



Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor
John R. Griffin, Secretary
Joseph P. Gill, Deputy Secretary

**Testimony of
John R. Griffin, Secretary
Maryland Department of Natural Resources**

before the

**U.S. Senate
Committee on Environment and Public Works**

August 1, 2012

Chairwoman Boxer and distinguished members of the Committee on Environment and Public Works, it is my pleasure to be here today to discuss with you the importance of taking action now to reduce our vulnerability to the current and future impacts of climate change. State and local governments are at the front lines of ensuring a safe and healthy environment, livable communities, and a sustainable economy. If states and local governments fail to adequately prepare for climatic changes, billions of dollars of federal, state, and local investments in public infrastructure will be threatened.

My testimony focuses on Maryland's long running efforts to research, plan, and prepare for the impacts of sea level rise, extreme storms, and climate change. Our efforts date back to the early 1990's when, in conjunction with the University of Maryland Center for Environmental Science, we began researching the impacts of sea level rise on coastal communities and marsh systems within the Chesapeake Bay. Since then, we have moved from research to planning to actions, and I am honored to be here to share Maryland's progress in adapting to climate change.

The impacts of major concern to our built and natural infrastructure include increased extreme events such as heat waves, droughts, storms, flooding, and forest fires; the spread of existing and new invasive species; and increased erosion and inundation of low-lying areas along the State's extensive shoreline and coast.

Here are some examples of observable impacts that we are already witnessing in Maryland:

- Maryland has experienced more than a foot of sea level rise in the last century due to the combined forces of regional land subsidence and global sea level rise. Current projections from the Maryland Climate Change Commission indicate that we could see as much as three to four feet of additional rise over the next 100 years. A recent study by the U.S. Geological Survey published in the journal *Nature Climate Change*ⁱ indicates that the 1,000 kilometer stretch of coast running north from Cape Hatteras to north of Boston is a "hot spot" for sea level rise caused by global warming. The study found that since 1990, sea levels along this stretch (which includes Maryland) are rising at an annual rate three times to four times faster than the global average. The impacts of sea level rise are already increasing our vulnerability to storm events, causing more frequent and severe coastal flooding, inundating our low-lying lands, submerging our tidal marshes, and causing more shore erosion, salt-water intrusion, and

higher water tables. Coastal communities are in harm's way, and public funding for disaster relief and restoration will be in increasing demand.

- Maryland is currently losing approximately 580 acres every year to shore erosion; and alarmingly, thirteen Chesapeake Bay islands once mapped on nautical charts have already disappeared beneath the water's surface. A 2008 report by the National Wildlife Federation calculated that approximately 400,000 acres of land on the Chesapeake's Eastern Shore (Maryland and Delaware) could gradually be submerged.ⁱⁱ Maryland has thousands of miles of developed waterfront property along its coast, including many historic human settlements such as Smith Island. These coastal areas contain billions of dollars worth of public and private investments that will be adversely impacted by sea level rise and the intensification of coastal storm events. Approximately 450 State-owned facilities and close to 400 miles of State highways are located within areas that will be vulnerable to coastal flooding from sea level rise and/or coastal storms over the next 100 years.
- Since 1960, Chesapeake Bay water temperature has increased approximately in 2.8° F.ⁱⁱⁱ Scientists are concerned that eelgrass, an underwater grass that provides critical nursery habitat for commercially and recreationally important fish and blue crab populations, will soon be eliminated from the Chesapeake and our seaside bays because of the rising temperatures and erosion from sea level rise^{iv}. Higher temperatures will also very likely increase the size of the Chesapeake Bay's oxygen depleted "dead zone", and the frequency and severity of harmful algal blooms. Fisheries in the Chesapeake Bay will be further stressed by higher surface temperatures and lower dissolved oxygen.^v These trends pose a real threat to the significant progress we have made toward the recovery of our recreational and commercial fisheries, which contribute more than \$1.42 billion to our State's GDP.
- Critical wetland habitat is already being lost to erosion and sea level rise. At least 5,000 acres of Blackwater National Wildlife Refuge have been lost since the 1930s with 300 more acres being lost each year.^{vi} Marshes across the Bay are being lost to the same process of erosion and sea level rise and many are not very likely able to keep up, eventually falling apart and sinking into the Bay. Commercially valuable forest lands in other areas of Maryland's Eastern Shore are being lost to flooding. Increased flooding and rising carbon dioxide provide an unfortunate opportunity for invasive species to takeover. All of these impacts affect species such as the saltmarsh sparrow, clapper rail, seaside sparrow, and willet just to name a few.
- Last year, Maryland was hit by Hurricane Irene and Tropical Storm Lee, impacting not only Maryland's coast but also many of our inland towns and communities. Warmer ocean waters will increase the impacts of storms such as these. As residential and commercial development increases on highly prized coastal land, more property will be at risk from intense storms.
- Maryland is one of 28 states across our nation that experienced record high temperatures from July 2011-June 2012. Heat waves in Maryland over the last three summers have been the hottest since 1943, the year of record, and have set one-hundred year records, particularly in urban areas, like Baltimore. In Maryland alone, 13 deaths were attributed to heat in an 11 day period in June and July of this year.

