



Climate Change in the Great Lakes Region

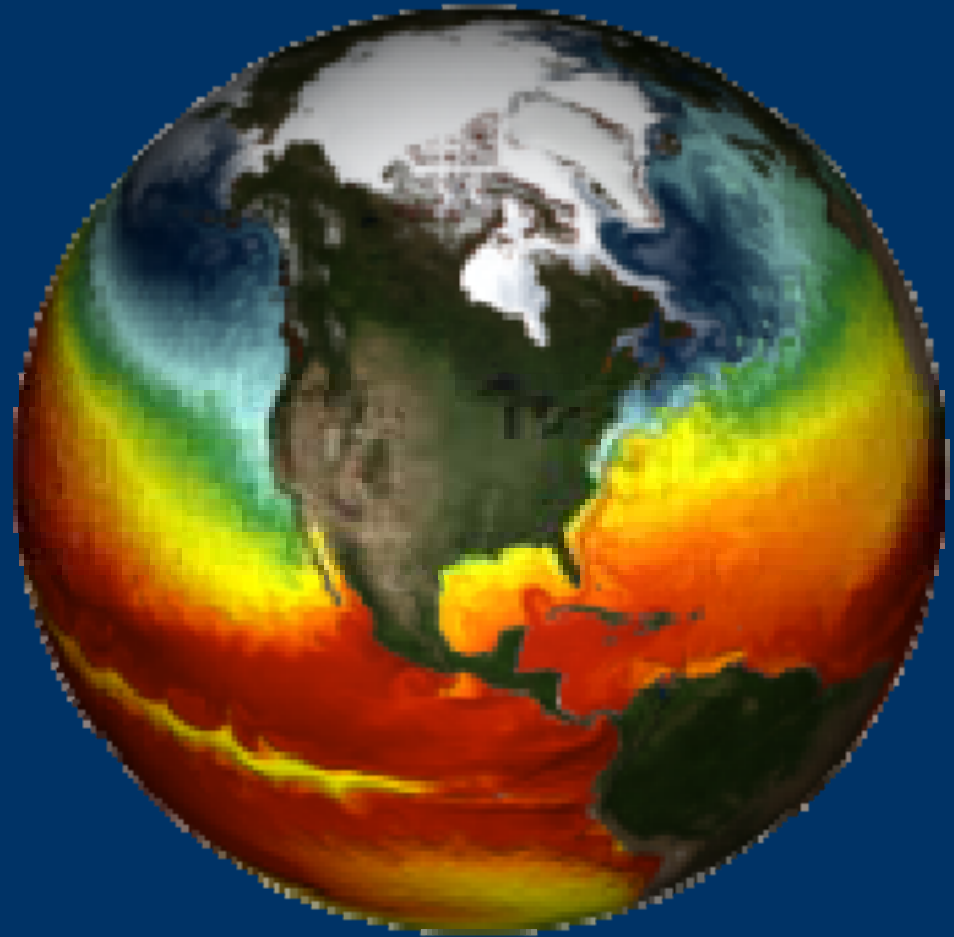
NOAA Coastal Services Center
Heather Stirratt



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Outline

- Climate trends
- Our future
- Lessons learned
- Need for adaptation
- Next steps



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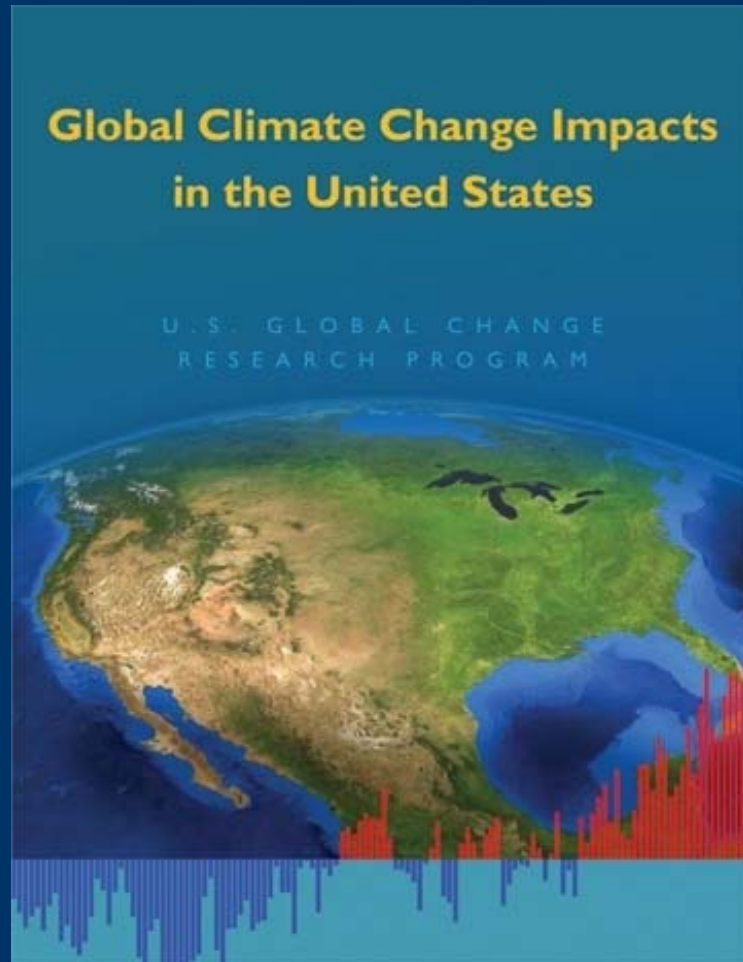
“Sense of Place”

Great Lakes Coastal Storm (October 27, 2010)



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U.S. Global Change Research Program



- **13 Agency Contributors**

Commerce, Defense, Interior, Energy, State, Transportation, Human Health, Agriculture, Environmental Protection Agency, NASA, and others.

