Preparing the Great Lakes Region for the Impacts of Climate Change

Presentation to
11th Annual Meeting & Conference
of the Great Lakes & St. Lawrence Cities Initiative

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The Need to Prepare for a Changing Climate

- The climate is changing at an increasingly rapid rate, outside the range to which society has adapted in the past.
- Many of the outcomes communities are trying to attain (*e.g.,* safe drinking water, economic growth) are sensitive to changes in climate.
- Until now, communities have been able to assume climate is relatively stable and future climate will mirror past climate.

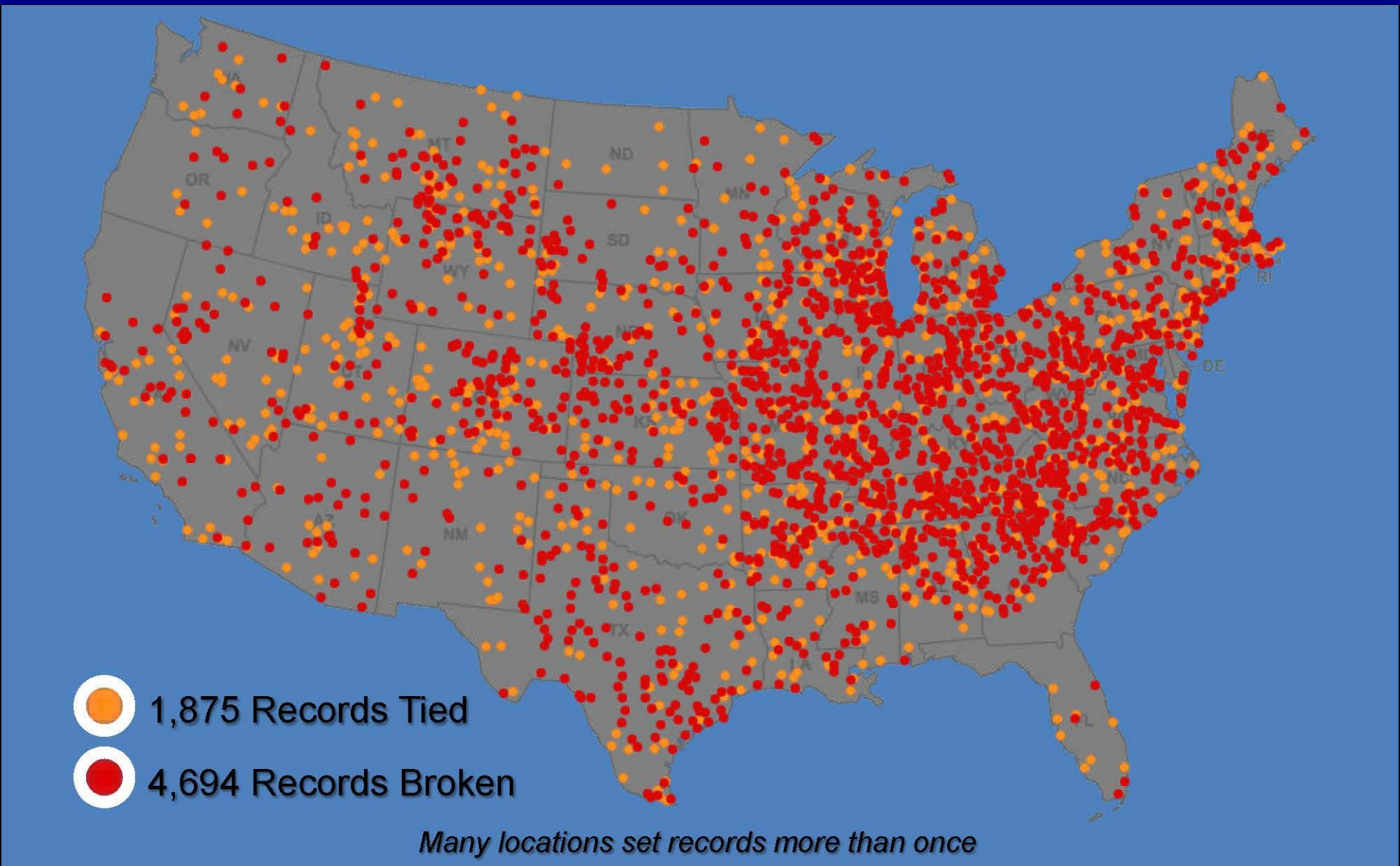
  ➡ But the past is no longer a good predictor of the future.

- **Communities must adapt.**
  - They must anticipate and plan for future changes in climate.
  - They must transform the way they do business.

Temperatures are Rising

- Year-round average temperatures in the U.S. have already risen 2°F over the past 50 years
- U.S. temperatures will continue to rise
  - **2°F - 4°F during next few decades**
  - By the end of the century, anywhere from **3°F - 5°F** (under low GHG emissions scenario that assumes substantial reductions in emissions after 2050) to **5°F - 10°F** (under high GHG emissions scenario)
- Strong evidence that human influence has already doubled the probability of extreme heat events like the record-breaking summer of 2011 in Texas and Oklahoma
- Chances of **record-breaking high temperature extremes** will continue to increase

