CLIMATE CHANGE ADAPTATION IN MASSACHUSETTS

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October 2011

The Global Warming Solutions Act of 2008

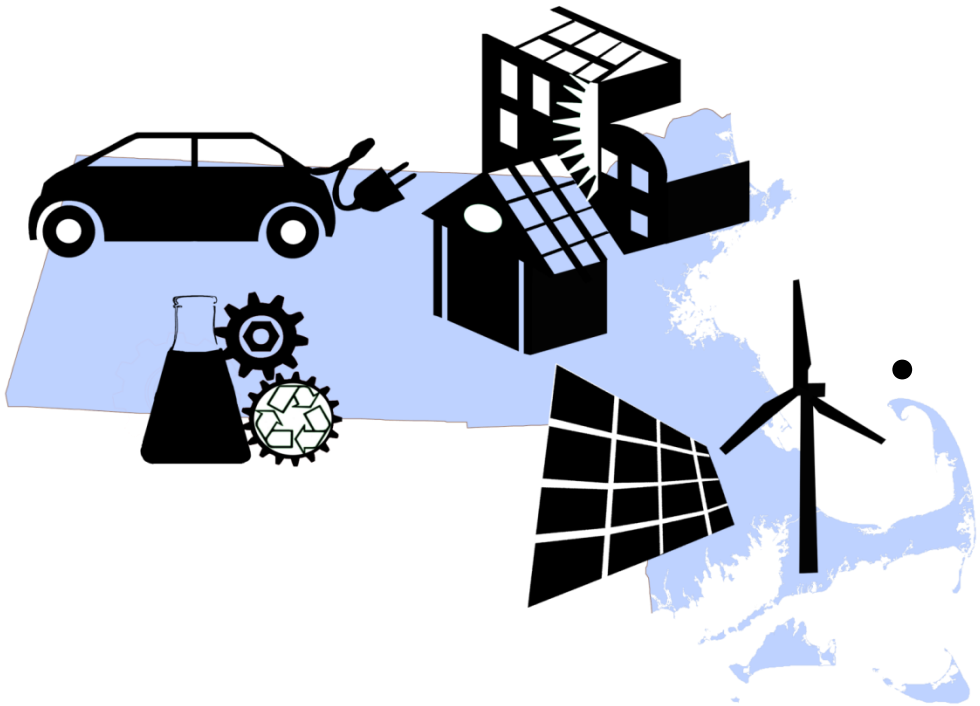
Mitigation – Reduce Greenhouse Gas (GHG) Emissions

- Track and report GHG
- Develop 1990 Baseline and 2020 “Business as Usual” GHG projections
- GHG reductions of 10-25% by 2020, 80% by 2050 (compared to 1990)
- Advisory Committee to Oversee Reduction Planning

Adaptation – Prepare for Effects of Climate Change

- Advisory Committee to Analyze Adaptation Strategies

Massachusetts Clean Energy and Climate Plan for 2020



- Policies to 10-25% reduction in greenhouse gas emissions by 2020 (compared to 1990)
- Road to 80% reduction in emissions by 2050

GWSA Adaptation Advisory Committee

Secretary: Convene Climate Change Adaptation Advisory Committee (CCAAC)

CCAAC: Prepare report to Legislature: “analyze strategies for adapting to the predicted impacts of climate change in the Commonwealth”

Public Involvement

Climate Change Adaptation Advisory Committee

- 35+ members
- 3 meetings

6 Subcommittees

- 200+ participants
- 4-6 meeting each

9 Public Meetings

4 Legislative Hearings

Advisory Committee Expertise

- transportation and built infrastructure
- commercial, industrial and manufacturing activities;
- low income consumers
- energy generation and distribution
- land conservation
- water supply and quality
- recreation
- ecosystems dynamics
- coastal zone and oceans
- rivers and wetlands
- local government
- also public health, insurance, forestry, agriculture, public safety

