Adapting to Climate Change in the Chesapeake Bay: Virginia’s Experience

Skip Stiles
Executive Director
Wetlands Watch

STAC Workshop
March 15, 2011
SEA LEVEL RISE ADAPTATION IN VIRGINIA

What Do We Know About Climate Change Impact Predictions for Virginia?

In 100 years we’ll see.....

• At Least 2.3 feet of sea level rise (as much as 5.2 feet) in next 100 years

• 3.1 °C increase in average temperature

• ~11 % increase in rainfall intensity

With 2’ of sea level rise over 100 years, Virginia stands to lose between 50 and 80 percent of its tidal wetlands.

Wetlands Watch - 2007
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Predicted Rates of Sea Level Rise Will ‘Drown’ Most of Virginia’s Tidal Wetlands

Blue, Red, Orange, and Brown areas will see wetlands converted to open water at current predicted rates of sea level rise ~ 2-5 feet/100 years

US CCSP SAP 4.1, 2009
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Sea Level Rise Will Move Shoreline Beyond Today’s Environmental Jurisdictions

Ecosystem Migration “uphill”

“Bay Act” Buffer Protections

Wetlands Regulations

MLW

MHW

Sea Level Rise

www.wetlandswatch.org
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Sea Level Rise Will Move Shoreline “Uphill” – Eventually onto “Nonjurisdictional” Land with Development Rights

Ecosystem Migration “uphill”

Developable “by-right”

TAKINGS?

Or

Common Trust Doctrine

(Coastal No Adverse Impact Handbook)

“Bay Act” Buffer Protections (Today)

Wetlands Regulations (Today)
85% of Virginia’s Shoreline is Privately Owned

Keeping the Tidal Shoreline Open and Resilient is Key = limit development, limit shoreline hardening

All Private Land Use Decisions, Occupancy Permits, Business Permits, Many Environmental Decisions are Made by Local Government

State Law Requires Local Governments to Review Long Range Land Use Plans Every 5 Years

Can we… + …Get Local Governments to Include Climate Change and Shoreline Ecosystem Adaptation in Long Range Plans?
Sea Level Rise Adaptation in Virginia

Who Are Adaptation Partners and What Are Their Tools?

Chesapeake Bay vulnerability to sea-level rise

Tools

State and federal wetlands laws

Chesapeake Bay Preservation Act

Easements, transfer and purchase of development rights

Local land use regulations

Goal: Protect Wetlands and Shoreline Buffers

Adaptation Partners

www.wetlandswatch.org
Virginia is a “Low Water” State with Private Property Ownership to Low Tide Line

Virginia Law Limits Local Government Powers

Virginia is a Strong Property Rights State

Virginia is 50th in US for Per-Capita Spending on Natural Resources

Virginia HAS NEVER MET its 2000 “No Net Loss” Wetlands Regulatory Goal for Tidal Wetlands (DEQ 305b Water Quality Report)

Virginia’s Tidal Wetlands Inventory Hasn’t been Updated in 30 Years (VIMS/CCRM 2010)

Virginia Has No Data Base to Track its Wetlands Restoration Efforts (2008 Annual Chesapeake Bay Implementation Report)
Sea Level Rise Adaptation in Virginia

Some Progress in Getting Climate Change in Long-Range Local Government Plans

Respecting the Past, Creating the Future:

Accomack County Comprehensive Plan

Adopted May 14, 2008

It's Our Future

Mathews County Comprehensive Plan 2030

Preserving and Sustaining the Pearl of the Chesapeake

Draft 12-30-2009
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Regional Governments are Planning
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Social Marketing Challenges Are Difficult...How do we Bridge the Gap?

Scale of Impact

Globe
Nation
Region
State/Province
Community
Individual

Cost of Solving Climate Change

Benefit of Solving Climate Change

Time to Impact

Day
Week
Month
Year
Decade
Century

Policy/Marketing Challenge

www.wetlandswatch.org
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Social Marketing Challenges Are Difficult...How do we Bridge the Gap?