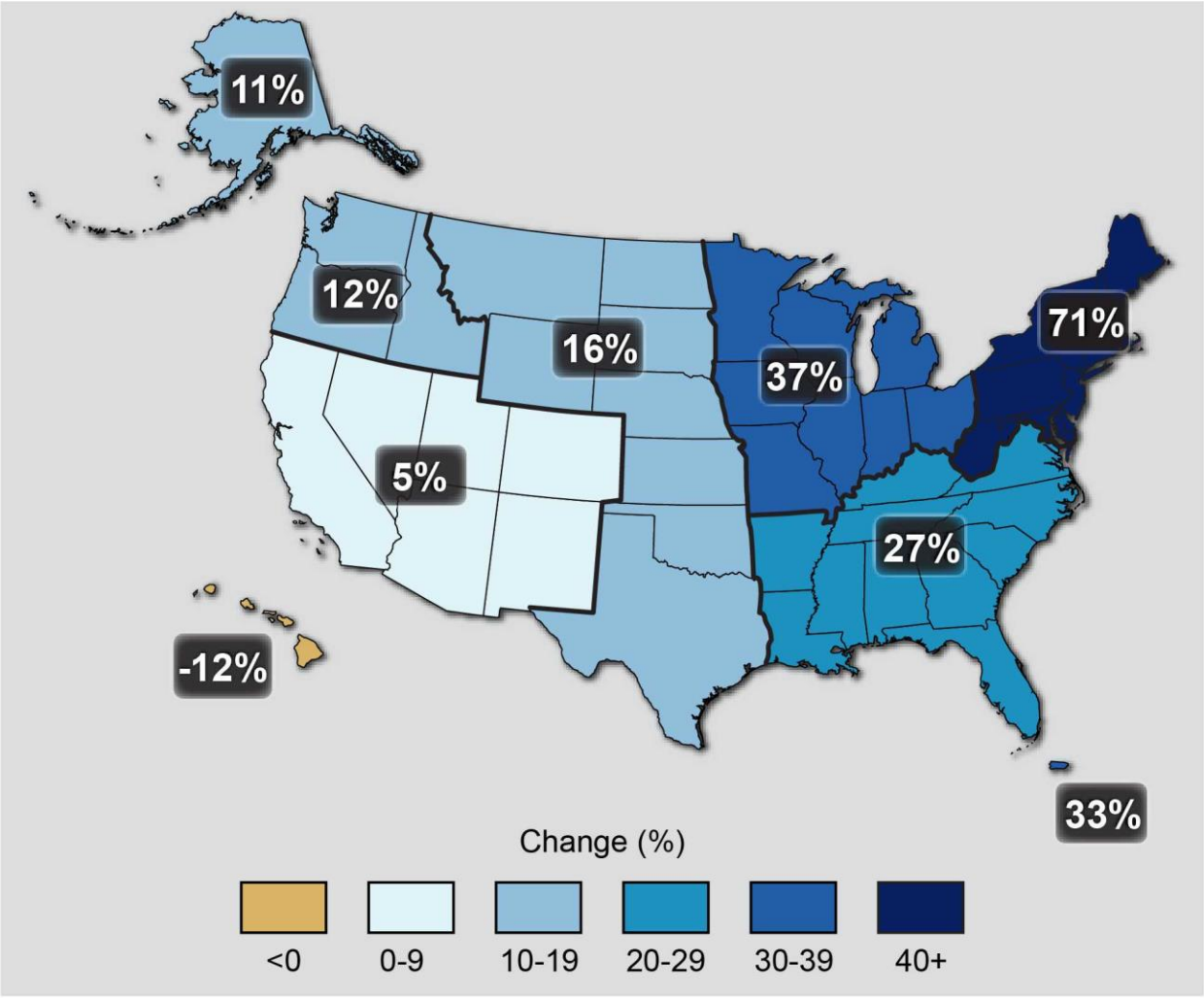
Hotter than average summers can lead to extreme heat; Many daily heat records were set during June-July 2012



Slide adapted from Climate Reality Project

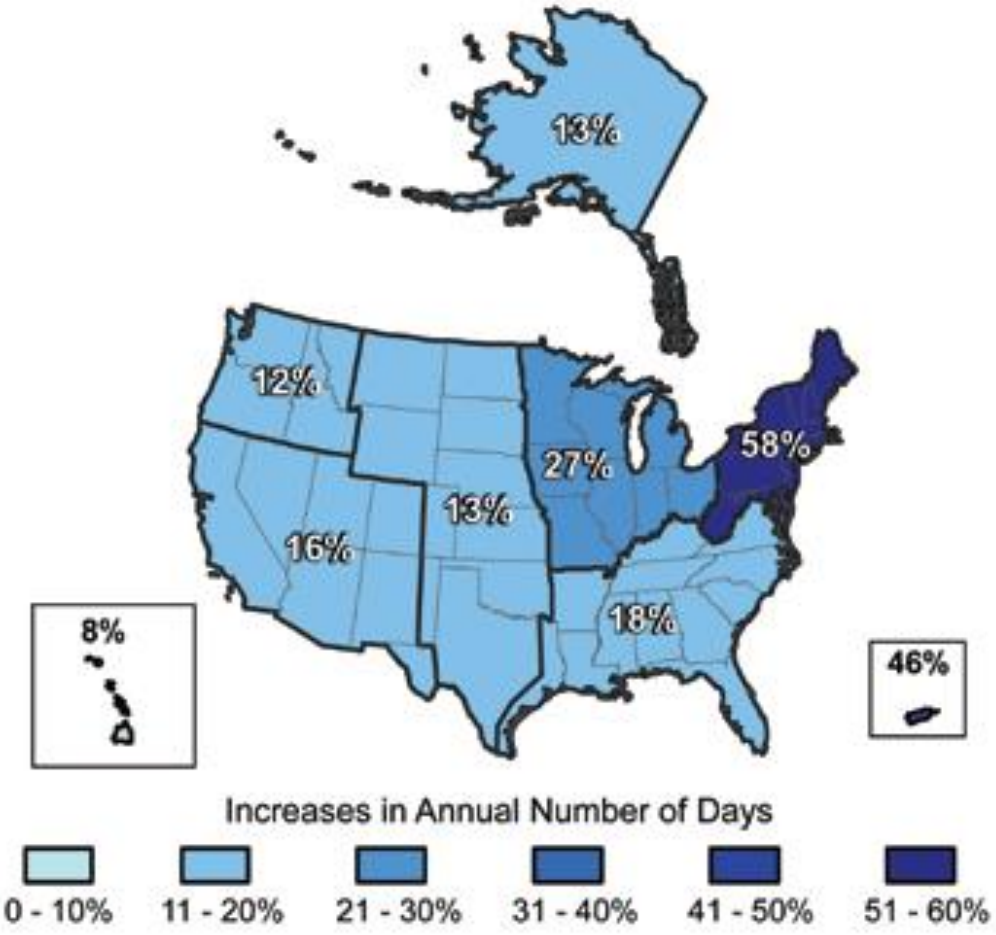
Source: National Climatic Data Center, NOAA

Observed Changes in Heavy Precipitation: 1958-2011



(Source: U.S. National Climate Assessment, 2014)