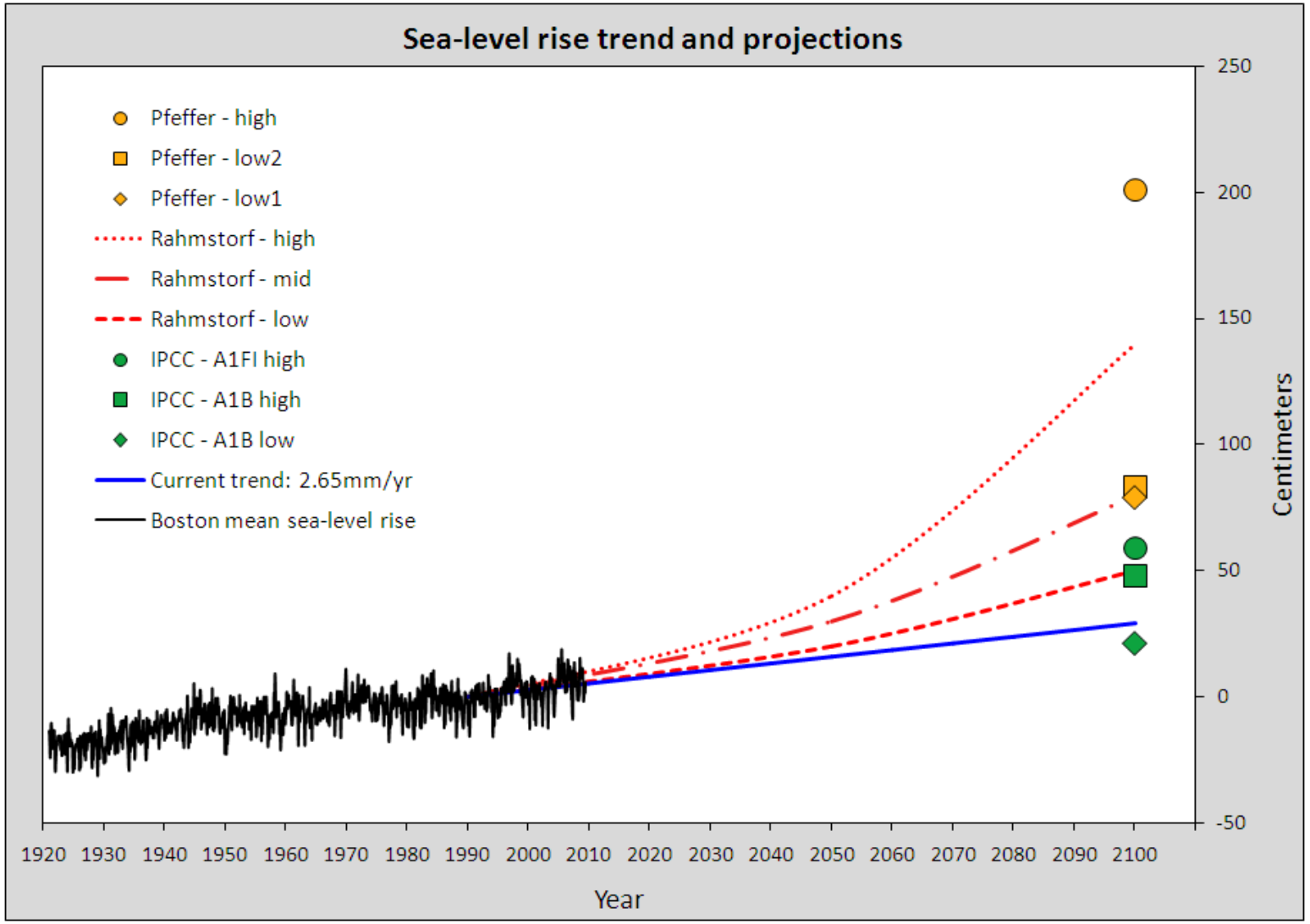
Adaptation Subcommittees

- Natural Resources and Habitat
- Key Infrastructure
- Human Health and Welfare
- Local Economy and Government (including Land Use)
- Coastal Zone and Oceans

Observed Northeast Climate Impacts

- Warmer annual temperatures - up 2 F since 1970
- Warmer winters - up 1.3 F per decade since 1970
- Decreasing winter snowpack
- Earlier flowering plants
- More frequent extreme summer heat

