CHANGE IT UP MARYLAND!

September Guide—

Sea Levels are Rising – Protect the Coast

CLIMATE COMMUNICATION CONSORTIUM OF MARYLAND

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Special thanks to Bill Husslander of the National Park Service for helping us with images for this guide.

Photos by Dave Harp.

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Introduction

Sea levels are on the rise (NOAA), and the likelihood of extreme storms is increasing, including the likelihood of Category 4 and 5 hurricanes.[1] According to a 2014 Climate Central analysis, the average risk for a local flood topping 5 feet by mid-century is 55 percent. All of these events will hit coastal states like Maryland hard, both economically and environmentally.

Maryland has the highest percent of coastline relative to total area (26%) of any state, and with its low and flat topography, it is extremely vulnerable to sea level rise and storm surges from extreme storms. Just this summer, on August 8th, Maryland's Atlantic shore was pounded with 8-foot waves from off-shore Tropical Storm Bertha, eroding areas of shoreline and beach, and causing lifeguards to evacuate the water in Ocean City and Bethany.[2]

It is important to know what can be done to defend against storm surges and rising sea levels at home and in your community.

The state of Maryland is actively taking precautions to make sure that the state, as well as local communities, are adapting to these new realities of stronger and more frequent storms. Maryland's Coast Smart

Initiative, led by the Maryland Department of Natural Resources, helps coastal communities address short- and long-term coastal hazards,

Key messages:

Main Message 1: Rising Waters: It's a Shore Thing!

- Tell your community members to prepare for stronger and more frequent storms
- Plant trees and native plants that naturally reduce flood impacts
- Join a marsh restoration project to help protect communities from rising seas and strong storms

Main Message 2: **Raise your voice! Sea levels are rising.**

- Tell your elected officials to adopt the state's "Coast Smart" construction guidelines
- Learn more about Maryland's Coast Smart construction program

The facts:

- Sea levels in Maryland are projected to rise nearly 3-6 feet by 2100, which could mean historical landmarks and Maryland icons could be under water in less than 100 years
- 1 million Maryland residents live in neighborhoods that could be affected by rising sea levels (CNS)
- Tide gauge measurements show that Maryland has experienced approximately one-foot of sea level rise over the last century (MD DNR)
- Annapolis and Baltimore have seen a 920% increase in the amount of nuisance flooding since 1960 (NOAA)

[1] IPCC, 2007:Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

[2] http://www.washingtonpost.com/blogs/capital-weather-gang/wp/2014/08/06/bertha-batters-maryland-and-delaware-beaches-with-big-waves-photos/

such as coastal flooding, storm surge, and sea level rise. *Coast Smart* connects local planners to essential information, tools, people, and training.

At the state level, Maryland is using a set of *Coast Smart* Construction Guidelines to ensure that the future impacts associated with sea level rise, coastal flooding and climate change are factored into the construction of state buildings and infrastructure.

Together these programs not only outline new standards for Maryland's state buildings and infrastructure, but also help communities get the resources they need to adopt similar policies and practices.

Sea Level Rise in Maryland

As hurricane and storm season reaches the peak month of activity in September, it is imperative that Marylanders understand how sea level rise, flooding and climate change are related. It is also important to convey that there are steps that Marylanders can take to protect our coastlines and their communities and to prepare for the future.

While global climate changes affect the oceans – and cause sea level rise – through warming and expansion of waters, melting of glaciers and ice sheets, and slowing of the Gulf Stream, so do changes in the height of the land surface, including shifts that have been ongoing for thousands of years.[3] In Maryland, about half of relative sea level is from land subsidence, mostly in response to glacial retreat from Northern America approximately 12,000 years ago.

