

# Addressing Climate Change with the Ocean SAMP

**Pam Rubinoff**

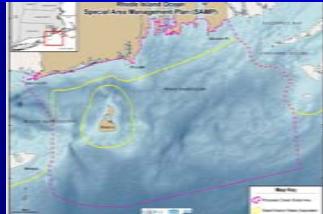
Coastal Resources Center, RI Sea Grant  
University of Rhode Island



*Simulation of 3' SLR, Providence, RI*

# Overview

- Climate change concerns for Rhode Island
- Impacts and issues
- Role of the SAMP to address climate change



# Acknowledgements

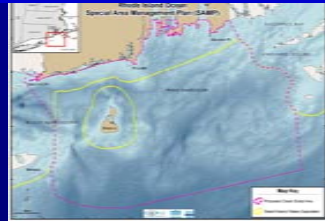
Union of Concerned Scientists - [www.climatechoices.org/ne/](http://www.climatechoices.org/ne/)

Grover Fugate, Janet Freedman – CRMC

Jon Boothroyd, Kate Moran, University of Rhode Island

Kelly Knee, Applied Sciences Associates

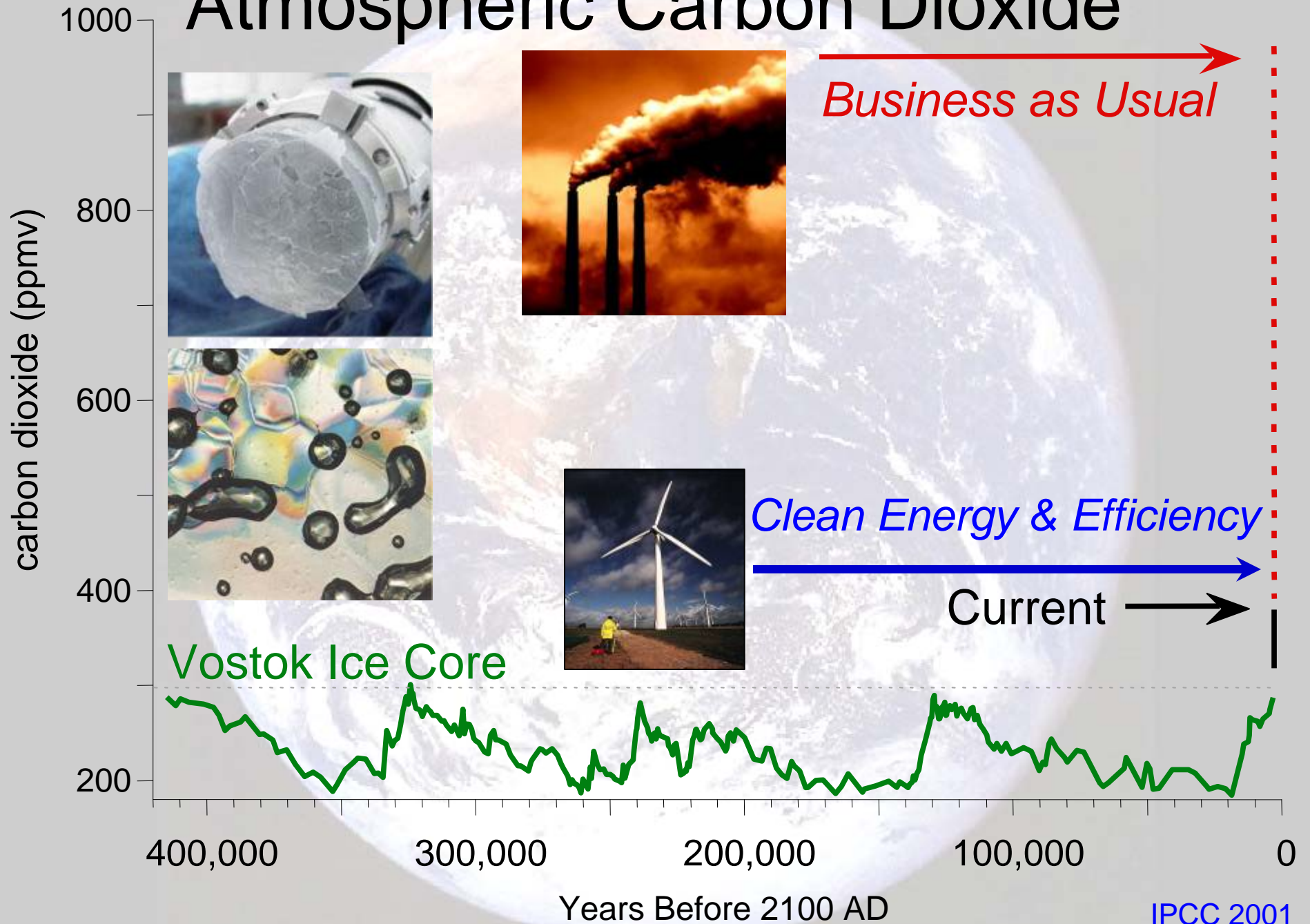
Cameron Wake, Institute for the Study of Earth, Oceans, and Space (EOS). University of New Hampshire