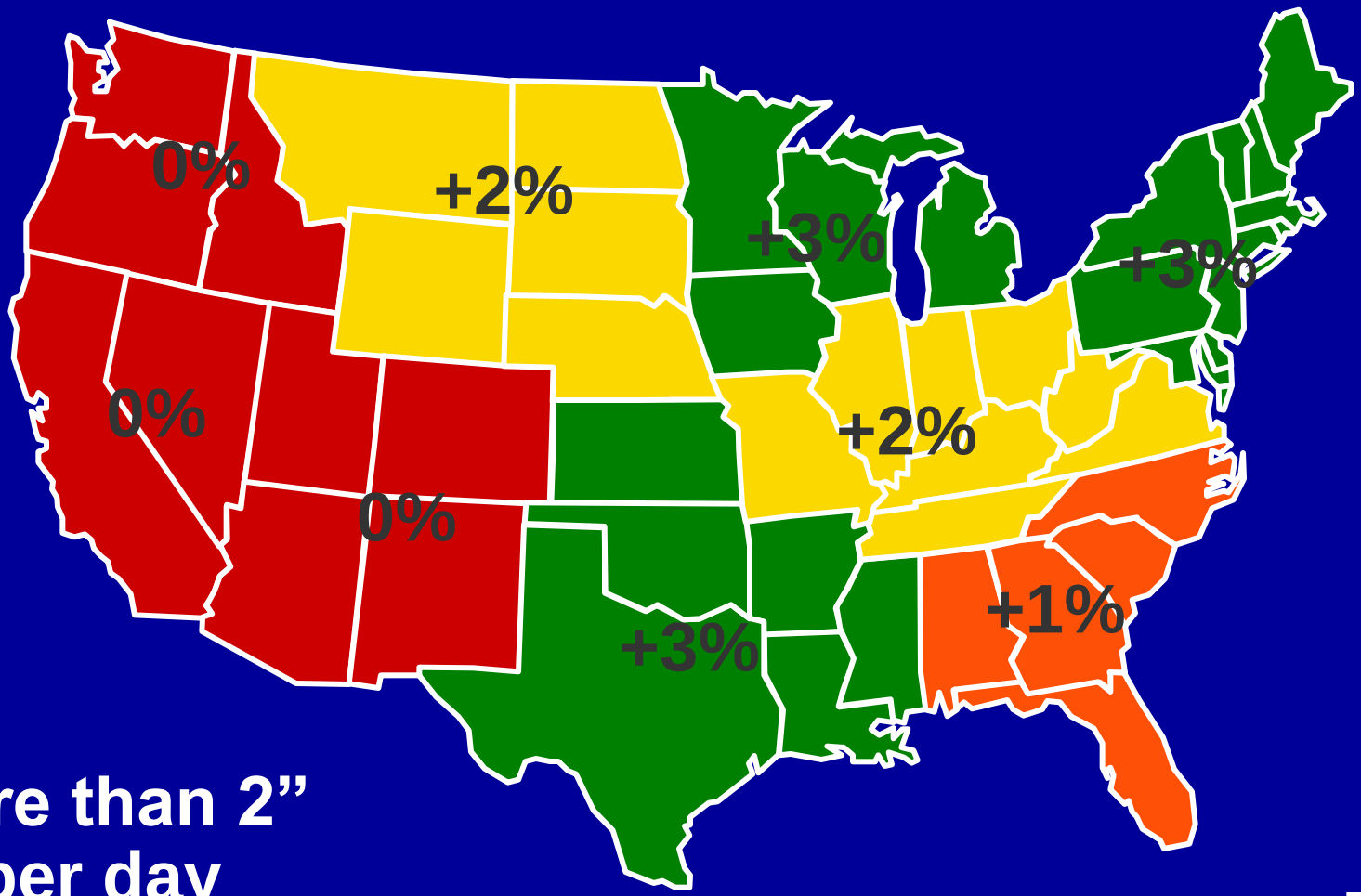
Increases in the Number of Days with Very Heavy Precipitation (1958 to 2007)



The map shows the percentage increases in the average number of days with very heavy precipitation (defined as the heaviest 1 percent of all events) from 1958 to 2007 for each region. There are clear trends toward more days with very heavy precipitation for the nation as a whole, and particularly in the Northeast and Midwest.

More Rainfall Occurring in Intense Downpours

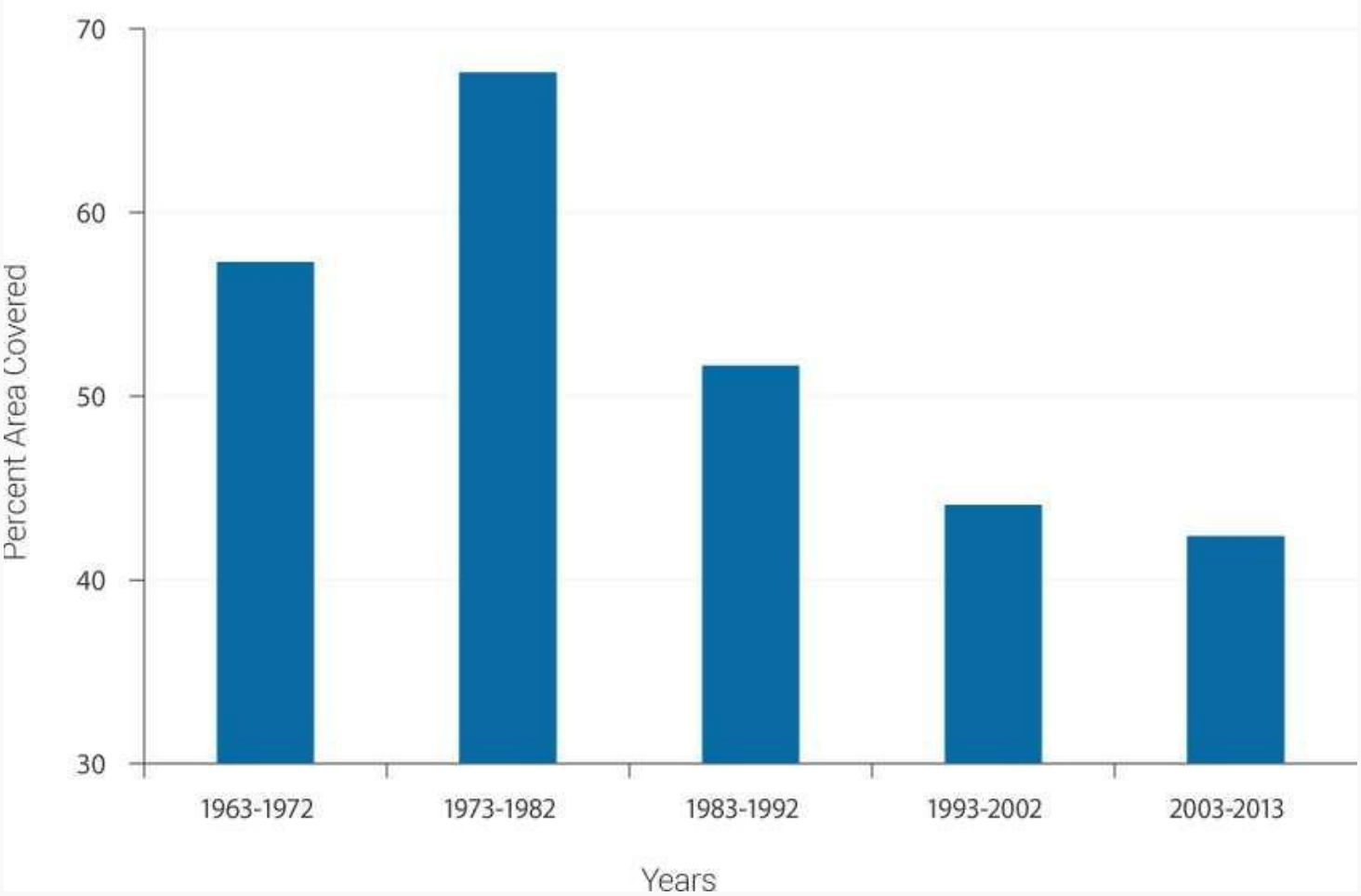
Trends of Annual Precipitation Intensity 1910-1994