Sea Level Rise: Northeast Predictions



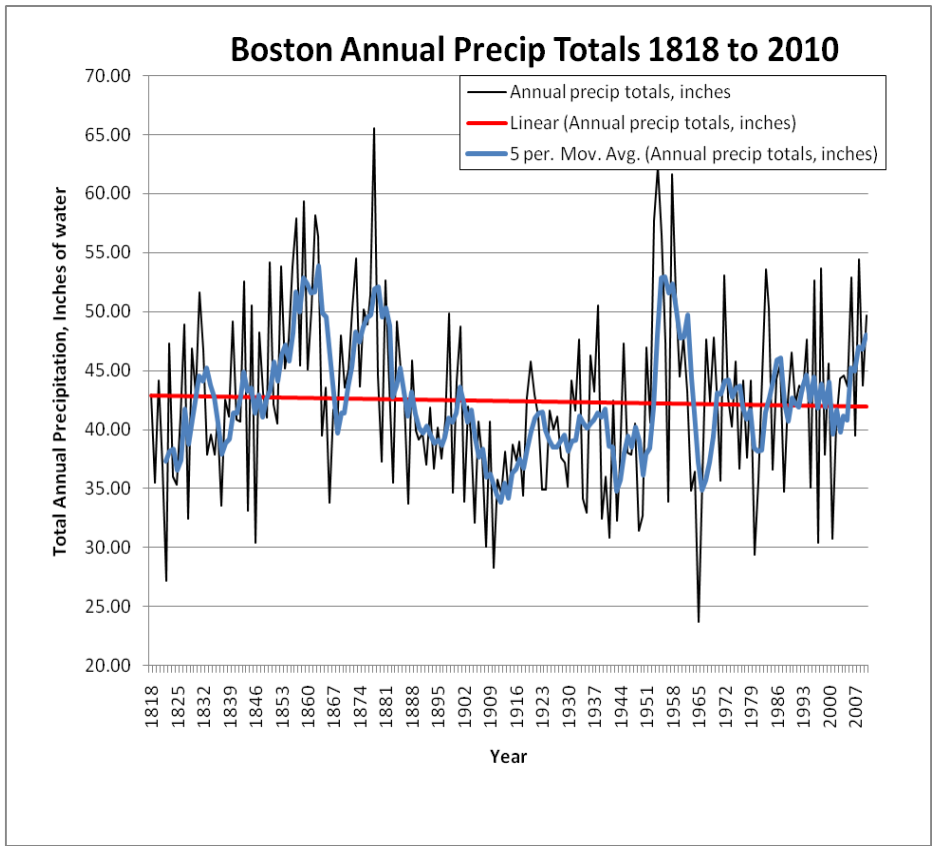
Predicted Northeast Climate Change Impacts

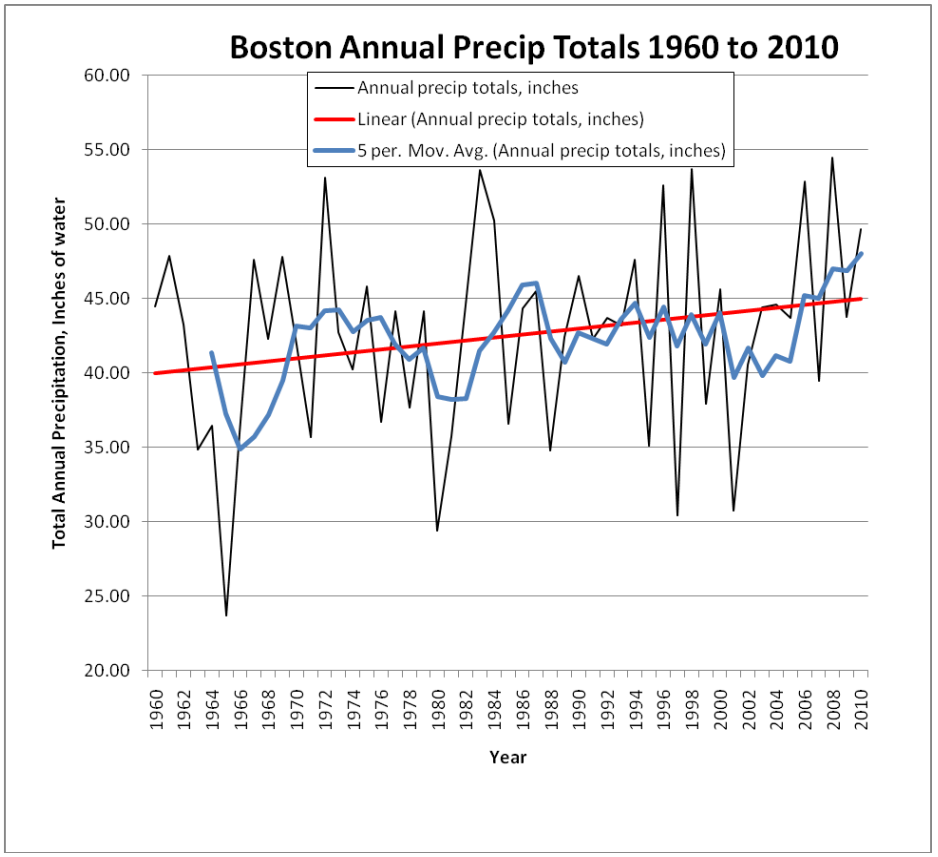
Parameter	Current (1961-1990)	Predicted Range by 2100
Temperature (°C)	7.8	10 to 13
Precipitation (inches)	40.5	43 to 46
Sea level rise (inches)	3.1	10 to 35
Streamflow-spring peak flow (days)	84.5	80 to 72
Short Droughts (#/30 yr)	12.61	16 to 23
Snow Days/Month (days)	5.2	4 to 1
Length of growing season (days)	184	196 to 227

Source: Wake et al., 2006

Annual precipitation in Boston

from January 1818 to December 2010





The blue line represents a five-year moving average and the red line a least squares regression.

