RI Ocean Special Area Management Plan

Source: Providence Journal photos / Sandor Bodo

Overview of the Ocean SAMP Climate Change Chapter

Jim Tobey
URI Coastal Resources Center
Stakeholder Workshop
April 6, 2010

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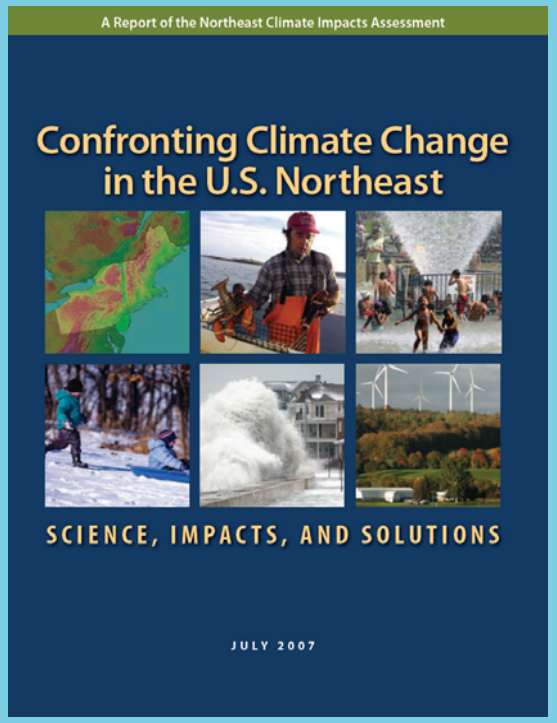
Methodology



1. Literature and data review
2. Workshops (Jan 5 and Feb 9)
3. Expert review and comments

Acknowledgments

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- **Leanna Heffner**
- **Pam Rubinoff**

Major Findings

- The effects of global climate change are already being witnessed globally, regionally and in Rhode Island and are projected to intensify in years to come
- Climate change affects many uses of the SAMP area
- The effects of global climate change should be considered when evaluating proposed future uses

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Findings: Climate Change Trends and Projections

- Air temperature
- Ocean temperature
- Sea level rise
- Storminess
- Precipitation
- Ocean acidification