These impacts are resulting in real and documented consequences to the health of Maryland's economy, society, and environment. I am very concerned about the consequences of climate change

impacts to the health of Chesapeake Bay. As shorelines are eroded, marshes are lost, and forests are flooded, the amount of nutrients and sediment entering Chesapeake Bay will increase and set us back in our efforts to restore the health of the Bay.

Due to the observed and increasing future risk that a changing climate poses to Maryland's citizens, ecosystems, and infrastructure, our State is increasingly focused on addressing greenhouse gas emissions and preparing for the impacts of climate change. In 2007, Governor Martin O'Malley signed an Executive Order establishing the Maryland Climate Change Commission, comprised of three working groups – a Scientific and Technical Working Group, a Greenhouse Gas and Carbon Mitigation Working Group, and an Adaptation & Response Working Group. The Governor charged the Commission with developing a plan of action to address both the causes and consequences of climate change.

Approximately a year after its formation, the Commission released Maryland's Climate Action Plan,^{vii} setting forth a course of action to address not only the drivers of climate change but also strategies and actions to adapt and respond to the very likely impacts. The work of the Commission resulted in the passage of Maryland's Greenhouse Gas Reduction Act in 2009, which commits the State to reducing greenhouse gas emissions by 25 percent by 2020. We are currently seeking public comment on Maryland's draft plan for achieving the reduction goals set forth in the Act.^{viii}

Maryland's Climate Action Plan includes two climate change adaptation strategies which are currently guiding state-level adaptation planning efforts. The first strategy (Phase I), released in 2008, addresses the impacts associated with sea level rise and coastal storms. The second strategy (Phase II), released in 2011, addresses changes in precipitation patterns, increased temperatures, and impacts to human health, agriculture, forest and terrestrial ecosystems, bay and aquatic environments, water resources, and infrastructure.

Following those plans, the Department of Natural Resources established a new policy to direct our investments and land management in order to better mitigate and adapt to climate change. The "Building Resilience to Climate Change" policy outlines practices and procedures related to new land investments, facility siting and design, habitat restoration, operations, research and monitoring, and resource planning. The policy has been instrumental in institutionalizing the following agency practices.

In 2011, DNR made two revisions to its land acquisition strategies. First, we are working to acquire key pieces of land that allow for the landward migration of wetlands in order to provide habitat and important ecosystem services, such as storm surge protection, as sea level rises. Second, we are shifting away from conserving land located in areas less than 2 feet in elevation above mean sea level, as these areas will very likely be under water within the next 50 years.

We are also siting and designing all new facilities and infrastructure to avoid or minimize likely climate change impacts, particularly those associated with sea level rise. A recent example is the new visitor center at Harriet Tubman Underground Railroad State Park in Dorchester County, which will be located outside of the area projected to be vulnerable to sea level rise within the next 50 years and will be elevated 2 feet above the existing 100-year base flood elevation to add extra protection against future coastal flooding. We are currently preparing similar siting and design criteria for all State facilities for consideration as gubernatorial Executive Order in the near future.

Our Department is also working with local governments to encourage sound investments in land and facilities, and to promote the management of natural resources with an understanding of climate change. One such effort is DNR's Coast-Smart Communities Initiative, created to ensure that Maryland's local communities have the tools and resources they need to be ready, adaptive, and resilient to the impacts of coastal hazards and climate change. We also created Maryland's Coastal Atlas^{ix}, an online interactive mapping tool widely used to access and assess coastal hazard and climate-related data and imagery.