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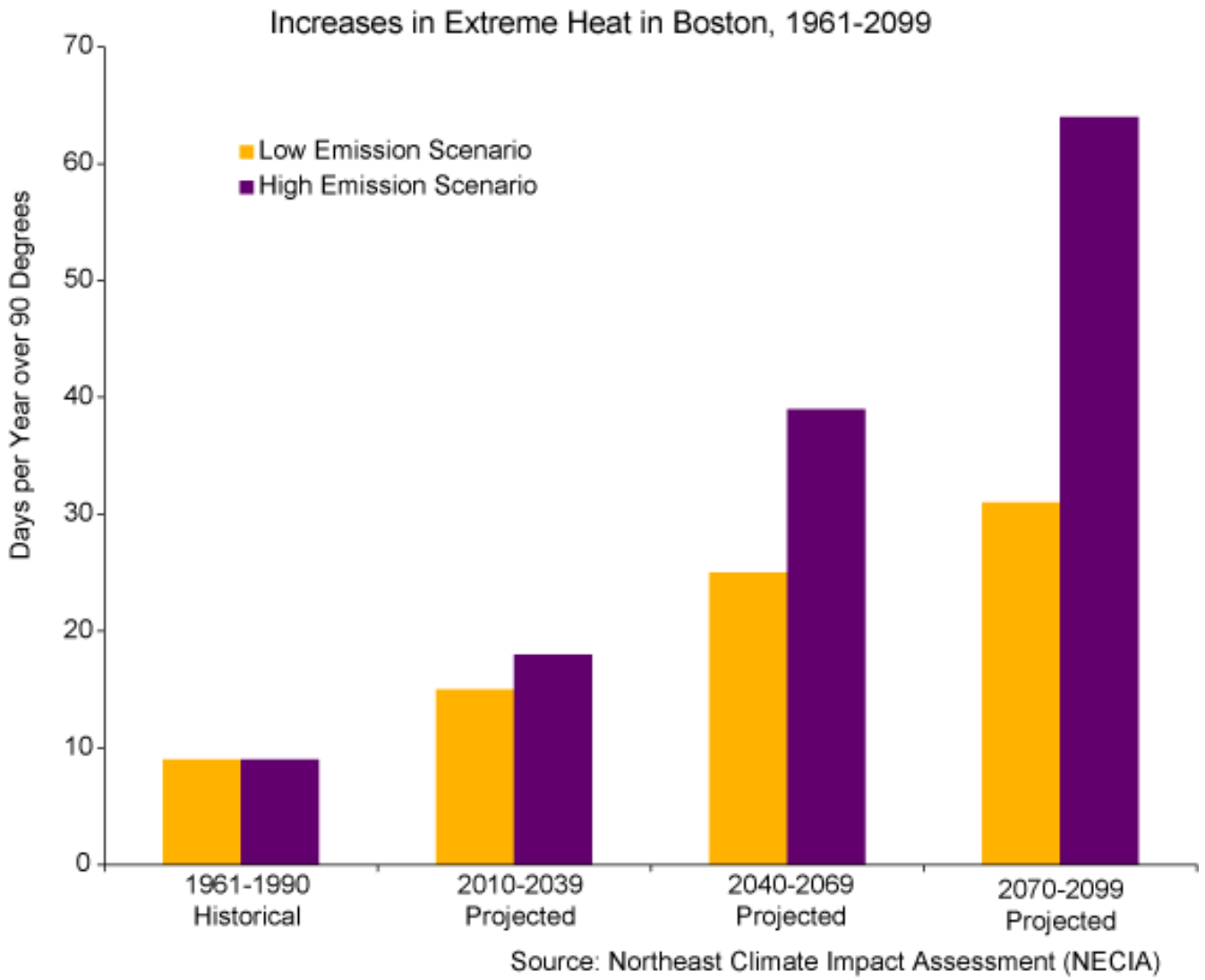