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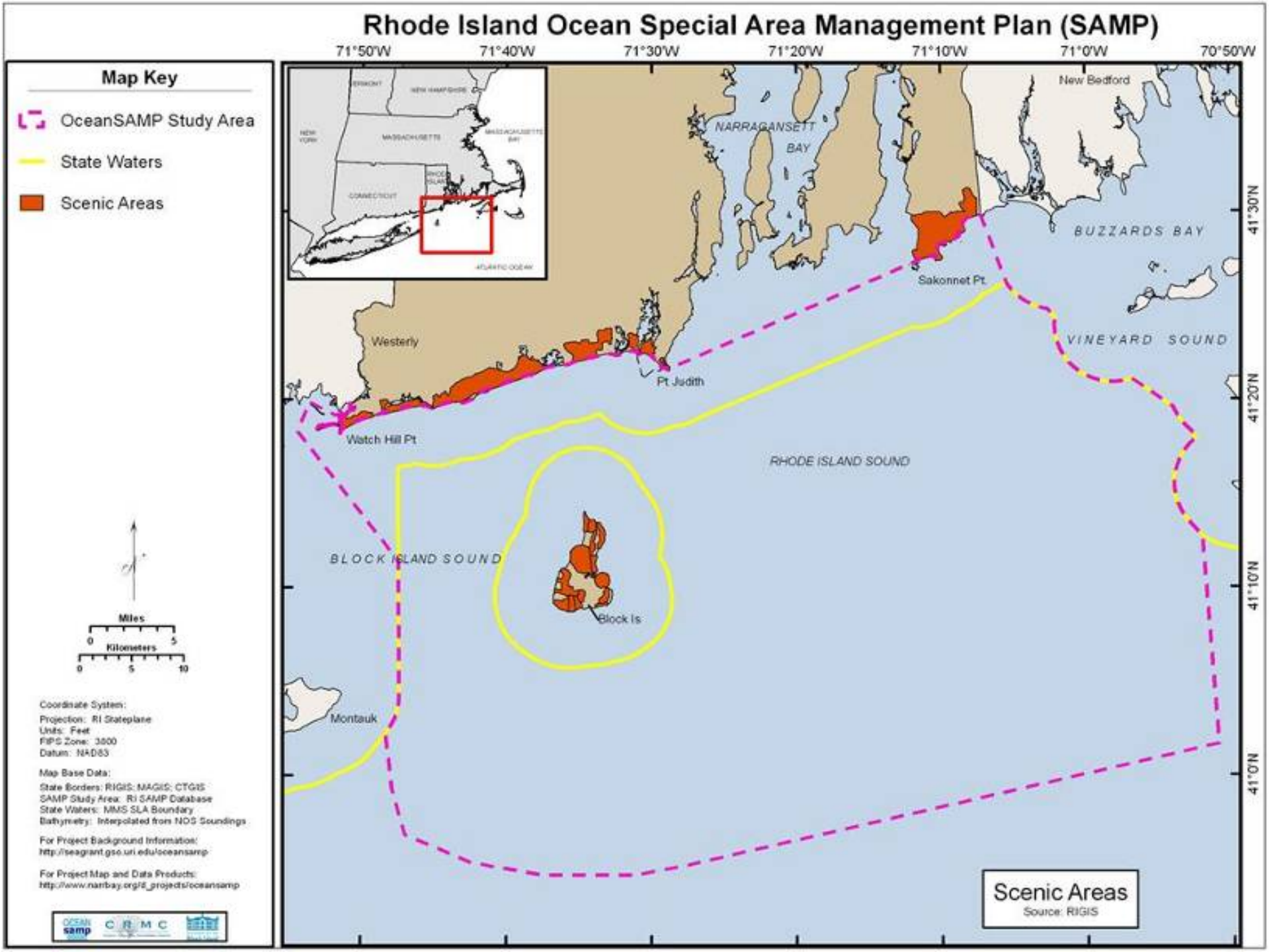
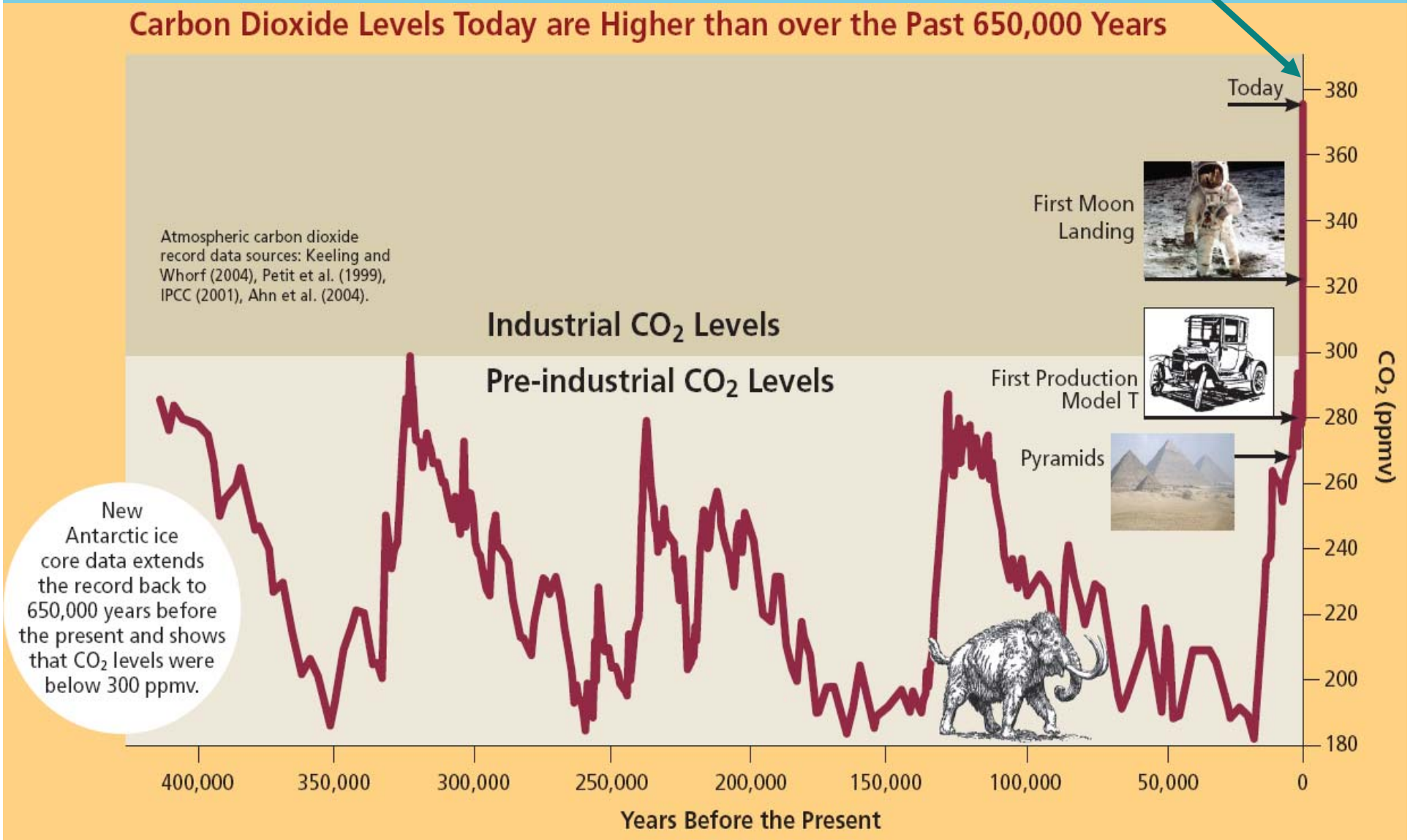
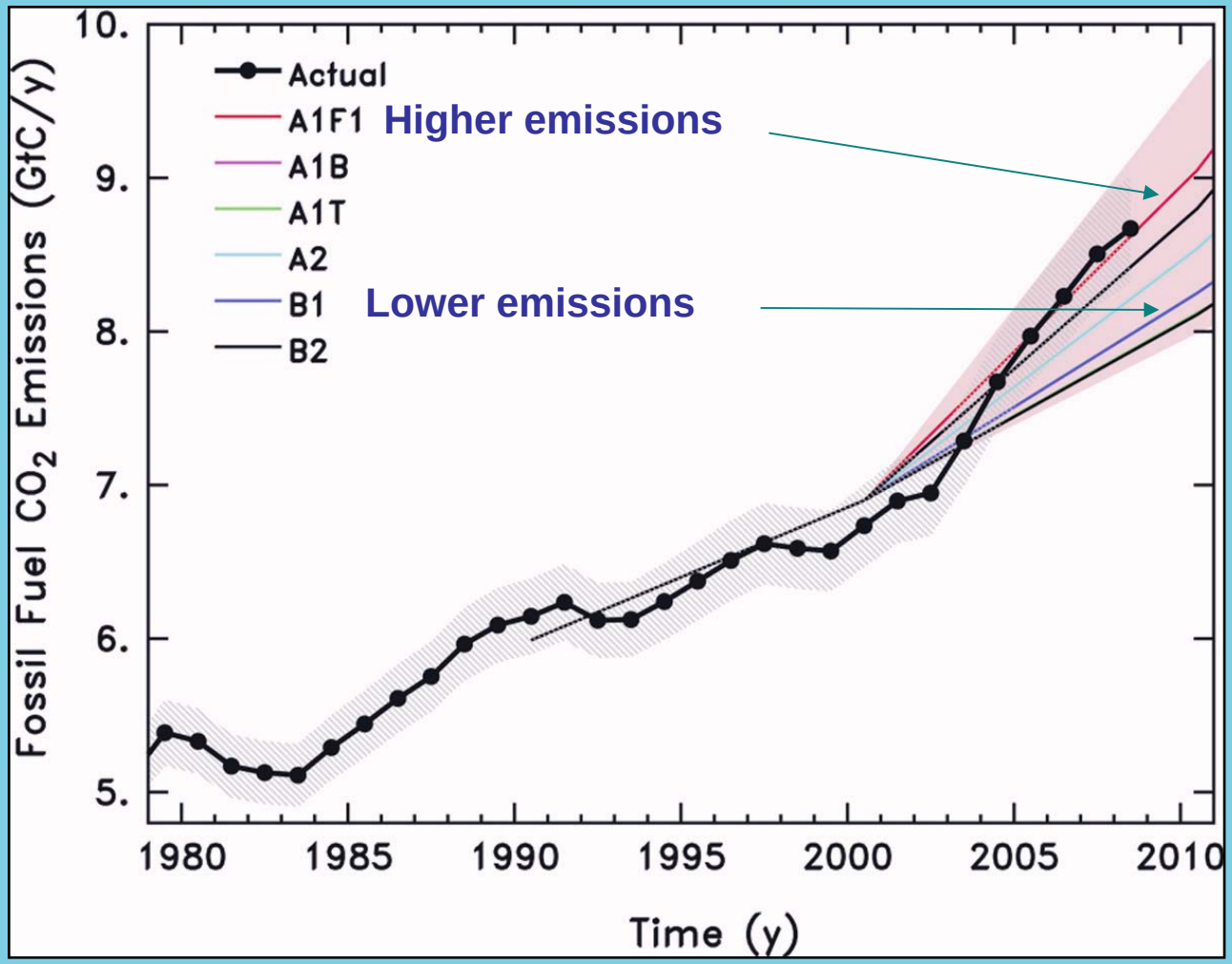
Rhode Island Ocean Special Area Management Plan (SAMP)



