

Climate Change and Public Policy:

Risks and Tools for Coastal Virginia

What Does “Climate” Really Mean?

CLIMATE is defined as an area’s long-term weather patterns. Useful elements for describing climate include average temperature, the type and the timing of precipitation, amount of sunshine, average wind speeds and directions, number of days above freezing, weather extremes, and local geography.¹ The climate of any particular place is influenced by a host of interacting factors, for example -- latitude, elevation, nearby bodies of water, ocean currents, topography, vegetation, and prevailing winds. The global climate system and any changes that occur within it also influence local climate.¹

In contrast, the term **WEATHER** describes the state of the air at a particular place and time: whether it is warm or cold, wet or dry, and how cloudy or windy it is.²

The National Oceanic and Atmospheric Administration (NOAA) National Weather Services defines **CLIMATE CHANGE** as a long-term shift in the statistics of the weather (including its averages): “For example, it could show up as a change in climate normals (expected average values for temperature and precipitation) for a given place and time of year, from one decade to the next.”³ It is common for people to mistakenly refer to short-term local weather patterns in a given year and draw conclusions about long-term climate change. NOAA National Weather Service also explains in its report:

“Climate change is a normal part of the Earth’s natural variability, which is related to interactions among the atmosphere, ocean, and land, as well as changes in the amount of solar radiation reaching the earth. The geologic record includes significant evidence for large-scale climate changes in Earth’s past.”

Is The Earth’s Climate Changing?

Past climate changes were natural in origin, however, now data suggest that most of the warming of the past 50 years is attributable to human activities.⁵ Burning of fossil fuels like oil, coal and natural gas during that time and today is adding substantial quantities of carbon dioxide (CO₂), water vapor (H₂O) and other gasses to the atmosphere, contributing to and enhancing the green house effect. Greenhouse effect refers to the circumstance that the visible short wavelengths light from the sun pass through a transparent medium and are absorbed, but longer ones cannot. CO₂, water vapor, methane largely work as the transparent medium. The trapping of the long wavelength radiation leads to more heating and a higher resultant temperature. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) concludes: “Most of the observed increase in the globally averaged temperature since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.”²³ The World Bank records show that “the eight warmest years on instrumental record (since 1850) have all occurred since 1998, the warmest being 2005.”²⁴ IPCC also pointed out that climate is a “non-linear” dynamical system – that is to say – even slight temperature changes can have a range of cascading effects.

Examples of **WORST-CASE SCENARIOS AND PREDICTIONS** of Climate Change⁶

1. *More powerful and dangerous hurricanes:* Warmer water in the oceans pumps more energy into tropical storms, making them stronger and potentially more destructive.
2. *More droughts:* Greater evaporation, particularly during summer and fall, could exacerbate drought conditions and increase the risk of wildfires.
3. *Heavier rainfalls:* Warmer temperatures increase the energy of the climatic system.
4. *More frequent and severe heat waves:* A greater number of heat-related deaths could be a consequence.
5. *Aggravated air pollution:* Hotter conditions could intensify pollen allergies and asthma, and aggravate local air quality problems.
6. *More widespread outbreaks of infections:* Like malaria, dengue fever, tick-borne encephalitis, and diarrheal illnesses.
7. *Disrupting ecosystems:* The first comprehensive assessment of the extinction risk from global warming found that more than 1 million species become extinct by 2050 if the current trend continues.
8. *Sea-level rise :* Thermal expansion of the oceans and melting of many of the world’s mountain glaciers result in a greater risk of flooding in coastal communities, like the Gulf of Mexico, the Chesapeake Bay and etc.

Climate Change and Public Policy

Risks and Tools for Coastal Virginia

So What Is The Controversy?

The climate change controversy is a variety of disputes in regard to the nature, causes, and consequences of global warming. The disputed issues include the causes of increased global average air temperature, especially since the mid-20th century, whether this warming trend is unprecedented or within normal climatic variations, whether or not human has significantly contributed to it. Additional disputes concern estimates of climate sensitivity, predictions of additional warming, and what the consequences of global warming will be.