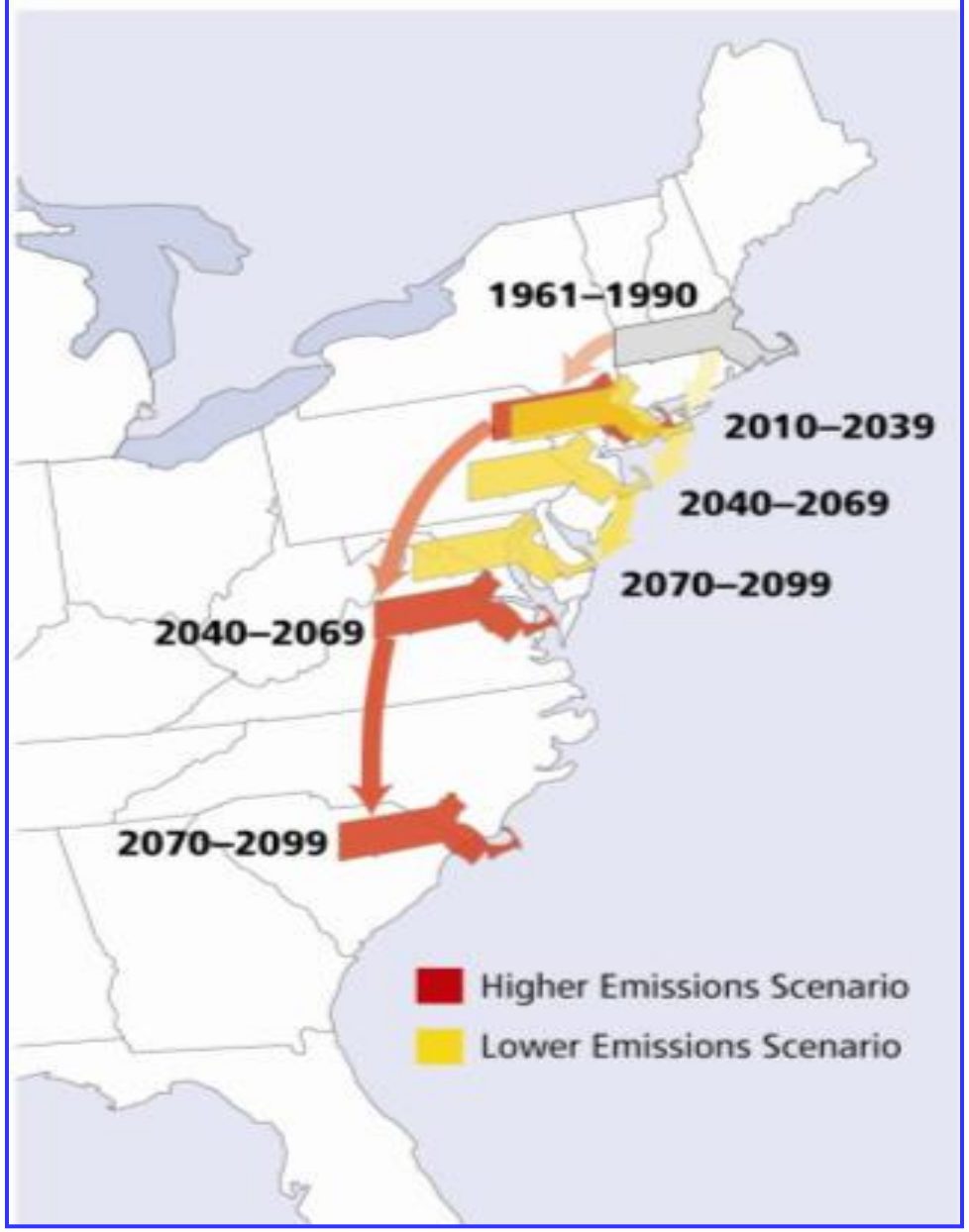
Projected Increases in Extreme Heat Days