Carbon Dioxide – CO_2 - Levels



Observed Global Warming and Climate change projections



Le Quéré et al. 2009

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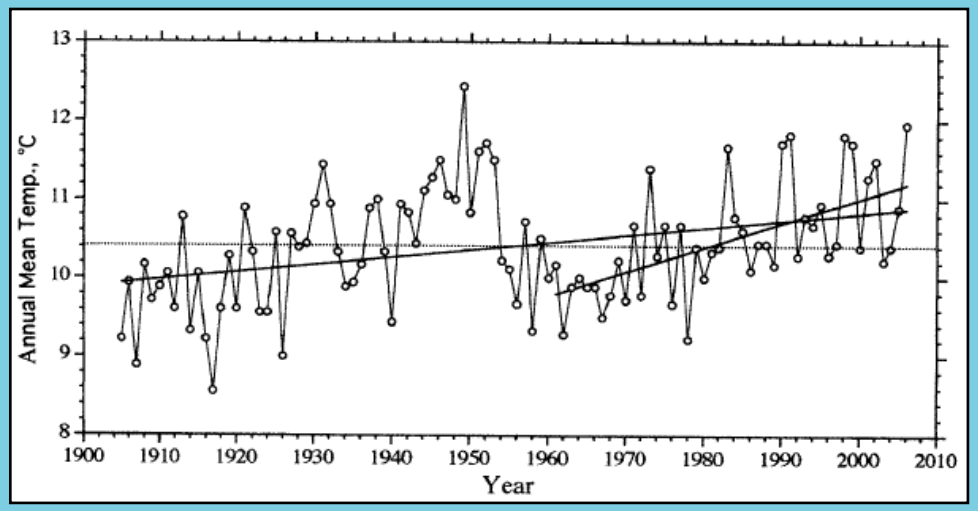
Air Temperature

Annual Mean Temperature for Providence and TF Green Airport (1905-2006)



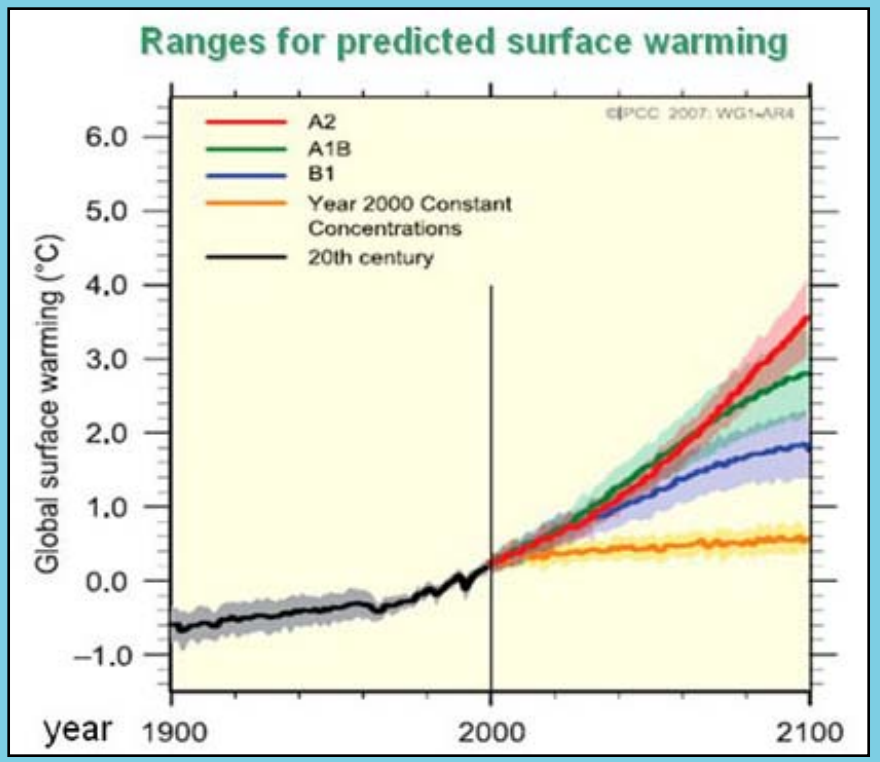
Source: Pilson 2008

Air Temperature Trends

- 1961 to 2006 – Increase of 0.3°C (0.6°F) per decade

Projected mean increase by 2100

- Global: 3.6-12.6°F
- Northeast: 3-14°F



Source: NOAA 2009

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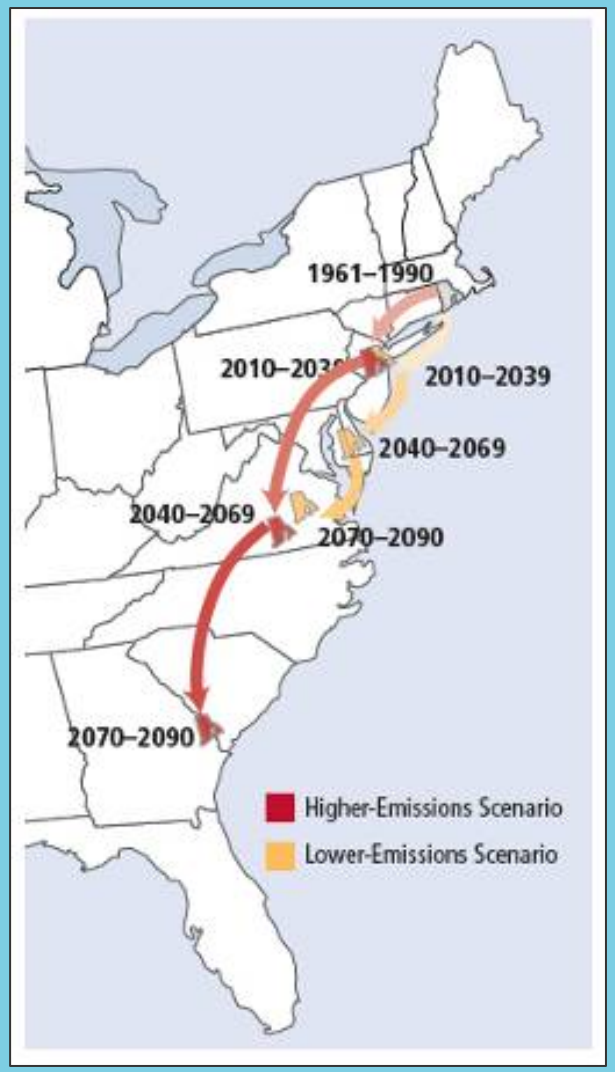
Rhode Island climate "migration"

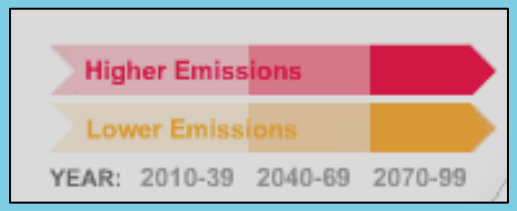


Courtesy of the Union of Concerned Scientists

By mid-century, summer in Rhode Island could feel like the

typical summer in the Chesapeake Bay area (lower emissions scenario)

or southern Virginia (higher emissions scenario)