Scale of Impact

Globe
Nation
Region
State/Province
Community
Individual

Time to Impact

Day
Week
Month
Year
Decade
Century

FOREGO FINANCIAL GAIN/PROPERTY TAX ON SHORELINE PROPERTY DEVELOPMENT TODAY

IN FIFTY YEARS, WE WILL HAVE AVOIDED COSTS FROM SEA LEVEL RISE
"It's the greenhouse effect, the greedy capitalists, and I'm not going to let them ruin my life. I'm not going be swept away. I'm just going to sit on my porch and watch the sunset."

_Baltimore Sun July 30, 2004_

"To say we can't build on the water because we think in 100 years the water is going to be 2 feet higher, that's not realistic," Chuck Miller, owner of Miller Custom Homes in Virginia Beach, said Friday. "It's not the builder who decides where people are going to live. It's the people who decide."

_Virginian Pilot February 3, 2007_

(Head of Tidewater Builders Association Green Building Council!)
GOAL: PROTECT WETLANDS AND SHORELINE BUFFERS

WE NEED:
More Tools and More Partners
More Compelling Arguments
Less Mention of Climate Change

Chesapeake Bay vulnerability to sea-level rise
The Bigger Picture of Sea Level Rise Impacts along Tidal Shorelines

Chesapeake Bay vulnerability to sea-level rise and storm surge
Outside of New Orleans, Hampton Roads is largest population area at highest risk from Sea Level Rise in the US

Wetlands Watch - 2007
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Impacts Need to be on the Same Personal, Time, and Geographic Scale = More Compelling

What Will Sea Level Rise Do in My Children’s/Grandchildren’s Life?

What Is Sea Level Rise Already Doing to my Community/To Me?

* How Many Times Have I Had to Change My Commute in the Last Year?

* Why is My House Insurance Getting More Expensive?

What Will Sea Level Rise Cost Me Over my Lifetime/Over my Business Horizon/During the time I Own My House?
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Climate Change Not Needed to Make the Case for Adaptation Here

Virginian Pilot Dec 5, 2010
# SEA LEVEL RISE ADAPTATION IN VIRGINIA

## Storm Surge History at Sewell’s Point (Norfolk, VA)

<table>
<thead>
<tr>
<th>DATE</th>
<th>STORM TYPE</th>
<th>ABOVE MHHW</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 23, 1933</td>
<td>Hurricane</td>
<td>6.27 feet</td>
</tr>
<tr>
<td>September 18, 2003</td>
<td>Hurricane Isabel</td>
<td>5.12 feet</td>
</tr>
<tr>
<td>March 7, 1962</td>
<td>Ash Wednesday Storm</td>
<td>5.05 feet</td>
</tr>
<tr>
<td>November 12, 2009</td>
<td>Veterans Day nor’easter</td>
<td>4.99 feet</td>
</tr>
<tr>
<td>September 18, 1936</td>
<td>Hurricane</td>
<td>4.92 feet</td>
</tr>
<tr>
<td>September 16, 1933</td>
<td>Hurricane</td>
<td>4.36 feet</td>
</tr>
<tr>
<td>November 22, 2006</td>
<td>Thanksgiving nor’easter</td>
<td>3.96 feet</td>
</tr>
<tr>
<td>October 6, 2006</td>
<td>Columbus Day nor’easter</td>
<td>3.76 feet</td>
</tr>
<tr>
<td>January 28, 1998</td>
<td>Twin nor’easters (#1)</td>
<td>3.26 feet</td>
</tr>
<tr>
<td>September 16, 1999</td>
<td>Hurricane Floyd</td>
<td>3.21 feet</td>
</tr>
<tr>
<td>February 5, 1998</td>
<td>Twin nor’easters (#2)</td>
<td>3.12 feet</td>
</tr>
</tbody>
</table>

NOAA
Mean Higher High Water = where the “spring tide” comes twice a month = lower limit of development

Why “Mean Higher High Water” Benchmark?