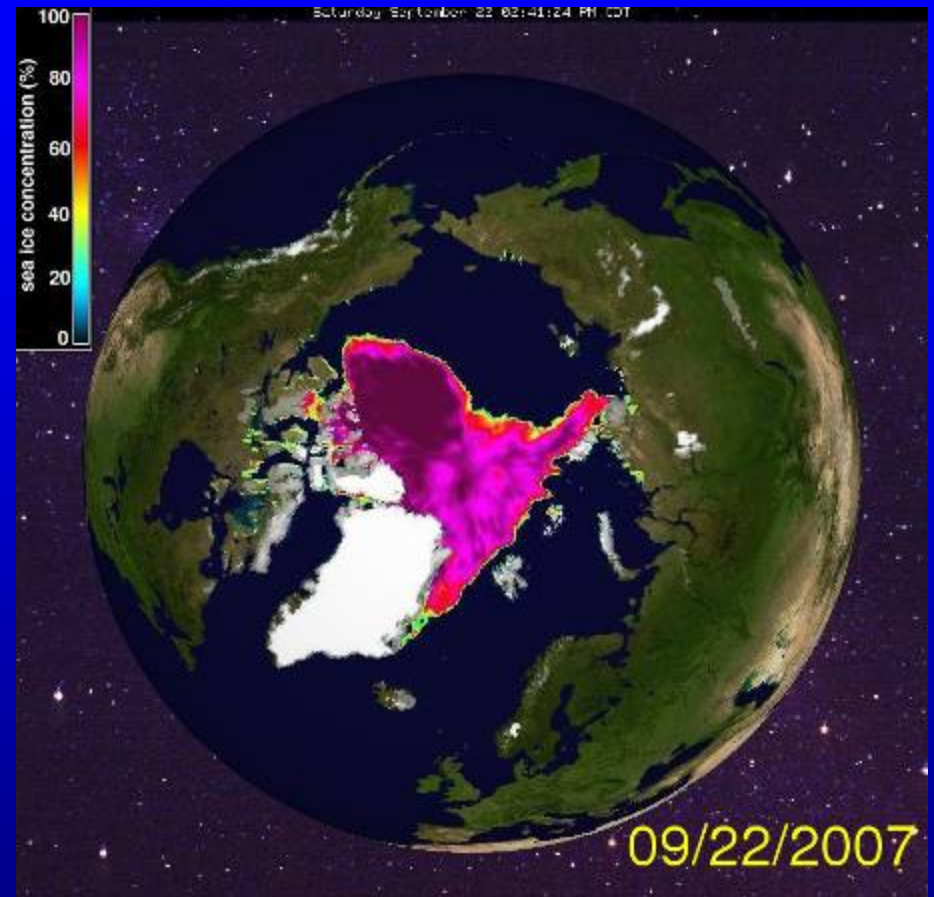
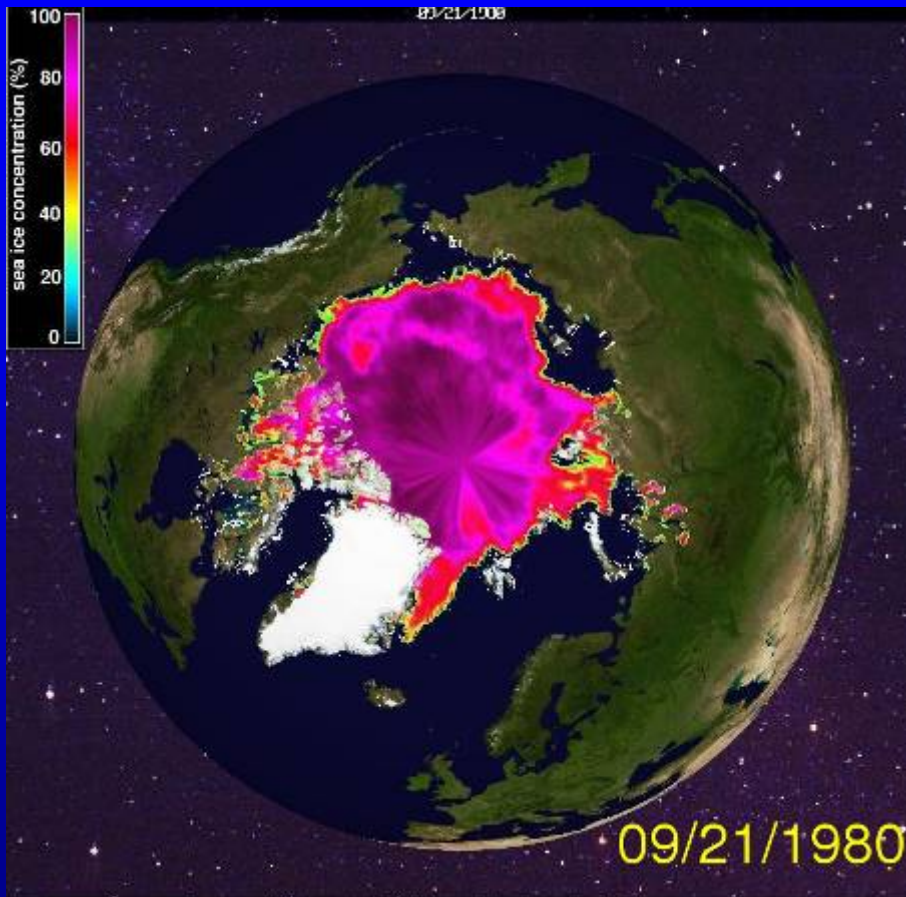
# Existing stresses in the coastal zone



# Atmospheric Carbon Dioxide

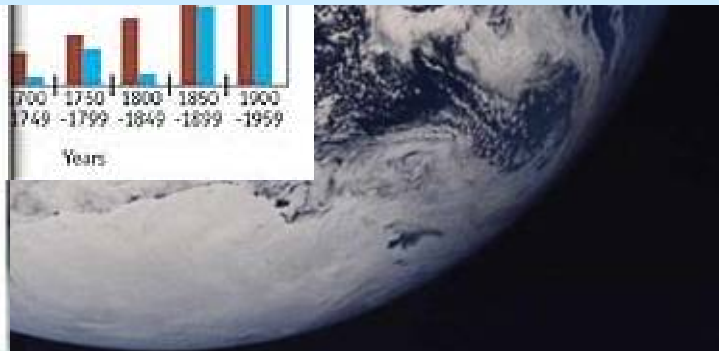
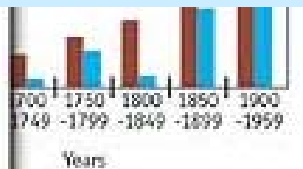
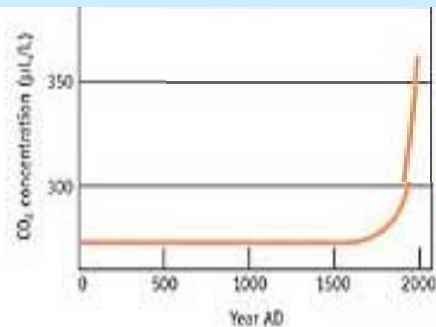


# Arctic Sea Ice: Sept 1980 vs Sept 2007



There is an unequivocal scientific consensus that increases in greenhouse gases in the atmosphere drive warming temperatures of air and sea, and acidification of the world's oceans from carbon dioxide absorbed by the oceans

(IGBP, 2002)



# Northeast Climate Impacts Assessment

A Report of the Northeast Climate Impacts Assessment

## Confronting Climate Change in the U.S. Northeast



SCIENCE, IMPACTS, AND SOLUTIONS

JULY 2007

[www.climatechoices.org](http://www.climatechoices.org)

- Collaboration between Union of Concerned Scientists and 50 independent scientists
- **Geographic Scope**  
Nine Northeast states, from Maine to Pennsylvania
- **Peer Review**  
*Climate Dynamics*, 2007  
14 papers in *Adaptation and Mitigation of Climate Change*, 2008