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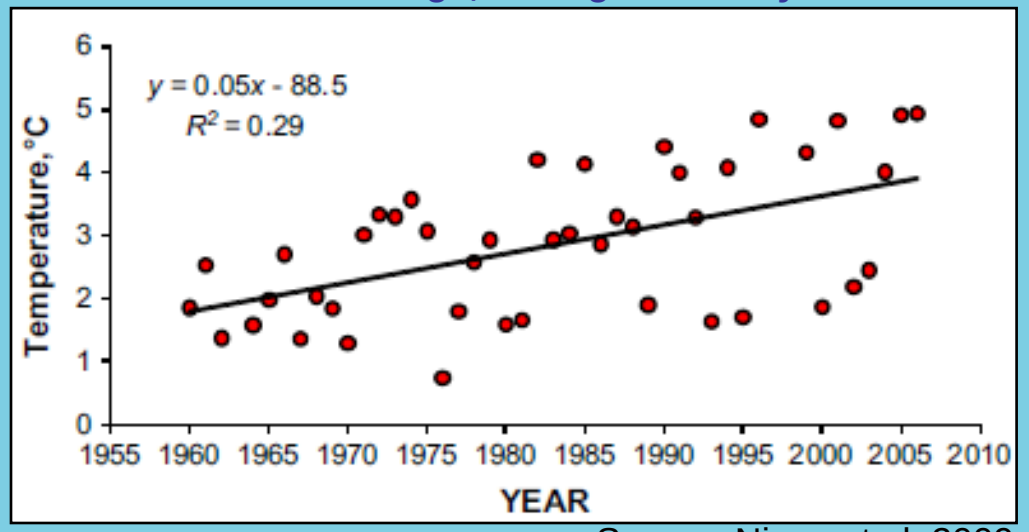
Ocean Temperature

Sea surface temperatures in Narragansett Bay have risen 2.2°C (4°F) since the 1960s

Mean Surface Water Temperatures (Dec, Jan, Feb)
West Passage, Narragansett Bay



Source: Nixon et al. 2009

Ocean Depth Temperature	Lower emissions scenario (B1)	Higher emissions scenario (A1FI)
Sea surface	4-5°F (2.2-2.8°C)	6-8°F (3.3-4.4°C)
Bottom	2°F (1.1°C)	5-7°F (2.8-3.9°C)

Frumhoff et al. 2007

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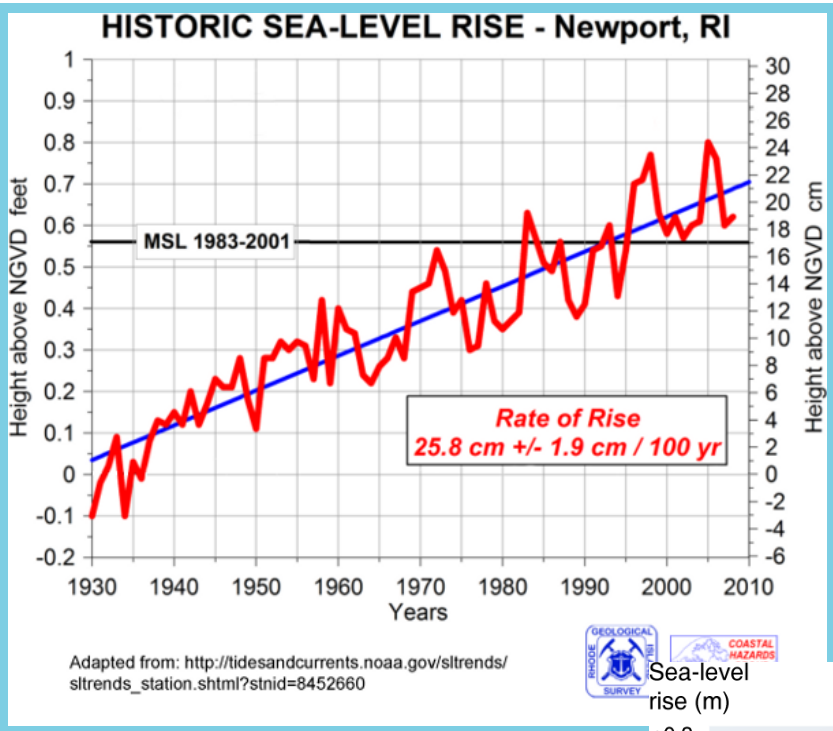
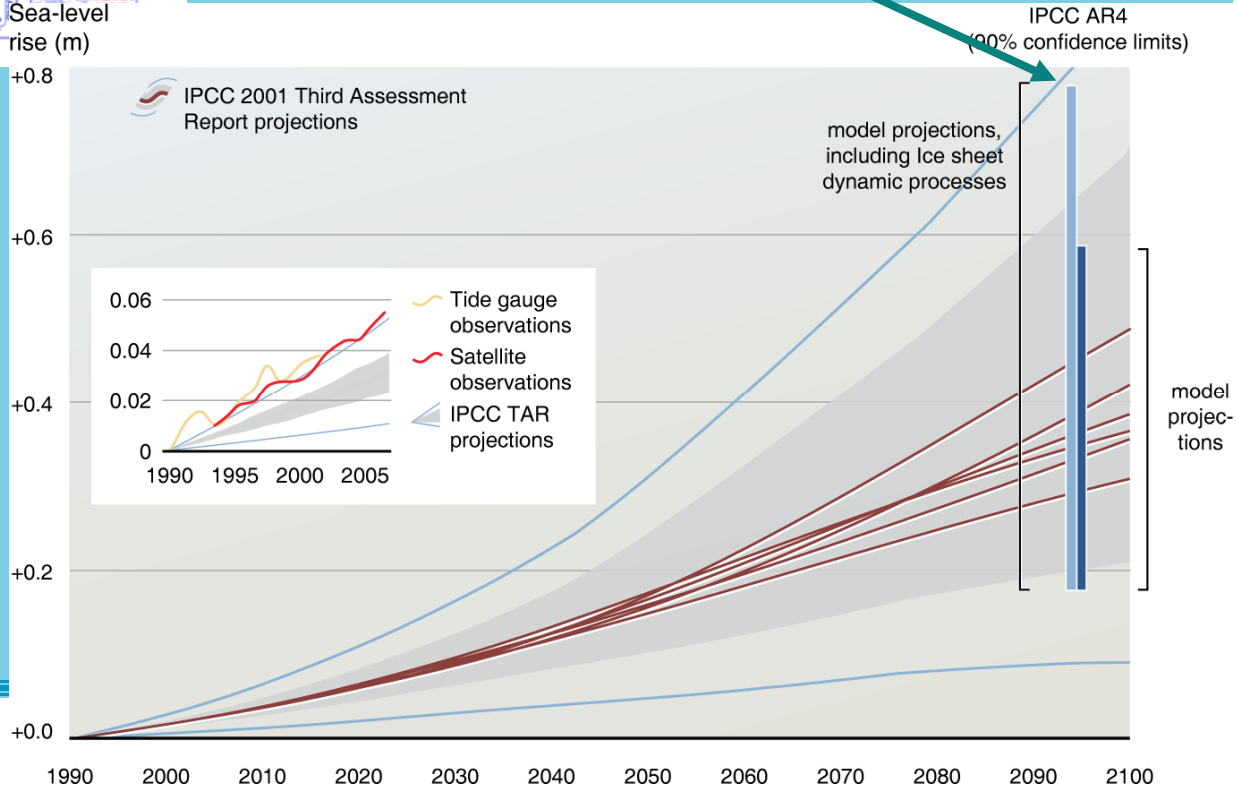
Sea Level Rise