My House
<table>
<thead>
<tr>
<th>DATE</th>
<th>STORM TYPE</th>
<th>ABOVE MHHW</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 23, 1933</td>
<td>Hurricane</td>
<td>6.27 feet</td>
</tr>
<tr>
<td>September 18, 2003</td>
<td>Hurricane Isabel</td>
<td>5.12 feet</td>
</tr>
<tr>
<td>March 7, 1962</td>
<td>Ash Wednesday Storm</td>
<td>5.05 feet</td>
</tr>
<tr>
<td>November 12, 2009</td>
<td>Veterans Day nor’easter</td>
<td>4.99 feet</td>
</tr>
<tr>
<td>September 18, 1936</td>
<td>Hurricane</td>
<td>4.92 feet</td>
</tr>
<tr>
<td>September 16, 1933</td>
<td>Hurricane</td>
<td>4.36 feet</td>
</tr>
<tr>
<td>November 22, 2006</td>
<td>Thanksgiving nor’easter</td>
<td>3.96 feet</td>
</tr>
<tr>
<td>October 6, 2006</td>
<td>Columbus Day nor’easter</td>
<td>3.76 feet</td>
</tr>
<tr>
<td>January 28, 1998</td>
<td>Twin nor’easters (#1)</td>
<td>3.26 feet</td>
</tr>
<tr>
<td>September 16, 1999</td>
<td>Hurricane Floyd</td>
<td>3.21 feet</td>
</tr>
<tr>
<td>February 5, 1998</td>
<td>Twin nor’easters (#2)</td>
<td>3.12 feet</td>
</tr>
<tr>
<td>DATE</td>
<td>STORM TYPE</td>
<td>ABOVE MHHW</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>August 23, 1933</td>
<td>Hurricane</td>
<td>6.27 feet</td>
</tr>
<tr>
<td>September 18, 2003</td>
<td>Hurricane Isabel</td>
<td>5.12 feet</td>
</tr>
<tr>
<td>March 7, 1962</td>
<td>Ash Wednesday Storm</td>
<td>5.05 feet</td>
</tr>
<tr>
<td>November 12, 2009</td>
<td>Veterans Day nor’easter</td>
<td>4.99 feet</td>
</tr>
<tr>
<td>September 18, 1936</td>
<td>Hurricane</td>
<td>4.92 feet</td>
</tr>
<tr>
<td>September 16, 1933</td>
<td>Hurricane</td>
<td>4.36 feet</td>
</tr>
<tr>
<td>November 22, 2006</td>
<td>Thanksgiving nor’easter</td>
<td>3.96 feet</td>
</tr>
<tr>
<td>October 6, 2006</td>
<td>Columbus Day nor’easter</td>
<td>3.76 feet</td>
</tr>
<tr>
<td>January 28, 1998</td>
<td>Twin nor’easters (#1)</td>
<td>3.26 feet</td>
</tr>
<tr>
<td>September 16, 1999</td>
<td>Hurricane Floyd</td>
<td>3.21 feet</td>
</tr>
<tr>
<td>February 5, 1998</td>
<td>Twin nor’easters (#2)</td>
<td>3.12 feet</td>
</tr>
</tbody>
</table>

What if These Storms Hit 100 Years Ago?