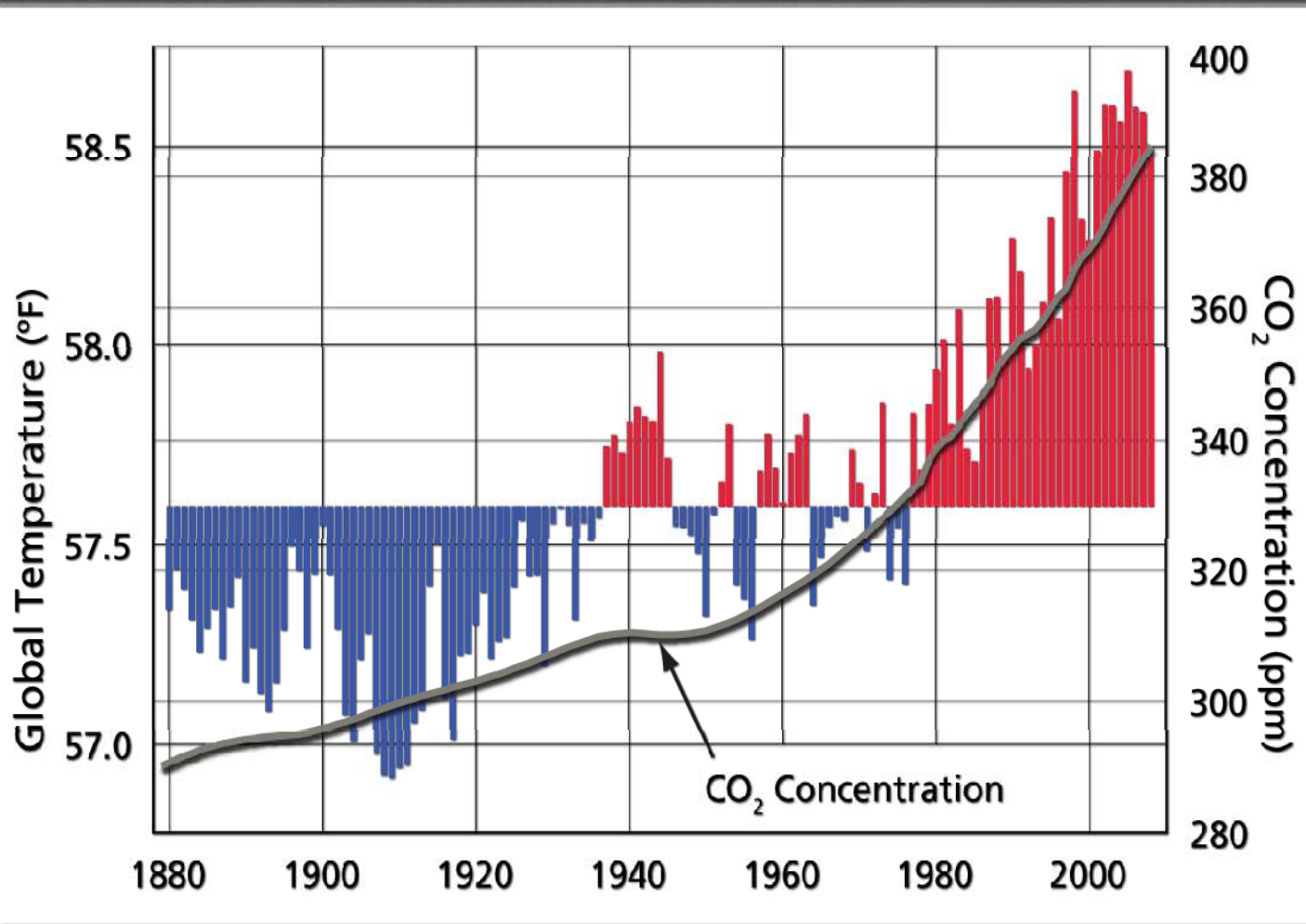
- **Congressional Mandate**

Global Change Research Act 1990



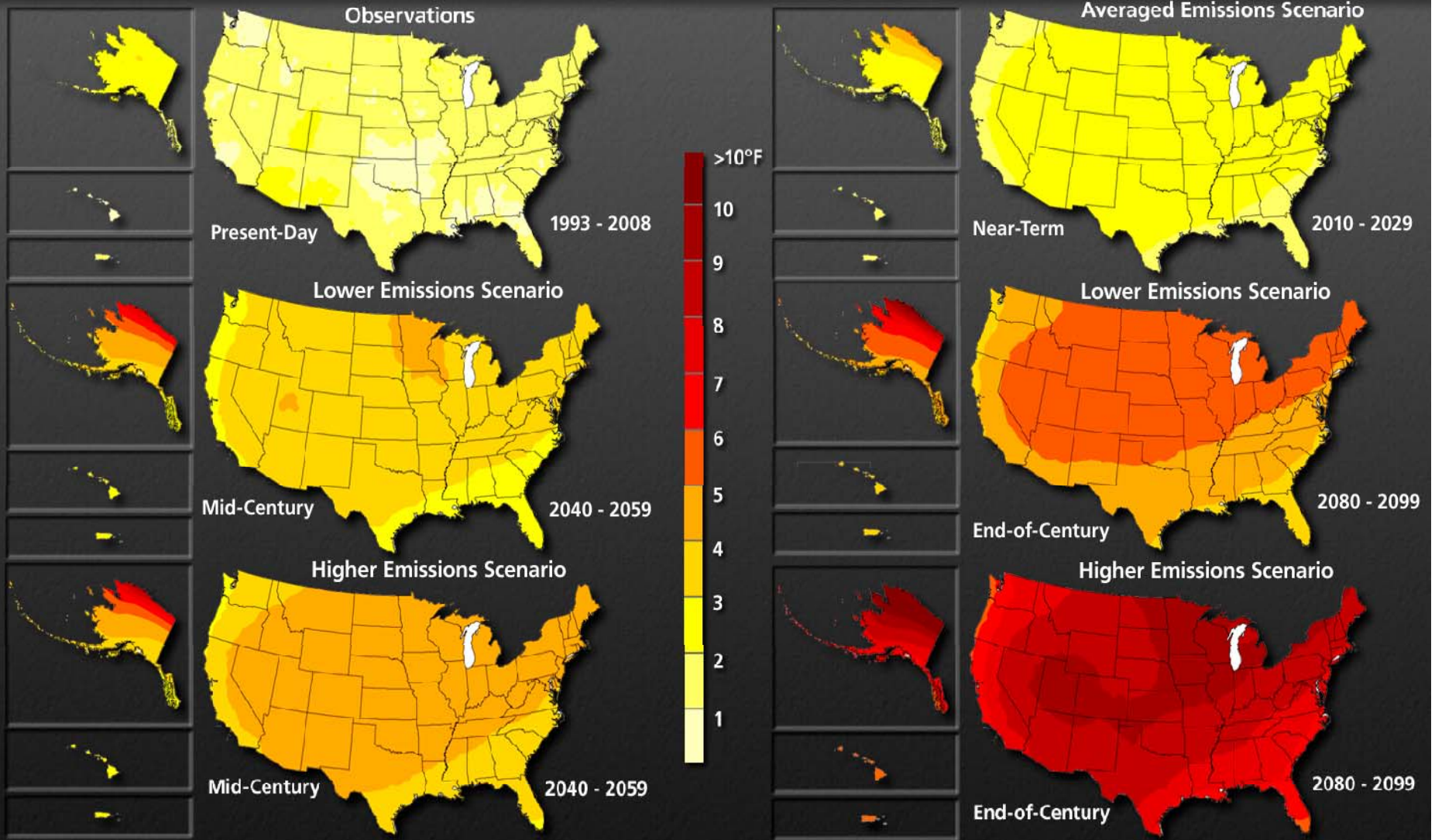
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Global Temperature and Carbon Dioxide