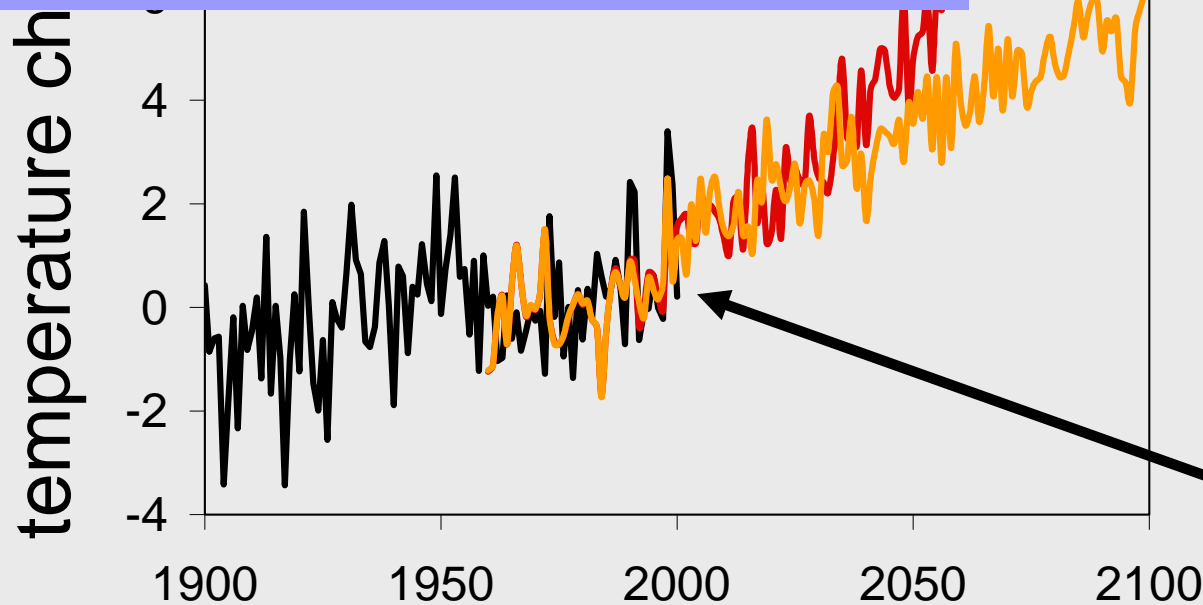
# Indicators of Climate Change in the Northeast US over the last 30-40 yrs

- Winter warming
- Decreased snowfall
- Fewer days with snow on ground
- Lake ice out dates earlier
- Lilac bloom dates earlier
- More frequent extreme precipitation
- Earlier spring runoff
- Sea levels continuing to rise

Hodgkins et al., 2002; 2003; Wolfe et al., 2005;  
Wake and Markham, 2005; Wake et al., 2006

# Projecting Rising Annual Temperatures

Narragansett Bay's average mean temperature has increased 2°F; average mean winter temperature has increased 4°F over last 30 years

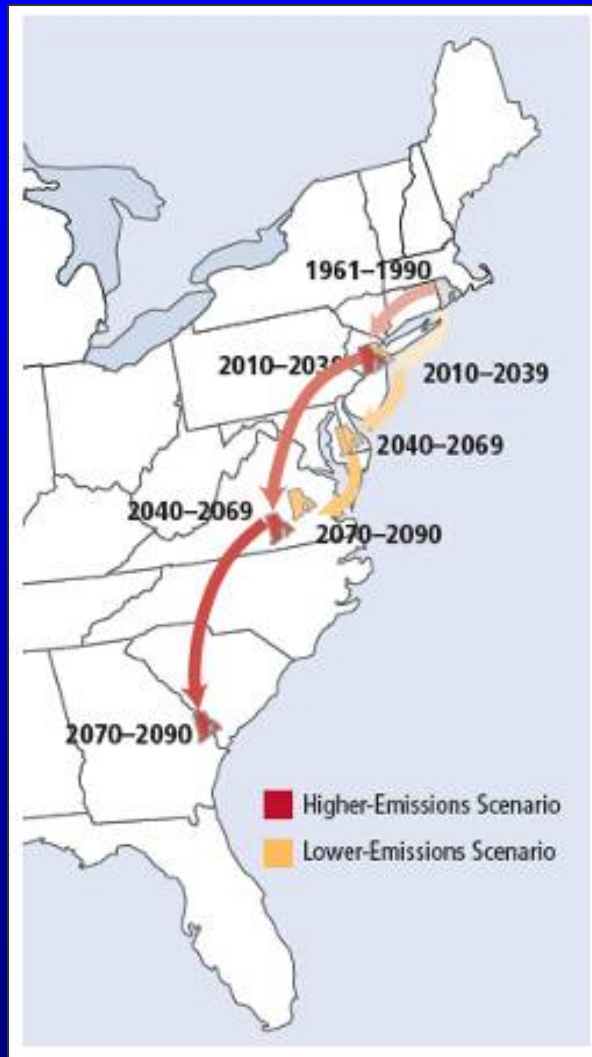


**Higher:**  
**6.5-12.5°F**  
*continued heavy  
reliance on fossil  
fuels*

**Lower:**  
**3.5-6.5°F**  
*A shift away from  
fossil fuels*

2°F warming  
since 1970

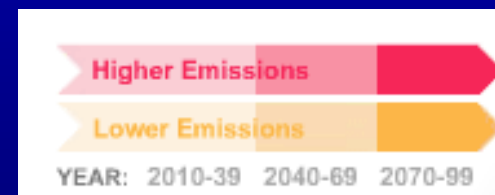
# Rhode Island climate “migration”