Sea level rise under accelerated ice melt



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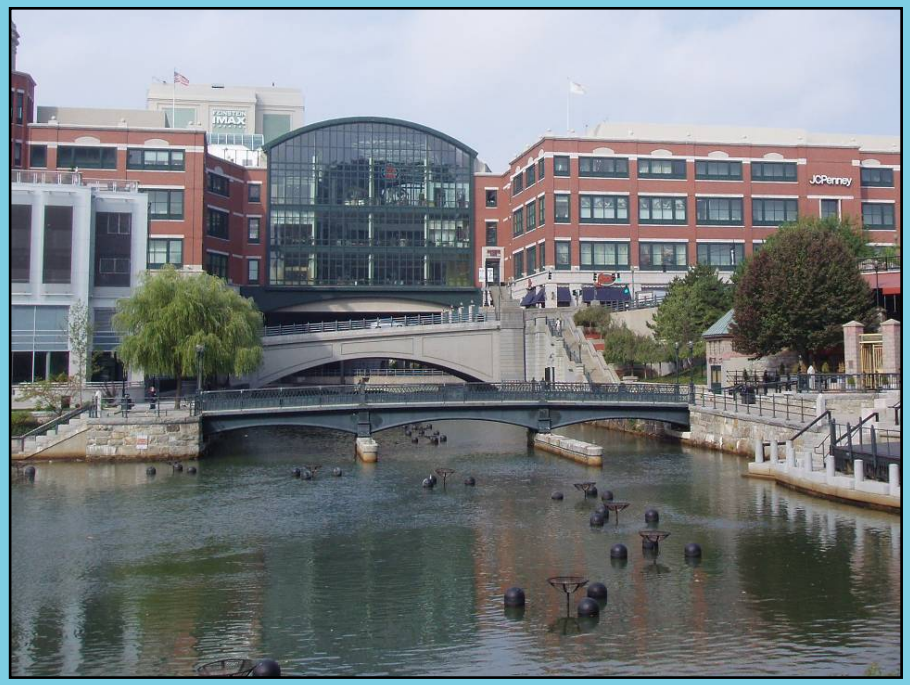
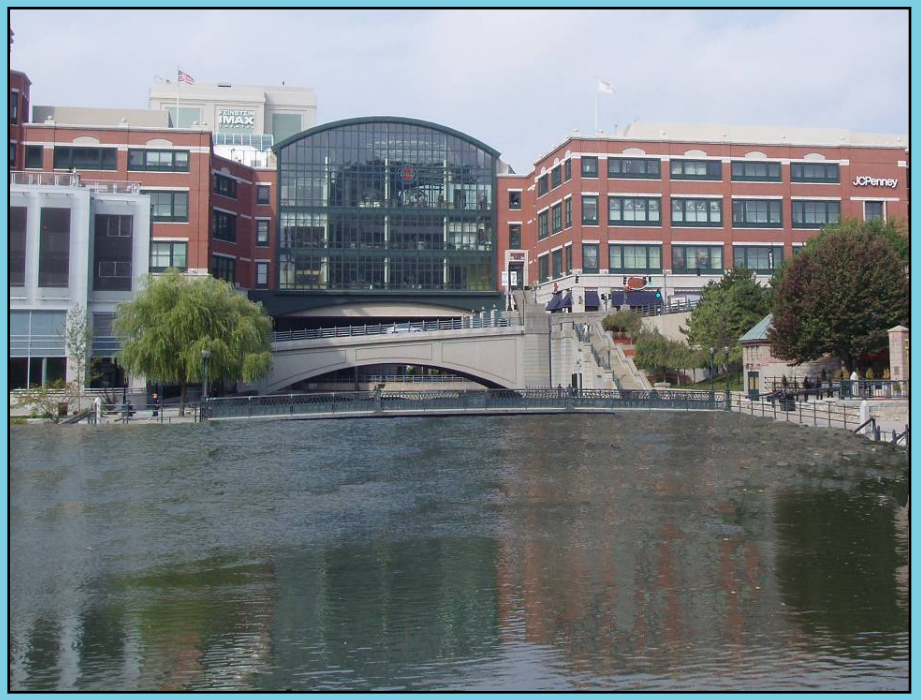
Sea Level Rise



Simulation of 3 foot Sea Level Rise Providence, RI



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Storminess

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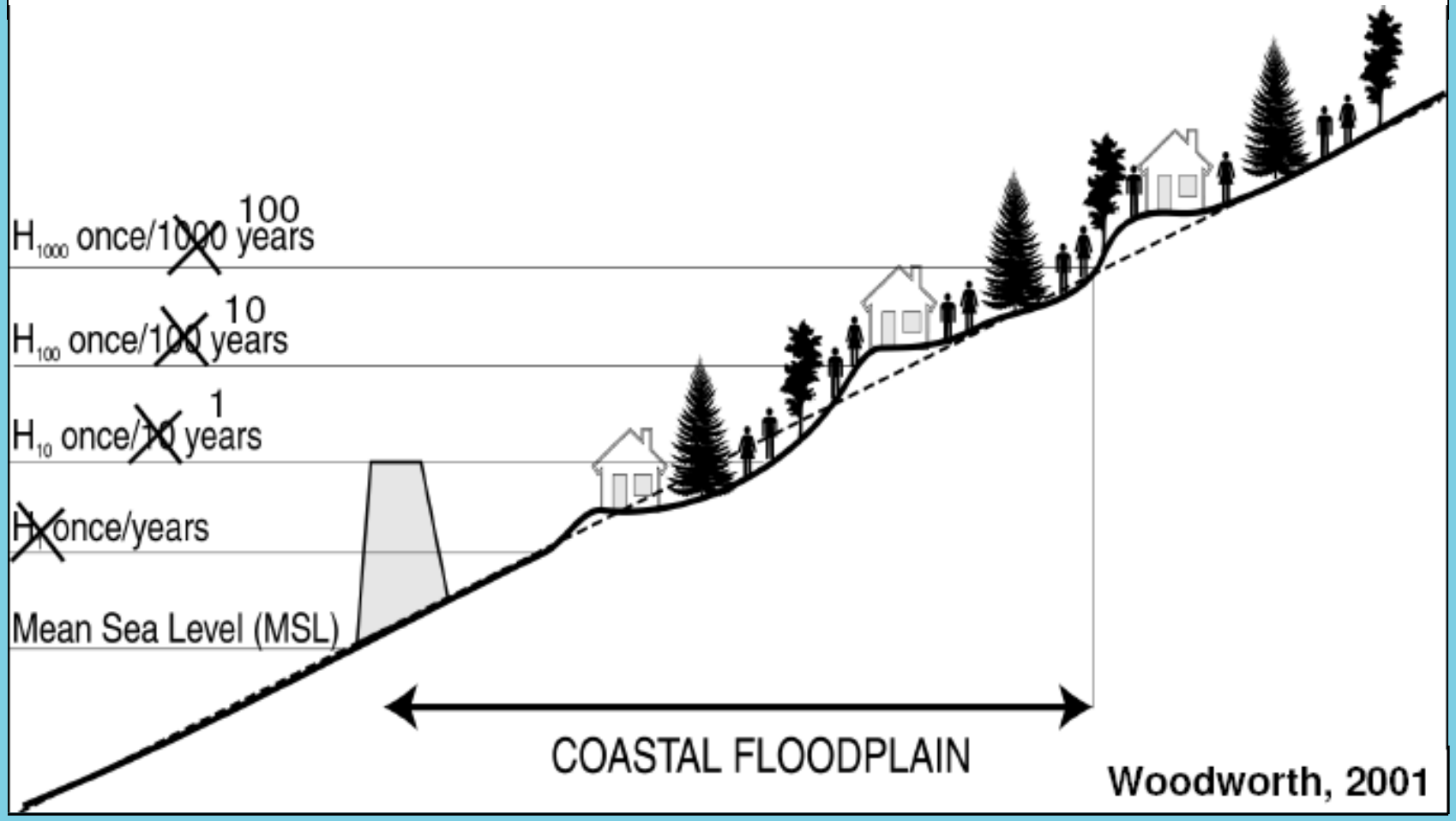
Increased Probability of Flooding