Atmospheric physicist S. Fred Singer, who founded the Science and Environmental Policy Project in 1990, believes the world is warming. However, he doesn't believe human-created CO₂ is the leading cause of the warming, or that climate change is a bad thing. Most importantly, says Singer, "climate change is part of a natural cycle and there is nothing we can do to stop it." He therefore feels there is no need to try measures that could reduce energy production and put entire economies in jeopardy.⁷



<http://www.epa.gov/climatechange/>

In a recent article in *Le Monde*, Singer laid out his arguments: "First, the climate is always changing – either warming or cooling – on time scales ranging from decades to millions of years. Nearly 20 ice ages have come and gone in the past two million years, controlled by predictable changes in Earth's orbit and tilt of its axis." Singer continues with:

"Our present interglacial warm period is 12,000 years old and may soon end. Geological evidence has also uncovered a 1,500-year climate cycle, likely caused by the sun — and also unstoppable. On top of all this, we have irregular, unpredictable short-term fluctuations. Since 1979, weather satellites have shown a slight warming trend that is well within historical experience. How can we tell whether this recent warming is due to human influences, such as the rise in atmospheric greenhouse gases, or whether it is simply another natural fluctuation?"⁷

Patrick J. Michaels is another prolific and widely quoted climate change skeptic. Michaels is a senior fellow in environmental studies at the Cato Institute.⁹ In Chapter 45 of the *Cato Handbook for Policymakers* (7th edition), Michaels argues that "the rate of overall warming appears to be quite constant and modest,... If this is indeed the rate that has been established as a result of greenhouse gas changes, that should be quite reassuring." Overall, he considers the IPCC's average warming forecast for this century is most likely an overestimate.¹⁴

From the other side, Michael E. Mann, the author of *Dire Predictions: Understanding Global Warming*, is a professor in the Meteorology department at Penn State University and director of the Penn State Earth System Science Center. In his recent article on *Washington Post*, he wrote:

*"The basic physics and chemistry of how carbon dioxide and other human-produced greenhouse gases trap heat in the lower atmosphere have been understood for nearly two centuries. Overloading the atmosphere with carbon dioxide from burning fossil fuels is heating the planet, shrinking the Arctic ice cap, melting glaciers and raising sea levels. It is leading to more widespread drought, more frequent heat waves and more powerful hurricanes. Even without my work, or that of the entire sub-field of studying past climates, scientists are in broad agreement on the reality of these changes and their near-certain link to human activity."*¹⁶

Mann published that article after Virginia's Attorney General, Ken Cuccinelli sought evidence from the University of Virginia as part of a fraud investigation into grants obtained by Mann during his employment there. The *Washington Post* reports:

*"University of Virginia is his former employer. In a motion filed in Charlottesville, the University of Virginia argued that Cuccinelli's subpoena for papers and e-mail from global warming researcher Michael Mann exceeds the Attorney General's authority under state law and intrudes on the rights of professors to pursue academic inquiry free from political pressure."*¹⁵

However, Cuccinelli, a global-warming skeptic, has said in the past that his office was not challenging Mann's research because of opposition to its conclusions, but conducting the inquiry to investigate possible fraud by Mann, on the grounds that Mann may have knowingly skewed data as he sought publicly funded grants. Fred Singer, Patrick Michaels and Michael Mann are the public faces of the global warming dispute. However, the vast majority of the world's climate scientists believe that global warming is occurring and that anthropomorphic factors are significant contributors.

Climate Change and Public Policy

Risks and Tools for Coastal Virginia

What Is The Federal Government's Role In Addressing Climate Change?

Current and Near-Term Greenhouse Gas Reduction Initiatives

The EPA plays a significant role in helping the Federal government reduce greenhouse gas emissions and emission intensity, by using "voluntary and incentive-based programs". These programs include ENERGY STAR, Climate Leaders, and Methane Voluntary Programs, which encourage emission reductions from large corporations, consumers, industrial and commercial buildings, and many major industrial sectors.¹¹

Climate Change Research and Technology Program

The Federal Government also supports Climate Change research and technology development. It established the multi-agency Climate Change Technology Program (CCTP) in February of 2002 to accelerate the development of key technologies.¹² The U.S. Global Change Research Program (USGCRP) coordinates and integrates federal research on changes in the global environment and their implications for society. The USGCRP began as a presidential initiative in 1989 and was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606), which called for "a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change."¹²



IPCC Fifth Assessment Report (AR5) now underway
<http://www.ipcc.ch/>

International Cooperation

The United States government is extensively engaged in international climate change activities as science, mitigation and environmental monitoring.¹² It is working to establish partnerships and provide leadership and technical expertise and assistance. For example, the United States is a strong supporter of activities under the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC). In addition, the United States has joined with Australia, China, India, Japan and South Korea to accelerate the development of clean, more efficient technologies under the Asia Pacific Partnership on Clean Development and Climate.¹²

What Is Virginia's Role In Addressing Climate Change?