By the end of the century, summer in Rhode Island could feel like the

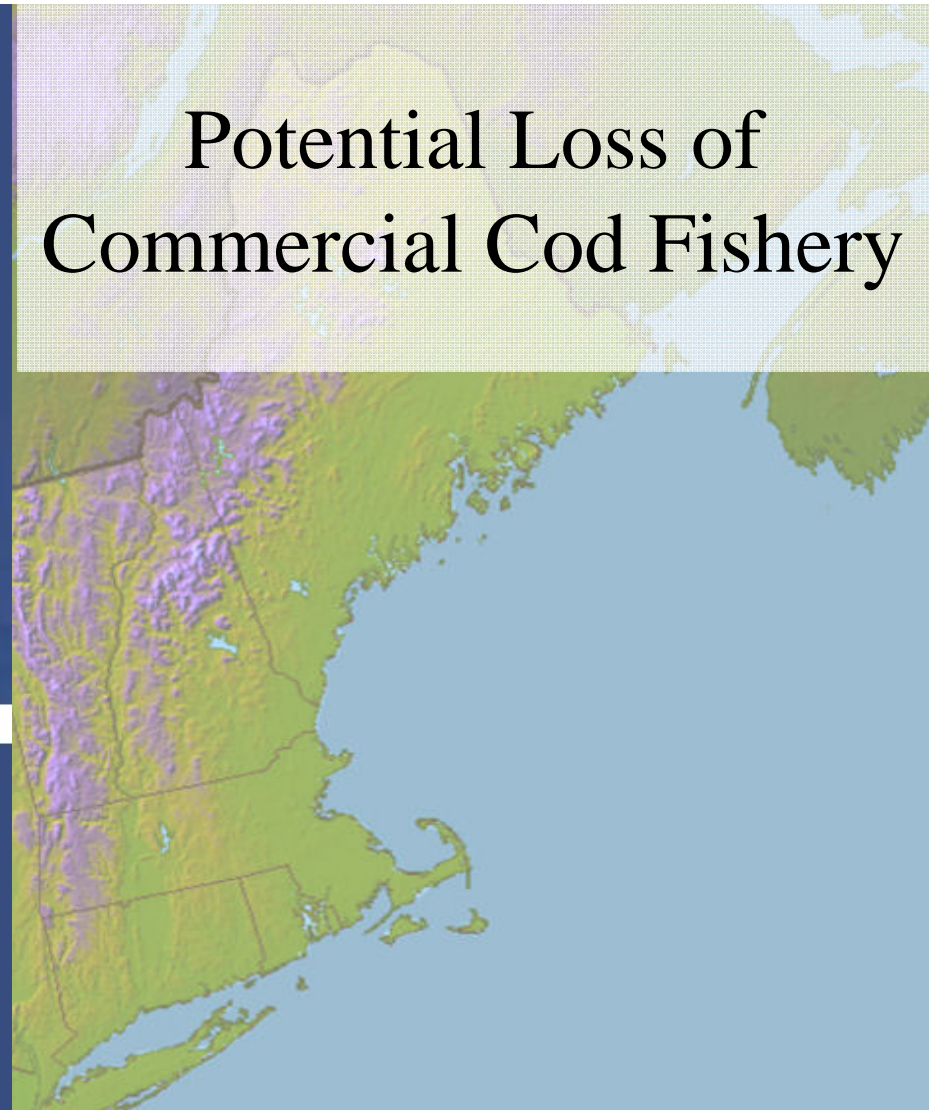
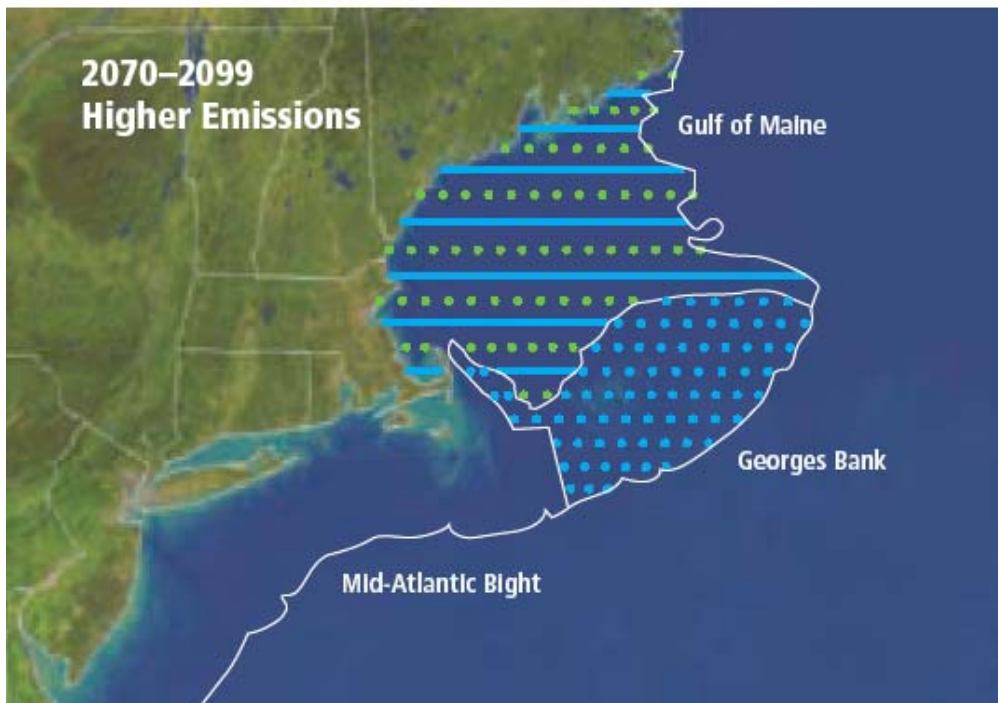
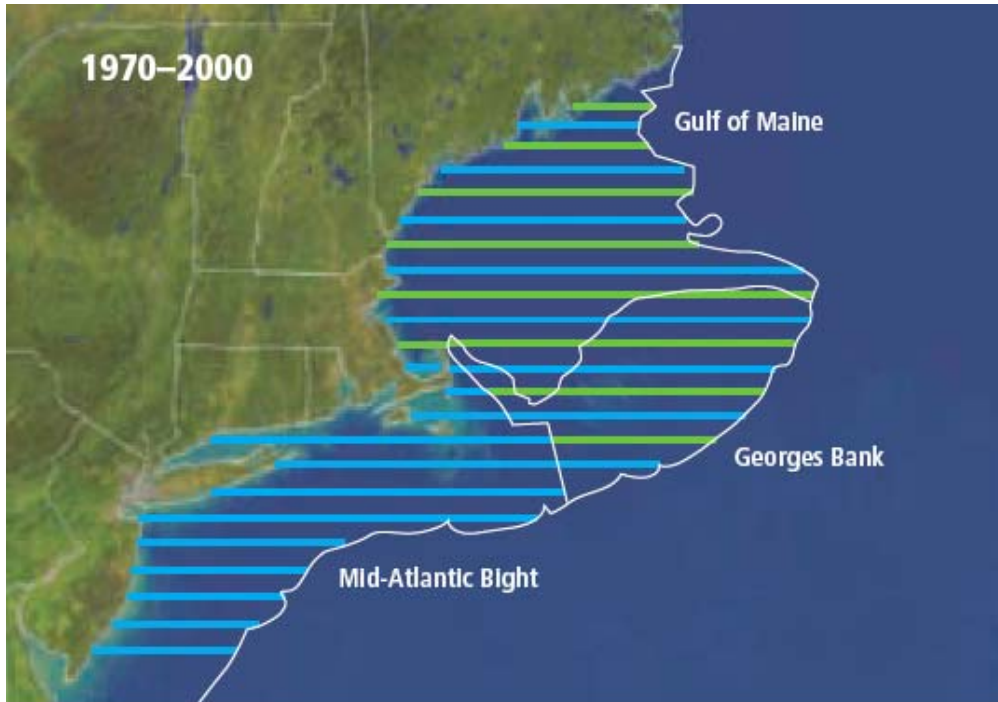
typical summer in Virginia  
(lower emissions scenario)

or coastal South Carolina and  
Georgia (higher emissions  
scenario)



*Courtesy of the Union of  
Concerned Scientists*

# Potential Loss of Commercial Cod Fishery



- adult cod thermal habitat
- young cod thermal habitat
- full lines: suitable
- dotted lines: marginal

# Economic Impacts: negative & positive?



Comments 0 | Recommend 0

## Mark Gibson/Candace Oviatt: Narragansett Bay turns into the Chesapeake

01:00 AM EDT on Friday, August 1, 2008

**MARK GIBSON CANDACE OVIATT**

IN LATE JUNE, Rhode Island Department of Environmental Management scientists from the Bay Window monitoring partnership observed through aerial flyovers and purse-seine sampling an estimated 24 million menhaden with an average weight of one pound apiece, in Narragansett Bay. The fish were predominantly in the Upper Bay and the Providence River.

That is a lot of fish, an amount not seen since the 1970s.