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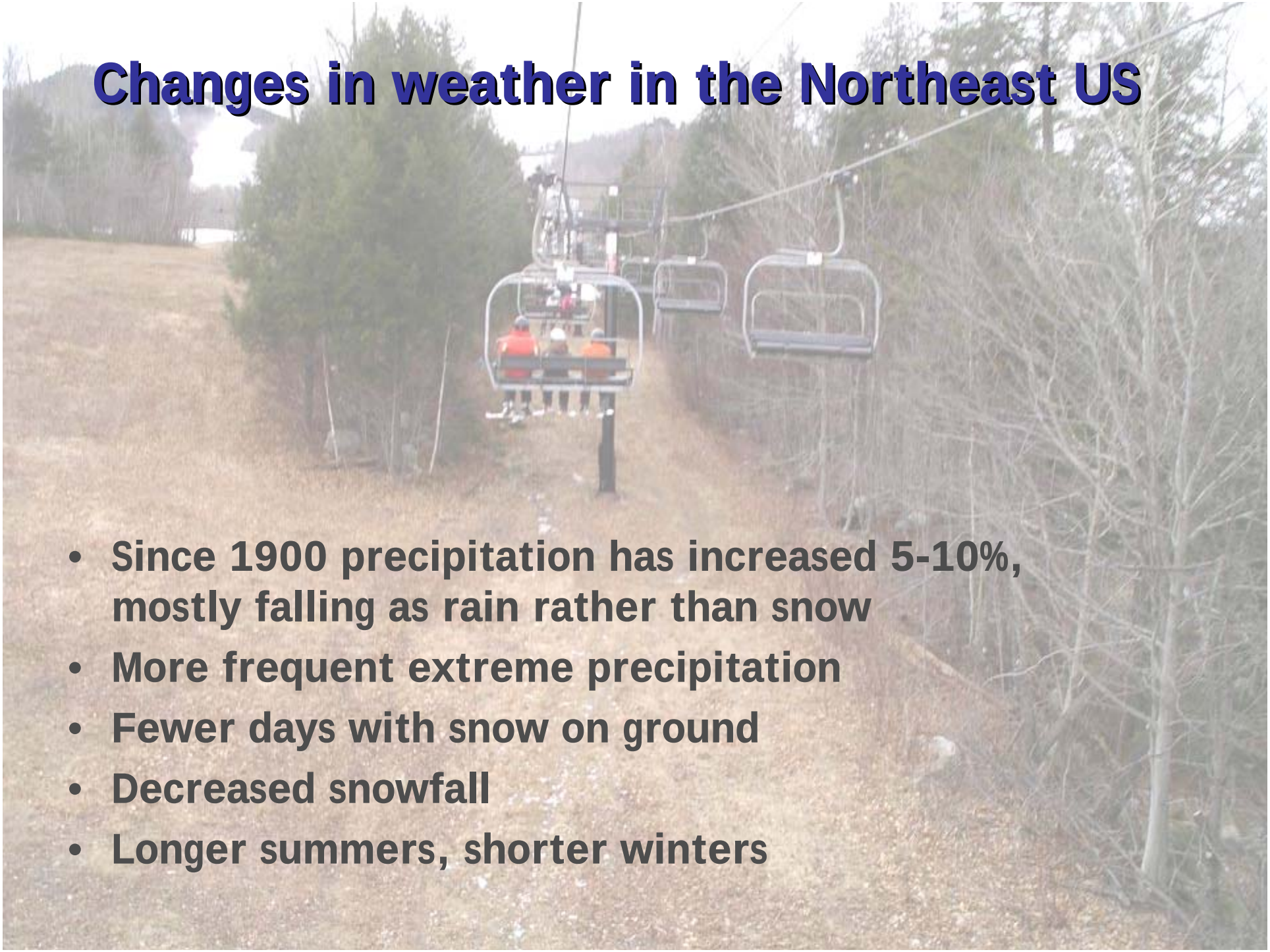
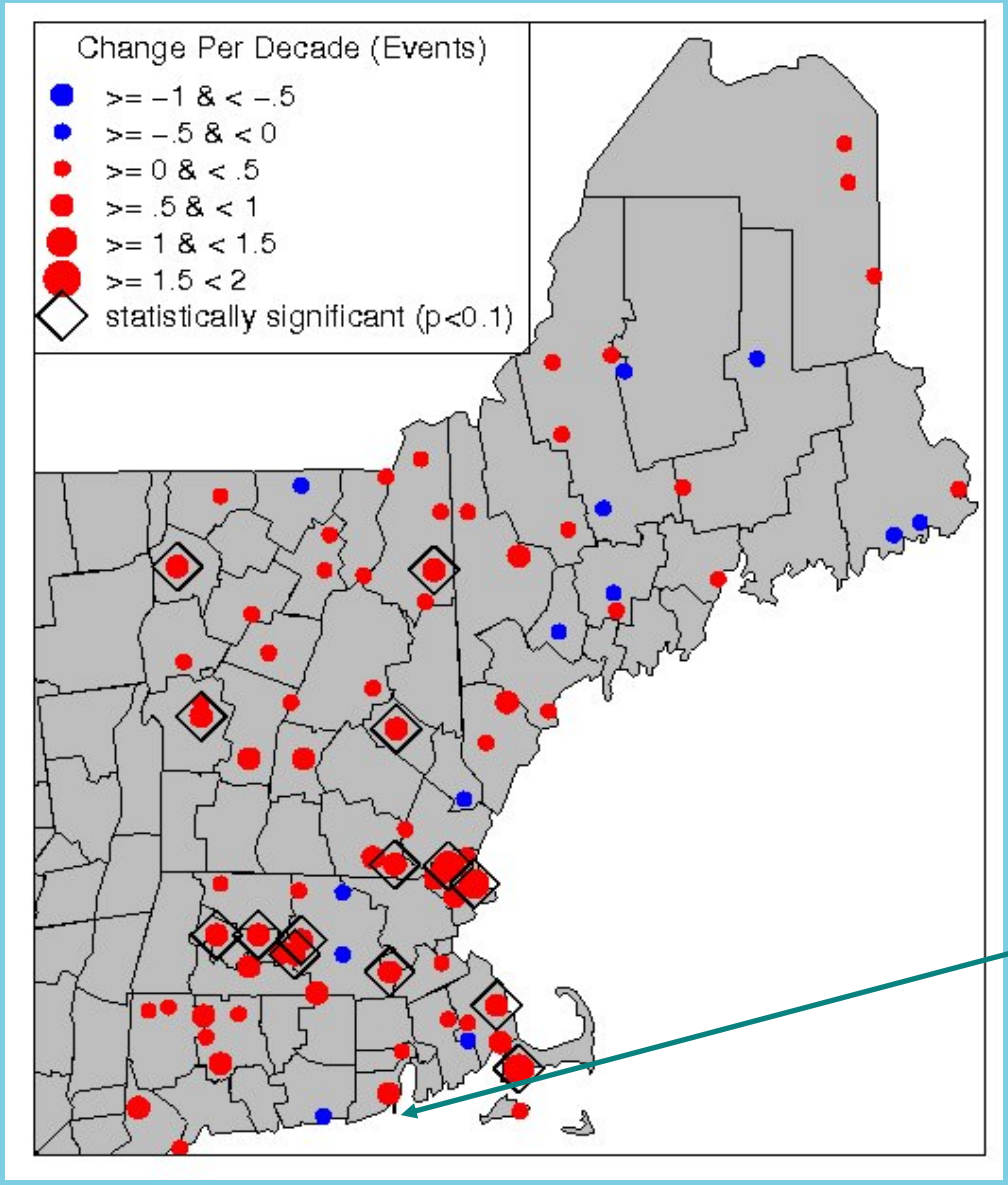
Changes in weather in the Northeast US