More than 2” per day

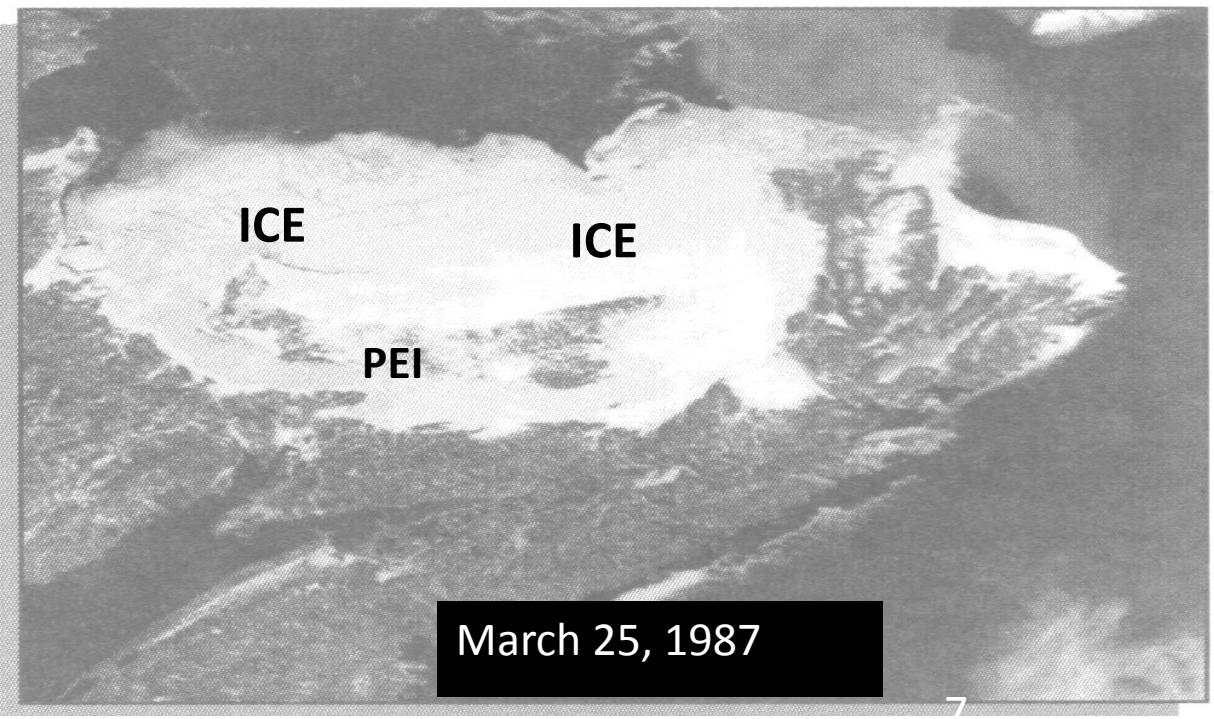
EPA

Declining Ice Cover on the Great Lakes



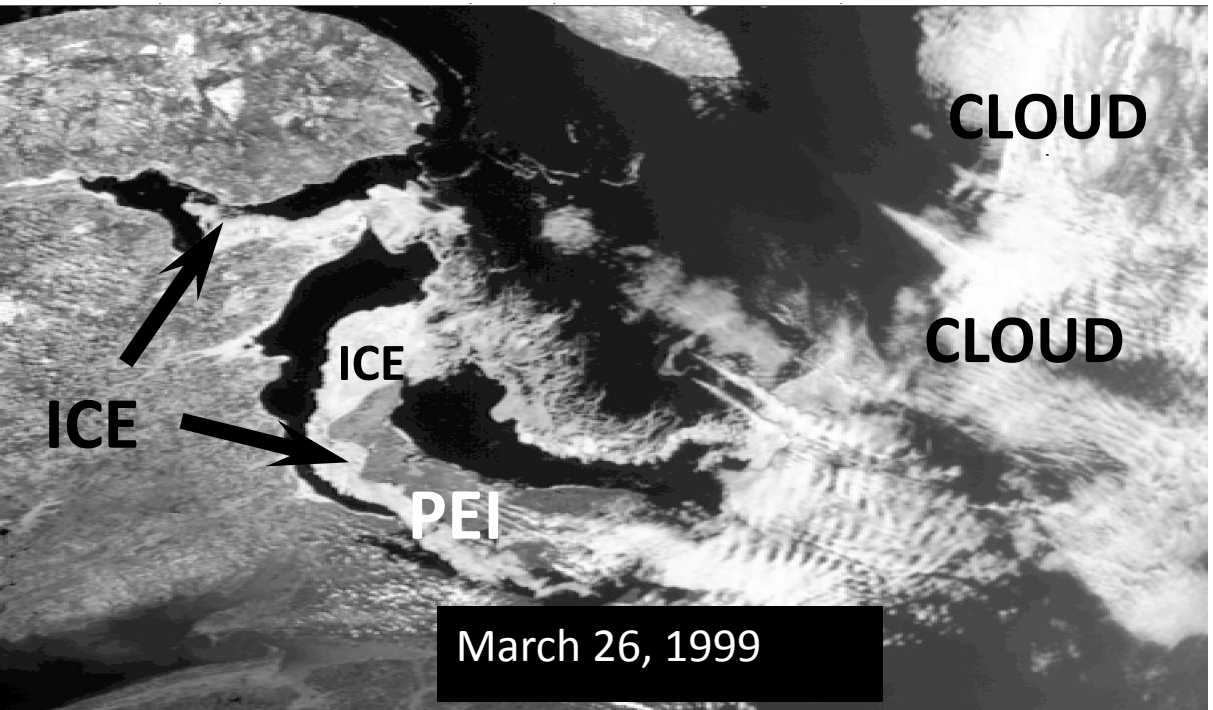
(Source: U.S. National Climate Assessment, 2014)

