning process for identifying a vision, priorities, and concerns about the future. The hazards associated with climate change will arise and evolve over a period of decades. As such, the comprehensive plan is a natural place to begin to lay out a community's expectations for how they will respond and adapt to changing environmental conditions. The comprehensive plan provides a convenient framework on which to locate and coordinate specific adaptation strategies. Hazard mitigation planning, stormwater and floodplain management, zoning, emergency planning, and land conservation can all inform and be choreographed by the comprehensive plan. Cambridge's comprehensive plan provides discussion of sea level rise expectations and impacts on the city but makes no recommendations. Similarly, Talbot County's 2015 draft comprehensive plan discusses sea level rise impacts and mentions general response strategies but offers no

recommended actions. Other towns and counties include less discussion but recommend “carefully [considering] flooding and sea level rise in the development process” (Chestertown) or restrictions on development based on sea level rise projections (Queen Anne’s County).

Economic development and investment plans may not necessarily be concerned with coastal hazards but they could include climate mitigation efforts like energy efficiency and community scale renewable energy projects. Climate mitigation planning and projects move beyond adaptation and aim to reduce the greenhouse gas emissions that cause climate change. Regional energy planning that diversifies generation and builds grid redundancy can improve resilience to short-term extreme events and decrease long-term vulnerability by curbing carbon emissions.

Land conservation has an important role in long-term adaptive capacity. With strategic acquisitions made today, land is protected so that it becomes a haven or refuge for ecosystems threatened by climate change. On the Eastern Shore, preserving saltmarsh migration zones will allow the wetlands to gradually move inland as sea level rises. This preserves critical habitat for wildlife as well as ecosystem services like flood storage, wave attenuation, water quality enhancement, and fishery support that contribute to vibrant human communities.

In most cases, towns and counties are adequately addressing the current hazards in their various planning procedures. However, none of the counties or towns in this assessment currently have meaningful recommendations addressing climate change in their comprehensive plans or in the long-range components of other planning documents. This means they may have some degree of resilience to today’s threats but, in the medium and long term, climate change increases their vulnerability and erodes their resilience.

Challenges and Opportunities

This report has established that Eastern Shore communities are highly vulnerable to a range of coastal hazards that will be exacerbated by climate change. Sea level rise is already increasing the frequency, duration, geographic extent, and depth of coastal flooding and will continue to do so. It has also been established that county and town governments, with few exceptions, are failing to plan for the medium- and long-term impacts of sea level rise and climate change. This section now explores local government readiness, public opinion, and the capacity on the Eastern Shore for action on climate change.

Local government readiness

As yet, there is no regulatory framework that supports climate or coastal resilience on the Eastern Shore. State and federal programs incentivize hazard mitigation and storm water management projects. However, these programs do not require the projects they fund to consider the impacts of climate change. Likewise, the state does not currently require that local governments address climate change in their long-range planning. The state does require its own agencies to

consider climate change effects, so it is not unreasonable to expect that in the future a “climate change element” may become a required part of comprehensive plans.¹⁴

Some Eastern Shore communities relied upon external funding and technical assistance to meet previously mandated additions to their comprehensive plans (such as the Water Resources Element). Similar assistance is necessary for counties and towns to meaningfully address climate change impacts, regardless of whether such action is mandated. In the counties interviewed for this assessment, the planning staff were eager to incorporate climate resilience into their work. However, they noted large gaps between their desire to be proactive and their ability to do so. The gaps include lack of funding and staff time, lack of technical knowledge, and uncertain support from their elected officials.

Recently, the Town of Oxford, where tidal flooding occurs several times a year and storm surge is a major threat, took steps to make additional financial resources available for flood mitigation. The storm water management fund is financed by an increase in property taxes garnering approximately \$100,000 a year. The fund is not intended to support major projects. Rather, it gives the town spending money for minor projects and hiring engineers or consultants for initial planning. State and federal assistance will still be needed for major projects.

Public opinion

According to a survey¹⁵ conducted in 2014 by the Center for Climate Change Communication at George Mason University, the majority of Eastern Shore residents¹⁶ recognize the threat of climate change and sea level rise and desire their local governments to take action. Of Eastern Shore residents:

- 18%, twice the statewide average, experienced flooding in the last year;
- 56% think sea level rise will significantly harm people and property in 25 years or less;
- 67% support state or local government action to reduce climate change impacts;
- 64% support long-range planning by governments that takes sea level rise into account;
- 67% support changes to local land-use regulations that discourage building in areas expected to be affected by sea level rise.