- 1.45 feet in 1906
# SEA LEVEL RISE ADAPTATION IN VIRGINIA

## What Happens 100 Years from Now?

<table>
<thead>
<tr>
<th>DATE</th>
<th>STORM TYPE</th>
<th>ABOVE MHHW</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 23, 1933</td>
<td>Hurricane</td>
<td>6.27 feet</td>
</tr>
<tr>
<td>September 18, 2003</td>
<td>Hurricane Isabel</td>
<td>5.12 feet</td>
</tr>
<tr>
<td>March 7, 1962</td>
<td>Ash Wednesday Storm</td>
<td>5.05 feet</td>
</tr>
<tr>
<td>November 12, 2009</td>
<td>Veterans Day nor’easter</td>
<td>4.99 feet</td>
</tr>
<tr>
<td>September 18, 1936</td>
<td>Hurricane</td>
<td>4.92 feet</td>
</tr>
<tr>
<td>September 16, 1933</td>
<td>Hurricane</td>
<td>4.36 feet</td>
</tr>
<tr>
<td>November 22, 2006</td>
<td>Thanksgiving nor’easter</td>
<td>3.96 feet</td>
</tr>
<tr>
<td>October 6, 2006</td>
<td>Columbus Day nor'easter</td>
<td>3.76 feet</td>
</tr>
<tr>
<td>January 28, 1998</td>
<td>Twin nor’easters (#1)</td>
<td>3.26 feet</td>
</tr>
<tr>
<td>September 16, 1999</td>
<td>Hurricane Floyd</td>
<td>3.21 feet</td>
</tr>
<tr>
<td>February 5, 1998</td>
<td>Twin nor’easters (#2)</td>
<td>3.12 feet</td>
</tr>
</tbody>
</table>

*+2.3 feet in 2106*
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Norfolk on a Dry Day (watch the trash can in the circle)
 SEA LEVEL RISE ADAPTATION IN VIRGINIA

October 2006 Nor’easter Flooding in Norfolk

Built 1904

2006 nor’easter in 2106 (‘33 storm)

Built 1902

Oct ’06 nor’easter in 1906
SEA LEVEL RISE ADAPTATION IN VIRGINIA

FEMA Post-Hazard Mitigation Program

~$130,000/house

$4.5 million in FEMA spending to raise houses in Norfolk after Isabel
$1.23 Million to Raise One Block 18”
SEA LEVEL RISE ADAPTATION IN VIRGINIA

What’s at Stake as Flood Zones Shift?

FEMA Flood Hazard Map

- Port of Norfolk
- Old Dominion University
- Norfolk Southern Piers
- Ship Repair Facilities
- East Ocean View Redevelopment
- Light Rail (under construction)

In 2009 FEMA increased Norfolk’s base flood elevation by 0.3 feet over their 1980 prediction.
Sea Level Rise Increases Frequency of Flooding Events

Northrop Grumman is the largest manufacturing employer in Virginia – the only "Nuclear Capable" shipyard in the US.

Table: Average Number of Years Between Inundation Events

<table>
<thead>
<tr>
<th>Event Severity</th>
<th>Flood Stage Level (ft)</th>
<th>Sea Level Rise change (Ft)</th>
<th>Historical Present</th>
<th>+2’</th>
<th>+3’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>5.00</td>
<td>1.71 0.33 0.10 0.08</td>
<td>1.71 0.33 0.10 0.08</td>
<td>1.71 0.33 0.10 0.08</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>6.00</td>
<td>7.32 1.71 0.33 0.10</td>
<td>7.32 1.71 0.33 0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>7.00</td>
<td>26.83 7.32 1.71 0.33</td>
<td>26.83 7.32 1.71 0.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record</td>
<td>8.02</td>
<td>80.50 26.83 7.32 1.71</td>
<td>80.50 26.83 7.32 1.71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend: Probability that Tide at Sewells Pt exceeds: Historical (Green), Present Day (Blue), Historical + 3’ (Red).

Increasing sea level combined with storm surge frequencies alters the risk analysis. Modest levels of rise on the average increase the frequency of extreme events dramatically.

Sea-level rise reduces the time between (increases the frequency of record-level inundation events. Colors represent relative risk.

<table>
<thead>
<tr>
<th>Flood</th>
<th>Flood (Ft)</th>
<th>Historical</th>
<th>Now</th>
<th>+2’</th>
<th>+3’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record</td>
<td>+8.02</td>
<td>80.5 yrs</td>
<td>26.8 yrs</td>
<td>7.3 yrs</td>
<td>1.7 yrs</td>
</tr>
</tbody>
</table>
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Rural Areas in Virginia are Threatened as Well When the Shoreline Moves

Who’s Responsible for this Residence?