In September 2007, Governor Timothy M. Kaine released the Virginia Energy Plan, an implementation document designed to demonstrate how the state energy policy (SB-262; Code of Virginia § 67-100) could be executed. Included in the Virginia Energy Plan was the recommendation that the Governor create a commission to address climate change and its possible impacts on Virginia.¹³ The Climate Change Action Plan created by the commission would do the following:¹³

1. Inventory the amount of and contributors to Virginia's greenhouse gas emissions, and projections through 2025;
2. Evaluate expected impacts of climate change on Virginia's natural resources, the health of its citizens, and the economy, including the industries of agriculture, forestry, tourism, and insurance;
3. Identify what Virginia needs to do to prepare for the likely consequences of climate change;
4. Identify the actions (beyond those identified in the Energy Plan) that need to be taken to achieve the 30% reduction goal of energy consumption;
5. Identify climate change approaches being pursued by other states, regions, and the federal government."

The final list of recommendations, as adopted by the full Commission, for steps that Virginia should take to plan for and adapt to climate change impacts include:¹³

1. Consider a more aggressive GHG reduction goal;
2. Focus and expand state capacity to ensure implementation of the Climate Change Action Plan;
3. Educate the public about climate change and the actions necessary to address it;
4. Continually monitor, track, and report on GHG emissions and the impacts of climate change;
5. Prepare for and adapt to the impacts of climate change that cannot be prevented;
6. Undertake a thorough review of state agency and local government authority to account for climate change in their actions."

Climate Change and Public Policy

Risks and Tools for Coastal Virginia

The forthcoming update of U.S. Department of Agriculture's Plant Hardiness Zone Map is about to make very clear how much rising temperatures have shifted planting zones northward.¹⁸ However, there are concerns that the American Clean Energy and Security Act of 2009, the current climate change bill in Congress, will negatively impact agriculture by raising production costs (higher fuel, fertilizer and energy costs) and lowering farm income, according to Virginia Farm Bureau.¹⁹

According to Virginia Department of Forestry, trees can sequester carbon and thereby play an important role in mitigating climate change. Since forests serve as large stores of carbon, when forest land is cleared, debris is burned and soil removed or disturbed, the conversion of forests to other uses makes an immediate contribution to CO₂ emissions. The loss of forest and land to agricultural or urban uses is estimated to contribute about 3% of Virginia's CO₂ emissions each year.¹⁹ On the other hand, changing climatic conditions could pose a severe threat to forest tree species, which have negative genetic consequences to forests in Virginia.²⁰

What Are Concerns For Virginia's Coastal Zone?

Rising Ocean Temperatures: In the Chesapeake Bay region, annual average temperatures of surface waters have increased by 1.4–2.0°F in the last 60 years,²¹ and the beginning of spring has advanced by about three weeks since 1960. Virginia's coastal ecosystems are especially sensitive to such climate-induced change because they occupy a unique biogeographic boundary between southern and northern marine regions; thus, many species are already near their range limits. Recruitment of commercially important fishes, acreage of underwater grasses, severity of fish and shellfish diseases, and strength of jellyfish blooms in the Chesapeake Bay are all sensitive to modest changes in climate and their impacts on complex interactions among species.²¹

Sea Level Rise: The consequences of sea level rise for coastal communities and regions are severe and many. Sea levels have already been rising; for example, the Atlantic coast has experienced about 1 foot of increase over the last hundred years, and the rate is likely to continue to increase.²⁵ Virginia stands to lose most of its tidal wetlands to sea level rise this century according to an analysis by a nonprofit organization Wetland Watch. The Norfolk-based group said in a letter to the governor that "the state could lose between 50 percent and 80 percent of the tidal marshes that surround the Bay and portions of its tributaries as water levels rise, submerging surrounding areas and threatening homeowners."²⁶ The city of Norfolk's relative sea level change is the worst of any major city on the East Coast, according to statistics from Kristen Lentz, the city's Director of Public Works.²⁷