Because Maryland's natural coastlines, spanning over 3,000 miles, provide endless economic and ecosystem benefits, it is important to convey that protecting and preserving these natural coastlines should be a priority for every Marylander. However, a recent survey showed that only 39% of Marylanders know that sea level rise is happening along Maryland's coastlines.[4]

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[3] Boesch, D., Atkinson, L., Boicourt, W., Boon, J. D., Cahoon, D., Dalrymple, R., Ezer, T., Horton, B., Johnson, Z., Kopp, R., Li, M., Moss, R., Parris, A., & Sommerfield, C. (2013). *Updating Maryland's Sea-level Rise Projections*. Special Report of the Scientific and Technical Working Group to the Maryland Climate Change Commission. University of Maryland Center for Environmental Science, Cambridge, MD.

[4] 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.

A Majority Support Policies Protecting Maryland from Rising Waters

A 2014 survey, *Adapting to Climate Change and Sea Level Rise*, revealed that although a majority of Marylanders (53%) say they do not know whether sea level rise is currently happening, more than half (55%) say that protecting coastal areas from sea level rise should be a high or very high priority for the state's General Assembly and the Governor. A majority of state residents support policies that protect shorelines and low-lying lands from sea level rise, such as changes to regulations like zoning laws and set-back distances for building (67%), long-range planning (66%), tax incentives to property owners to take protective actions (55%), and using government funds to buy natural areas as buffers against rising waters and storms (55%).

Rising Seas, Rising Expectations for Hurricanes…

Maryland has long been dependent on the Chesapeake Bay and other coastal waterways, but a continued increase in sea level rise has a multitude of implications for Marylanders. Some threats include, but are not limited to, an increase in damage to coastal economies and coastal ecosystems, contamination of drinking and fresh water supplies, threats to transportation, damage to infrastructure, and damage to personal property. Sea level rise in combination with a possible increase in storm intensity means more damage to our ecosystems and economies. As Hurricane Isabel has shown, Maryland is very susceptible to storm surges and rising waters. One report estimates the total average annual costs of coastal storm damage in Maryland to be upwards of $548 million by 2020.[5] In addition, a new report from Climate Central revealed that in the coming few decades, many tidewater and coastal communities on the Delmarva peninsula are likely to face record floods. More than 183,000 people, 116,000 homes, $42 billion in property value and 3,400 miles of roads in the region sit on land less than 5 feet above local high tide lines.[6]

According to the Intergovernmental Panel on Climate Change (IPCC), the frequency of Category 4 and 5 hurricanes has increased over the past 30 years. This means more instances of hurricanes like Isabel, Sandy, and Katrina hitting along the East Coast.

[5] http://riskybusiness.org/report/overview/regions/southeast
[6] http://sealevel.climatecentral.org/

Protect Natural Coastlines → Be Protected By Them

Preserving, protecting, and improving our natural shorelines is far more than just aesthetically pleasing. Tidal wetlands and marshes, vegetated buffers and Bay islands significantly decrease the impacts of storms surges and hurricanes. One study showed that wetlands are crucial in slowing storm surges, and that a sufficiently wide and tall vegetation canopy reduces inundation on land by 5 to 40 percent.[7] These natural barriers can be damaged in various ways, including from human development, but serve as one of our greatest allies in the battle with rising waters.

Bay grasses are also vital in maintaining healthy ecosystems. Oysters, fish, crabs and other marine wildlife are dependent on bay grasses to thrive. Maryland's illustrious seafood industry is a result of the complex ecosystem, which is largely centered around healthy vegetation. In addition, grasses help hold the sea floor in place, which decreases the rate of erosion. Nevertheless, both pollution and sea level rise have had a tremendous impact on the sea grass populations, but there are feasible steps Marylander's can take to help revitalize them.

Although there are many proposals to improve infrastructure to protect against sea level rise and an increase in storm severity, taking steps to revitalize our shorelines is also important and cost-effective. By replanting grasses and creating "living shorelines," Marylanders can help naturally protect their homes and communities while also providing wildlife with the natural habitat they need to survive. The Maryland Department of Natural Resources' Shoreline Conservation Service defines living shorelines as "the result of applying erosion control measures that include a suite of techniques which can be used to minimize coastal erosion and maintain coastal process. Techniques may include the use of fiber coir logs, sills, groins, breakwaters or other natural components used in combination with sand, other natural materials and/or marsh plantings. These techniques are used to protect, restore, enhance or create natural shoreline habitat."[8]

Living shorelines are just as effective at providing storm surge and rising sea level protection as sea walls, but in a more effective and natural manner. Living shorelines allow for the continuance of ecosystem processes like sand movement and nutrient cycling, provide valuable habitat for fish and other wildlife and beautify the shoreline. See below for a table outlining the advantages of living shorelines over sea walls and levies.