4’ Erosion/yr

www.wetlandswatch.org
Allstate stopped writing new policies in 19 coastal communities:
Accomack, Gloucester, Isle of Wight, King and Queen, Lancaster, Mathews, Middlesex, Northumberland, Northampton, Southampton, Surrey, Sussex, York counties and Chesapeake, Franklin, Hampton, Newport News, Norfolk, Virginia Beach

Nationwide is withdrawing new coastal coverage
State Farm will not write new policies within one mile of the ocean shoreline
Farmer’s will not write a new policy within two miles of ocean shoreline or one mile of tidal Bay
USAA – withdrawing new coverage
Do These Broader Concerns Bring More People to the Table and Provide More Adaptation Tools?

........YES!
Each Sector of Shoreline Community Brings New Potential Adaptation Partners to the Table

Chesapeake Bay vulnerability to sea-level rise and storm surge

Water-Dependent Businesses

Maryland DNR
“Non-Water Dependent” Businesses

Chesapeake Bay vulnerability to sea-level rise and storm surge

Each Sector of Shoreline Community Brings New Potential Adaptation Partners to the Table
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Each Sector of Shoreline Community Brings New Potential Adaptation Partners to the Table

Chesapeake Bay vulnerability to sea-level rise and storm surge

Homeowners - Real Estate Industry – Insurance Industry – Mortgage Providers

Maryland DNR
Who are the New Partners and What are the New Tools?
FEMA requires hazard mitigation plans by states (44 CFR 201.4) and localities (44 CFR 201.5)

National Flood Insurance Program (NFIP) gives reduced rates for publicly developed and regularly updated Floodplain Management Plans (NFIP Community Rating System)

IV. ANALYSIS OF ECONOMIC DEVELOPMENT PROBLEMS AND OPPORTUNITIES

Threats

• Rising Sea Levels and other Potential Impacts of Climate Change
Long-Range transportation plan required of each state (23 CFR § 450.206) and region (23 CFR § 450.306) before receiving federal transportation funds.

Climate Change

“Climate change poses a serious and growing threat to Virginia’s roads, railways, ports, utility systems, and other critical infrastructure...”
US Fish and Wildlife Service requires a “Wildlife Action Plan” prior to receiving funding - 16 U.S.C. § 669e (Virginia and many other states address climate change impacts)


HUD Consolidated Plan required of every locality prior to receiving funding - 24 CFR Part 91.215 (Could include climate change impact on disadvantaged community housing.)

Stormwater planning, Mandatory public involvement and participation – 40 CFR 122.34 (b) 2 (ii) (A place to insert climate change impacts)
Planning is Just the Start – it Gets Harder as Decisions Change Behavior

REGULATION

INVESTMENT/INFRASTRUCTURE

PLANNING

Increasing Political Difficulty
Fig. 1. Scope and scale of adaptation to climate change [based on an extensive literature review (ref. 14, especially refs. 15–18)].

Moser and Ekstrom, PNAS, 2010
“Convincing people that you're right about an issue--say, the scientific consensus about the threat posed by global warming--can seem vitally important, but in the end may be somewhat beside the point.

In the long run, you have to move the debate beyond beliefs, and into incentives: lining up the economic and social incentives such that the right choices are the easy, natural ones.

To do that, we need smart and effective policies. Appeals to people's reason may help, but rational belief alone won't carry the day.

Clark Williams-Derry, Sightline Institute
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Change Requires Engaging the Whole Brain
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Role for Visual Arts in Climate Change Debate to Engage the Right Brain

“Melting Men” – Nele Azvedo
SEA LEVEL RISE ADAPTATION IN VIRGINIA

Show a Path Forward - but be Realistic
Sea Level Rise Adaptation in Virginia

Next Steps – Listening Sessions

Wetlands Watch/UVA/PDC/Virginia Beach Collaboration

Funded by Virginia Sea Grant

Leads to pilot projects on adaptation planning
Partnerships with “fact based” NGO’s are Essential!
SEA LEVEL RISE ADAPTATION IN VIRGINIA