Across the country, only a handful of Gulf cities such as New Orleans and Corpus Christi, Texas, have worse natural conditions in terms of potential for damage.²⁸

The combination of sea level rise and land subsidence, referred as relative sea level rise, makes the situation even worse. According to Lenz, potential long-term impacts of relative sea level rise are:

1. More frequent and severe flooding;
2. Flood insurance required for more properties and at higher cost;
3. Public facilities and infrastructure more susceptible to flooding;
4. Transportation disruptions;
5. Reduction in suitable land for development/redevelopment;
6. Environmental effects including loss of wetlands and wildlife habitat;
7. Businesses and residents may relocate inland from coastal areas.²⁷

How Can Virginia's Coastal Communities Plan For Sea Level Rise?

According to William A. Stiles, Jr., the Executive Director of Wetlands Watch, his organization has worked for nearly four years in this region to initiate local government sea level rise adaptation planning and to see those plans implemented through land use and other regulatory decisions. The broadened set of local government policy tools developed by Wetlands Watch has been assembled into a draft "toolkit" and once finalized, will seek to apply the "toolkit" in a pilot adaptation strategy development project along a representative reach of tidal shoreline.²⁴

Wetlands Watch, working with the Southern Environmental Law Center, has intervened in Federal Court to support the EPA "Endangerment Finding" that greenhouse gases cause climate change and thus endanger human health and welfare. As Wetlands Watch pointed out,

"Virginia communities like Tangier, Saxis, Norfolk, Portsmouth, Hampton, Poquoson, Guinea Neck, Bayvon, Windmill Point, and Lewisetta are already experiencing economic impacts due to increased flooding due to higher sea level. Without action to check greenhouse gas emissions, if sea level rise rates continually grow higher, these tidewater communities will suffer even more."

In their opinion, Virginia's Attorney General acted in error when he challenged EPA's endangerment finding. They argue that sea level rise is a fact, is accelerating, and can be linked to climate change.²⁹

Climate Change and Public Policy

Risks and Tools for Coastal Virginia

BOX 2: Local Governments for Sustainability (ICLEI) CHECKLIST for Climate Change Adaptation

Milestone 1: Initiate your climate resiliency effort

1. Scope the climate change impacts to your major sectors
2. Pass a resolution or administrative order directing your government to prepare for climate change
3. Build and maintain support to prepare for climate change
4. Build your climate change preparedness team
5. Identify your planning areas relevant to climate change impacts

Milestone 2: Conduct a climate resiliency study

1. Conduct a climate change vulnerability assessment
2. Conduct a climate change risk assessment
3. Prioritize planning areas for action

Milestone 3: Set preparedness goals and develop your preparedness plan

1. Establish a vision and guiding principles for a climate resilient community
2. Set your preparedness goals
3. Develop, select and prioritize your preparedness actions

Milestone 4: Implement your preparedness plan

1. Ensure that you have the right implementation tools

Milestone 5: Measure your progress and update your plan

1. Develop and track measures of resilience
2. Update your plan

Local governments in Virginia currently bear more responsibilities for coping with the rising sea levels. However, it is difficult for them to do so without state level inundation data, ecological resource mapping, and other programmatic and financial support.³¹ In addition, local governments have a particularly difficult task developing sea level rise adaptation strategy because that the vast majority of the tidal shoreline in Virginia is privately owned.³⁰

The current efforts of Norfolk to manage sea level and storm event flooding offers an example of local government action. The city of Norfolk realizes that tidal flooding has occurred with greater frequency in recent years and can be expected to continue to occur due to two major factors: weather events of greater severity (related to increased ocean water temperatures), and relative sea level rise.²⁷ And Norfolk recognizes that addressing

flooding challenges is important for the continued quality of life and economy. It is working to build upon its existing storm water program to address current flooding challenges and prepare for those of the future. By working with local and international experts, the city expects to complete its flooding analysis in early 2011.²⁷ Once completed, the city will prioritize and implement actions in its comprehensive long-term flooding mitigation plan. The city recognizes that extensive policy level decisions will be needed to ensure the future livability of the coastal city.²⁷

What Tools Do Virginia Local Governments Have To Address Climate Change?