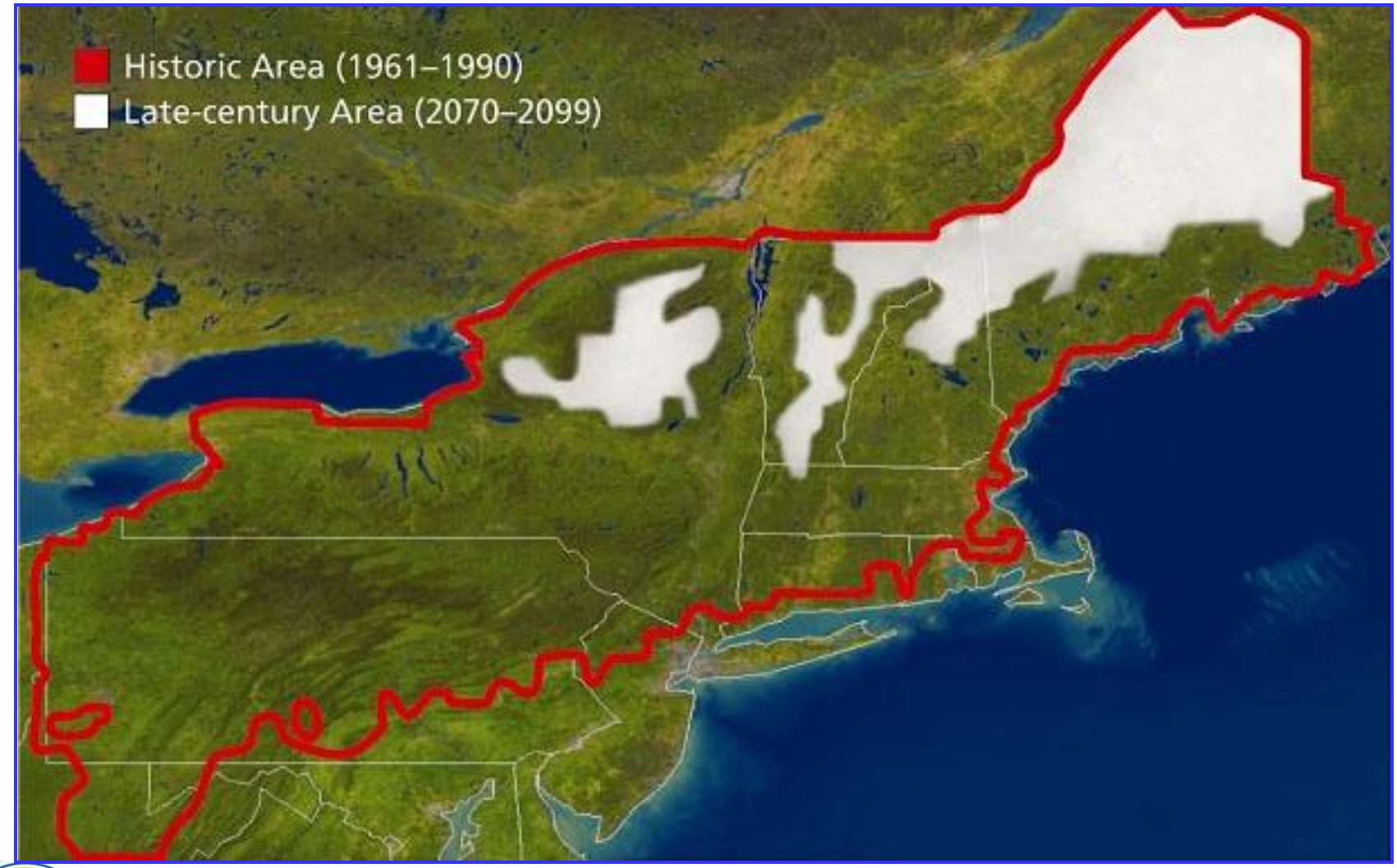


How hot will it feel?



Source: NECIA/UCS, 2007 (see: www.climatechoices.org/ne/

Predicted Snow Cover



Source: NECIA, 2007

Examples of Potential Vulnerabilities

- Temperature Increases
  - Increased warm weather energy demand
  - Increased irrigation demand affecting public water supply
  - Aircraft performance deteriorates, longer runways required
  - Heat stress in vulnerable populations
- Precipitation (more droughts and floods)
  - Increased loads to wastewater and stormwater systems result in combined sewer overflows
  - Localized flooding
  - Decreased water supply in summer months

Recent Record High Spring Flows in MA Rivers

STATION NAME	March-April 2010 Peak Flows		Historic Peak Flow		Start of Analysis Period
	Date	Gage Height (ft)	Date	Gage Height (ft)	
Charles River at Waltham	3/15/2010	7.56	2/3/1976	6.54	1932
Indian Head River at Hanover	3/15/2010	7.32	3/18/1968	7.13	1967
Taunton River near Bridgewater	4/1/2010	14.97	3/20/1968	14.48	1930
Segreganset River near Dighton	3/15/2010	8.66	3/18/1968	7.69	1967

Examples of Potential Vulnerabilities

- Sea Level Rise (SLR) and Flooding
  - Property damage
  - Interruption of key services (emergency response, infrastructure)
- Extreme Weather Events
  - High winds, hurricanes, storm surges, waves, ice storms can cause damage
  - Reduced emergency response capacity and public safety hazards

Principles

- Broad-based participation
- Best available science & technology
- Strong leadership
- Coordination of efforts
- Assist vulnerable populations
- Cost-effective and risk-based approaches

Types of Potential Strategies

- 200+ recommendations
- “No-regrets”
- Cross-cutting
- Sector-specific

Cross-Cutting Strategies

- Combine mitigation and adaptation strategies
- Identify and fill critical information gaps
- Advance risk and vulnerability assessments
- Evaluate and prioritize adaptation strategies for implementation
- Support local communities
- Improve planning and land use practices
- Enhance emergency preparedness
- Encourage ecosystem-based adaptation
- Continue to seek expert advice and stakeholder input
- Ensure agency and regional coordination
- Promote communication and outreach
- Start now – be bold!

