

CLIMATE CHANGE ADAPTATION in MASSACHUSETTS



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Executive Office of Energy and Environmental Affairs



Content

- The Global Warming Solutions Act and the Adaptation Advisory Committee
- Observed Climate Change and Impacts
- Predicted Climate Change
- Impacts and Vulnerabilities
- The Report
- Ongoing State Agency Activities
- Immediate Next Steps



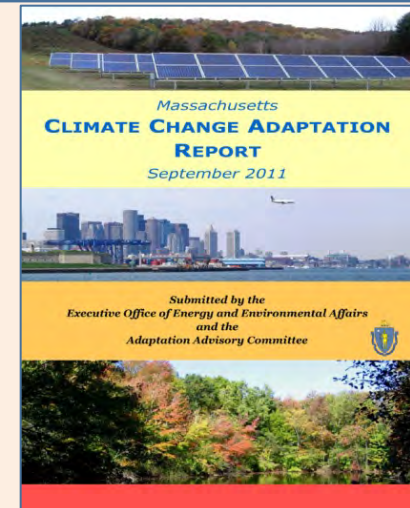
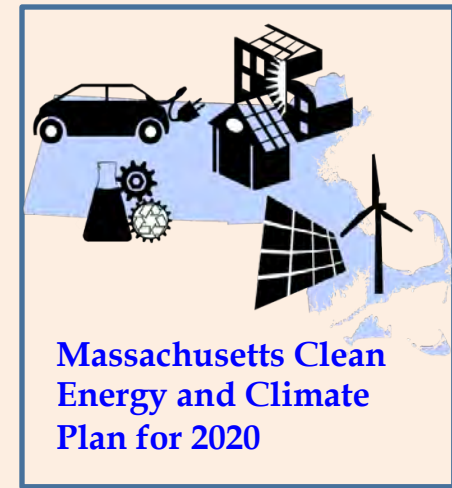
The Global Warming Solutions Act (2008)

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



GWSA - Adaptation Advisory Committee

- EEA 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”
- CCAAC and Development of the Report
 - CCAAC: Consisted of 35+ members; 3 meetings
 - 5 Subcommittees: 200+ participants; 4-6 meetings each
 - 9 Public Meetings
 - 4 Legislative Hearings



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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
- ecosystems dynamics
- coastal zone and oceans
- rivers and wetlands
- recreation
- local government
- public health
- insurance, forestry
- agriculture
- public safety

