

Climate Change Impacts in the United States – and Beyond

BU GLACIER Lecture
3 August 2016



The Frederick S. Pardee Center
for the Study of the Longer-Range Future

Outline

- Context
- What do we know, and how do we know?
- Implications for the future
- Actions for today

Quality of Life Issues for All of Us



Why Does This Matter?

- Because the global environmental changes about which we are rightly concerned have immediate local implications
- As well as implications for decades to come
- Are quality of life issues for residents and the entire region
- Do not have the luxury to ignore what the facts tell us, or the experiences of others
- Recognize that we are collectively managing risks even as we seek to understand more

A Long History

- For over 25 years in the US, the federal government agencies have collaborated on all the fields of climate science
- For the past 15, we have published our assessments of the state of the science regarding impacts in the US
- Paralleling the international scientific assessment process
- Where have we been, and where are we now in our understanding?

A History of US Assessments

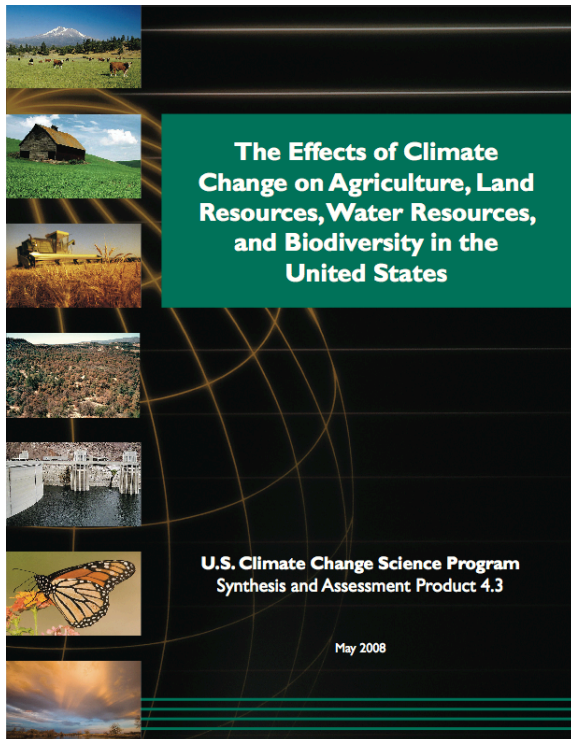
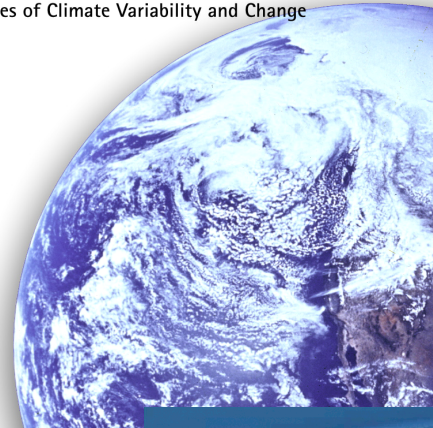
CLIMATE CHANGE IMPACTS ON THE UNITED STATES

The Potential Consequences of Climate Variability and Change

National Assessment
Synthesis Team

US Global Change
Research Program

Public Comment Period:
June 12 to August 12

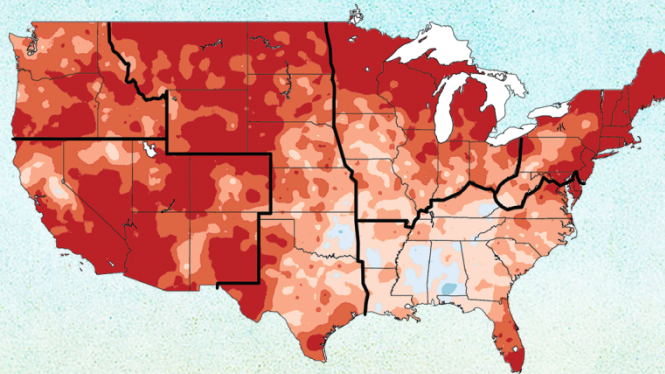


BOSTON
UNIVERSITY

THE FREDERICK S. PARDEE CENTER
FOR THE STUDY OF THE LONGER-RANGE FUTURE

Third National Climate Assessment

Climate Change Impacts in the United States



Human-induced climate change has moved firmly into the present.