- Since 1900 precipitation has increased 5-10%, mostly falling as rain rather than snow
- More frequent extreme precipitation
- Fewer days with snow on ground
- Decreased snowfall
- Longer summers, shorter winters



Precipitation

Decadal Trends
in 1 inch
Precipitation Events
1948-2007

Red shows locations with increasing number of 1 inch precipitation events

Spierre et al., 2008

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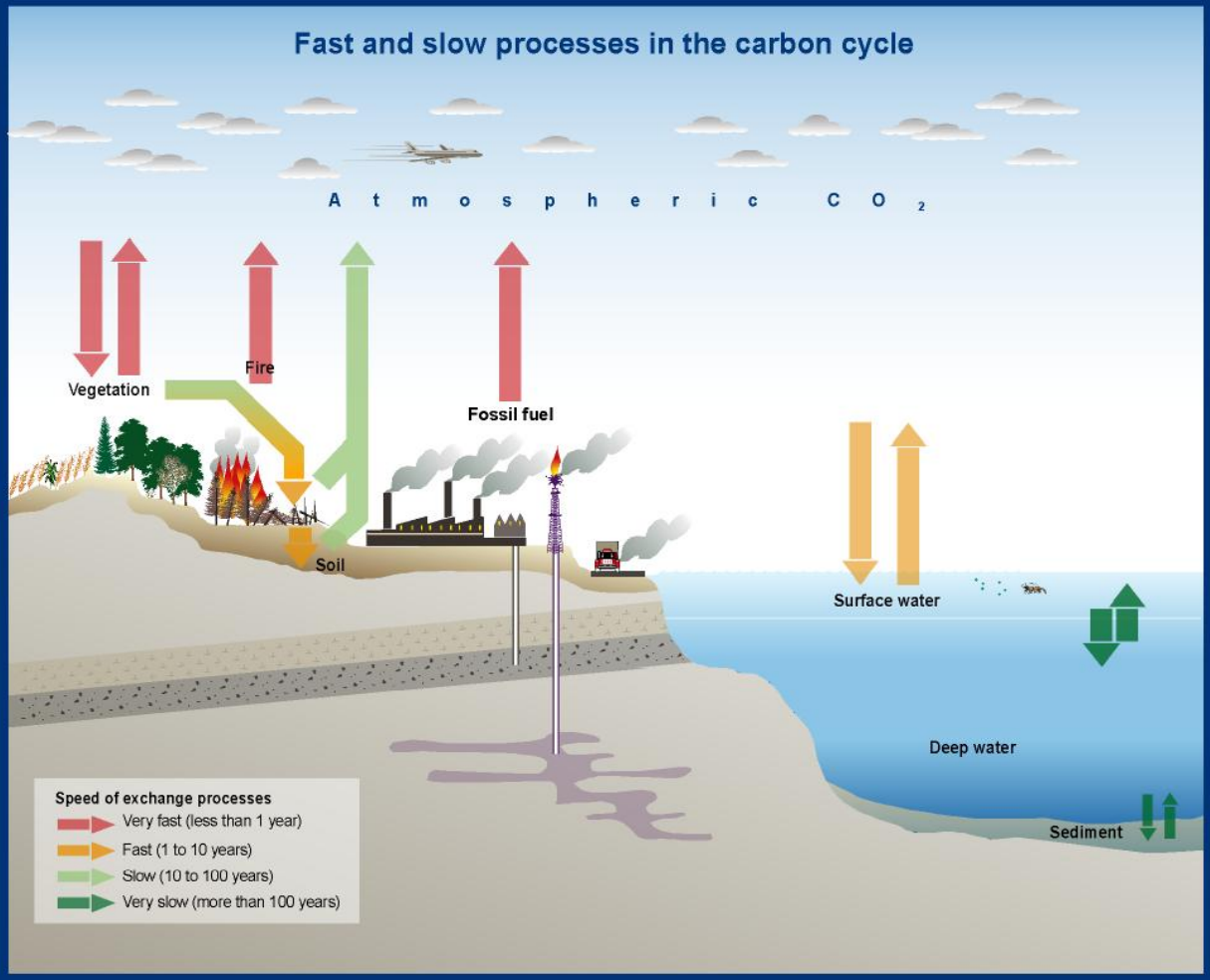
Ocean Acidification



SYR - FIGURE 5-4

Ocean Acidification

- Globally averaged marine surface atmospheric CO2 has increased 13.2% since 1981. This has resulted in a reduction of surface ocean seawater pH levels by 0.1 pH units
- The most recent IPCC report projects that by late century pH will drop 0.3 to 0.4 units from current levels
- With the exception of rare events, a change of this magnitude has not occurred in the last 300 million years

What does all this mean for the Ocean SAMP study area?