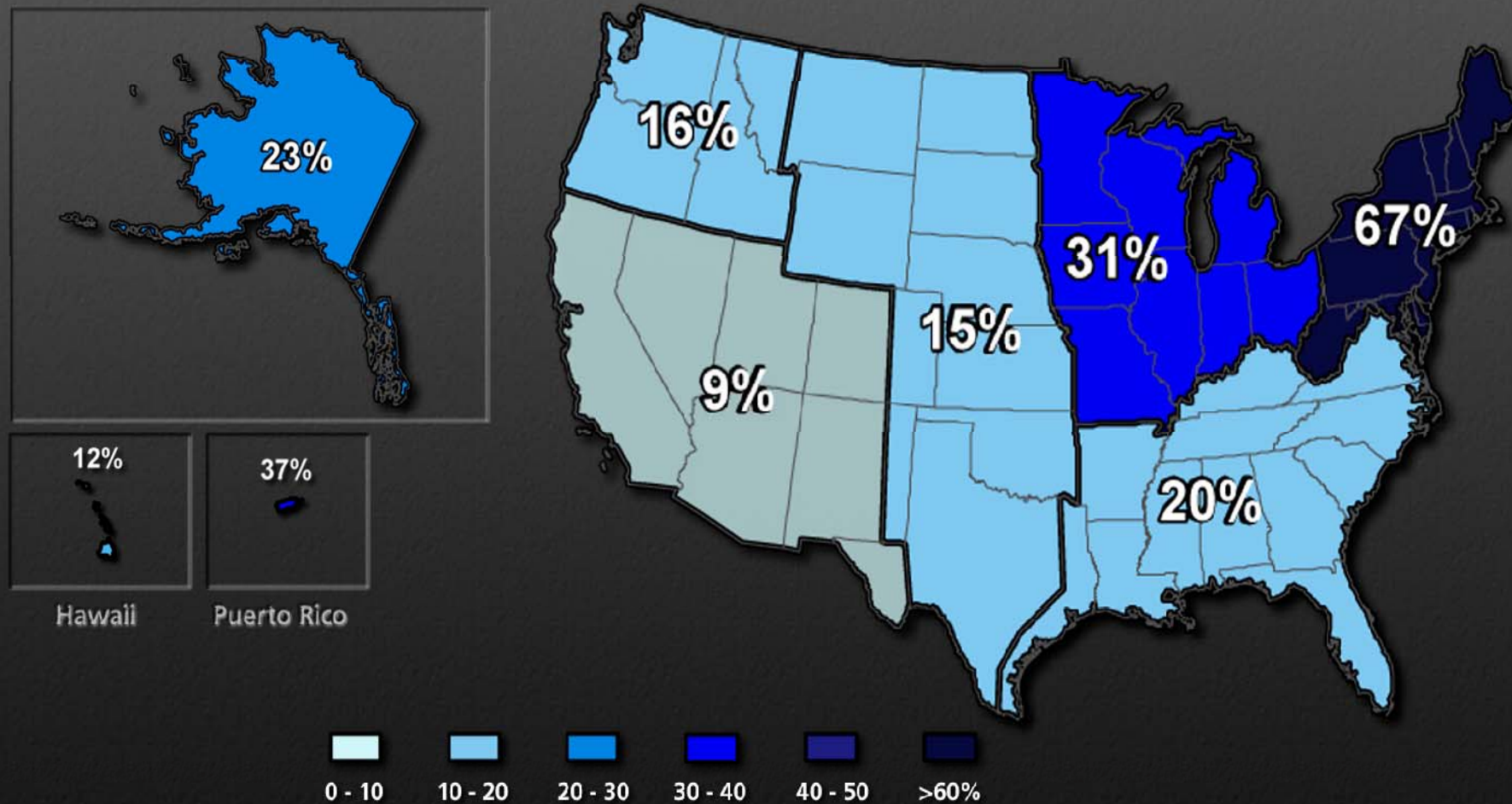
Observed and Projected Average Change °F

from 1961 - 1979 Baseline

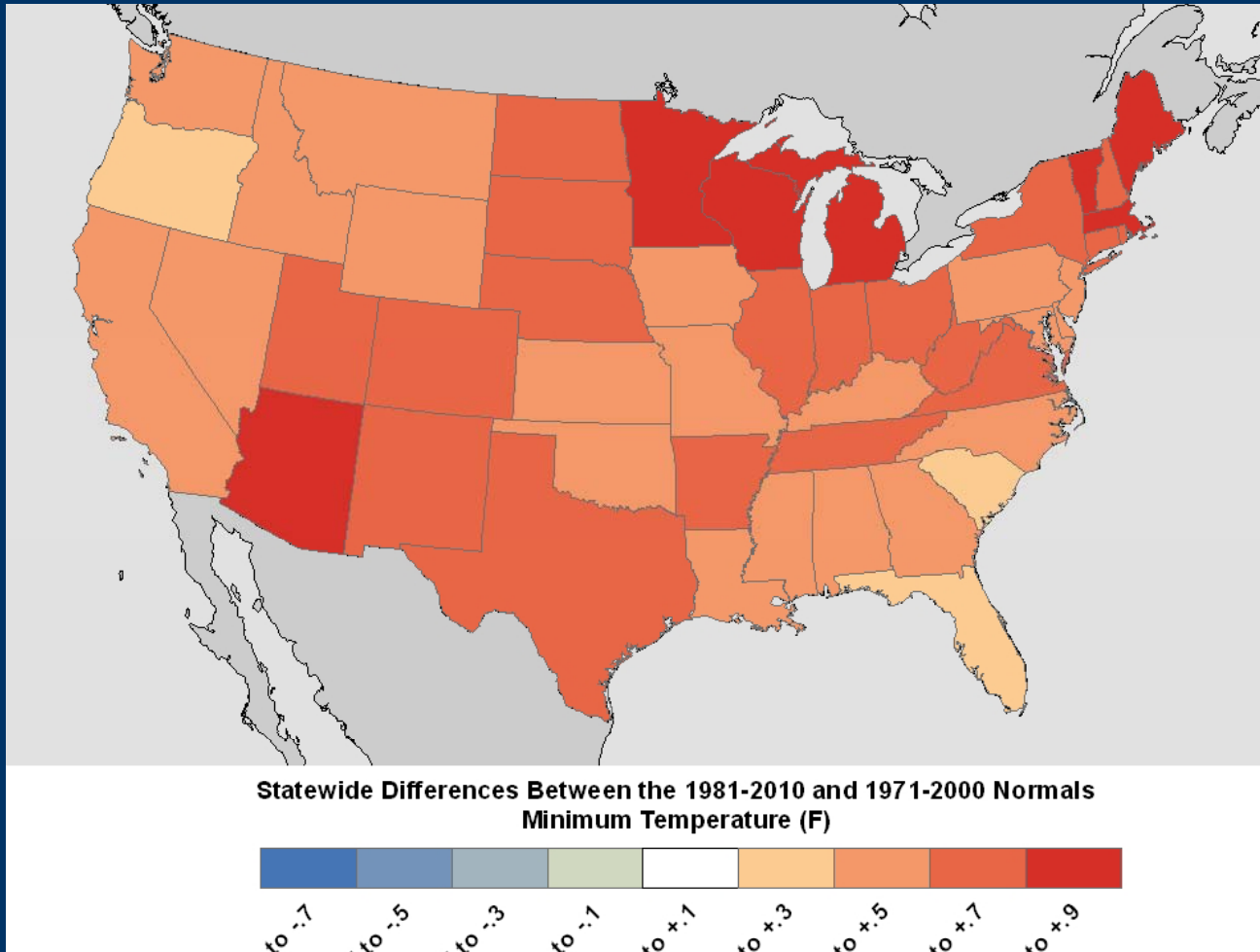


Increases in Amounts of Very Heavy Precipitation 1958 to 2007

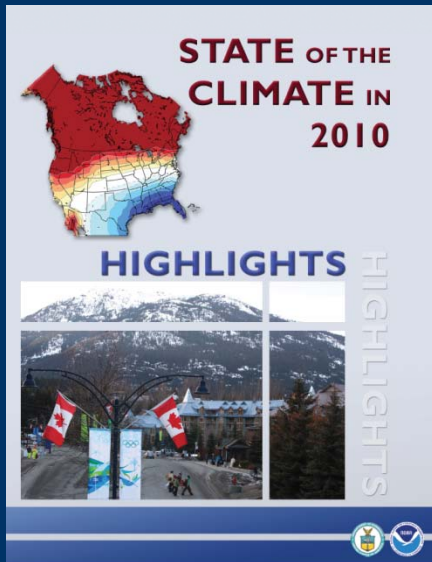
Percent Change



The New Climate Normals (1981 to 2010)