Natural Resources and Habitat

- Ecosystem Types: Forest, Coastal, Aquatic, Wetland

- Guiding Principles:
  - Protect ecosystems of sufficient size, across environmental settings, & in multiples
  - Maintain large-scale ecosystem processes, prevent isolation; maintain diversity
  - Use nature-based adaptation solutions; embrace adaptive management

- Strategies: 4 broad categories
  - Land Protection
  - Policy, Flexible Regulation, Planning and Funding
  - Management and Restoration
  - Monitoring, Research and Adaptive Management

Key Infrastructure

- Sectors:

  Energy (electric, gas, petroleum)
  Water (supply, wastewater, stormwater)
  Waste (solid and hazardous)
  Telecommunications
  Transportation (land, sea, air)
  Dam Safety and Flood Control
  Built Infrastructure and Buildings

- General Strategies:
  - Accurate Mapping and Surveys
  - Change Land Use, Design, Site Selection and Building Standards
  - Enhance Natural Systems
  - Identify Lead Times for Adaptive Construction

- Key Infrastructure Interconnections
  - Energy and Transportation
  - Within Water Resource Sectors – integrated water to mimic natural hydrology
  - Increased Conservation Measures and “Green” Designs – in energy, transportation, and using urban forests

Mother's Day Storm - 2006

Mother's Day Storm - 2006

Ice Storm - 2008

Human Health and Welfare

- Sectors:
  - Public Health (infrastructure and vector-borne diseases)
  - Air Quality (ambient and indoor)
  - Water Quality/Sanitation
  - Agriculture and Food Systems
  - Vulnerable Populations

- Advancing Adaptation and Mitigation from a Public Health Perspective
  - A Healthy Cities Initiative
  - Alternative Fuel Vehicles
  - Improving Electricity Grid Infrastructure

Local Economy and Government

- Sectors:

  Agriculture
  Forestry
  Fisheries
  Cultural Resources
  Government
  Manufacturing (computers, electronics, fabricated metal, machinery)
  Services Industry (real estate mgmt, tourism & recreation, health care, higher education)

- Economic Opportunities: green jobs, new technologies, research and design opportunities

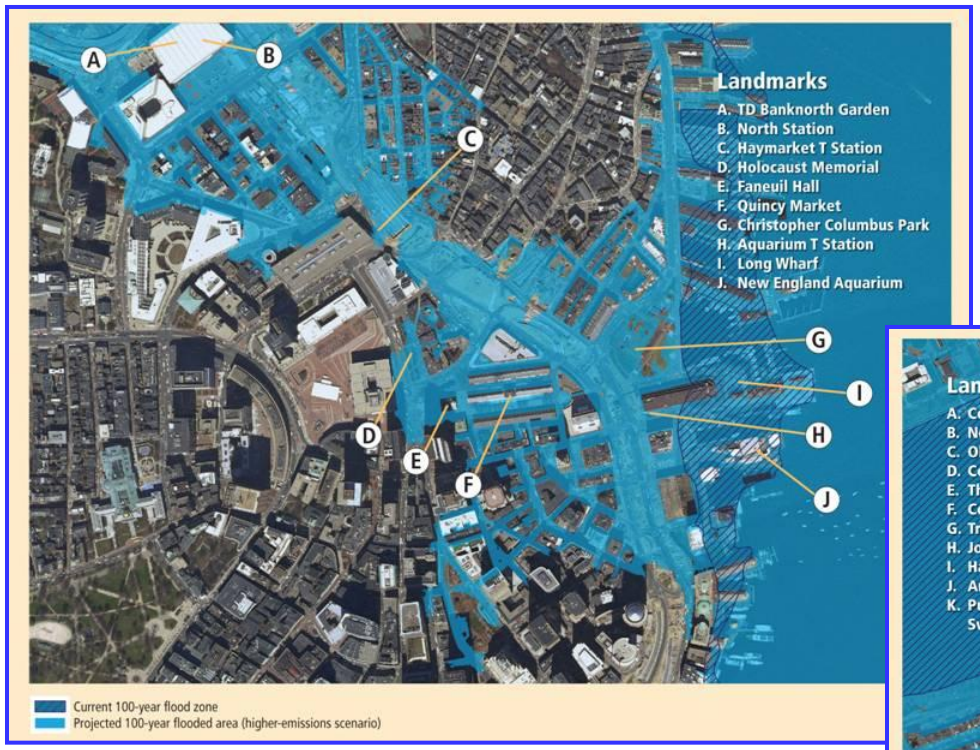
- Government:
  - General Strategies: sponsor data collection & research; procurement, grant criteria, standards, codes and regulations
  - Enhance Emergency preparedness
  - Improve Planning and Land Use Practices