These survey results from the Eastern Shore largely mirror statewide opinion despite the Shore’s more conservative political inclination. Furthermore, more than half of Eastern Shore residents expect coastlines, wetlands, and agriculture to be “harmed by climate change in the next several years.” The survey indicates a clear public sentiment on the Eastern Shore that climate change impacts will affect well-being and should be addressed by state, county, and town governments. This sentiment stands in contrast to the miniscule public resources allocated at the local level to

¹⁴ Likewise, the federal government has new requirements for sea level rise planning when federal funds are to be spent on projects in the coastal zone. Additionally, FEMA disaster preparedness funding will now only be available to states that have policies for climate change mitigation and adaptation.

¹⁵ Akerlof, K. & Maibach, E. W. (2014). Adapting to climate change & sea level rise: A Maryland statewide survey, fall 2014. Fairfax, VA: Center for Climate Change Communication, George Mason University.

¹⁶ The survey defines the Eastern Shore as Caroline, Dorchester, Kent, Queen Anne’s, Somerset, Talbot, Wicomico, and Worcester counties.

resilience or adaptation. Broad support for action on climate change has not yet translated to broad demand for action on the Eastern Shore.

Despite the support indicated by the GMU survey, there is a politically influential segment of the public that chooses not to engage in climate change mitigation and adaptation discussions. A subset of this group vocally opposes and may obstruct planning or action on climate change, even though they recognize that the related coastal hazards are currently affecting their communities. In an interview, one member of the planning community suggested that the phrases “climate change” and “sea level rise” are emotional and political triggers that should be avoided in discussions with this group. The phrases “erosion,” “coastal hazards,” and “coastal resilience” are more positively received and more likely to engender constructive conversation.

Resources & Support

Information on climate change impacts and coastal hazards is available in variety of federal, state, and academic reports, many of which are cited throughout this assessment. Published principles and practices for building resilience into society and the landscape are more difficult to find because resilience planning is necessarily a locally or regionally specific activity. Shoreline characteristics and vulnerability vary widely across large geographies, so printed resilience materials tend to be guidelines or roadmaps. The Ecological Society of America and Smart Growth America are two examples of such resources.

Technical advice and training on the topic of adaptation to climate change and sea level rise are available from NOAA, particularly through the Coastal Services Center, the Sea Grant program, and the Office of Ocean and Coastal Resource Management. Maryland’s DNR also provides technical assistance through the CoastSmart and Be Flood Ready projects. The Georgetown Law School Climate Center maintains a clearinghouse of helpful legal information on adaptation practices. The University of Maryland’s Environmental Finance Center provides assistance with financing strategies to towns and counties. Washington College’s Shore Power program provides assistance to town and counties interested in energy efficiency and renewable energy projects. NASA is in the process of starting the Mid-Atlantic Coastal Resilience Institute (MACRI) at Wallops Island, Virginia. The group will have representatives from federal agencies, regional universities, and nonprofits. MACRI’s work plan has not yet been communicated.

There are many organizations that share common goals and form a peer network that aligns with a coastal resilience effort on the Eastern Shore. The Nature Conservancy and the Chesapeake Bay Foundation are two large potential partners with broad-based activities and interests in coastal resilience. The Climate Change Communication Consortium of Maryland seeks to coordinate and amplify messages to the public concerning the impacts of climate change and the urgent need for action at the state and local levels. Smart Growth America and the National Working Waterfront Network are potential venues for learning about coastal community design practices.

Gaps

These findings indicate a number of considerable gaps that prevent Eastern Shore communities from starting on a path towards resilience. The greatest gap is between the need for long-term resilience planning that addresses vulnerabilities and the ability of town and county governments to undertake such an effort. On one of the country's most vulnerable landscapes, many of the towns and counties do not have the staffing, the funding, or the technical capacity to carry out resilience planning or projects.

There is also a gap between the public support for planning and the priorities of local governments and elected officials. Redevelopment and revitalization top many of the larger towns' priorities, yet it is rare for these projects to include climate resilience goals despite surveys showing support for coastal resilience planning. Redevelopment projects, with their multi-decade lifetimes, would be a prime opportunity to build resilience into a community. For example, Cambridge's sustainable working waterfront project will seek to include sea level rise preparedness into its goals.