# **Some other climate change impacts to coastal resources**

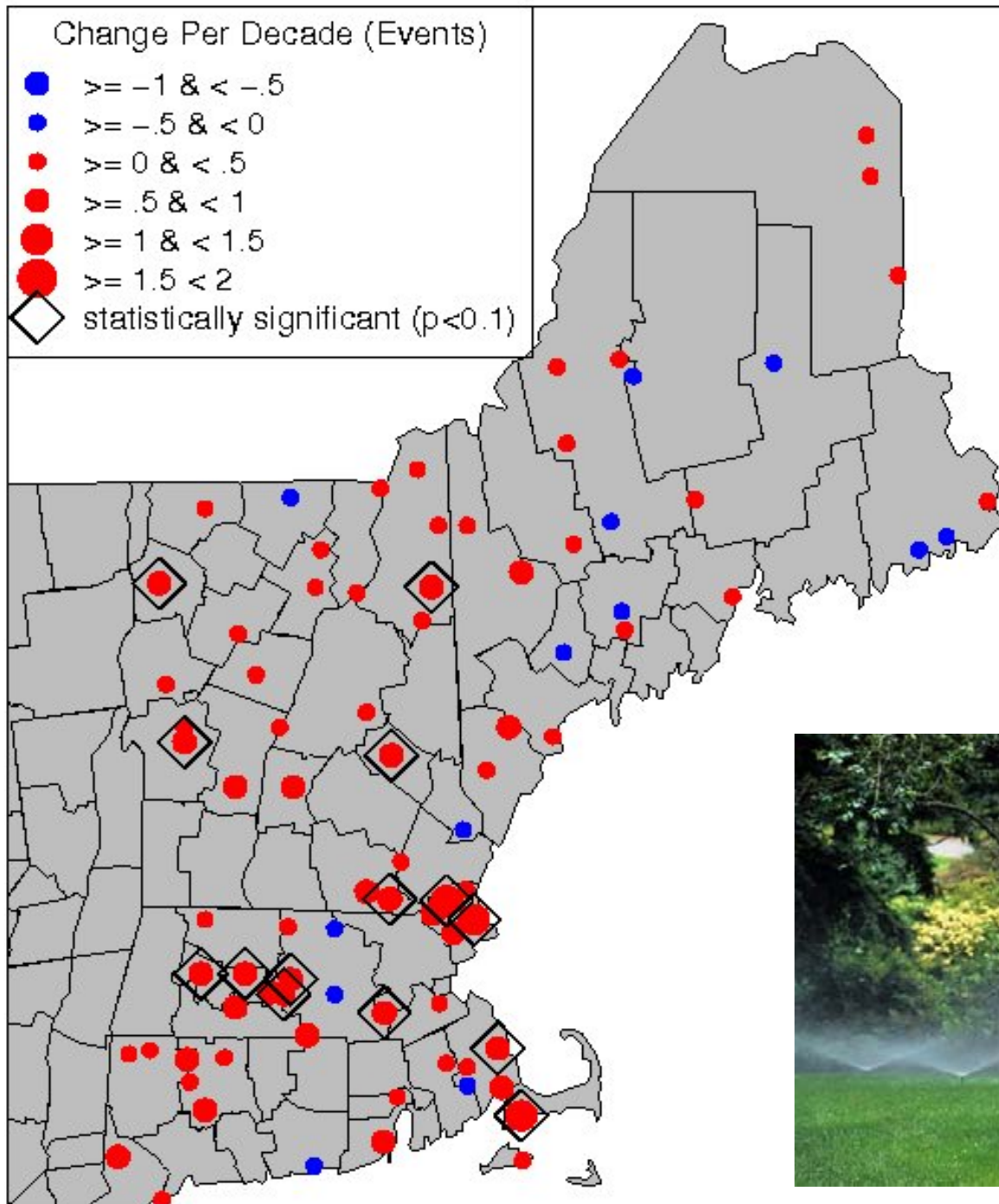
**Wetlands loss and introduction of new pathogens (sudden wetlands dieback)**

**Habitat changes in species and function**

**Changes to ecological processes (i.e. plankton and the food chain)**

**Recent studies have shown that ocean acidification impacted mussels**

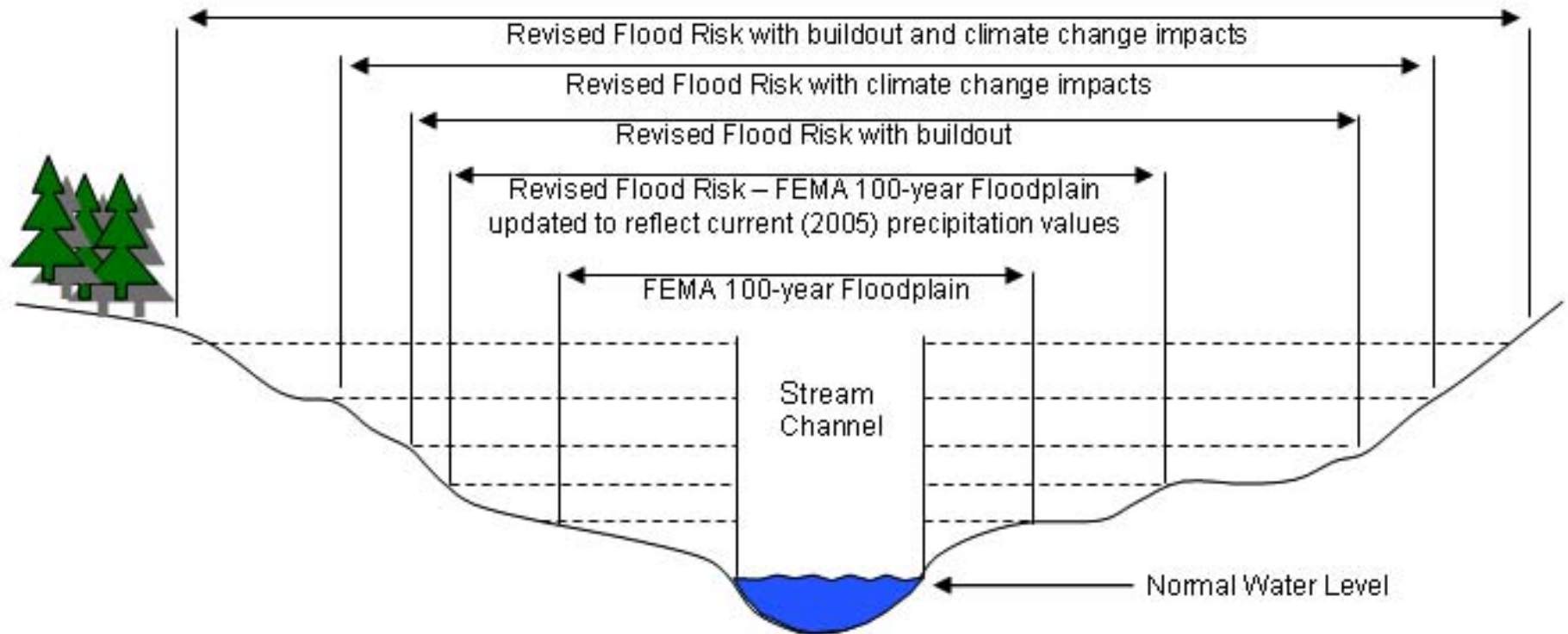
# Decadal Trends in 1 inch Precipitation Events 1948-2007