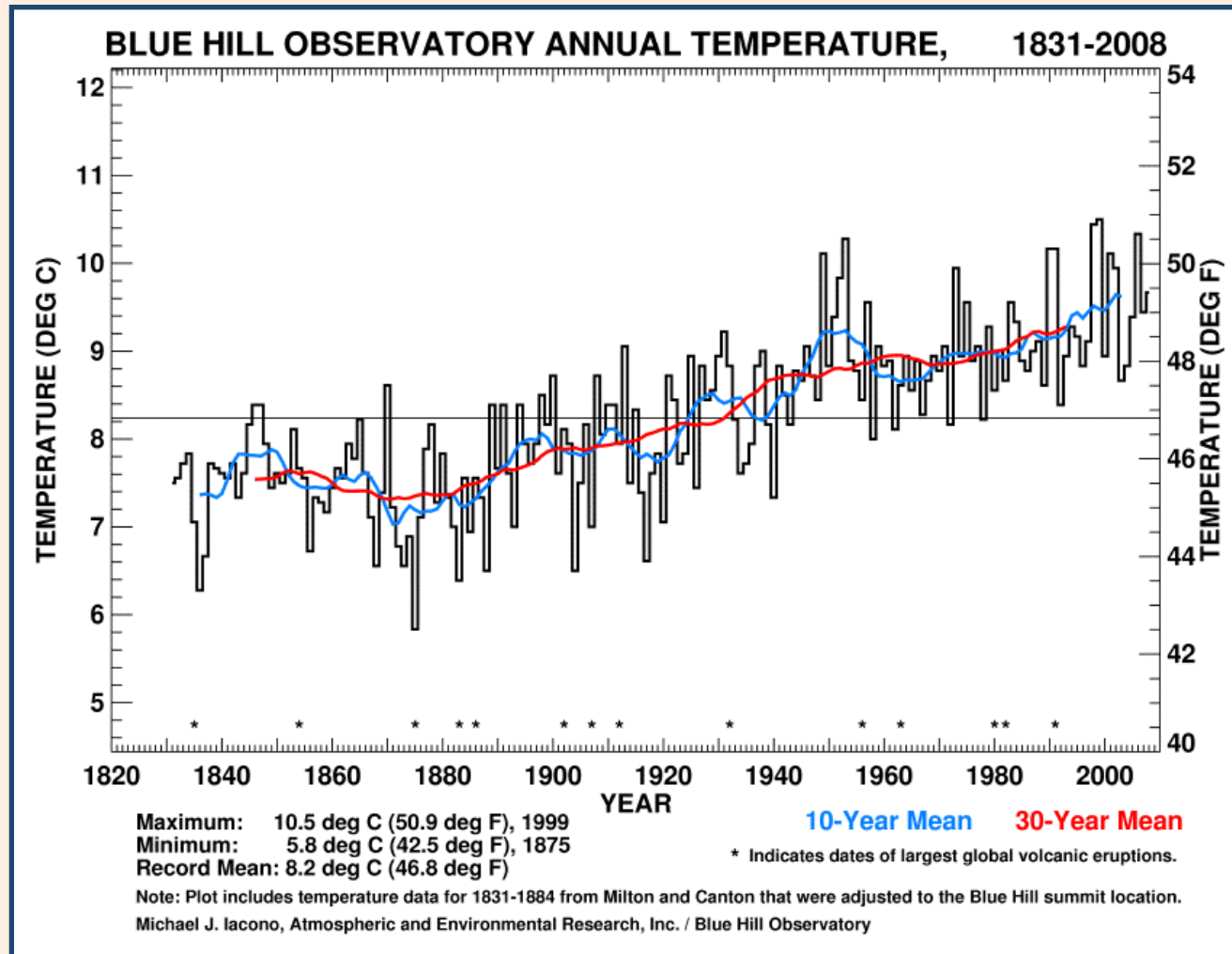


Observed Northeast Climate Impacts

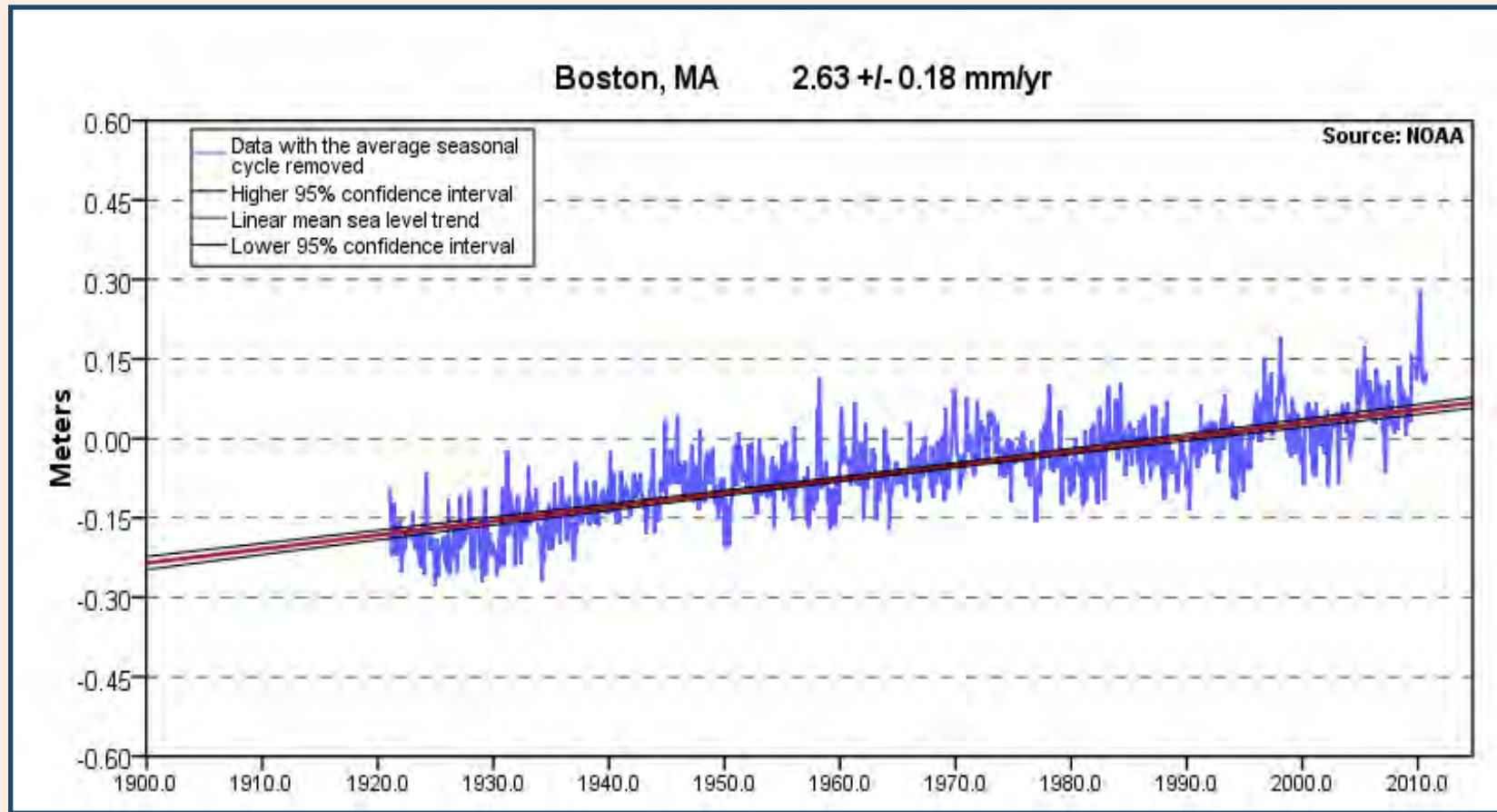
- Warmer annual temperatures - up 2°F since 1970
- Warmer winters - up 5.2°F since 1970
- Sea surface temperatures – up by 2.3°F between 1970-2002
- Sea level rise – 22 cm between 1921-2006
- Decreasing winter snowpack & earlier snowmelt
- Earlier flowering plants
- 24% breeding bird species have smaller distributions since 1979
- Earlier nesting for 28 migrating east coast bird species
- More frequent extreme summer heat