Americans are already feeling the effects of increases in some types of extreme weather and sea level rise.



© Stan Honda/AFP/Getty Images

Impacts are apparent in every region and in important sectors including health, water, agriculture, energy, and more.



© Scott Olson/Getty Images

There are many actions we can take to reduce future climate change and its impacts and to prepare for the impacts we can't avoid.



©Dennis Schroeder, NREL



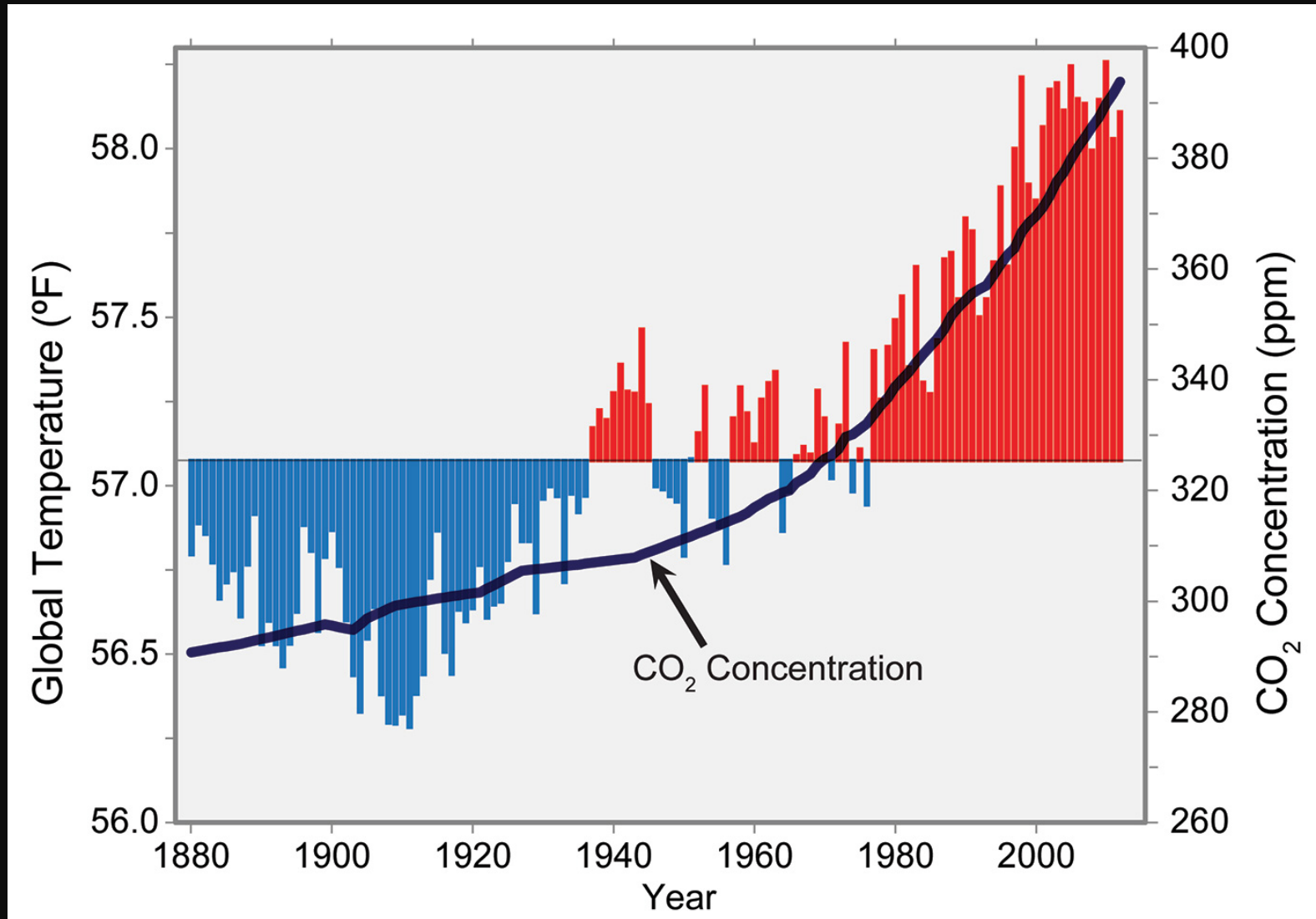
©Esperanza Stancioff, UMaine Extension and Maine Sea Grant