Spiero et al. 2009



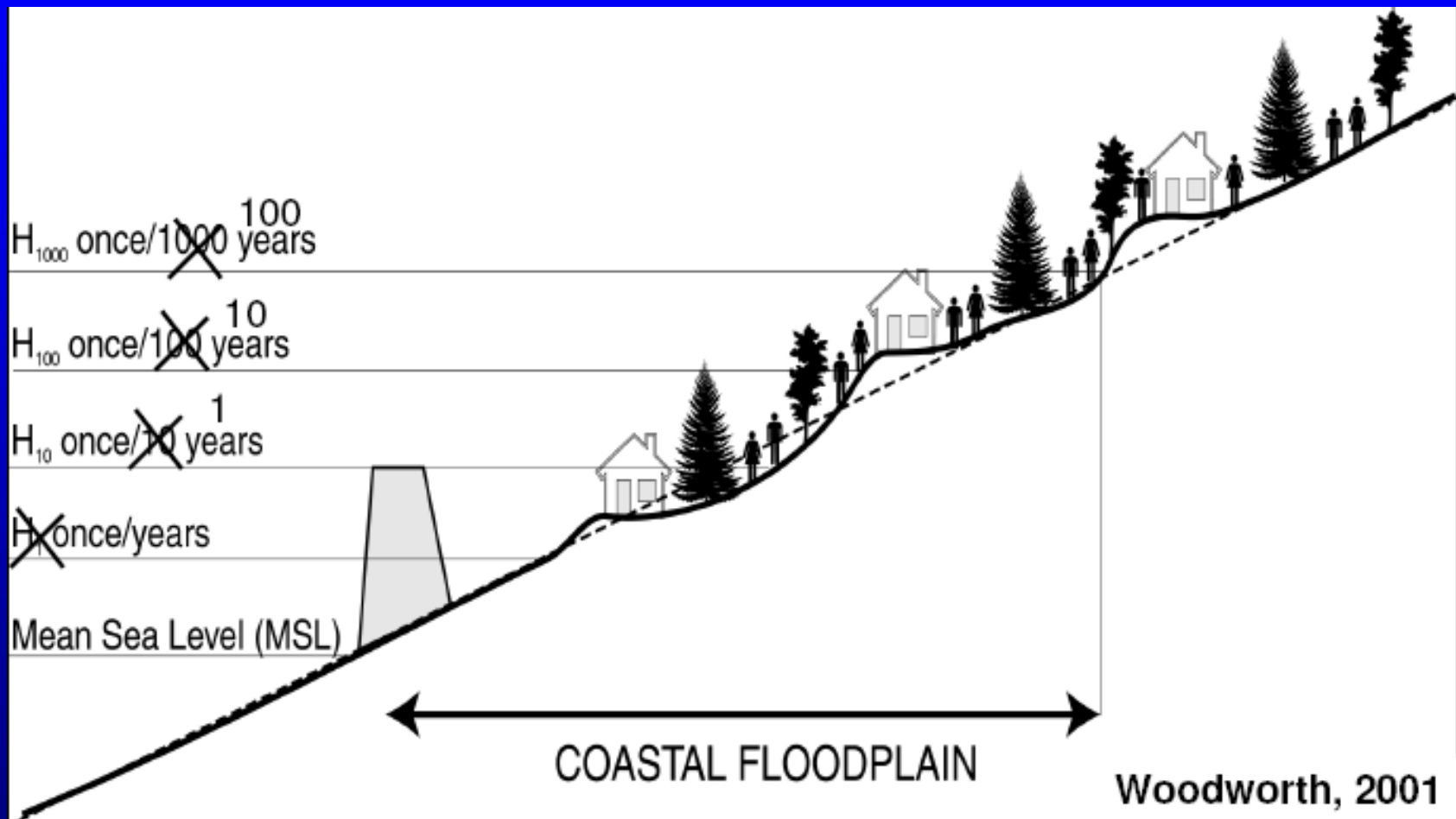
# Increased Riverine Flooding



Projected 100-year Freshwater Floods in the Lamprey River Watershed, NH



# Increased Probability of Storms





October 2005 floods –  
estimated damages  
\$38 million in  
Blackstone River  
Valley

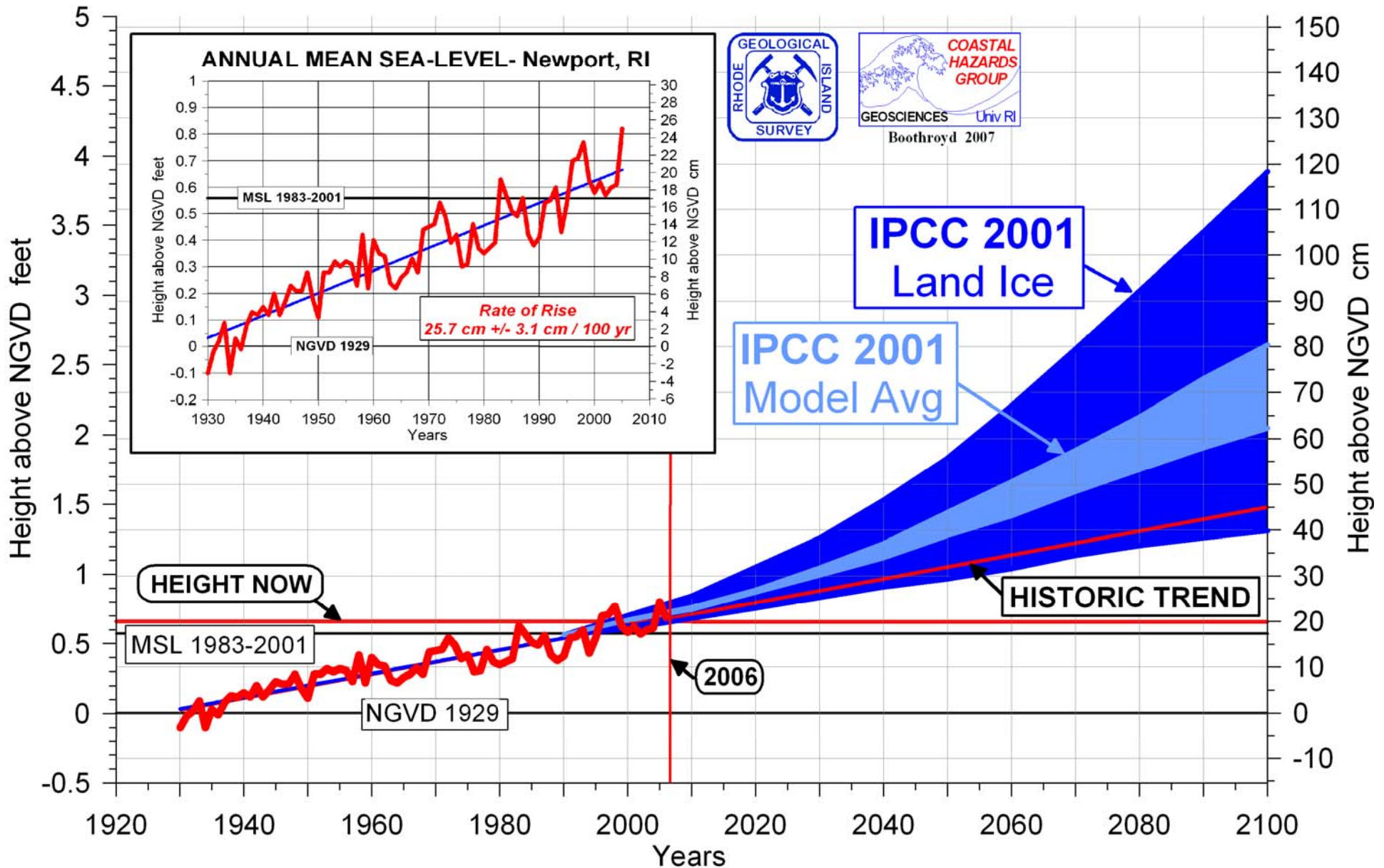
Patriots Day Storm, April  
2007 – flooding in Newport  
and Washington County