State of the Climate Report (2011)



Source:

www.ncdc.noaa.gov/bams-state-of-the-climate/2010.php

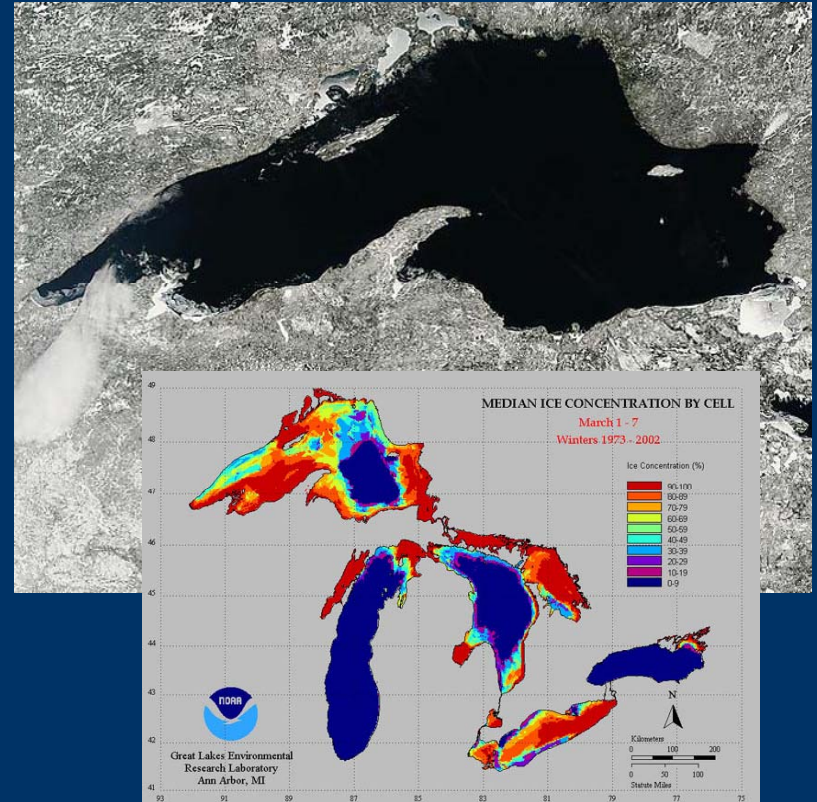
- 2010 marks the end of the warmest decade on record in the Arctic since instrumental records began in 1900.
- The Greenland ice sheet lost more mass in 2010—410 gigatons—than any other year over the last decade. This loss is equivalent to sea level rise of 1.1 millimeters.
- Average temperature for Canada during winter 2009-2010 was 7°F above average—warmest winter since national records began in 1948.



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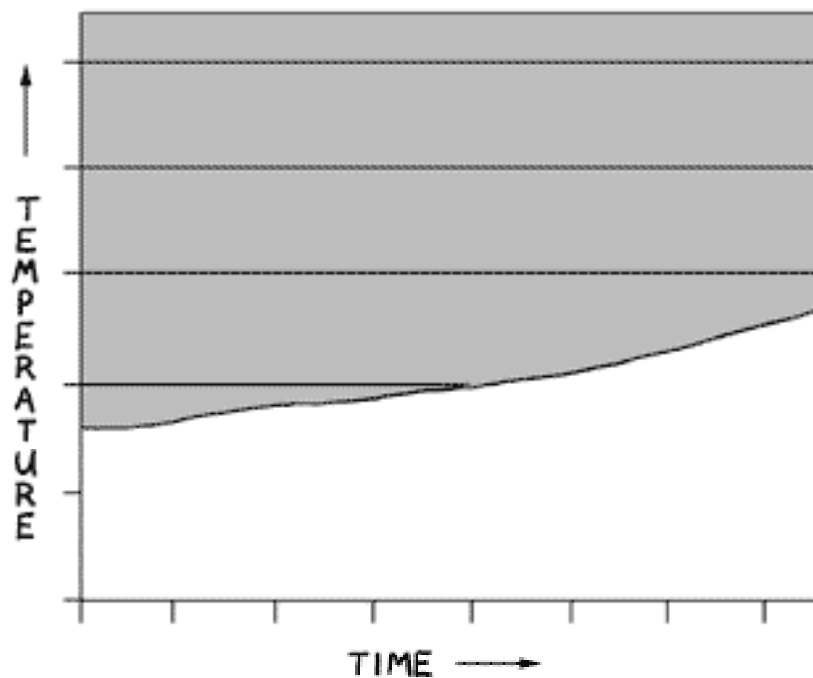
What Does the Future Hold for the Great Lakes?

- Decreased ice cover
- Changes in habitat and species composition
- Water resource variation
- Wetter winters
- Drier summers
- More severe storms
- Infrastructure damages
- Health risks

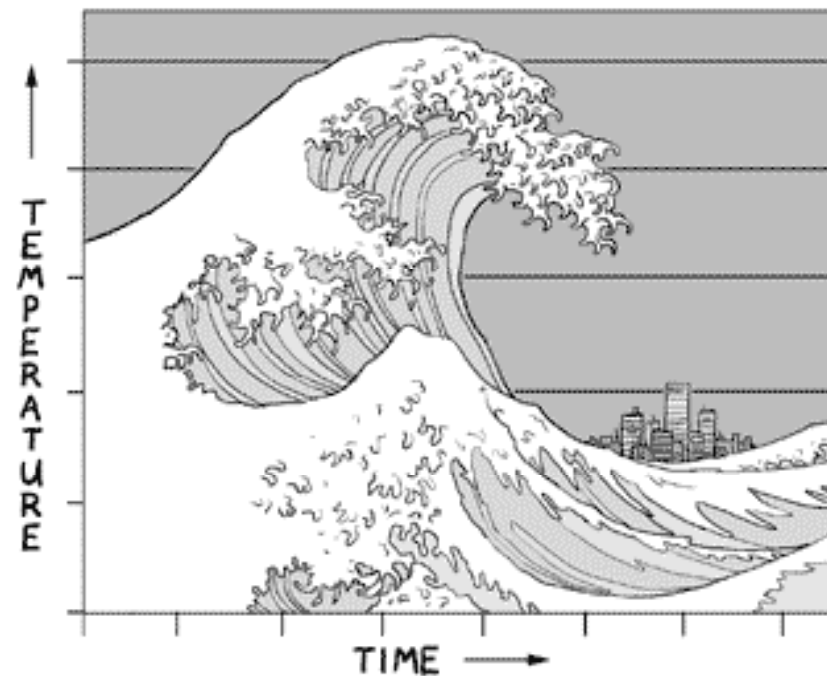


THE GRAPH OF GLOBAL WARMING

MAY START
UNEVENTFULLY...



BUT ...