Under the initiative, the Department provides financial and technical assistance to local governments to reduce their vulnerability to the effects of climate change and sea level rise through planning, code revisions, and permitting authorities. To date, the initiative supported hazard resilience projects within 12 of Maryland's 16 coastal counties, which resulted in policy and programmatic changes such as enhanced building codes, and improved floodplain management practices, shore erosion management, and land-use planning. Within the past two years, several local governments including Dorchester County and the cities of Crisfield, Cambridge and Princess Anne, increased the elevation standard for built structures within their tidal floodplains to provide an extra level of flood protection in the event of future sea level rise.

Climate change adaptation planning is happening across all levels of Maryland state government. A few examples include:

- In 2008, the Maryland General Assembly enacted the Living Shoreline Protection Act, requiring non-structural shoreline protection practices in response to coastal erosion and sea level rise. "Living shorelines" include a suite of techniques to minimize coastal erosion and maintain coastal process, while also providing valuable intertidal and near-shore habitat. Living shoreline projects are an increasingly important shoreline management technique, given the additional stressors to Maryland's shoreline from sea level rise, coastal storms and climate change.
- In 2010, the Maryland Department of Housing and Community Development conducted a review of current state-wide building codes and recommended enhancements in coastal regions of Maryland.
- In 2011, the Maryland Emergency Management Agency assessed climate change related hazards, including drought, wildfires, sea level rise vulnerability, storm surge, and shore erosion, and included related hazard mitigation measures in the State Hazard Mitigation Plan.
- In 2012, Maryland activated a State heat emergency web site^x which includes links to the State Heat Plan, facts about heat related illness, and weekly Heat Reports that provide guidance and information about deaths and illness caused by extreme heat in the region.
- The Maryland Port Administration, State Highway Administration, and Maryland Historic Trust are currently working to assess the vulnerability of the assets, infrastructure and cultural resources that they manage, and to develop and implement adaptation strategies.

The tools and guidance produced through our adaptation initiatives mentioned previously have resulted in the development of a framework for addressing climate change resilience in the planning process across the State. In the context of the reality that we are continuing to grow, live and recreate in areas that are already vulnerable, the State incorporated, "Climate Change Impact Areas" as areas of Special Designation in its' State Development Plan, *Plan Maryland*^{xi}, released by Governor O'Malley in December of 2011.

Climate Change Impact Areas include areas currently targeted by the Department of Natural Resources for land-use planning and zoning code enhancements, heightened building codes, increased protection, and habitat restoration. They include: the projected 50 and 100-year Sea Level Rise Inundation Zones, 50-Year Erosion Vulnerable Zones, Category 2 Storm Surge Inundation Zones, Marsh Transition Zones, Temperature Sensitive Streams, Drought Hazard, and Wildfire Risk Areas. The intent of these designations is to ensure that the State and local governments make wise decisions about how we protect our natural resources, and where and how we develop and redevelop in light of climate change induced hazards and risks.

The continuation of federal, state, and local government leadership is imperative if we are to continue to adapt to climate change. The Obama Administration should be commended for convening the Interagency Climate Change Adaptation Task Force, co-chaired by the Council on Environmental Quality, the Office of Science and Technology Policy, and the National Oceanic and Atmospheric Administration. The Task Force is working to ensure that federal agencies align their climate change adaptation planning efforts to build a coordinated and comprehensive response to the impacts of climate change on public health, communities, oceans, wildlife, and water resources. The issuance of the *Water Resource Policies and Authorities for Incorporating Sea-Level Change Considerations in Civil Works Programs*^{xvii} by the U.S. Army Corps of Engineers in July 2009 and updated in November 2011^{xviii}, and the recent amendments to the National Flood Insurance Program under the Biggert-Waters Flood Insurance Reform Act of 2012 (“Reform Act”) also represent great instances of leading by example at the federal level.