Existing Planning Authorities in Virginia That Mention Climate Change

1. *Water Quality Protection Plans:* In areas of the state with tidal waters, localities are required to include water quality protection measures, including shoreline setbacks, in their long range planning and zoning (Va. Code § 10.1-2100).³⁰ Some tidal area Virginia localities are already including climate change discussions in these plans (Accomack County 200832, City of Virginia Beach 200933; Shoreline Management Plan, Mathews County 201034).

2. *Hazard Mitigation Plans:* These FEMA-required programs are natural places to start planning for sea level rise impacts. Some hazard mitigation plans in Virginia include sea level rise impacts. Some hazard mitigation plans in Virginia include sea level rise discussions (City of Poquoson 200835). Other localities are including sea level rise in their floodplain management plans (Gloucester 200836).

3. *Economic Development Plans:* The Hampton Roads, Virginia CEDS mentions climate change as part of the economic challenge facing the region. (Hampton Roads Partnership 201037)

Climate Change and Public Policy

Risks and Tools for Coastal Virginia

The “Adaptation Program Policy Toolkit” that Wetlands Watch has developed has four categories:³⁸

1. *Planning Tools:* Local government planning programs, especially longer range planning programs with greater than 20 years planning horizon, are useful tools for raising public awareness of sea level rise impacts and for beginning to direct public and private activities away from areas of increasing inundation risk.
2. *Incentive Tools:* Federal, state, and local government and private sector programs provide incentives to encourage certain behavior (or disincentives to discourage other behavior) that can include sea level rise adaptation measures.
3. *Investment And Infrastructure Tools:* Government programs that directly fund public buildings, bridges, roads, and other public structures should keep that infrastructure “out of harm’s way,” away from coming sea level rise impacts.
4. *Land Use And Regulatory Tools:* Many proposed uses of coastal land require affirmative government action or regulatory permits and certification before the land use changes can be undertaken.

Helpful CLIMATE CHANGE ADAPTATION references

1. NOAA Coastal Climate Change Adaptation website:
<http://community.csc.noaa.gov/climateadaptation/>
2. EPA Adaptation Planning site:
<http://epa.gov/climatechange/effects/adaptation.html>
3. NYC Climate Change Planning:
<http://www.nyc.gov/html/planyc2030/html/plan/climate.shtml>
4. Lloyds Climate Change and Coastal Community Insurability:
http://www.lloyds.com/NR/rdonlyres/33811190-E508-4065-BB15-92EF5F3DFD41/0/360_Coastalcommunitiesandclimatechange_final.pdf
5. Heinz Center Study on Adaptation Planning:
http://www.heinzctr.org/Press_Releases/adaptation_survey.shtml
6. Climate Change 101 – Pew:
http://www.pewclimate.org/docUploads/Adaptation_0.pdf
7. Preparing for Climate Change – a Guidebook for Local, Regional, and State Governments:
http://www.ccap.org/docs/resources/442/King_County_Global_Warming_Adaptation_Guidebook.pdf
8. Role of Coastal Zone Management Programs in Adaptation Planning:
<http://www.coastalstates.org/uploads/PDFs/CSO%202008%20Climate%20Change%20Report.pdf>
9. GAO Study on Federal Role:
<http://www.gao.gov/new.items/d10113.pdf>
10. Shaping Climate Resilient Development (European Study):
http://ec.europa.eu/development/icenter/repository/ECA_Shaping_Climate_Resilient_Development.pdf
11. Six City Study of Climate Change Preparedness (Canada):
http://www.cleanairpartnership.org/pdf/cities_climate_change.pdf

Climate Change and Public Policy

Risks and Tools for Coastal Virginia

Sources:

1. "Exploring Earth," accessed November 7, 2010, http://www.classzone.com/books/earth_science/terc/content/investigations/es2101/es2101page01.cfm
2. "Clouds R Us.com-Weather Features", accessed November 7, 2010, <http://www.rcn27.dial.pipex.com/cloudsrus/whatis.html>
3. "Climate Change", NOAA National Weather Services, October 2007, 1, <http://www.nws.noaa.gov/om/brochures/climate/Climatechange.pdf>
4. "Climate Change", World Bank, accessed November 7, 2010, <http://youthink.worldbank.org/issues/climate-change>
5. "Is the Current Climate Change Unusual Compared to Earlier Changes in Earth's History?" IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, accessed November 7, 2010, "http://ocean.service.noaa.gov/education/pd/climate/factsheets/iscurrent.pdf" <http://ocean.service.noaa.gov/education/pd/climate/factsheets/iscurrent.pdf>
6. "The Consequences of Global Warming", Natural Resources Defense Council, December 1, 2008, accessed November 7, 2010 <http://www.nrdc.org/globalwarming/fcons.asp>
7. Shany Totten, "Leading Climate Change Critic to Speak at UVMP", March 27, 2007, accessed November 7, 2010, <http://www.vermontguardian.com/local/032007/SingerTalk.shtml>
8. "Patrick J. Michaels", Logical Science, accessed November 7, 2010, <http://www.logicalsociety.com/skeptics/patMichaels.html>
9. Patrick J. Michaels, "Holes in the Greenhouse Effect?", CATO Institute, accessed November 7, 2010, http://www.cato.org/pub_display.php?pub_id=6129
10. Patrick J. Michaels and Paul C. Knappenberger, "Scientific Shortcomings in the EPA's Endangerment Finding from Greenhouse Gases", Cato Journal, Vol. 29, No.3 (Fall 2009, accessed November 7, 2010, <http://www.cato.org/pubs/journal/cj29n3/cj29n3-8.pdf>
11. "Climate Change-Basic Information", United States Environmental Protection Agency, May 2010, accessed November 7, 2010, <http://www.epa.gov/climatechange/basicinfo.html#policy>
12. "U.S. Climate Policy and Actions", United States Environmental Protection Agency, May 2010, accessed November 7, 2010, <http://www.epa.gov/climatechange/policy/index.html>
13. L. Preston Bryant, Jr. Secretary of Natural Resources Chair, Governor's Commission on Climate Change, "Governor's Commission on Climate Change-Final Report: A Climate Change Action", December 15, 2008, accessed November 7, 2010, http://www.deq.state.va.us/export/sites/default/info/documents/climate/CCC_Final_Report-Final_12152008.pdf
14. Patrick J. Michaels, "Global Warming and Climate Change," Chapter 45, In Cato Handbook for Policymakers, 7th edition, 485-495, Cato Institute, 2009, accessed November 7, 2010, <http://www.cato.org/pubs/handbook/hb111/hb111-45.pdf>
15. "UVa goes to court to stop Cuccinelli's subpoena of Prof's Paper", The Huffington Post, July 28, 2010, accessed November 7, 2010. http://www.huffingtonpost.com/2010/05/28/cuccinelli-uva_n_593463.html
16. Michael Mann, "Get The Anti-science Bent out of Politics", Washington Post, October 8, 2010, accessed November 7, 2010, <http://climatechangeandpsychology.blogspot.com/2010/10/michael-mann-get-anti-science-bent-out.html>
17. "Climate change bill will negatively impact agriculture industry", Virginia Farm Bureau, June 25, 2009, accessed November 7, 2010, <http://www.vafarmbureau.org/newsroom/Lists/Headlines%20List/SearchResultItem.aspx?List=6207873d-4390-424c-84ce-79bd851a245a&ID=341>
18. Jennifer Weeks, "USDA Revises Its Plant Hardiness Map, Bringing Climate Change Down to Earth for Millions of Households across The Country", The Daily Climate, 23 March 2009, accessed November 7, 2010, <http://www.dailyclimate.org/tde-newsroom/usda/climate-change-comes-to-your-backyard>