Observed Annual Average Temperature



Observed Mean Sea Level Rise in Boston



Source: http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8443970



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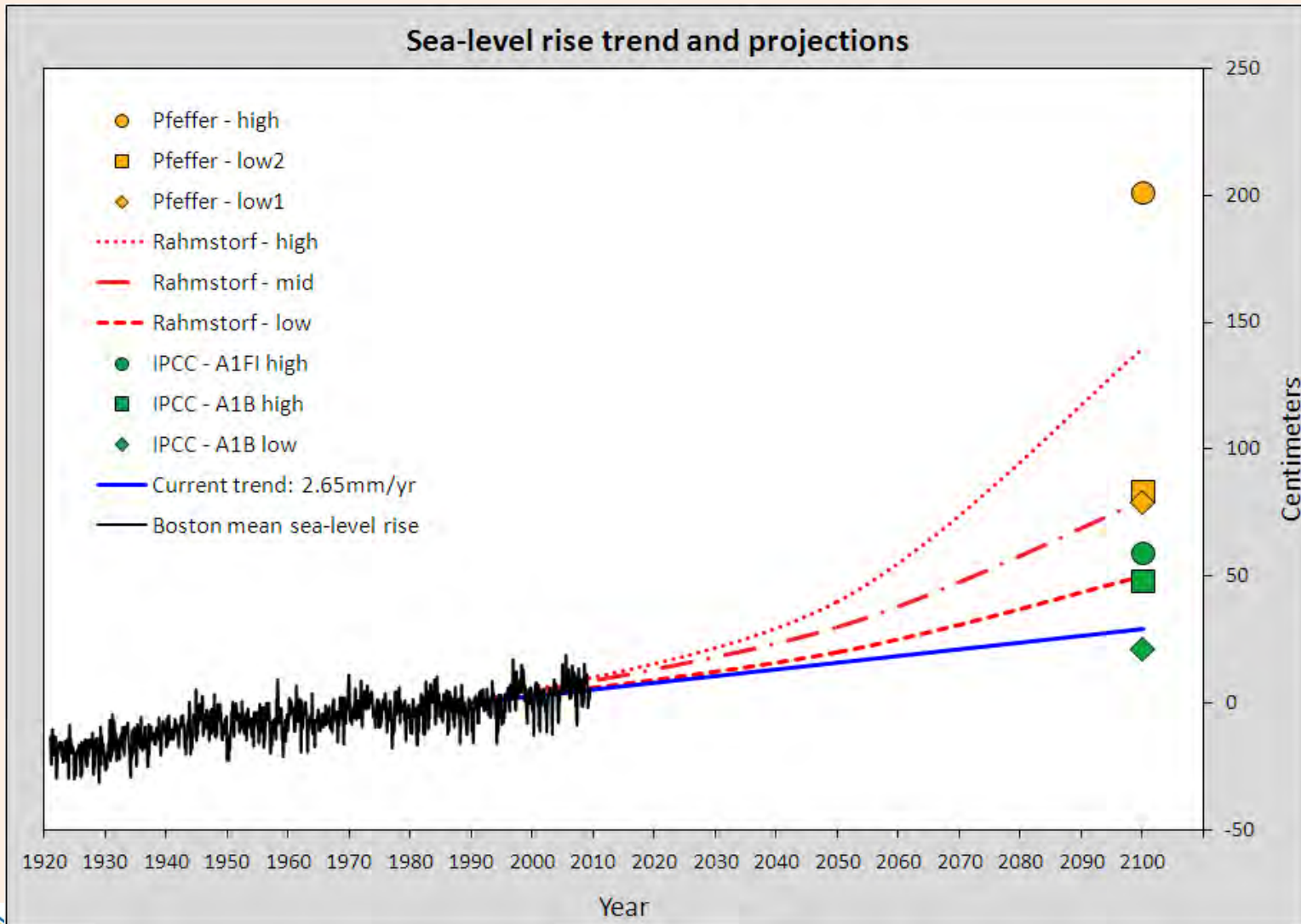