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Consequences of Climate Change



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Coastal Communities: Vital to U.S. and International Economies

- 57 percent of U.S. gross domestic product is contributed by coastal watershed counties.
- Coastal counties contain 53 percent of the nation's population—but account for only 17 percent of U.S. land area (excludes Alaska).
- Coastal habitats help reduce impacts of floods, storms, and climate change on coastal communities by absorbing water, wave energy, and other stressors.



Port Huron, Michigan

Source: <http://linguistlist.org/fund-drive/2009/hometown-tour/Bethany/>



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Everything Has Its Price, Even the Weather

- Economic cost of weather may total \$485 billion in U.S.
- From wildfires to flight delays to running our air-conditioning, “This research shows that a substantial percentage of the U.S. economy is linked to variability in weather.”

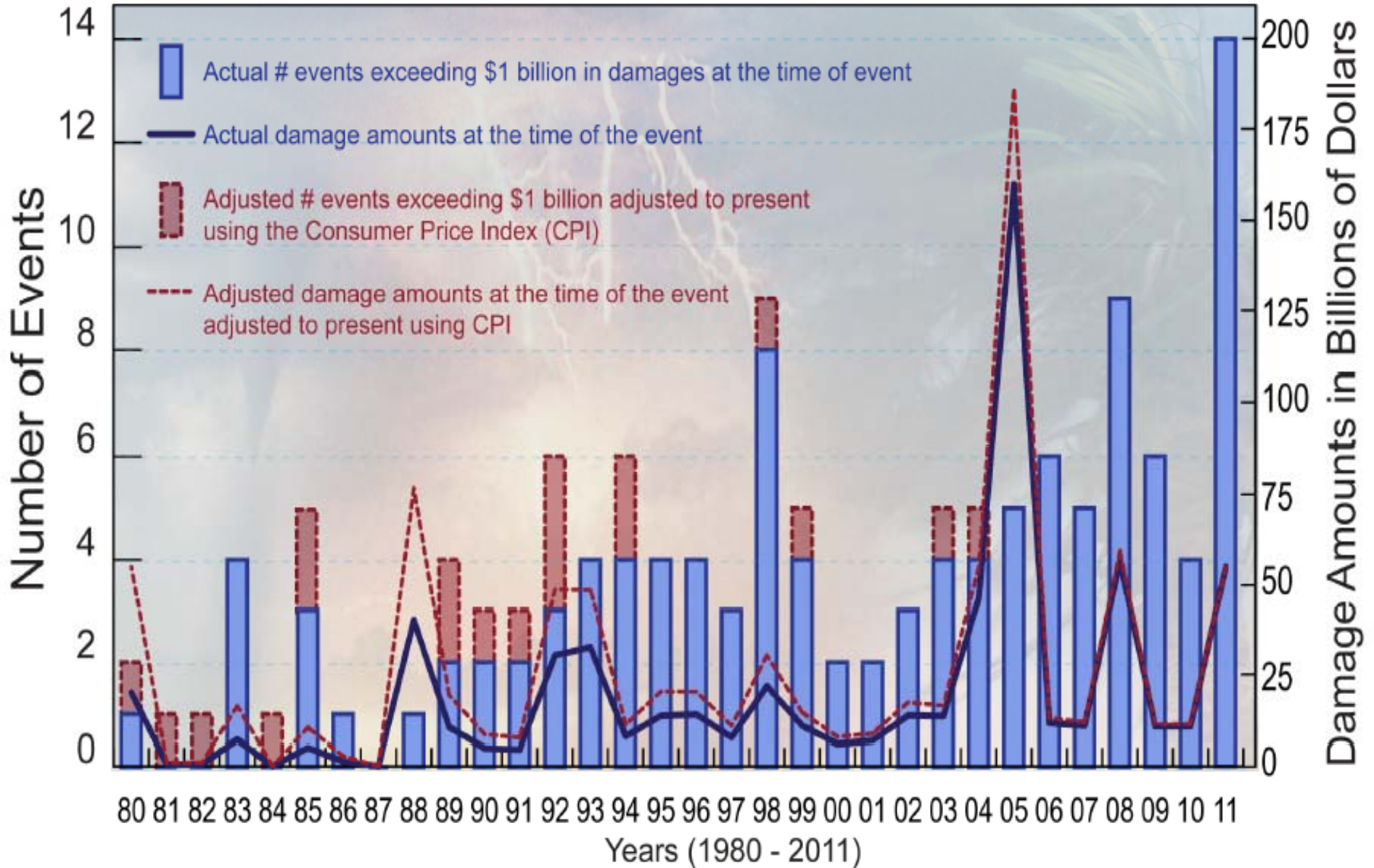




Billion Dollar Weather/Climate Disasters

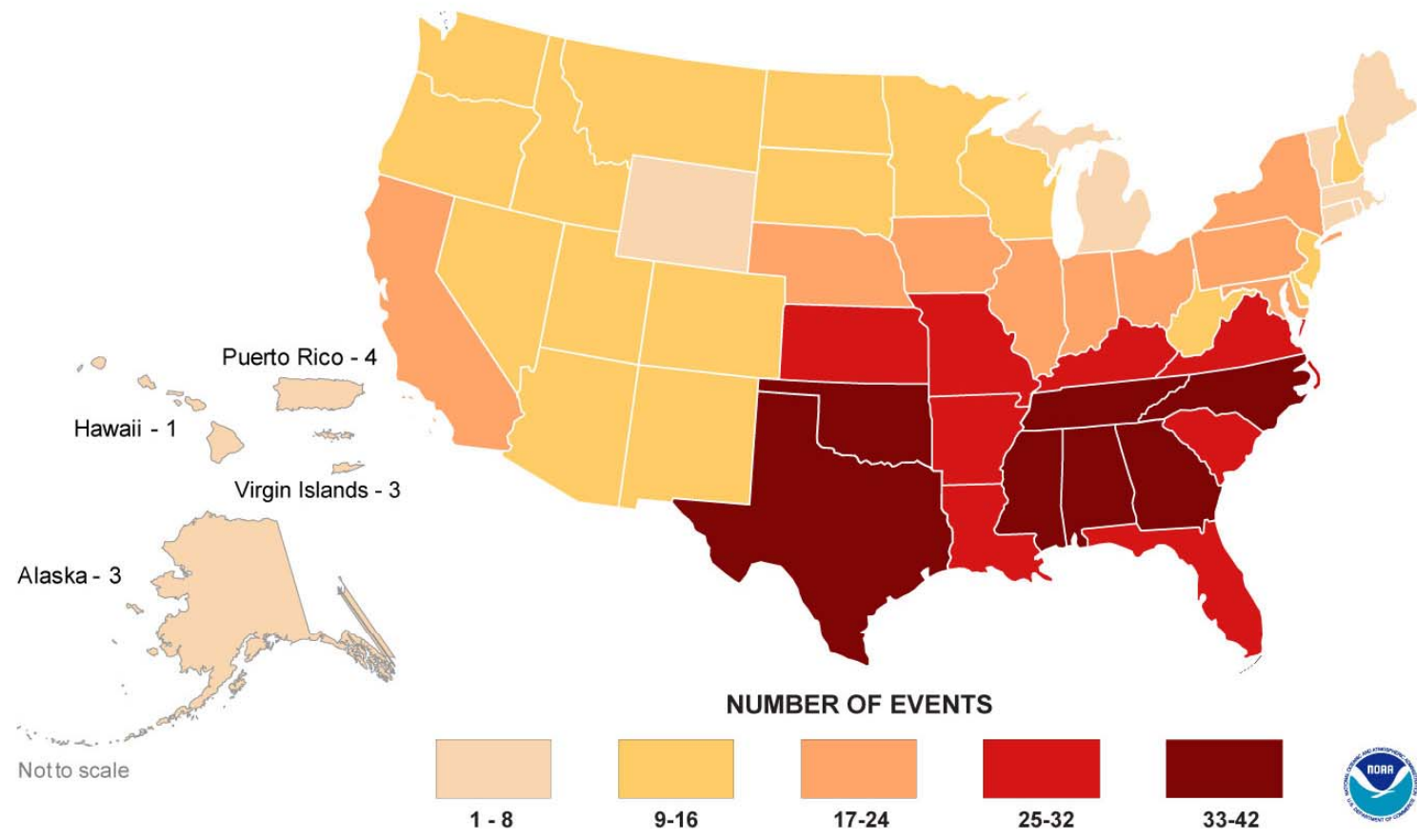
1980 - 2011

NOAA/NESDIS/NCDC



Ready to Move?

Billions Dollar Weather/Climate Disasters 1980 - 2011



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“The Present Is the Key to the Past”

Uniformitarian – James Hutton

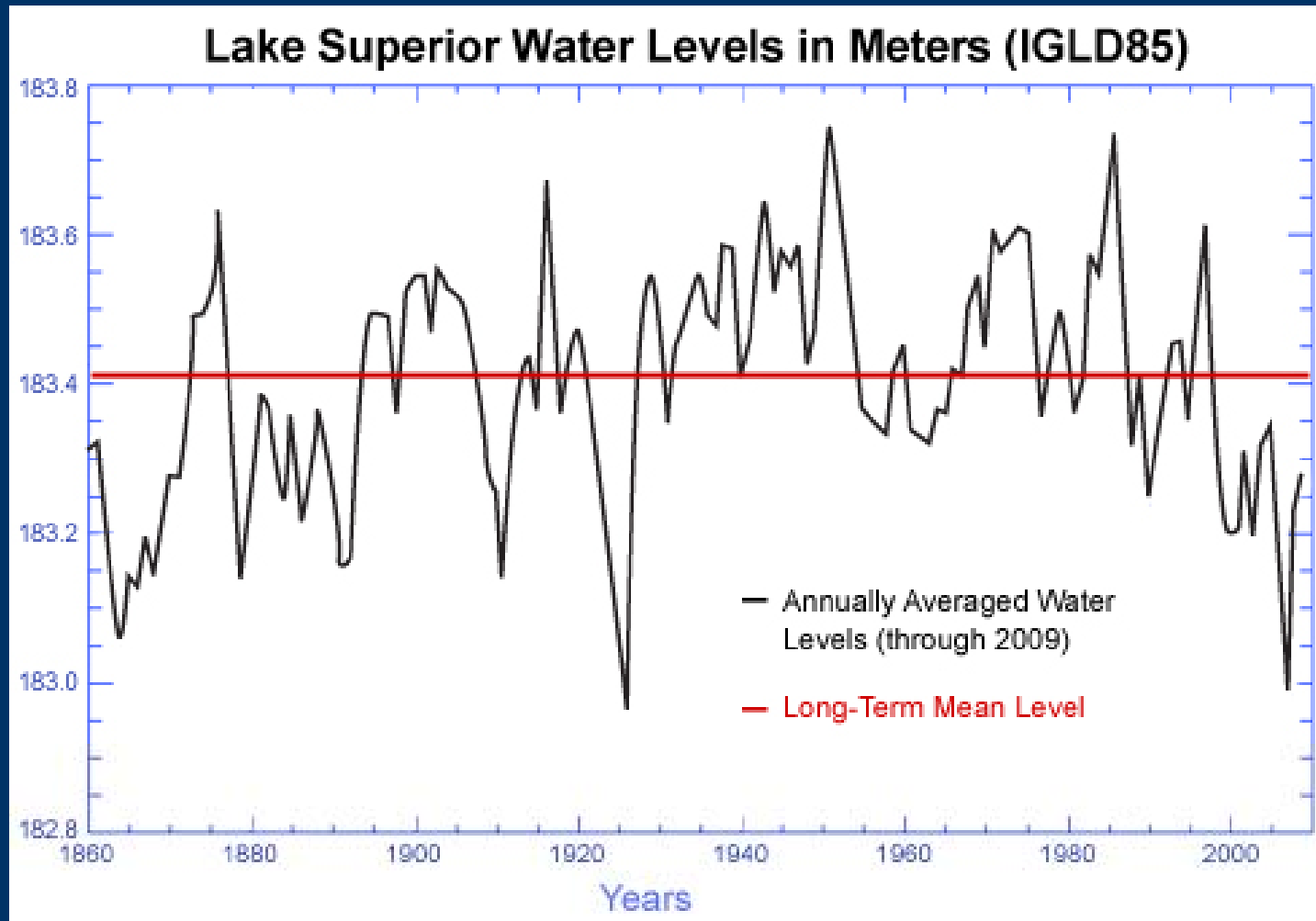
But is the past the key to the future?

- Current methods for determining risk are based on historical data and statistics (example: return periods)
- The next 100 years won't be like the last 100
- Is it possible we aren't looking far enough into the past?



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Lake Level Variation



*“It’s not just what we do,
but how we do it and what we
learn in the process.”*

– Margaret Davidson



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Data and Science Matter

Research, Modeling, and Development

- Integrated mapping
- Dynamic elevation
- Integrated observations