# Increased Erosion and shoreline retreat

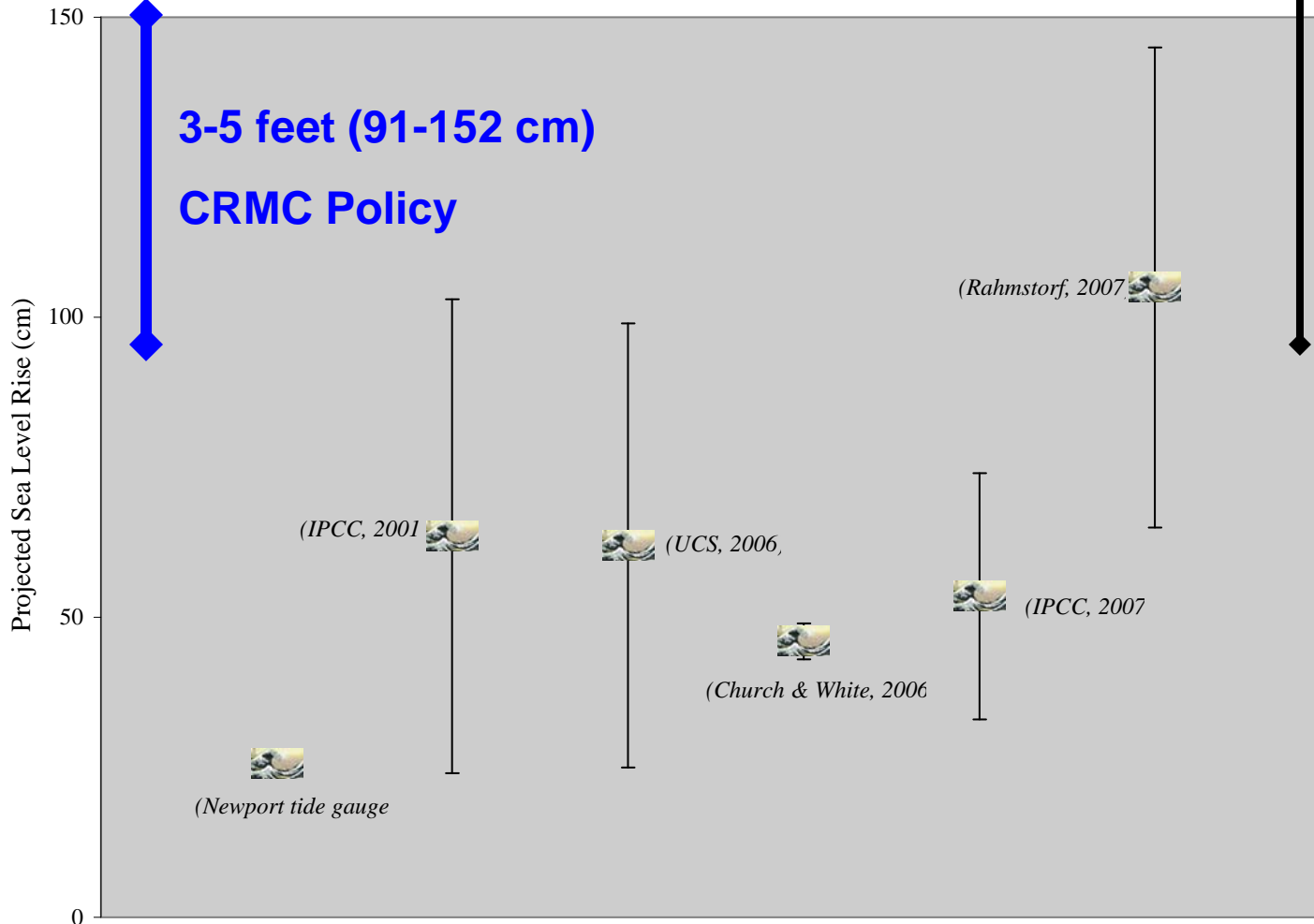


# ACCELERATED SEA-LEVEL RISE - Newport, RI



# Projecting Sea Level Rise

**Projected Change in Relative Sea Level for RI by 2100**  
Mean projections with upper and lower values shown



**95-215 cm**  
**Science,**  
**Sept 2008**

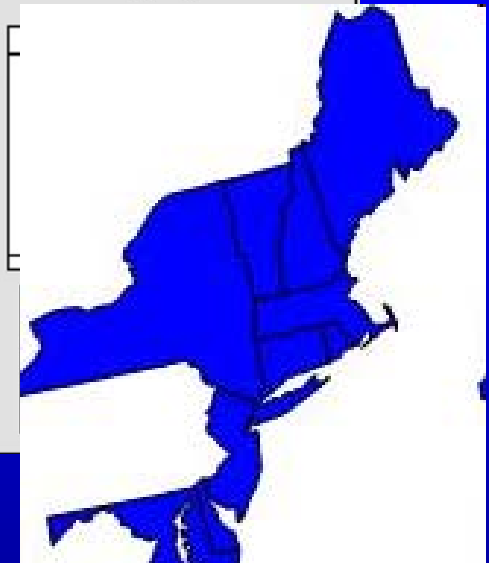
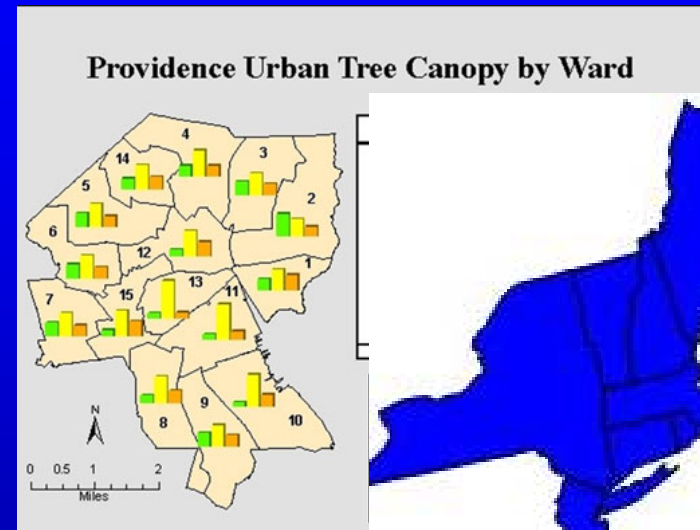
# Flood zones move landward





# What can we do? MITIGATE

A human intervention to actively reduce the production of greenhouse gas emissions or to remove the gases from the atmosphere



Regional Greenhouse Gas Initiative





# What can we do? ADAPT

Adjust natural or human systems in response to actual or expected climatic changes or their impacts, so as to reduce harm or exploit beneficial opportunities.