Predicted Northeast Climate Change Impacts

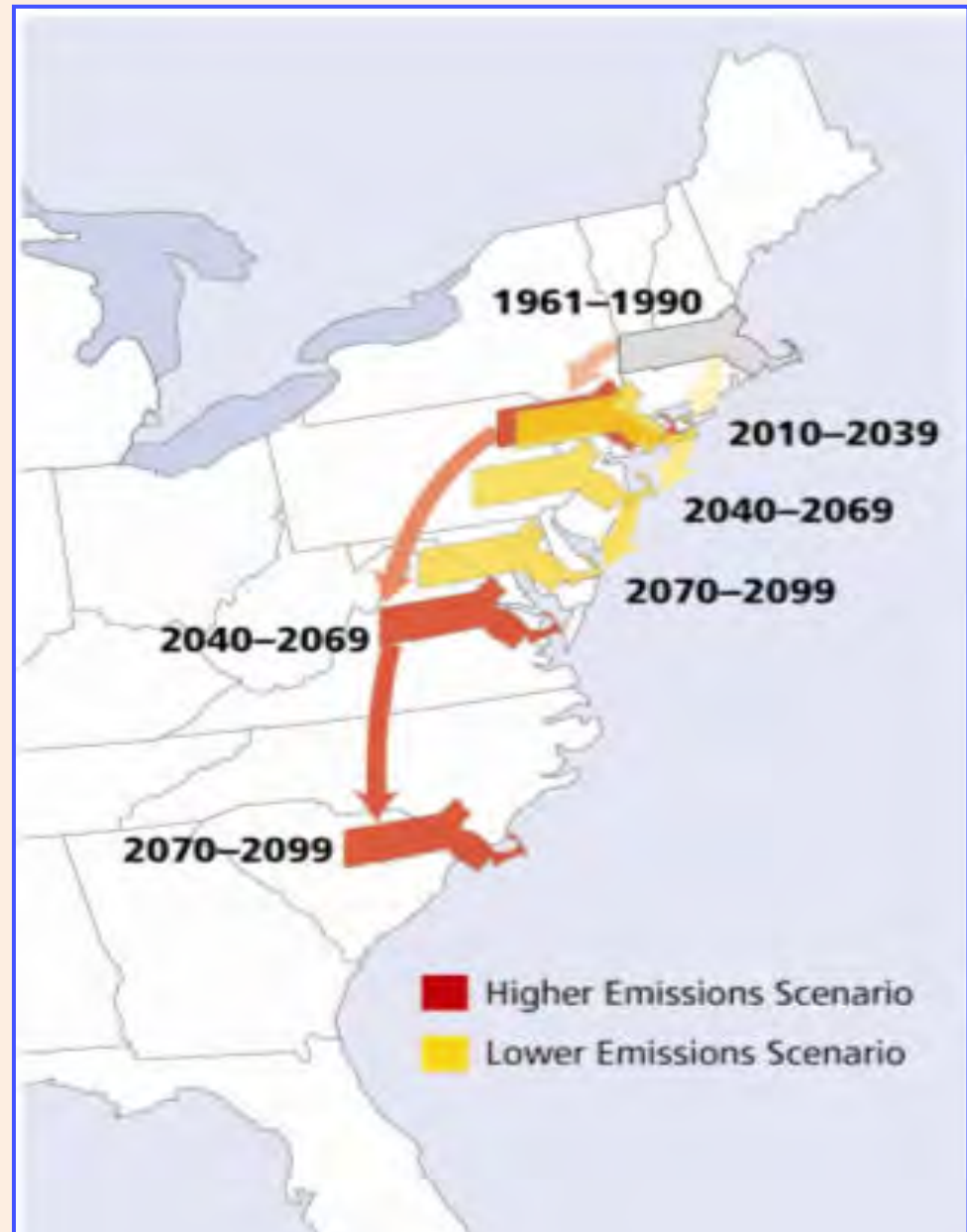
PARAMETER	CURRENT (1961-1990)	PREDICTED RANGE by 2100
Annual Temperature (°C)	8	10 to 13
Annual Precipitation (inches)	41	43 to 46
Sea Level Rise (inches)	3.1	11 to 79
Streamflow-spring peak flow (days from Jan 1)	85	74 to 75
Short Droughts (#/30 yr)	13	16 to 23
Snow Days/Month (days)	5	3 to 1
Length of growing season (days)	184	213 to 227