- Integrated atmospheric and hydrologic modeling
- Integrated hydrodynamic and surge modeling
- Levee protection
- Partnerships – rubbing our nickels together



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Visualization and Intuitive Tools: NOAA's Digital Coast Providing Geospatial Solutions

The screenshot shows the NOAA Digital Coast website homepage. At the top, there is a navigation bar with the logo and menu items: Home, Data, Tools, Training, Approaches, and In Action. Below the navigation bar is a banner with the text "More than just data..." and a description of the Digital Coast's mission. A map of the United States is visible in the background. Below the banner, there are three main content areas: Data, Tools, and Training. Each area has a brief description and a link to learn more. There is also a section for "In Action" and a "Recent Updates" section with three featured items: Topographic Data, Marine Inundations, and Outer Continental Shelf. A testimonial quote is also present.

DIGITAL COAST
NOAA COASTAL SERVICES CENTER

Home Data Tools Training Approaches In Action

More than just data...

The Digital Coast also provides the tools, training, and information needed to turn these data into the information most needed by coastal resource management professionals. Read more...

Welcome to the new Digital Coast. If you have questions or comments, please contact us.

Data
Learn more about the kinds of data available and download data.

Tools
Use these tools to turn data into the useful information your organization needs.

Training
Update your skills by participating in one of these training programs.

In Action
See how data and tools are used to address coastal management issues.

Approaches
In this section, Digital Coast resources are packaged in a way that best assists coastal communities working to address a specific issue.

Coastal Inundation Toolkit
Understand the risks and get the tools that will help save your community from a storm.

Offshore Renewable Energy Planning
Get the data and tools needed to make strong decisions.