## Coastal Features

### CRMC to adopt Sea Level Rise regulations

*Landmark regulations would be a first for RI*

The Rhode Island Coastal Resources Management Council has developed new regulations to address sea level rise, a side effect of climate change and global warming, which scientists have declared is already becoming a major concern.

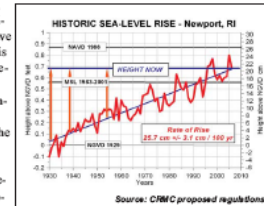
The CRMC's Planning and Procedures subcommittee on September 24 authorized Executive Director Grover Fugate to seek public input on the proposed new Red Book Section 145 - Climate Change and Sea Level Rise. After that time, the

proposed section returned to the full Council on November 27 for a recommendation to begin rule-making, which begins a 30-day public notice period. The CRMC

Oceanography, also spoke to the Council on October 9 on the issue of sea level rise at the semi-monthly meeting. RI Sea Grant and the University of

Rhode Island's Coastal Resources Center helped the CRMC to facilitate the synthesis of the science behind the proposed regulations and formulate policy options.

"The CRMC will be in leader in creating the country's first regulations to address sea level rise," said CRMC Chairman Michael M. Thioian. "Sea level rise is quickly becoming a



Source: CRMC proposed regulations  
This graph shows a historic sea level rise of 0.64 feet between 1910 and 2006.

# The Role of the SAMP

*Promote a balanced approach to development and protection of ocean-based resources*

- ✓ Platform for managing multiple uses (existing & future), such as transportation, fisheries, renewable energy, habitat protection
- ✓ Science-based approach that compiles baseline data and monitoring information
- ✓ Engage a broad public constituency to address current and future needs and opportunities

# How can the SAMP contribute?

- Secure existing and future management areas for fisheries which will be increasingly stressed by climate variability/ change
- Maintain healthy marine transportation network, responding to future needs and technologies



# How can the SAMP contribute?

- Identify options for renewable energy - reduce greenhouse gas emissions and mitigate climate impacts
- Provide baseline and future monitoring data critical to identifying changes and understanding localized climate concerns.



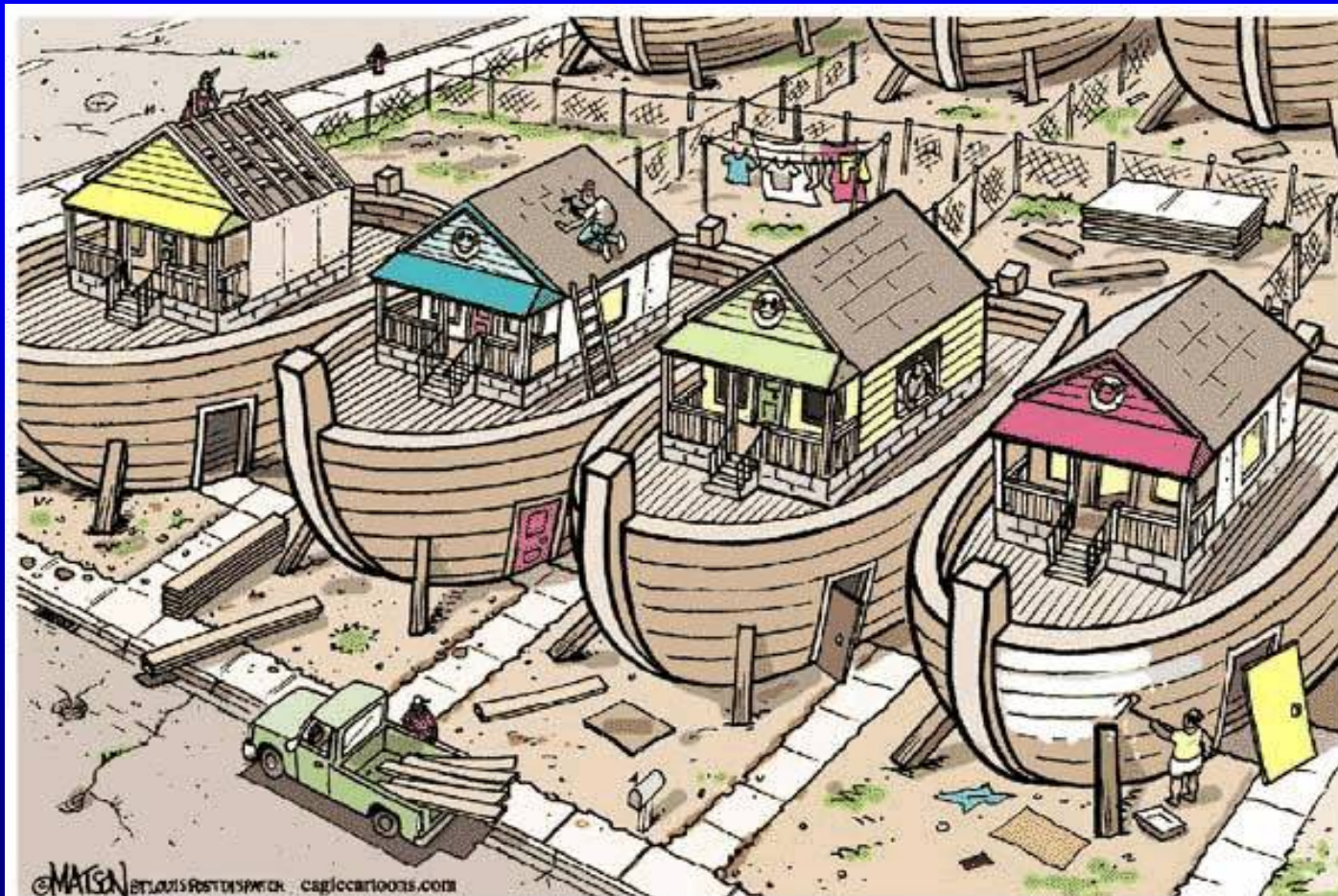
# How can the SAMP contribute?

- Engage a broad constituency - a conduit to get input from and inform stakeholders regarding opportunities and challenges related to climate change
- Adaptive management approach, with periodic evaluation and updates....

*Living document*



And then there are other options...



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MORE REALISTIC F.E.M.A. GUIDELINES FOR REBUILDING IN NEW ORLEANS

*Disaster Resilience*  
Coastal Community Development



Pam Rubinoff,  
rubi@crc.uri.edu

Rhode Island Sea Grant  
URI Coastal Resources Center

<http://seagrant.gso.uri.edu/ccd/haz.html>