[7] http://www.agu.org/pubs/crossref/pip/2012GL053577.shtml#content
[8] http://www.dnr.state.md.us/ccs/livingshorelines.asp

Living Shoreline Advantages and Limitations

	Living Shoreline	Structural Practice
Reduce shoreline erosion	✓	✓
Prevent or reduce future shoreline erosion	✓	✓
Decrease nutrient run-off	✓	x
Maintain ecosystem processes (sand movement, nutrient cycling)	✓	x
Protect, restore, and enhance habitat for fish and trust species	✓	x
Provide spawning/rearing habitat	✓	x
Provide shallow water habitat that results in higher abundance and diversity of aquatic species – both near-shore and offshore	✓	x
Help maintain a link between aquatic and upland habitats, providing shoreline access for wildlife recreation	✓	x
Look natural rather than artificial	✓	x
Improve water quality by settling sediments and filtering pollution	✓	x
Absorb wave energy, storm surges, and flood waters	✓	x
Maintain natural shoreline dynamics and sand movement	✓	x
Maintain shoreline in high-energy environment	x	x
Maintenance – free on a daily basis	x	✓
Adapt to possible sea-level rise	✓	✓
Efficient permitting process	✓	x

Table 1: Living Shorelines Advantages and Limitations. Data retrieved from Maryland Department of Natural Resources. Available from www.dnr.state.md.us/ccs/livingshorelines.asp

There are various forms of action Marylanders can take to help reduce their vulnerabilities, some which can also benefit the environment. For tips on how to create your own living shoreline, and get financial assistance in doing so, see the tabs at the bottom of the page on Living Shorelines on the Maryland Dept. of Natural Resources webpage.

Threats to Protective Salt Marshes

A big threat to salt marshes and the Chesapeake Bay is eutrophication, which is caused by intense nutrient overload from the overuse of fertilizers on neighborhood lawns and large farms, as well as nutrient run-off from impervious surfaces like paved roads and parking lots. The resulting excessive growth of algae and low levels of dissolved oxygen harm plants and fish.

According to the Environmental Protection Agency (EPA), urban and suburban stormwater is the source of about 15 percent of the total nitrogen entering the Bay, and is the only source that is still increasing (CBF). This means that even though nitrogen from farms may be a larger over-all contributor to eutrophication, urban and suburban run off from lawns and pavements is the only contributor still growing. This is due to natural forests and undeveloped areas being developed and paved over, and to the conversion of natural land to lawns and non-native flower gardens.

Check out this video on climate change tidal marshes in Maryland by Defenders of Wildlife and Audubon Maryland-DC: http://md.audubon.org/videos/climate-change-and-tidal-marshes

What You Can Do to Protect Our Natural Defenses

So what can you do to help protect the salt marshes and the health of the Chesapeake Bay? Plenty!

1. Grow Right:

Here are some tips for how to grow lawns and gardens that will help the Bay and its marshes, not hurt them:

a) **Follow the Law:** In 2009 and 2011, the Maryland General Assembly passed laws that control lawn fertilizer use. These laws prohibit the use of phosphorous in maintenance lawn fertilizer used by homeowners; limit the amount of nitrogen allowed in lawn fertilizer and include rules about where and when you can spread fertilizer.
If you *do* fertilize, be in compliance:
    - Check the bag! Make sure there is no phosphorous in the ingredients list.
    - Don't spread fertilizer within 15 feet of waterways.
    - Don't fertilize between Nov. 15th and March 1st, or when the ground is frozen.

b) **Grow native plants which don't require fertilizer:** For native species that create habitats for wildlife, try Eastern Columbine, Milkweed, Wild Blue Indigo, White Turtle Head, the Maryland Butterfly Pea and many others. For a full list of what is native to Maryland, see the U.S. Fish and Wildlife Service's document, Native Plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed.

c) **If you just can't give up your lawn**:
    - Recycle your grass clippings back into your lawn to act as natural fertilizer.
    - Keep your grass at least two and a half inches long to work like a sponge, absorbing run off.