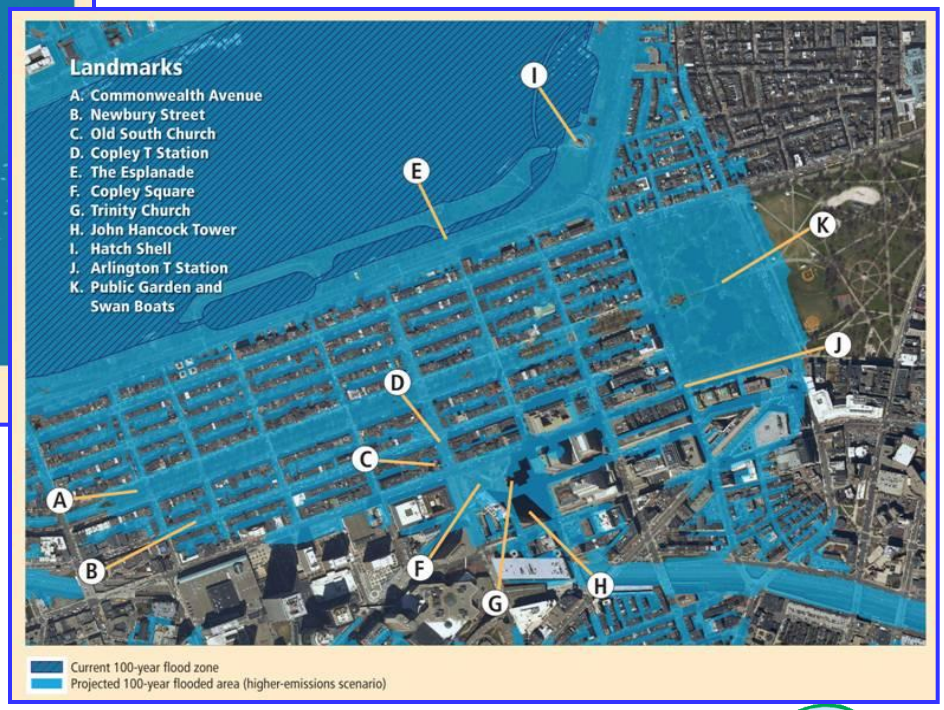
Coastal Zone and Oceans

- Residential and Commercial Development, Ports and Infrastructure
  - Avoid vulnerable areas; design according to projected risk
  - Decrease repetitive losses to existing development
- Coastal Engineering for Shoreline Stabilization and Flood Protection
  - assess local erosion and flooding, evaluate coastal hazards mgmt approaches
  - Incorporate higher sea levels in new coastal designs
- Coastal, Estuarine, and Marine Habitats, Resources, and Ecosystem Services
  - Bolster land conservation
  - Improve resiliency through habitat restoration, green infrastructure, design
  - Reduce anthropogenic stressors through improved water quality
  - Incorporate flexibility into fisheries mgmt systems
  - Improve shellfish management
  - Increase monitoring, observations, and assessments

Potential Coastal Flooding in Boston

Under Present and High Emission Sea Levels





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Source: NECIA/UCS, 2007 (see: www.climatechoices.org/ne/)

Examples of Ongoing Agency Activities

- DAR: Promote “buy local, ” improve storage for local produce
- DFG: Climate-smart State Wildlife Action Plan
- DCR: Regional precipitation modeling (using data in design)
- DEP: Promoting “green infrastructure,” assisting with energy security and diversification
- CZM: StormSmart Coast tools, technical information (i.e. visualization of sea level rise and coastal surges)
- DOER: Zero Net Energy buildings

Immediate Next Steps

- Agencies evaluating potential strategies
- EEA and agencies will assess feasibility of implementation of these strategies
- Stakeholder group to assess impacts of climate change as part of MEPA review

Thank you

Report Website:

http://www.mass.gov/environment/cca