Maryland’s climate change planning efforts have been advanced in great part due to a number of federal programs and resources. Maryland relies heavily on climate data, observation and synthesis products, decision support tools, technical planning guidance, and training programs provided by federal agencies including the National Oceanic and Atmospheric Administration, the U.S. Environmental Protection Agency, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service. To emphasize this point, we look forward to the release of the “National Fish, Wildlife and Plants Climate Adaptation Strategy” (a collaborative effort between the federal, state, and tribal governments) which we anticipate will serve as an important resource to managers in Maryland working to safeguard our natural resources against the impacts of climate change.

In Maryland, we clearly recognize the need to take action now to prepare for the consequences of climate change. Harnessing nature’s ability to adapt and heal itself, we are planting more trees to capture excessive carbon pollution and reduce stormwater and heat impacts, restoring more wetlands and living shorelines to help shield us from flooding and coastal storms, and planning ahead to reduce the vulnerability of Maryland’s citizens, infrastructure, and natural resources. As a nation, we must do more to advance our scientific understanding of climate change and reduce our shared societal, economic, and environmental vulnerability to its impacts. We must all continue to advocate for sound planning and strategic actions to avoid or mitigate against the most damaging and likely effects.

For example, coastal wetlands provide a “speed bump” to advancing coastal storms and sea level rise by slowing down and absorbing the damaging effects of waves and storm surges. Similarly, informed land use policies and infrastructure design standards, like those that we are developing in Maryland, can serve as “speed bumps” that mitigate impacts to our built environment.

The challenge before us as we move forward is to accept the fact that the realities faced by our parents’ generation are most certainly not the same realities that we face today. We need to learn from the

already observed effects on our built infrastructure and natural resources. We need to recognize the value and resiliency of healthy ecosystems and the services they provide, and we need to adjust our management of our built environment and natural resources accordingly. Doing so is certainly a challenge, but also an opportunity – an opportunity that, if taken advantage of, will ensure the prosperity of our children’s and grandchildren’s generations.

ⁱ Asbury H. Sallenger Jr., K.S. Doran, P.A. Howd. 2012. Hotspot of accelerated sea-level rise on the Atlantic coast of North America. *Nature Climate Change*. Published online:

<http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1597.html>

ⁱⁱ Glick, Patty, et.al.. 2008. Sea-Level Rise and Coastal Habitats in the Chesapeake Bay Region. National Wildlife Federation. Reston, Virginia.

ⁱⁱⁱ Boesch, D.F. (ed.). 2008. *Global Warming and the Free State: Comprehensive Assessment of Climate Change Impacts in Maryland*. University of Maryland Center for Environmental Science, Cambridge, MD.

^{iv} Najjar, R., C. Pyke, M.B. Adams, D. Breitbart, C. Hershner, M. Kemp, R. Howarth, M. Mulholland, M. Paolisso, D. Secor, K. Sellner, D. Wardrop, R. Wood. 2010. Potential climate-change impacts on the Chesapeake Bay. *Estuar. Coastal Shelf Sci.* 86: 1–20.

^v Boesch, D.F. (ed.). 2008. *Global Warming and the Free State: Comprehensive Assessment of Climate Change Impacts in Maryland*. University of Maryland Center for Environmental Science, Cambridge, MD.

^{vi} U.S. FWS. 2009. Blackwater National Wildlife Refuge: Marsh loss and restoration.

^{vii} Maryland Commission on Climate Change. 2008. Maryland Climate Action Plan. Maryland Department of Environment. Baltimore, Maryland.

^{viii} The draft plan is available online at:

<http://www.mde.state.md.us/programs/Air/ClimateChange/Pages/Air/climatechange/index.aspx>.

^{ix} <http://shorelines.dnr.state.md.us/>

^x <http://dhmh.maryland.gov/extremeheat>

^{xi} Maryland Department of Planning. 2011. PlanMaryland: A Sustainable Growth Plan for the 21st Century. Maryland Department of Planning, Baltimore MD.

^{xii} Department of the Army, U.S. Army Corps of Engineers. 2009. Water Resource Policies and Authorities for Incorporating Sea-Level Change Considerations in Civil Works Programs. Circular No. 1165-2-211.

^{xiii} Department of the Army, U.S. Army Corps of Engineers. 2011. Water Resource Policies and Authorities for Incorporating Sea-Level Change Considerations in Civil Works Programs. Circular No. 1165-2-212