- Go Green by doing less: You can save money and save the environment by simply fertilizing less frequently.
- Try a native and low maintenance type of lawn grass like Pennsylvania Sedge or Red Fescue, both native to Maryland.
- See The Chesapeake Bay Foundations "10 Steps to a Bay-Friendly Lawn" for more information.

2. Try a New Approach to Paving:

An increase in developed land and paved surfaces has also led to more pollution of the Bay due to increased stormwater runoff. Traditionally, water is filtered through ground soil and tree and plant roots in a natural process that cleanses the water of impurities, but with increased impermeable surfaces, like pavement, water rushes over these surfaces, unable to reach the soil. That water then washes harmful bacteria, like E. coli, chemicals from fertilizers, along with other pollution like motor oil, cigarette butts and animal waste from the pavement into storm drains which eventually dump all that pollution into larger water bodies like the Chesapeake Bay.

So what can you do to stop this from happening? Try Permeable Pavement the next time you re-pave your driveway or walkway.

1) Permeable pavement captures run off and allows the water to seep into the ground, following the natural filtration cycle and recharging depleted ground water aquifers.
2) Permeable pavement is recommended by the EPA for best management practices for stormwater.
3) Permeable pavement comes in many forms, from pavement that is porous itself, to paving stones with porous edging that allows water to seep through a series of filters and finally into the ground.
4) For more information, see Montgomery County's Environmental Protection page on Permeable Pavement here: http://www.montgomerycountymd.gov/DEP/water/permeable-pavement.html
5) Montgomery County also offers financial incentives to install permeable pavement. See here: http://www.montgomerycountymd.gov/DEP/water/permeable-pavement.html

Assateague Island

Assateague Island is an undeveloped barrier island off the coast of Maryland that is managed in conjunction by the National Park Service, U.S. Fish and Wildlife Service, and the Dept. of Natural Resources. Barrier islands are important natural resources as they protect valuable mainland

shorelines from storms, and provide habitat for many species of plants and animals, some of which are endangered. See more information on Assateague here. As part of the National Wildlife Refuge System, Assateague Island is home to a variety of plant and animal species, including the endangered Delmarva Fox Squirrel and Piping Plover and other important species like the Atlantic Bottlenose Dolphin and Bald Eagle.

In further efforts to keep the island undeveloped, the National Park Service (NPS) Rangers on Assateague make a strong effort to teach the public about climate change and its impacts on the island and our ecosystem in general. Scientists agree that due to climate change, the island will experience a rise in sea level anywhere between 3.5 and 9 inches, altered precipitation patterns, increases in temperature and extreme weather all by 2040. To protect the island, and the coastlines that the island protects, NPS has gone to great lengths to make the island more sustainable, from restoring the salt marshes, to installing permeable paving surfaces. NPS has also improved their structures on the island. They built their new visitor's center on 5 ft. posts to protect it from rising seas and strong storms. They also have transitioned other structures on the island to modular structures that can be moved to higher ground in the event of a storm or flooding threat. For more information on what the Park Service is doing to mitigate the effects of climate change on the island, visit their website Changing Landscapes on Assateague Island, and for more on what the Park Service is doing across the country to educate the public and mitigate the effects of climate change within their parks, see the NPS website on Climate Change. NPS, together with The University of Maryland Center for Environmental Studies (UMCES), has also developed an interactive module as an educational tool for the public on the island and climate change, which you can find here.