Sea Level Rise: Northeast Predictions



How hot will it feel?



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

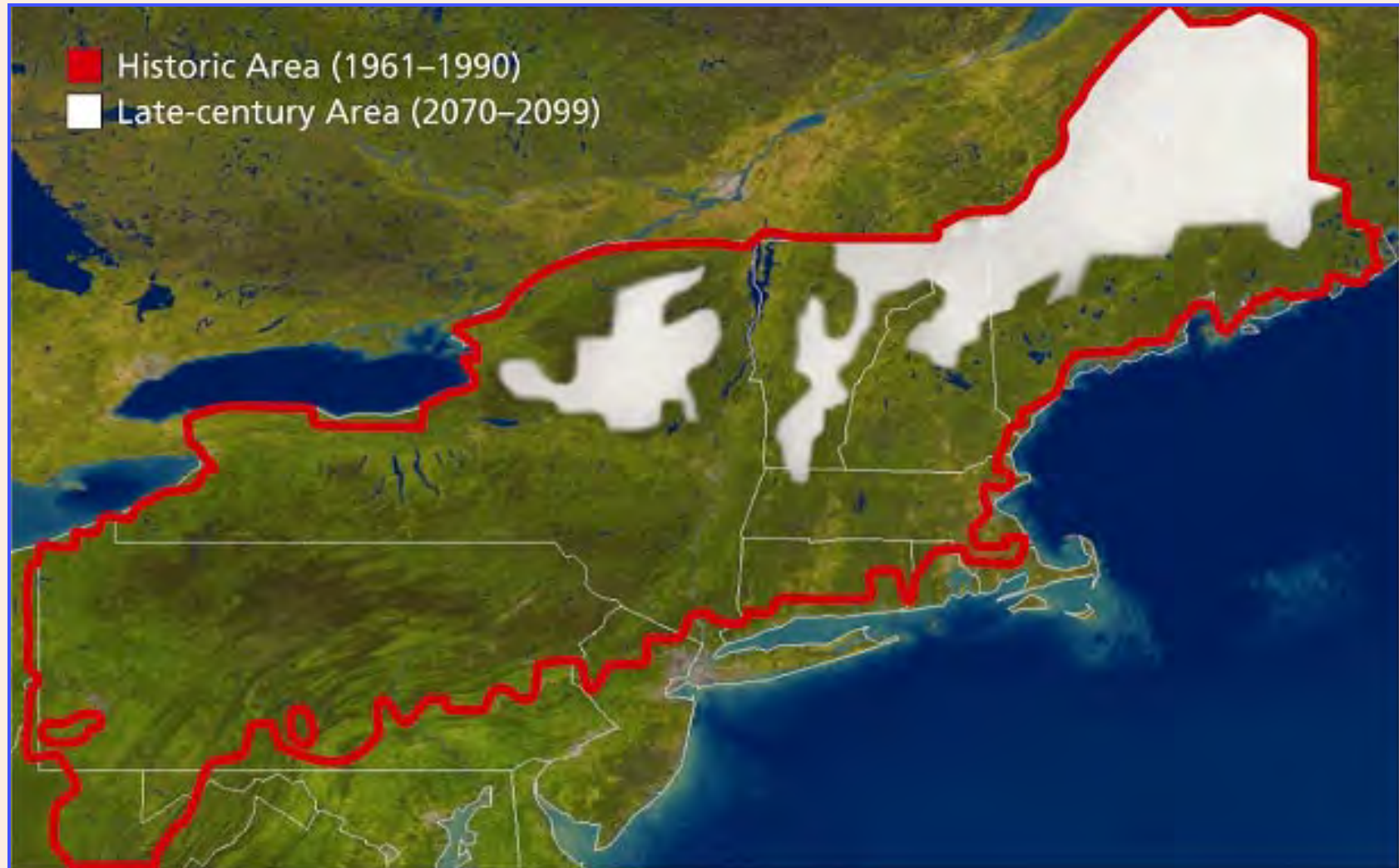


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(NECIA, 2007)

Observed and Predicted Snow Cover



Source: NECIA, 2007

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Potential Impacts and Vulnerabilities

- **Temperature Increases**

- Air quality (asthma)
- Extreme heat and heat stress
- Warm weather energy demand
- Irrigation demand on public water supply



- **Precipitation Changes: to amount, frequency and timing - more droughts and floods**

- More winter precipitation as rain and not snow
- More extreme precipitation & flooding
- Current 100-year flood could occur every 2-3 years by 2100
- Increased CSO discharges
- More low streamflow periods, decreased summer water supply
- Decrease in traditional winter recreation



Examples of Potential Vulnerabilities

■ Sea Level Rise and Flooding

- Coastal inundation and storm surges
- Property damage, loss of natural habitats
- Interruption of key services (emergency response, infrastructure)



■ Extreme Weather Events

- Damage due to high winds, hurricanes, storm surges, waves, ice storms
- Increased flooding
- Reduced emergency response capacity



THE REPORT: 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!



THE REPORT: Natural Resources and Habitat

- Identified Ecosystem Types in MA

Forest, Coastal, Aquatic, Wetland

- Established Guiding Principles

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

- Developed Broad Categories of Strategies

- Land Protection
- Policy, Flexible Regulation, Planning and Funding
- Management and Restoration
- Monitoring, Research and Adaptive Management



THE REPORT: Key Infrastructure

- **Sub-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 using current & future conditions
- Timely maintenance, Building Redundancies
- Increased conservation, Efficiencies & Reuse of resources
- 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



THE REPORT: Human Health and Welfare

- Sub-Sectors

Public Health (infrastructure and vector-borne diseases)

Air Quality (ambient and indoor)

Agriculture and Food Systems

Water Quality/Sanitation

Vulnerable Populations

- Advancing Adaptation and Mitigation from a Public Health Perspective

- A Healthy Cities Initiative
- Alternative Fuel Vehicles
- Improving Electricity Grid Infrastructure



- General Strategies

- Enhance regionalization efforts to address non-emergency situations
- Relocating vulnerable health care facilities
- Improve capacity to detect and treat against pests and diseases
- Address and maintain outdoor air quality
- Improve indoor air quality



THE REPORT: Local Economy and Government

- **Sub-Sectors**

Agriculture

Forestry

Fisheries

Manufacturing (computers, electronics, fabricated metal, machinery)

Services Industry (real estate mgmt, tourism and recreation, health care, higher education)

Cultural Resources

Government

- **Local Economy Strategies**

- Industries establish redundant routes and sources
- Develop local and renewable sources of energy
- Assess and protect vulnerable facilities and cultural sites
- Insurance markets to better capture future climate risks



- **Government Strategies**

- Sponsor data collection and research;
- Include predictions in procurement and grant criteria
- Develop standards, codes and regulations
- Enhance emergency preparedness and essential services
- Improve planning and land use practices



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THE REPORT: Coastal Zone and Oceans