Featured Resources

Building Resilient Coastal Communities
See how coastal counties can use Digital Coast to build resilient communities.

Mississippi Geospatial Clearinghouse
A comprehensive spatial information warehouse of geographic information system (GIS) resources for Mississippi for use by government, academia, and the private sector.

Recent Updates [Sign up for updates](#)

Testimonials

“ Digital Coast has a real role in standards, guidelines, specifications for elevation data, datums, and inundation mapping. ”

- Coastal data
- Data accessibility
- Techie and non-techie tools
- Training
- Case studies
- Outreach and awareness

www.csc.noaa.gov/digitalcoast/



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Digital Coast Partners

- American Planning Association (APA)
- Association of State Floodplain Managers (ASFPM)
- Coastal States Organization (CSO)
- National Association of Counties (NACo)
- The Nature Conservancy (TNC)
- National States Geographic Information Council (NSGIC)

www.csc.noaa.gov/digitalcoast/

Wetland Benefits Snapshot
Delta County, Michigan


COASTAL COUNTY SNAPSHOTS
www.csc.noaa.gov/snapshots/

Protecting Wetlands = Coastal Communities That Are Safer, Cleaner, and More Economically Productive

Healthy wetlands provide more than just a pretty view. Wetlands are a pivotal part of the natural system, supplying tremendous benefits for coastal communities. Even small acreages can provide some level of benefit. The location, health, and size of individual wetlands also play a role. This snapshot demonstrates three key benefits of wetlands in Delta County.

Based on 2006 NOAA land cover.

47%
362,485 acres of Delta County is wetland.



More Economically Productive: Wetlands Support Fishing Economies

Coastal wetlands provide habitat for many aquatic species that contribute to local food supplies and fishing-related industries.

In addition to providing a base for commercial fishing jobs and revenue, wetlands also support recreational and charter fishing. These economic benefits extend beyond county boundaries.

Based on 2009 ENCW and 2009 U.S. Census Nonemployer Statistics.

Commercial Fishing	County	State
Jobs	10	1,530
Output from businesses	unavailable	\$6.3 million
Revenue from self-employed	\$22,000	\$2.7 million

See the frequently asked questions page to learn why this data is not available.


Safer: Wetlands Reduce Flood Impacts

4% (30,169 acres) of Delta County is in the floodplain.

Wetlands located in coastal and riverine floodplains can protect people and their property, community infrastructure, and agricultural investments from floods. Wetlands act as natural sponges, holding floodwaters and lowering flood heights.


Based on Best available as of 2010 FEMA Flood Zones (100-year), 2006 NOAA land cover.

What is in Delta County's Floodplain?



Based on Best available as of 2010 FEMA Flood Zones (100-year), 2006 NOAA land cover.

Date Printed: February, 2012



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State Coastal Zone Programs

Michigan Coastal Management Program
Office of the Great Lakes
Department of Environmental Quality

Section 309 Assessment and Five-Year Strategy for
Coastal Zone Management Program Enhancement
Fiscal Years 2012-2016

March 2011



Final Section 309
Assessment and Strategy 2011

Strategy: Climate Change Adaptation in Coastal Wetland Management

Issue Area:
Wetlands

Program Change Description:

- New or revised coastal land acquisition, management, and restoration programs; and
- New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local governments and other agencies that will result in meaningful improvements in coastal resource management

This strategy will support the identification of research-based adaptation actions and strategies for Great Lakes coastal wetlands, and incorporation of coastal wetland climate change adaptation into State and local resource management plans. Specifically, Section 309 funding will be used to:

- Identify specific climate change impacts to Great Lakes coastal wetlands through review of the published literature and contacts with the coastal wetland research and management community. Identify adaptation measures and strategies for addressing these impacts that are appropriate for Michigan's coastal wetlands, and suited to Michigan's state and local wetland protection and management framework. Train staff on how to incorporate climate change measures into wetland regulatory processes including permitting, enforcement, and mitigation. Adaptation actions that will maintain or expand overall biodiversity, increase connectivity of coastal wetland areas, and improve water management to address multiple natural resource goals are priorities;
- Incorporate preservation, restoration, and similar climate change adaptation measures for coastal wetlands into the state's Climate Change Action Plan, Wetlands Action Plan, Wildlife Action Plan, and CELCP plan;
- Work with the Michigan Association of Regions, Michigan State University Extension - Michigan Natural Features Inventory (MNFI), and other agencies and organizations that provide land use planning assistance to local governments to develop technical assistance on incorporating climate change adaptation measures for coastal wetlands in local green infrastructure plans, land use plans, and zoning ordinances.

<http://coastalmanagement.noaa.gov/mystate/docs/mi3092011.pdf>



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NOAA Coastal Storms Program

<http://www.csc.noaa.gov/csp/index.html>



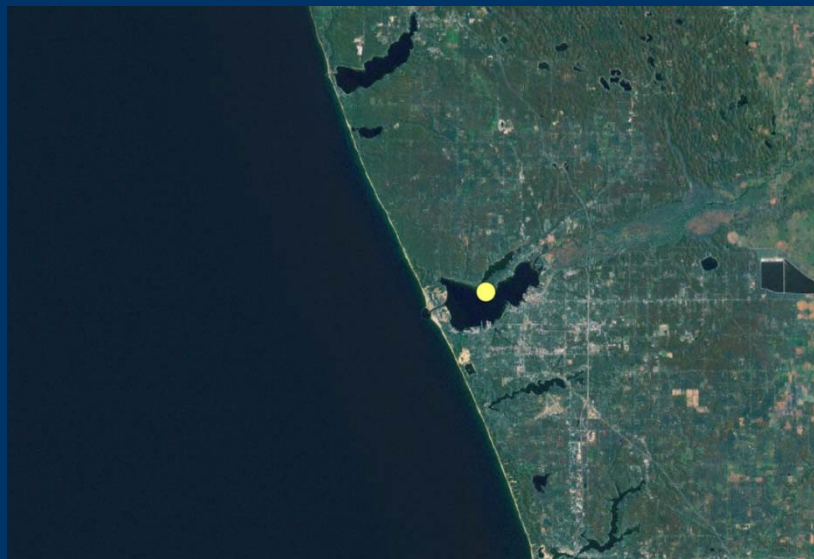
FY2012 Kick-Off Projects

- Great Lakes shoreline management workshop
- Stormwater toxicity from sealants
- Shore based observations
- Beach signage risk communication
- Outreach coordinator support



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NOAA Habitat Restoration



From 2011 to 2013, the West Michigan Shoreline Regional Development Commission will develop designs for a project that will soften 2,850 feet of shoreline, restore up to 126 acres of floodplains and emergent wetlands, and remove more than 197,000 metric tons of unnatural lake fill debris.

Muskegon, MI



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Climate Adaptation Strategies



ADAPTING TO CLIMATE CHANGE: A PLANNING GUIDE FOR STATE COASTAL MANAGERS— A GREAT LAKES SUPPLEMENT



NOAA Office of Ocean and Coastal Resource Management
www.noaa.gov

Coastal Habitat Conservation in a Changing Climate: Strategies and Tools for the Great Lakes Region

September 12-14, 2011
Ann Arbor, MI

Issue: Coastal habitats in the U.S. and the valuable ecosystem services that they provide are already impacted by multiple stresses, and climate change will further exacerbate these existing challenges.¹ The Great Lakes region, in particular, is currently experiencing warmer air and water temperatures, decreases of lake ice, longer onset of lake stratification, changes to migration patterns of wildlife, more variable water levels, decreases in soil quality, longer growing seasons and extreme precipitation. Coastal habitat managers, ecological restoration experts and other decision makers at the federal, state, and local level need additional information, tools, and capacity to support the management and conservation of coastal habitats under changing climatic conditions.