- Ecological impacts
  - Marine ecology
  - Fish and invertebrates
  - Seabirds, marine mammals, sea turtles
- Human use impacts
  - Marine transportation, navigation, and related infrastructure
  - Recreation and tourism
  - Renewable energy
  - Historical and cultural assets
  - Fisheries resources and uses
  - Future uses

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Ecological Impacts

- Changes in the distribution of fish
- Warmer water temperatures can lead to the spread of disease organisms and invasive species that cause harm to the ecosystem
- Harmful Algal Blooms (HABs)?
- Hypoxia (very little oxygen in the water column)?
- Reduced survival rate of marine animals that have shells or skeletons made of calcium carbonate

Fish and invertebrates moving North

- Species at the southern extent of their range in the Ocean SAMP study area: American lobster, Atlantic cod, silver hake
- Species at the northern extent of their range in the Ocean SAMP: black sea bass, butterfish, scup, summer flounder

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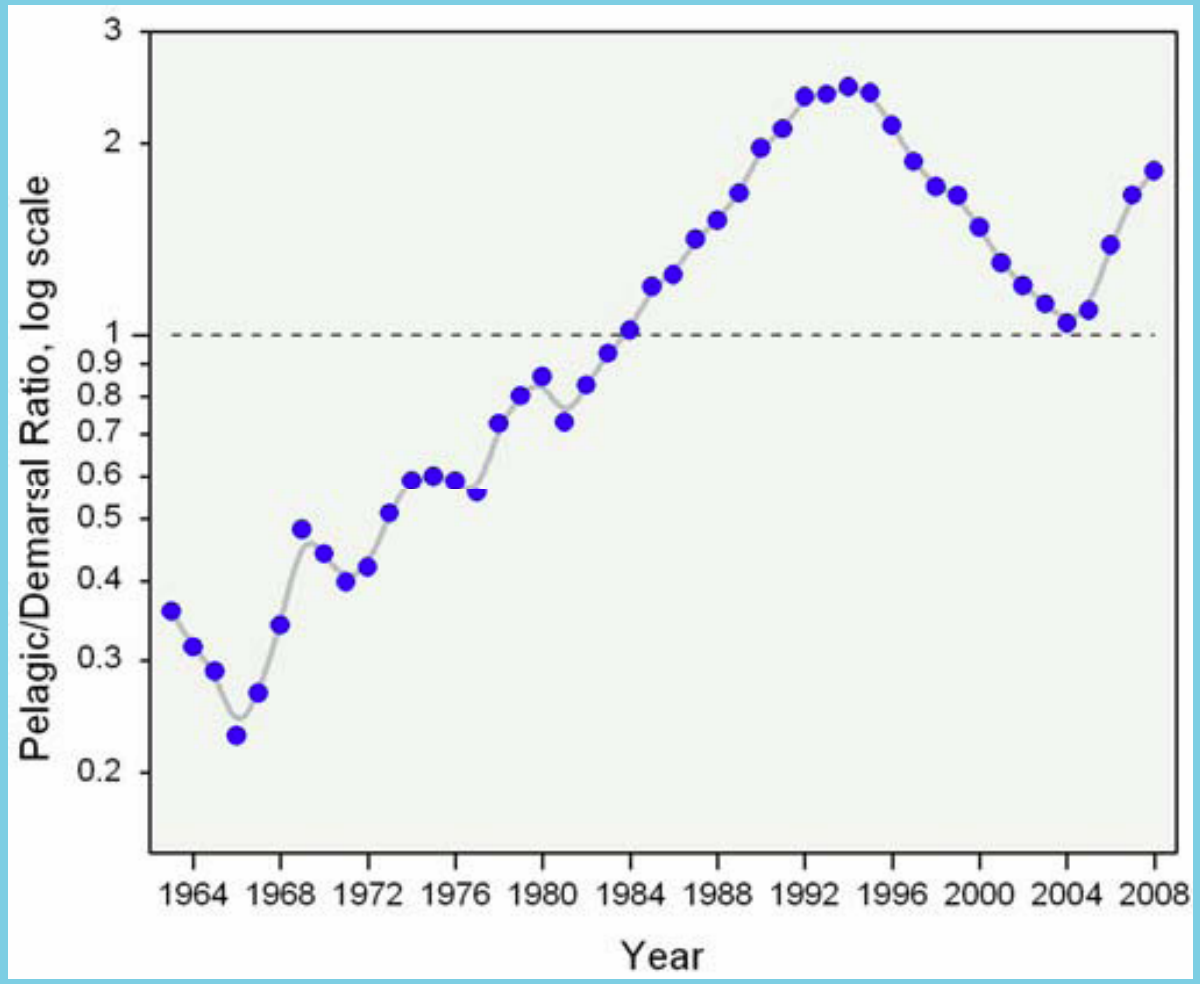

Ratio of pelagic to demersal fish species caught in Northeast Fishery Science Center, Autumn Bottom Trawl Surveys

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Threats to Survival of Whales, Seabirds and Sea Turtles

- Changes in abundance, timing and distribution of prey
- Loss of beach and salt marsh nesting habitat due to sea level rise and coastal retreat
- Loss of low-lying islands outside the Ocean SAMP that seabirds rely on

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Impacts on Marine Transportation, Navigation and Related Infrastructure

- Extended shipping season and less problems with icing on vessels and infrastructure

But,

- Greater damage from more intense storms
- Increased decay from increasingly acidic seas
- Higher risk of flooding with higher sea levels
- More exposure to intense storm events

Source: LIN Television 2007

Source: NOAA 2009

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Impacts on Recreation and Tourism

- Longer summer season
  - More opportunity for recreation activities

But

- Warmer water may introduce more algae and jellies
- Increased rainfall and runoff increase nutrients and pollutants entering the sea
  - More beach closures, decreased water quality and red tide
- Barrier beaches, coastal lagoons and tidal salt flats vulnerable to increased erosion and loss of habitats

Ibis in Misquamicut

Source: Flickr 2007

Misquamicut beach

Source: Wikimedia Commons 2009

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Climate Change
Recommended Policies and Standards

- Review policies, plans and regulations related to the activities within CRMC jurisdiction of the Ocean SAMP
- Promote data collection and monitoring programs
- Assess vulnerability of key infrastructure to climate change projections
- Develop design standards that account for projected wind, storms, and waves
- Support public awareness and interpretation programs to increase public understanding of climate change

Source: Lacoastpost 2009

Source: General Dynamics Electric Boat 2010

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Thank you!

For further information, see http://seagrant.gso.uri.edu/oceansamp/

Jim Tobey: 874-6411 or
tobey@crc.uri.edu

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