19. "Virginia Forests and Climate Change", Virginia Department of Forest, March 26, 2010, accessed November 7, 2010, <http://www.dof.virginia.gov/resinfo/climate-change.shtml>
20. Kevin Potter, "Assessing Forest Tree Risk of Extinction and Genetic Degradation from Climate Change", U.S. Forest Services, May 2010, accessed November 7, 2010, <http://www.forestthreats.org/current-projects/project-summaries/assessing-forest-tree-risk>
21. J. Emmett Duffy, "Climate Change in Virginia's Chesapeake Bay Region", Virginia Institute of Marine Science, October 2008, accessed November 7, 2010, http://www.vims.edu/research/units/programs/icccr/_docs/coastal_ecosystems.pdf
22. Eric Walberg, "Regional Climate Change Project", HRPDC Minutes, December 16, 2009, 3-5, accessed November 7, 2010, http://www.hrpdc.org/MTGS_%20AGDS/Agendas/2010/01_2010_HRPDC_Packet.pdf
23. "HRPDC Annual Retreat", February 10, 2010, accessed November 7, 2010, http://www.hrpdc.org/MTGS_%20AGDS/Agendas/2010/Feb2010/REVISED%20FEB%20RETREAT.pdf
24. William A. Stiles, Jr, "Sea Level Rise Adaptation at the Local Government Level in Virginia", submitted to the Watershed Science Bulletin – in review as of Oct 2010.
25. Timothy Beatley, "Planning for Coastal Resilience", Island Press 2009.
26. Karl Blankenship, "VA could lose up to 80 percent of its tidal wetlands this century", Chesapeake Bay Journal, July/August 2007, accessed November 9, 2010, <http://www.bayjournal.com/article.cfm?article=3129>
27. Kristen M. Lenz, acting director of public works, "Flooding in Norfolk and the region", August 25, 2010, accessed November 9, 2010, http://www.wetlandswatch.org/sea_level/norfolk_city_flooding_pres_2010.pdf
28. Meghan Hoyer, "Consultants work on flood plan as tides rise and Norfolk sinks", The Virginian-Pilot, August 26, 2010, accessed November 9, 2010, <http://hamptonroads.com/2010/08/consultants-work-flood-plan-tides-rise-and-norfolk-sinks>
29. "Wetlands Watch Takes Legal Action on Climate Change", Wetlands Watch, accessed November 14, 2010, http://www.wetlandswatch.org/SLR_SELIC_WW_suit_031810.asp
30. William A. Stiles, Jr, "Local Land Use Tools for Adapting Tidal Wetlands to Sea Level Rise", draft of October 2010.
31. John Blandin, "The Rising Tide- Cause, Effect and Planning for Rising Sea Level", Wetland Watch, accessed November 1, 2010, http://www.wetlandswatch.org/sl_govt_response.asp
32. Chapter 6, Future Land use plan, Accomack Comprehensive Plan, Adopted May 14, 2008, accessed November 22, 2010, <http://www.esva.net/~accomack/Planning/Comp%20Plan%20Update/20080514%20Accomack%20Comp%20Plan%20Chap%206.pdf>
33. City of Virginia Beach Comprehensive Plan, Adopted December 8, 2009, accessed November 22, 2010, <http://www.ourfuturevb.com/complandocs/Pages/default.aspx>
34. Mathew Shoreline Management Plan, March 2010, accessed November 22, 2010, http://web.vims.edu/physical/research/shoreline/docs/Mathews_ShorelineMgtPlan/Final%20PDF/Mathews_SMP.pdf
35. City of Poquoson, Virginia Multi-Hazard Mitigation Plan, September 2009, accessed November 22, 2010, <http://www.ci.poquoson.va.us/pdf/City%20of%20Poquoson%20FINAL%20to%20FEMA%20RIII%20091409.pdf>
36. A Coastal Floodplain Management Plan for Gloucester County Virginia, Adopted by September 1, 2009, accessed November 22, 2010, <http://www.docstoc.com/docs/28243434/A-Coastal-Floodplain-Management-Plan-for-Gloucester-County-Virginia>
37. Hampton Roads Partnership. 2010. Vision Hampton Roads. Norfolk, Virginia, Adopted July 12, 2010, accessed November 22, 2010, http://hrp.org/Site/docs/Publications/Vision_Hampton_Roads_FINAL_Document_Amended_07-12-10.pdf
38. William A. Stiles, Jr, A "Toolkit" for Sea Level Rise Adaptation in Virginia, draft of 2010.