While efforts are underway to address the impacts of a changing climate on coastal ecosystems at a variety of levels, additional work is needed to build capacity, experience, and collaboration. In an effort to begin to address these needs of coastal habitat managers, ecological restoration experts and other decision-makers, NOAA is working with its partners to develop region-focused workshops on climate change and coastal habitats such as this one in the Great Lakes.

Action: As part of a series of regional workshops, conduct a two-day workshop focused on tools and strategies to assess vulnerability and develop actions for climate-smart conservation of freshwater coastal habitats in the U.S. Great Lakes (MI, WI, MN, IN, IL, OH, PA, NY) region.

Goals:

- Increase understanding of the current state of the climate science for the Great Lakes region and examine vulnerabilities of Great Lakes coastal habitats and species to climate change
- Provide habitat managers and ecological restoration experts with the tools and information necessary to incorporate climate change into their projects
- Connect federal agencies, states, tribal nations and non-governmental organizations in the Great Lakes region to identify potential strategies and opportunities for collaboration related to climate change adaptation, and identify information gaps
- Initiate or codify development of strategies for incorporating climate change into the conservation of freshwater coastal habitats

¹ Global Climate Change Impacts in the United States, T.R. Karl, J.M. Melillo, & T.C. Peterson, (editors), Cambridge University Press, 2009.



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“These impacts [forestry, built environment, transportation, communities, safety, and others] are interrelated, and a successful . . . adaptation strategy requires an integrated and multi-sector approach.”

Western Association of Fish and Wildlife Agencies

Sector	Use of Climate Data
Agriculture	<ul style="list-style-type: none"> Choose seed types and planting and harvesting schedules. Plan for irrigation needs and forecast crop yields. Match garden and landscape design to long term expected conditions.
Energy	<ul style="list-style-type: none"> Forecast fuel needs and electricity demand based on expected conditions. Analyze how temperature conditions affect demand. Assess the best sites for solar and wind energy.
Water	<ul style="list-style-type: none"> Manage reservoirs in drought or flood conditions. Balance competing water demands such as industry, agriculture, recreation, and wildlife. Understand spring snowmelt in the West and the impact on water supply.
Insurance	<ul style="list-style-type: none"> Help businesses and individuals manage financial risks by designing insurance products based on raw and modeled climatic data such as temperature, wind, and sea surface temperatures.
Infrastructure	<ul style="list-style-type: none"> Plan airports, roads, bridges, levees, and other infrastructure to withstand extreme weather conditions. Design building performance for expected heating and cooling needs.
Health	<ul style="list-style-type: none"> Prepare public health response measures such as cooling centers, vaccination programs, and epidemic action plans.



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Sectoral Crosscuts and Opportunities for Integration



Commerce



Coasts



Recreation



Ecosystems



Hydropower



Farming



Wind Energy



Private Sector

“All our greatest challenges are pervasive around the globe, and all are local in their solution.” A stakeholder from Missouri

Regional Climate Service: Next Steps

- Collect climate data and improve monitoring
- Provide robust and enhanced climate science and modeling
- Educate, train, and create climate-literate communities
- Build climate capacity (at the community scale) and inform adaptation
- Develop robust partnerships and strategic investment opportunities



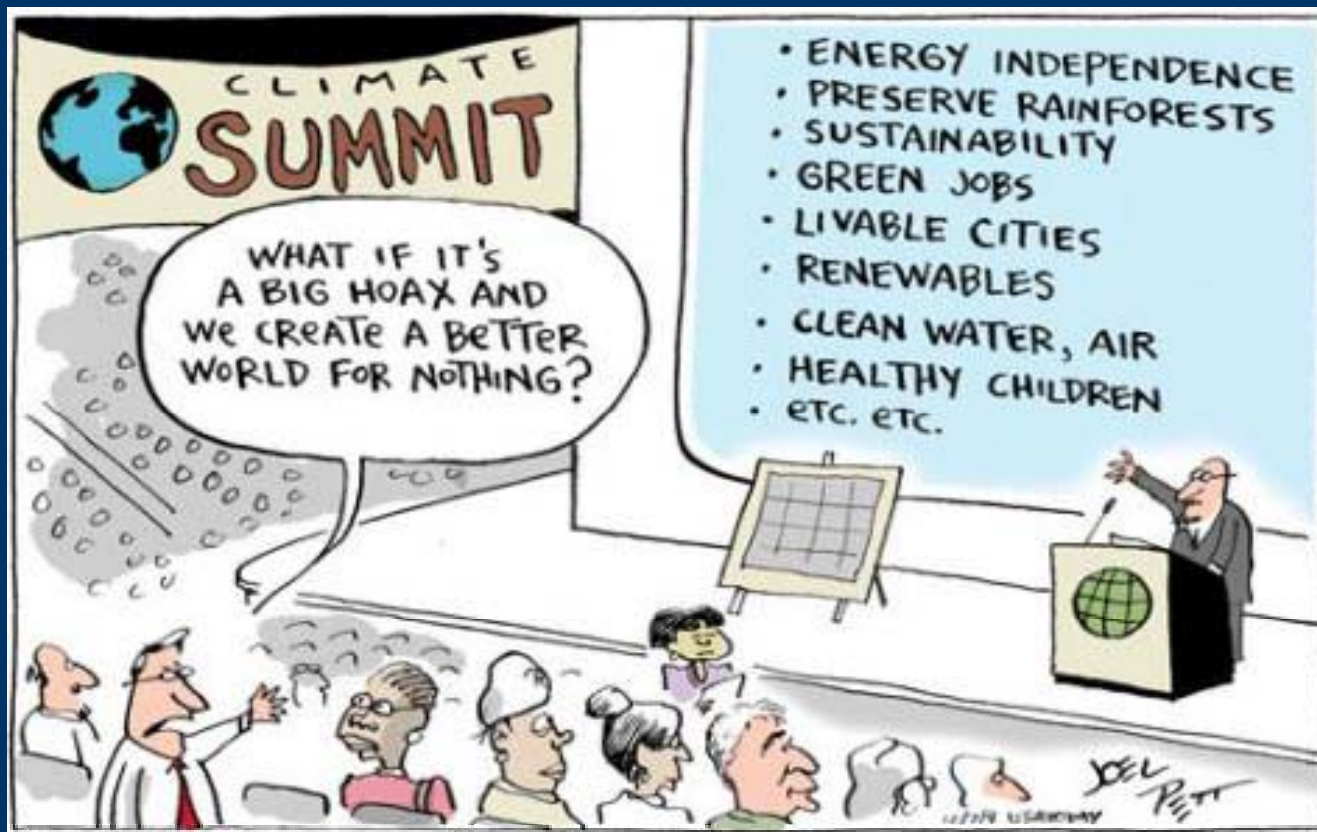
Pictured Rocks – Environmental Protection Agency



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Questions?

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