- Common Theme – Strong Planning, Management and Collaboration!
- Residential/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

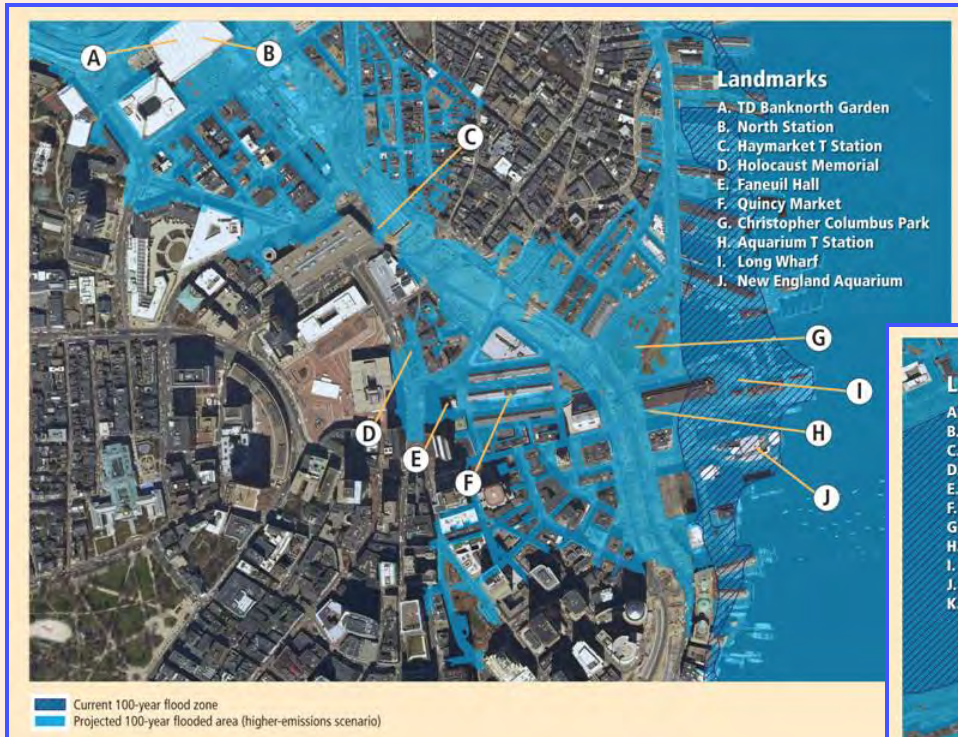


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Potential Coastal Flooding in Boston