Creating Resilient Coastal Communities

With its low-lying topography and position along the Atlantic coast, Maryland is one of the most vulnerable states in the nation to the threat of sea-level rise. However, Maryland is currently a national leader in adaptation strategies for climate change, as well as carbon mitigation, a position that is made possible by Gov. Martin O'Malley's 2007 Maryland Commission on Climate Change (MCCC). MCCC's 2008 Climate Action Plan outlined an Adaptation Strategy that "details the actions necessary to protect Maryland's environmental heritage, public safety and future economic well-being from the impacts of climate change."[9] This strategy includes new siting guidelines to avoid construction of new properties, or reconstruction of damaged properties, within areas likely to be inundated by sea-level rise within the next 50 years; guidelines against siting of essential or critical facilities within Flood Hazard Areas; a push for identification, maintenance, and protection of ecological features that serve to buffer the area from the threats of sea-level rise, coastal flooding, or storm surges and onsite mitigation measures for enhancing, restoring and creating "ecological features to provide additional protection against future sea level rise and coastal storm impacts."

[9] http://dnr.maryland.gov/climatechange/pdfs/ClimateChange_CoastSmartReport013114.pdf

To find out more about the guidelines, see The State of Maryland Climate Change and Coast Smart Construction Infrastructure Siting and Design Guidelines, published in Jan. 2014.

The climate is changing, and there are dangers associated with this, but there are also strategies to provide safety to Maryland residents. If swift action is taken to adopt these strategies, damage to the public, communities and the economy can be mitigated to a great extent. Take this month to further prepare yourself in your home and to spread awareness of the importance of sea level rise and climate change adaptation and mitigation policy.

The Maryland Department of Natural Resources (DNR) also created a community self-assessment tool for calculating their community's risk and vulnerability to coastal hazards. The Coast Smart Communities Scorecard is available **here**, and is intended to provide:

- Facilitated, in-person discussion among local government departments
- Shared information on vulnerabilities and risks to relevant coastal hazards
- Awareness of strengths and weaknesses of hazard preparedness and planning
- Next steps for increasing resilience to short and long-term coastal hazards.

Aug. Featured Marylanders:

Bill Husslander, Chief of Resources Management at Assateague Island National Seashore is featured in this month's toolkit. Bill has worked for the National Park Service for more than 20 years helping to educate visitors, elected officials and communities about the importance of preserving our natural resources and natural coastlines.

Getting Help

As always, if you have questions about the use of this guide and the monthly toolkit materials, please contact us, we are here to help.

Social Media

September	Social Media *Hashtags: , #ActOnClimate #climatechange #sealevelrise*
Week 1	**Emphasize climate change's role in sea level rise and the need to be prepared for rising waters and stronger storms.** **Twitter:** • *Most Marylanders want gov't action against #climatechange & #sealevelrise @batlimoresun @climatecentral http://bsun.md/1uR0oyD #ActOnClimate* • *Sept. is #NationalPreparednessMonth. Learn how to prepare for rising sea levels in Md. #actonclimate #sealevelrise http://bit.ly/YM8DCi* • *Sept.is #NationalPreparednessMonth DL the MD Prepares app 4 info on how 2 prepare for rising waters. #actonclimate http://1.usa.gov/1h7Kt7U* • *1 million+ people will be affected by #sealevelrise in MD. Learn how 2 protect your family and cmty #actonclimate http://bit.ly/YM8DCi* • See what Ocean City, Baltimore and Annapolis are projected to look like by 2100 due to #sealevelrise. #actonclimate http://bit.ly/1qhAxyI
	Facebook: [Download visuals from toolkit files] Send messages to your members and other stakeholder organizations. Ask them to Like and share your messages. • A new study by Climate Central warns that Maryland will face more climate-driven flooding and sea level rise. The good

news? 73 percent of Marylanders want the government to take action against climate change, and more than half believe protecting coastal areas from sea-level rise should be a high or very high priority for the Governor and the General Assembly. http://bsun.md/1uR0oyD #ActOnClimate