Recommendations

Given the challenges and opportunities, there are important roles that potentially can be filled by the nonprofit sector. By providing or coordinating technical assistance, nonprofits can help local governments develop climate adaptation plans, disaster preparedness plans, or climate change elements within comprehensive plans. Nonprofits can also catalyze public support and encourage local governments to prioritize coastal resilience planning. Finally, nonprofits can provide leadership, convene stakeholders and decision makers, and coordinate activities on a scale that transcends local jurisdictions. Regional approaches to climate adaptation and preparedness may provide more options and increased capacity to communities that individually are unable to meet the challenge on their own.

Through 25 years of land preservation and town projects, ESLC has forged a reputation as a regional leader and voice for thoughtful, sustainable land use practices and community development. This esteem places ESLC in a unique position to define and communicate a vision for a resilient Eastern Shore. ESLC has a long record of convening discussions on challenging issues and forging solutions with partners and stakeholders.

The vision of ESLC's Coastal Resilience Program is an Eastern Shore that is prepared for immediate and long term coastal hazards and is able to survive, adapt, prosper, and transform in face of uncertainty and vulnerability. The process of improving regional resilience can lead to an Eastern Shore society that is more aware, engaged, cohesive, and promotes dignity for people and the landscape. With this vision in mind, our recommendations for improving coastal resilience are oriented around three themes: creating capacity and leadership, focusing public support and political will, and building resilience. Within each theme there are several objectives where ESLC can be an active driver.

Creating Capacity and Leadership

As the findings illustrate, a lack of planning, action, and local government capacity prevents the Eastern Shore from addressing its vulnerability to coastal hazards. ESLC can alleviate this condition by providing leadership and assistance. ESLC is already regarded as a regional leader for conservation and sustainability. With this standing, ESLC is positioned to convene stakeholders in order to define a vision for coastal resilience. ESLC can expand its leadership in issue education, regional dialogue, and problem solving.

Build expertise

Building in-house expertise will enable ESLC to be a hub for resilience planning and coordination. ESLC must accumulate knowledge and experience with resilience planning, projects, and politics. Initially, this learning can be accomplished by collaborating with experts in state and federal agencies, academia, and the nonprofit sector.

Foster a regional approach

A regional approach to building resilience would have several benefits, including stimulating learning and sharing across political boundaries; allowing resources, capacity, and costs to be shared across a wide area; making projects more appealing to funders; and encouraging cooperation among jurisdictions to solve complex problems. A well-conceived regional approach could foster increased dialogue, understanding, and cooperation among the towns, counties, and state agencies. Small early successes in regional cooperation can gently build support within governments for a more formal regional alliance on resilience. Such an alliance would include towns and counties that are committed to a sustained effort to improve resilience, such as a regional climate action plan.

Focusing Public Support and Political Will

In order for resilience to be achievable, it must become a community and regional priority. Polls show that two-thirds of Eastern Shore residents support government action to reduce climate change impacts. This support, however, has not yet translated into political will on the part of the public or decision makers. ESLC can bridge this gap through outreach, education, storytelling, and messaging as well as providing opportunities for local government staff and officials to learn about the public's desire for policies and practices that improve resilience.

Engage stakeholder groups

Decision makers are attuned to input from stakeholder groups, including faith-based groups, business groups, water-related interests, homeowners' associations, and under-represented and at-risk groups. These groups can provide valuable input on resilience policies and projects. ESLC should engage stakeholders to encourage local governments to support resilience planning.

Outreach to the public

Making coastal resilience a priority for local, state, and federal government hinges on helping citizens and business owners connect increased flooding and extreme weather with sea level rise and climate change. ESLC can provide information and resources that enable voters to educate themselves about their vulnerabilities. ESLC can also provide venues for Eastern Shore residents to share with each other their personal experiences of climate impacts.

Engage elected officials

The policy process at all levels of government may be susceptible to ‘decision paralysis’ arising out of uncertainty about causes, costs, and consequences. Responses to sea level rise and climate change are not immune to this challenge. Increasing decision makers’ understanding of and comfort with the issue can increase the likelihood that resilience planning will become a recurring theme for local governments. ESLC can provide outreach and educational opportunities to local elected officials on sea level rise science, coastal hazards, and options for improving resilience.