Ice in the Gulf of St. Lawrence



<u>1987</u>

Sea ice reduces wave action and amount of shore erosion.



<u>1999</u>

Little sea ice is present. (Most white areas are clouds.)

Shore exposed to wave action of winter storms.

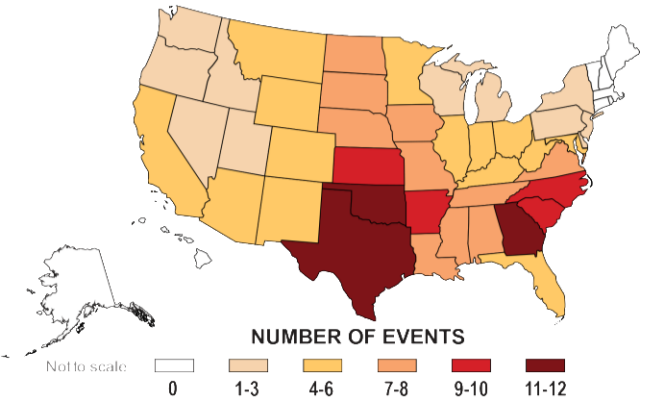
(Source: Environment Canada)

Why Do We Care?

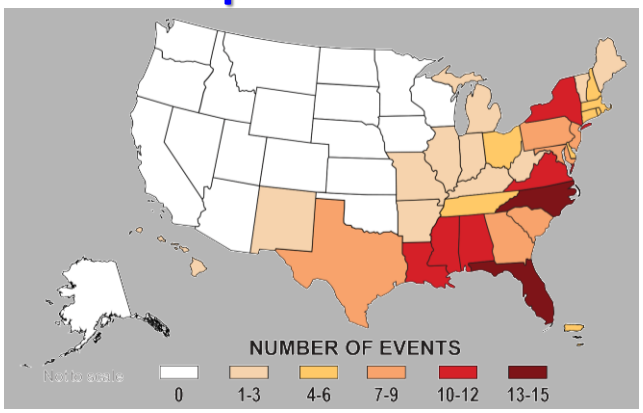
The Nation Is Climate-Conscious…
for Good Reason

U.S. Billion-Dollar Weather and Climate Disasters: 1980 – 2012*

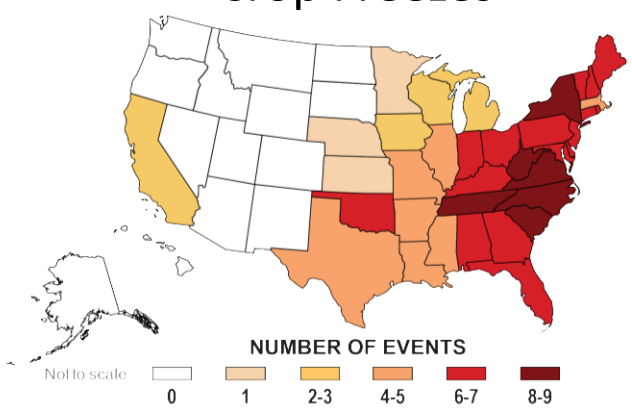
Drought and Heatwaves



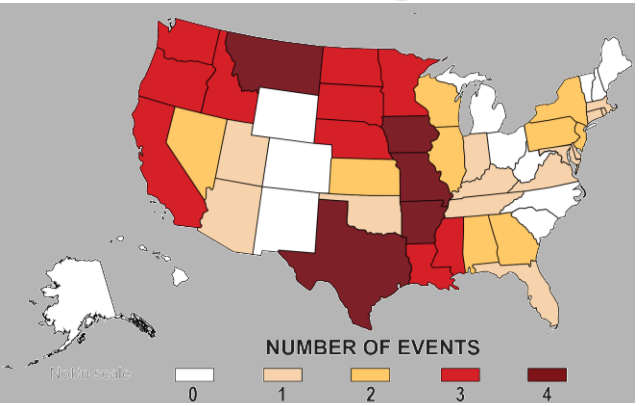
Hurricanes and Tropical Storms



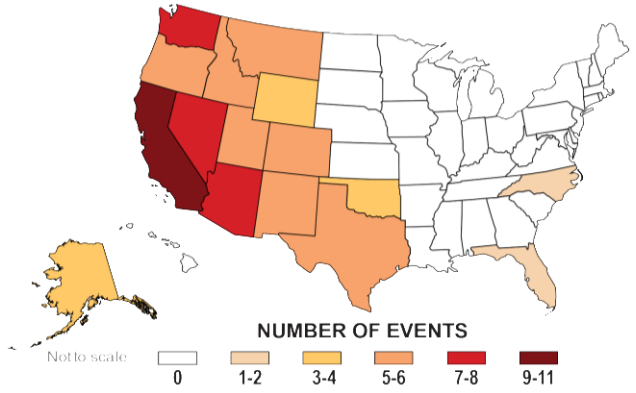
Winter Storms and Crop Freezes



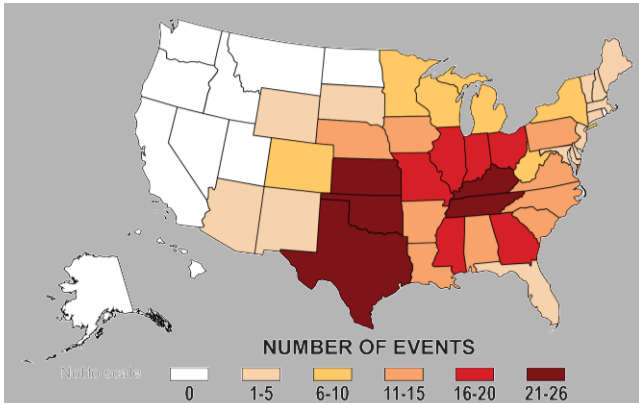
Flooding



Wildfires



Severe Local Storms



Figures: NOAA's National Climatic Data Center

USA: Combined sewer overflows

1.2 trillion gal of sewage & stormwater a year discharged during combined sewer overflows – would keep Niagara Falls roaring for 18 days