- September is National Preparedness Month. Learn how to prepare for rising sea levels in Maryland and to protect you and your community from strong storms. Visit http://www.climatemaryland.org/prepare/ to learn more.
- September is National Preparedness Month. Download the free Maryland Prepares mobile app that provides important information and tools to help Maryland residents be more informed and prepared for emergency situations. http://mema.maryland.gov/Pages/mdprepares.aspx
- **It is estimated that more than 1 million people will be affected by rising sea levels in Maryland and it is important to know what can be done to defend against storm surges and rising sea levels at home and in your community. Visit http://www.climatemaryland.org/prepare/ to learn more.**
- See what Ocean City, Baltimore and Annapolis are projected to look like by 2100. http://bit.ly/1qhAxyI

Week 2

Twitter: Emphasize the need for state action to adapt to the effects of sea level rise and highlight the progress that the state is already making:

- MD's new Coast Smart Initiative helps communities address short&long-term coastal hazards. Learn more:http://bit.ly/1uE25jZ #sealevelrise
- Encourage MD policymakers to support and strengthen the new Coast Smart Construction guidelines. http://bit.ly/1tX4ZCp #ActOnClimate
- Encourage your local government to assess their level of preparedness to #sealevelrise using the Coast Smart ScoreCard http://bit.ly/1zFZoPb
- Learn more about Maryland's plan to reduce vulnerability to #climatechange #sealevelrise and coastal storms http://bit.ly/X8eWhS

Facebook: [Download visuals from toolkit files] Send messages to your

members and other stakeholder organizations. Ask them to Like and share your messages.

- Learn more about Maryland's new Coast Smart Initiative, led by the Maryland Department of Natural Resources, that helps coastal communities address short- and long-term coastal hazards, such as coastal flooding, storm surge, and sea level rise. *Coast Smart* connects local planners to essential information, tools, people, and trainings. http://bit.ly/1uE25jZ
- *Encourage Maryland policymakers to support and strengthen the new Coast Smart Construction guidelines to ensure that the future impacts associated with sea level rise, coastal flooding and climate change are factored into the construction of state buildings and infrastructure. http://bit.ly/1tX4ZCp*
- *Encourage your local government to assess their level of preparedness using the Coast Smart ScoreCard. They can even apply for a community grant to aid in coastal hazard preparedness, planning and outreach.* http://dnr.maryland.gov/CoastSmart/grants.asp
- *Learn more about the state's Comprehensive Strategy for Reducing Maryland Vulnerability to Climate Change, sea level rise and coastal storms:* http://www.dnr.state.md.us/coastsmart/pdfs/comprehensive_strategy.pdf

Week 3

Emphasize ways to restore natural coastlines as a way to adapt to climate change and rising waters.

Twitter:

- Concerned about Maryland's rising seas? Join a wetland restoration project and #ActOnClimate #sealevelrise : http://bit.ly/1qXdium
- #Maryland experts weigh in on the need for saltwater marsh restoration to adapt to #sealevelrise #actonclimate http://bit.ly/1tYzlEy

Facebook [Download graphic from toolkit files] Send messages to your members and other stakeholder organizations. Ask them to Like and share your messages.

	• *Concerned about Maryland's rising seas?* ***Join a restoration project to help restore a saltwater marshes or plant native plants to help prevent severe flood damage! For a list of current projects, go to http://www.climatemaryland.org/restore/*** • Maryland experts say that restoring and preserving saltwater marshes are imperative to adapting to rising sea levels. Learn more: http://bit.ly/1tYzlEy
Week 4	**Record your month's activities, and send them to us at CCCoM@gmu.edu or record them online at** https://docs.google.com/forms/d/1HE_ArJe8YxKMfOP_SobS5DBqaX2eMzFyEsNlt6C8t7I/edit

Facebook Graphic Visuals

Marylanders in coastal communities are featured in a set of graphics (see toolkit materials online) that can be used in conjunction with the Facebook content provided above about adapting to rising sea levels.