Building Resilience

To date, the hazard mitigation efforts taken by counties address current flood risks, not the future risks compounded by sea level rise and climate change. The two themes described above create opportunities for the real work of building long-term resilience. ESLC can pilot several approaches to assessing specific community vulnerabilities, creating options, and implementing resilience practices.

Pilot community vulnerability exercises

For communities to begin addressing long-term resilience, they must identify vulnerabilities and generate action items. Stakeholders are communities’ sensory organs and have useful knowledge of where to expect flooding, erosion, and other negative impacts. Even if governments already have this information, engaging the public creates a crucial sense of buy-in and ownership. One example for a stakeholder-oriented approach is the Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) method. This process was used with success in rural Beaufort County, SC to identify sea level rise adaptation options.

Draft model planning language

Municipal and county planning processes are another opportunity for ESLC to provide assistance. Planning is a long-range process so it is a natural place to address long-term hazards. ESLC can save towns and counties hours of staff time by providing them with model planning language they can easily adapt for their own planning documents. The state already provides model language for floodplain ordinances, which has been adopted by several communities.

Encourage resilience planning in town design projects

Town design projects offer access points for weaving resilience into municipal activities. The smaller scale of town design projects allows communities to test and gain comfort with resilience concepts before committing to them more broadly. ESLC can be a voice for considering long-term coastal risks and implementing resilience practices in town projects.

Testing multiple approaches speeds learning and expands the region's resilience toolbox. It also creates opportunities for sharing knowledge across jurisdictions. The Eastern Shore, one of America's most vulnerable landscapes, will become a test bed for refining methods and practices that build coastal resilience in rural communities. By sharing these lessons with regions across the country, we ensure that the Eastern Shore becomes a model for rural approaches to resilience.

Societal co-benefits

Living safely and prosperously in a vulnerable landscape is the main pillar of our vision. A secondary outcome is recognizing that change is needed in the societal behaviors that prevent us from addressing our most challenging problems. Partisanship, civic apathy, and distrust of leaders and science are obstacles to solving our most complex problems. An intended consequence of our work is a society that is engaged and equipped to tackle pressing issues.

Creating a broadly shared vision for resilience depends not only on increasing individuals' understanding of the problem but also on creating an environment that promotes inclusion and tolerance of disparate standpoints. The activities described above must include participatory exercises that collect the wide range of stakeholders' opinions and experiences. Greater inclusion and respectful dialogue will produce a vision for resilience that is representative of the region's diversity and accepted by the Shore's residents. That vision will enable and guide decision makers to act boldly to counter our vulnerabilities.

Activities must also prioritize transparency. When projects and decision processes are transparent, the public is more likely to perceive them as fair, inclusive, and non-threatening. This leads to greater public appreciation and ownership of resilience efforts.

Similarly, activities must emphasize learning and sharing knowledge with the public. No civilization in history has had to adapt to rising seas on this scale. Mistakes will be made. Lessons must be drawn and shared. As government and the public together become more experienced with hazards and options, the public will become more trusting of the government's role in adaptation. When trust and opportunities for learning increase so too will the public's willingness to participate, which further improves the quality of decisions and policies.

In addition to improved resilience to coastal hazards, the long-term societal impact will be increased public participation in the civic processes associated with addressing coastal hazards. This participation will be a model for engaging the public on other complex issues. Lessons learned about stakeholder engagement and frameworks that enroll the public will enable the Eastern Shore to have respectful, informed dialogue on other issues, which ultimately leads to more successful, broadly supported policies.

Conclusion

The Eastern Shore, with its current and projected vulnerabilities, has a clear need for coastal resilience planning. ESLC is uniquely and strongly positioned to be a regional leader on resilience issues as well as a trusted resource to local governments. ESLC's role will be to provide leadership, capacity, and technical assistance to local governments; to increase public support and political will for resilience planning; and to coordinate a regional vision and practical approaches to resilience. These roles dovetail with ESLC's mission and vision for a vibrant, sustainable landscape and public support for sound land use. If the region can muster a broad commitment to implementation, the Eastern Shore has the potential to be a national leader in rural approaches to coastal resilience.

Corrections

May 27, 2015 – The Community Rating System section was amended to include recent revisions to the CRS that award credits to communities for considering future flooding conditions.