(Source: Center for Water & Health, JHU Bloomberg School of Public Health)

Combined Sewer Overflow in the Great Lakes Region

(EPA report released February 2008)

- Issue: There are 182 combined sewer systems in the Great Lakes Region. Billions of dollars are being spent redesigning and rebuilding these systems.
- Does climate change matter to the redesign of combined sewer systems in the Great Lakes Region?
- If combined sewer systems are designed to meet the EPA's CSO Control Policy design standard of 4 events per year, but fail to plan for climate change:
  - ✓ climate change may result in failure to meet the standard
  - ✓ **there could be an average of 237 events per year above the control policy's objectives across 182 communities**
- Communities must transform the way they plan for the future and design combined sewer systems.

The Risks are Manageable

1. Climate change will affect future performance of many CSSs in the Great Lakes Region.

2. Calculations of system size should not be based on current hydrology and historic precipitation data.

3. A *policy* decision must be made about additional investments to build in a margin of safety.

4. **The risks posed by climate change to CSSs are manageable.**

http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=188306

Adaptation is Essential

Adaptation is critical if communities in the Great Lakes Region are to attain their desired environmental, human health, and economic outcomes.

Adaptation is Smart Government

Climate adaptation helps ensure that investments (*e.g.,* water infrastructure) made with scarce taxpayer dollars are effective even as the climate changes.

The Good News

Opportunities exist *today* to anticipate and adapt to a changing climate

Many Opportunities to Adapt Exist (examples)

- Modify long-term planning, engineering standards, and infrastructure design to account for climate change
- Separate combined sewer and storm sewer systems
- Use more green infrastructure
- Land use planning (*e.g.,* limit development in flood-prone areas!)
- Maintain vegetated buffer zones around significant water bodies, rivers and streams, channels, and wetlands
- Enhance water use efficiencies
- Restore and maintain watersheds as an integrated strategy for managing water quality and quantity

Leadership in the Great Lakes Region

Great Lakes Advisory Board

David Ullrich, Chair

Patricia Birkholz, Vice Chair

Provided recommendations for the FY2015-2019 Great Lakes Restoration Initiative (GLRI) Action Plan

Recommendations to the Great Lakes Interagency Task Force

Great Lakes Advisory Board: Charge Question 1

Currently climate change impacts and adaptation are not explicitly included in the Action Plan. Should the connection between the Action Plan focus areas and the protection of the Great Lakes from the impacts of climate change be expressed more clearly in the next Action Plan? If so, how?

Great Lakes Advisory Board: Response

- Work under the GLRI Action Plan must proceed with protection and restoration projects that help reach the goal of making the Great Lakes ecosystem more resilient to climate change.
- Climate change can compromise the long term effectiveness of the restoration work being done through the GLRI.
- GLRI project sponsors should encourage the incorporation of climate change adaptation practices into GLRI projects during the development process.

Leadership in Local Communities

Grand Rapids Emphasizes Climate Adaptation In its Sustainability Plan

- Increasing tree canopy to regulate temperature and offset urban heat island effect, scrub the air of pollution, preserve natural habitat, improve water conservation, and enhance parks and greenspaces for residents to enjoy.
- **Adding pervious or porous pavement to slow stormwater runoff and preserve water quality in the Grand River.**
- Powering 100% of city operations with renewable power (by 2020).
- Improving City preparedness and response to disasters and emergencies such as extreme heat events.

City of Windsor

Climate Change Adaptation Plan

September 2012

windsor environmental master plan

THE CITY OF WINDSOR

Cedar Falls, Iowa

- New floodplain ordinance expands zoning restrictions from 100-year floodplain to 500-year floodplain.
- Significant steps to reduce future flood damage
  - ✓ Buyouts of more than 1,000 properties
  - ✓ Numerous buildings adapted with flood protection measures

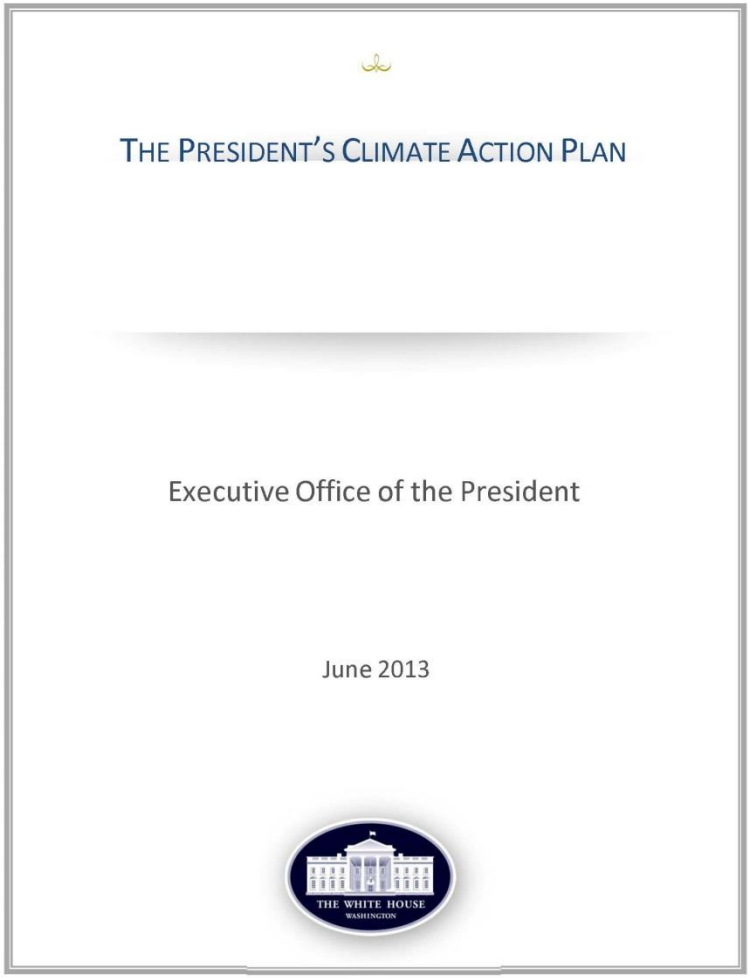
An Example of Effective Adaptation

Boston's Deer Island sewage treatment plant

Photo credit: MA Water Resources Authority

Leadership by the Federal Government

EPA Plans Aligned with President's Climate Action Plan and Executive Order 13653



Executive Order 13653
(November 1, 2013)