Under Present and High Emission Sea Levels



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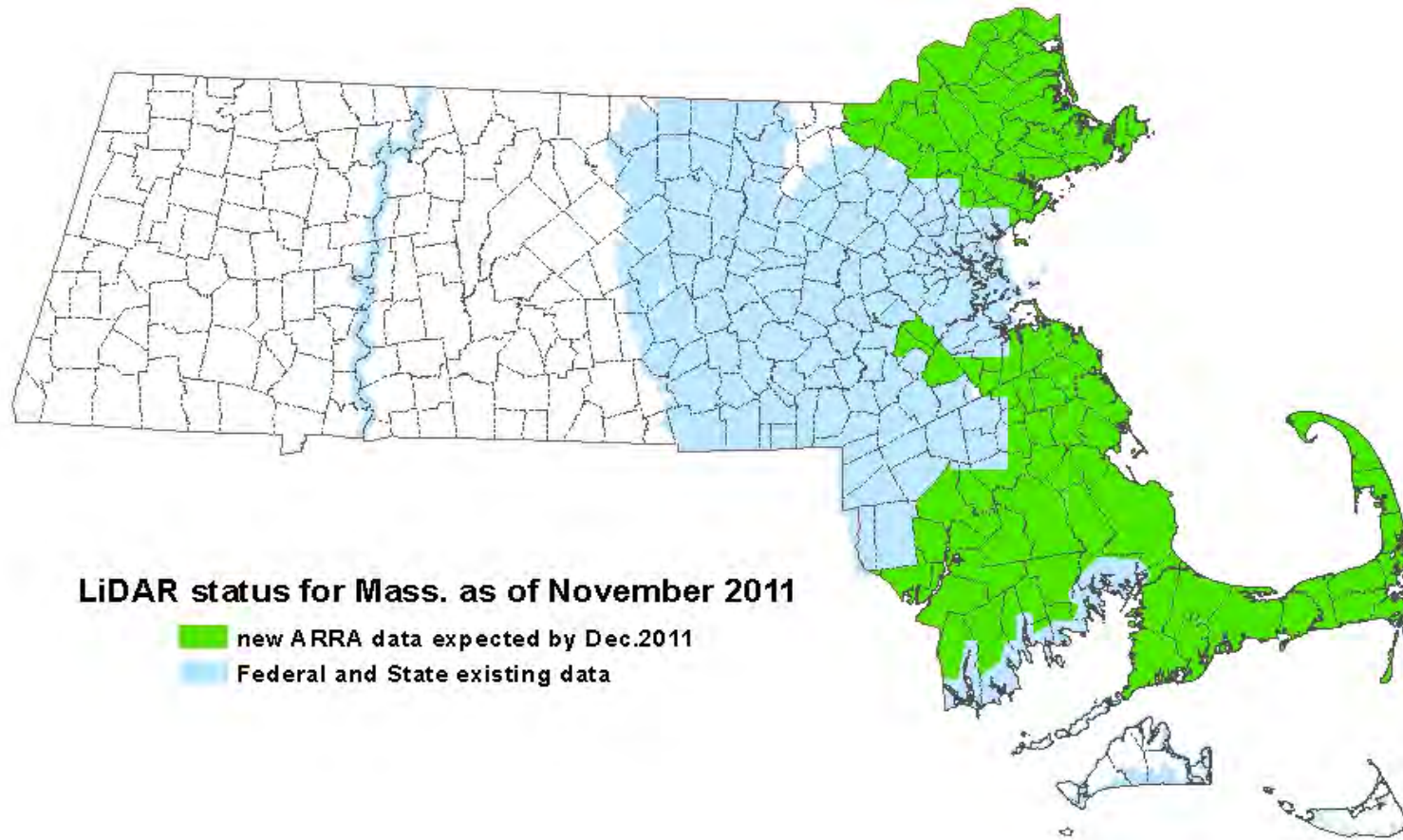
Source: NECIA/UCS, 2007 (see: www.climatechoices.org/ne/)

LiDAR (Light Detection and Ranging)

- Cooperative project with contributions from federal, state and research agencies (USDA, WHOI, MassDOT, EEA, FEMA)
- Highly detailed elevation data for coastal MA
- Detailed terrain model, with data points every meter or two measuring vertical elevation to within 15 cm or better
- Data suitable for
 - determining vulnerability of built infrastructure
 - analyzing drainage at a watershed or even a town-wide scale
 - doing preliminary planning for major construction projects
 - characterizing habitat and vegetative cover
 - deriving the locations of structures and many other purposes
- Data supports detailed analysis of inland flooding and coastal inundation scenarios associated with extreme weather events



LiDAR in Massachusetts



Examples of Ongoing EEA Agency Activities

- **DAR, DFG, DCR, CZM:** Protecting existing habitats, forests and farms through land acquisition & conservation restrictions
- **DAR:** Promoting buy-local, pest management, encouraging best practices to control runoff of pesticides, nutrients & fertilizers
- **DFG:** Climate-smart State Wildlife Action Plan
- **DCR:** Regional precipitation modeling (using data in design)
- **DEP:** Promoting “green infrastructure,” assisting with renewable energy, conservation and treatment plants
- **CZM:** StormSmart Coast tools, technical information (i.e. visualization of sea level rise and coastal surges)
- **DOER:** Zero Net Energy buildings



Examples of Activities at Other State Agencies

Department of Public Health

- CDC grant supporting needs and capacity assessments to create plans for towns to address health consequences of climate change

MassPort

- Developing complete topographic ground survey information for its waterfront properties in Boston Harbor
- Incorporating design refinements in response to projected sea level rise in Green Bus Depot (under construction)
- Emergency response planning in response to sea level rise

Department of Transportation

- Determining flood prone areas on highway network; developing methodology for ranking vulnerability of assets
- Incorporating climate change effects into stormwater design & engineering
- Pervious pavement: 25% of all new non-highway facilities by 2015, 75% by 2020
- Partnering with federal agencies to help develop local/regional climate prediction model to meet engineering needs
- Energy efficiency, audits, solar panels, electric vehicle charging stations, wind turbine, transforming highway fleet to renewable fuels



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>



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