"Preparing the United States for the Impacts of Climate Change"

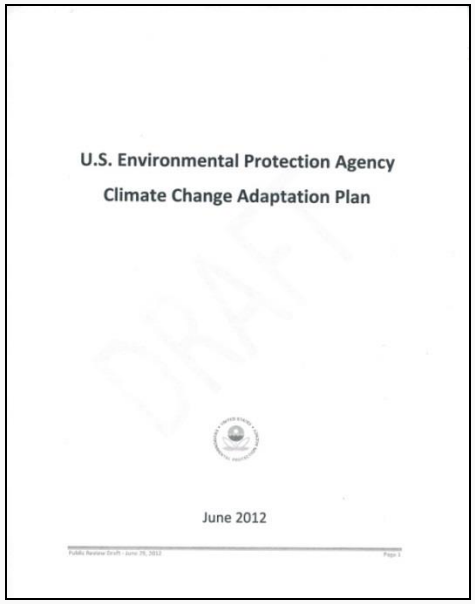
Key Mechanisms to Support Transformation and Adaptation

- Support climate-resilient investments in communities across the country
- Provide states, tribes, and local communities with the information, data, tools, and training they need to increase resilience and prepare for climate change.

- State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience established to inform Federal efforts.

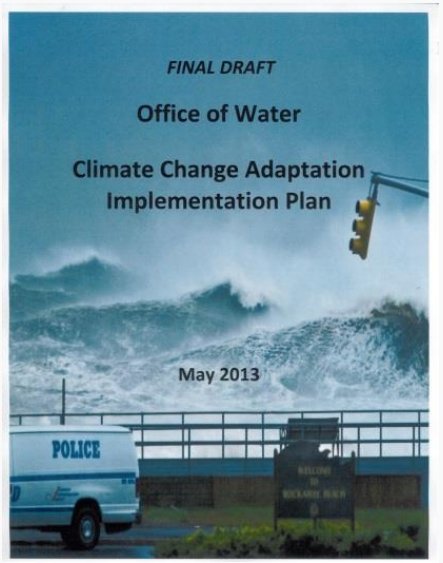
EPA Has Developed Climate Change Adaptation Plans

Agency-wide *Climate Change Adaptation Plan*



http://epa.gov/climatechange/pdfs/EPA-climate-change-adaptation-plan-final-for-public-comment-2-7-13.pdf

Program & Regional Office *Implementation Plans*



http://epa.gov/climatechange/impacts-adaptation/fed-programs/EPA-impl-plans.html

Central Element of EPA's Efforts: Building Adaptive Capacity

EPA is mainstreaming climate adaptation planning by:

- Building and strengthening the "adaptive capacity" of its staff and its partners in the states, tribes, and local communities
- Supporting their efforts to integrate climate adaptation into the work they do by:
  - ✓ **Training:** increasing awareness of ways climate change may affect their ability to implement effective programs
  - ✓ **Financial incentives:** supporting climate-resilient investments in communities across the country
  - ✓ **Tools:** providing necessary data, information and tools

Empowering communities through partnerships!

Progress is Already Being Made

Training…

… to increase awareness and understanding of the importance of climate adaptation


Menu
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2. Climate Change Basics
2.1. Climate Change Basics
2.2. Climate change
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2.4. Air and ocean temperature
2.5. Historical U.S. Temperature Trends
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2.8. Historical Precipitation Patterns in the U.S.
2.9. Rate of Precipitation Change in the United States, 1901-2011
2.10. A Scenario of Changes in
EPA Climate Change Adaptation Introductory Training
Climate Change Adaptation Introductory Training

Integrating Climate Adaptation Assistance Agreements

- October 2011: Memorandum to EPA Senior Resource Officials encouraging programs to **integrate climate adaptation into announcements of competitive funding opportunities**
- Relevance:
  - To projects whose outcomes are sensitive to changes in climate (*e.g.,* safe drinking water)
  - In cases where projects would be more effective if they addressed climate change adaptation issues (*e.g.,* development of models and tools to support decision making)
- Example: Projects to assess water utilities' vulnerabilities to climate change and alternative management options.

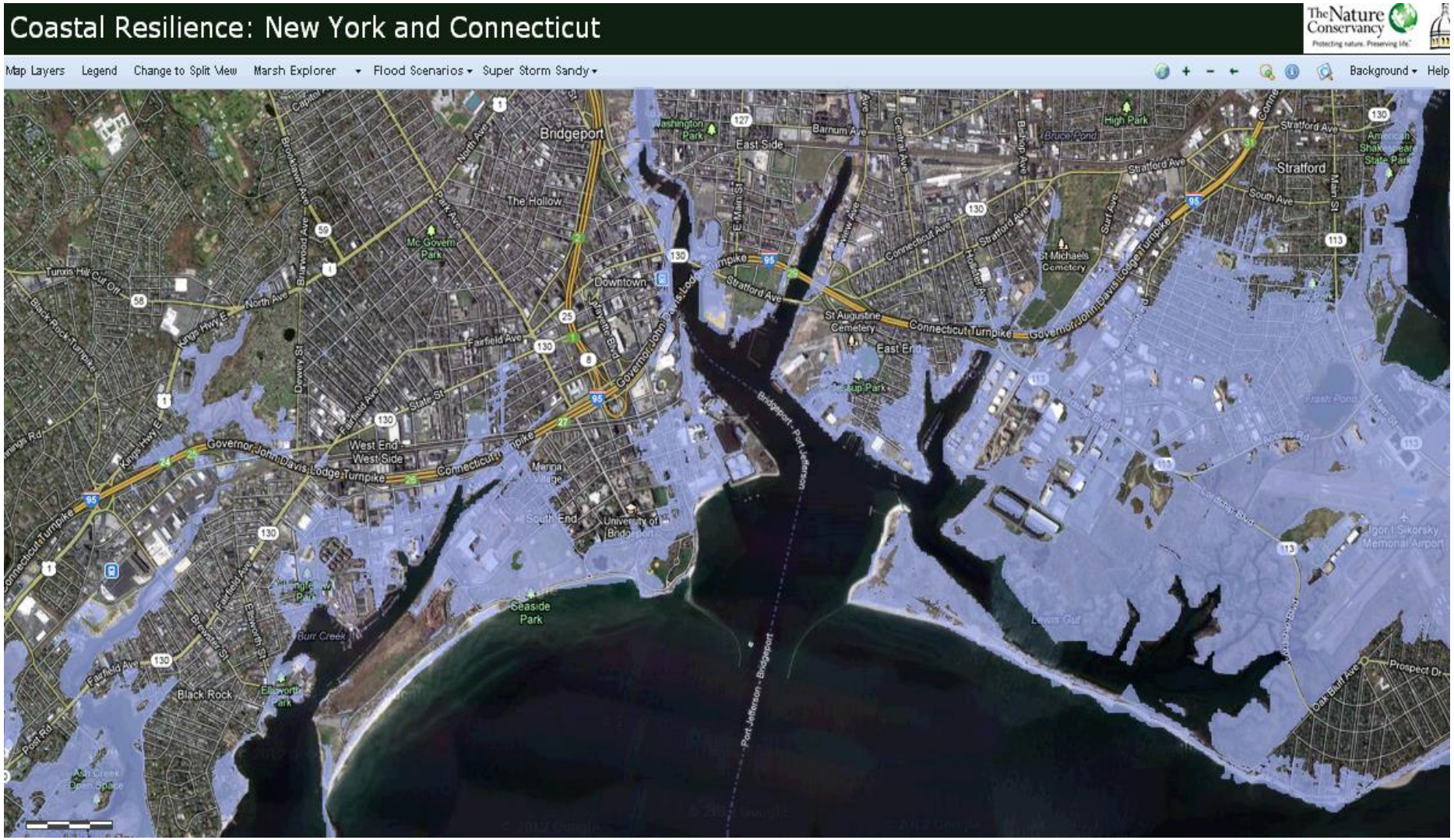
Supporting Climate-Resilient Investments

- State Revolving Loan Funds: EPA's National Water Program is recognizing and encouraging consideration of climate change in the management of Clean Water and Drinking Water State Revolving Loan Funds. **(Commitment in the President's *Climate Action Plan*.)**

- Brownfield Grants: The EPA Office of Solid Waste and Emergency Response is requiring brownfield grant recipients to take potential changing climate conditions into consideration when evaluating cleanup alternatives. **(Commitment in the President's *Climate Action Plan*.)**

- EPA Region 2: Working with stakeholders to build climate resiliency into Hurricane Sandy recovery activities.

- EPA Region 5: **Integrating consideration of climate impacts and adaptation into Great Lakes Restoration Initiative-funded projects**.



SANDY FLOODING, GREATER BRIDGEPORT REGION

Source: FEMA

Decision Support Tools and Resources

EPA and other federal agencies
are already producing data, information,
and tools to inform adaptive management decisions.

www.data.gov/climate

National Stormwater Calculator and Climate Assessment Tool Package

- Released January 30, 2014
- Commitment in President's *Climate Action Plan*
- Estimates the annual amount of stormwater runoff from a specific location
- Includes projected climate impacts:
  - ✓ changes in seasonal precipitation levels
  - ✓ effects of more frequent high-intensity storms
  - ✓ changes in evaporation rates

http://www.epa.gov/nrmrl/wswrd/wq/models/swc/

CLIMATE READY WATER UTILITIES

EPA

Climate Resilience Evaluation & Awareness Tool (CREAT)

CREAT

CLIMATE READY WATER UTILITIES

EPA

About CREAT

- Software tool for conducting **risk assessment** of potential climate change impacts at your utility
- Multiple climate scenarios provided to help **capture uncertainty**
- Assessments will help inform **adaptation planning**
- Results from CREAT help utilities compare potential **costs, risk reduction and energy implications** of different options

"Enhanced" BASINS: An EPA Decision Support Tool for Water Resource Managers

- BASINS is a widely distributed tool designed for use by regional, state, and local agencies in performing watershed and water quality-based studies
- EPA's Office of Water encouraging use of BASINS to support regulatory compliance (*e.g.* TMDLs)
- New version (ver. 4) released in May 2007
- Enhanced BASINS with a **Climate Assessment Tool** (CAT)
- CAT provides a capability for understanding
  - ✓ how water resources could be affected by a range of potential changes in climate
  - ✓ the effectiveness of management practices for increasing the resilience of water resources to changes in climate

http://www.epa.gov/waterscience/BASINS/

Tool for Assessing Development of Riparian Buffer Zones [2008]

- Online tool for assessing and managing impacts of climate change on sediment loading to streams
- Capability for assessing effectiveness of BMPs including riparian buffers under a range of climate change scenarios

- Motivation:
  - Soil erosion is highly sensitive to amount and intensity of rainfall
  - Sediment management strategies must be developed
  - EPA Climate Assessment Tool incorporated into Water Erosion Prediction Project (WEPP) model (one of best known and validated models for simulating soil erosion)

Investments in Adaptation

It's not a question of *if* you'll pay to adapt…

It's a question of *when* you'll pay.

We can plan ahead and get to where we want to go (Anticipatory Adaptation)

GREEN ROOFS Programs in Urban Areas

Help address:

- **stormwater runoff**
- **urban heat island effect**

- **regional warming due to global climate change**

or…

We can incur damages later, clean up the mess, and live with the consequences (Reactive Adaptation)

(Scheraga, 2010)

Smart Climate Change Policy Portfolio

- A smart policy portfolio consists of a mix of strategies to ***mitigate*** GHG emissions and to ***adapt*** to a changing climate
- **Mitigation:** essential to slow the rate of change
- **Adaptation**: essential because climate will continue to change
  - ✓ regardless of actions taken to mitigate
  - ✓ due to natural variability in climate
  - ✓ as well as human-induced climate change

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