The World is Warming

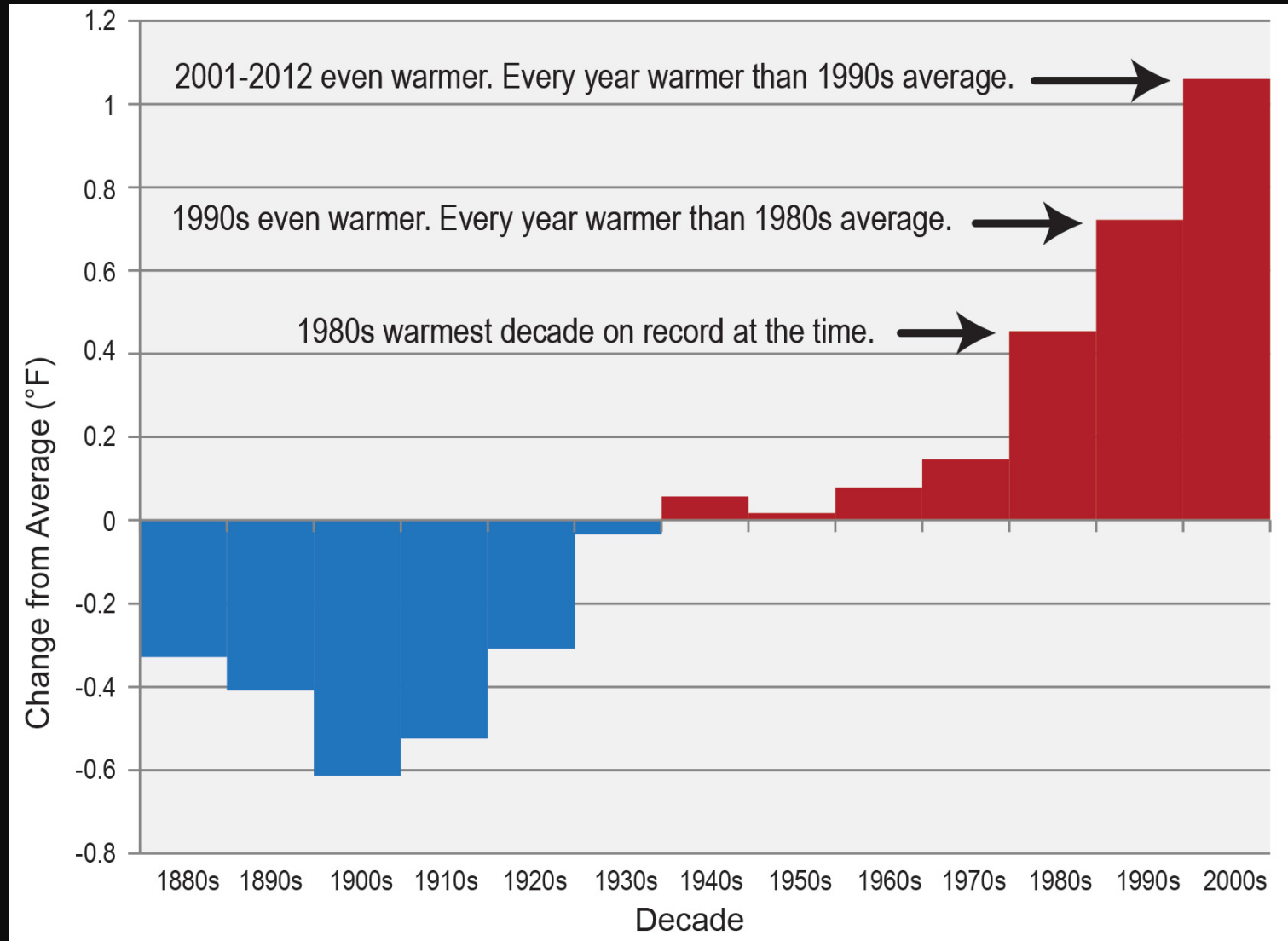
Numerous independent lines of evidence demonstrate that warming has continued.

Because human-induced warming is superimposed on a naturally varying climate, rising temperatures are not evenly distributed across the globe or over time.

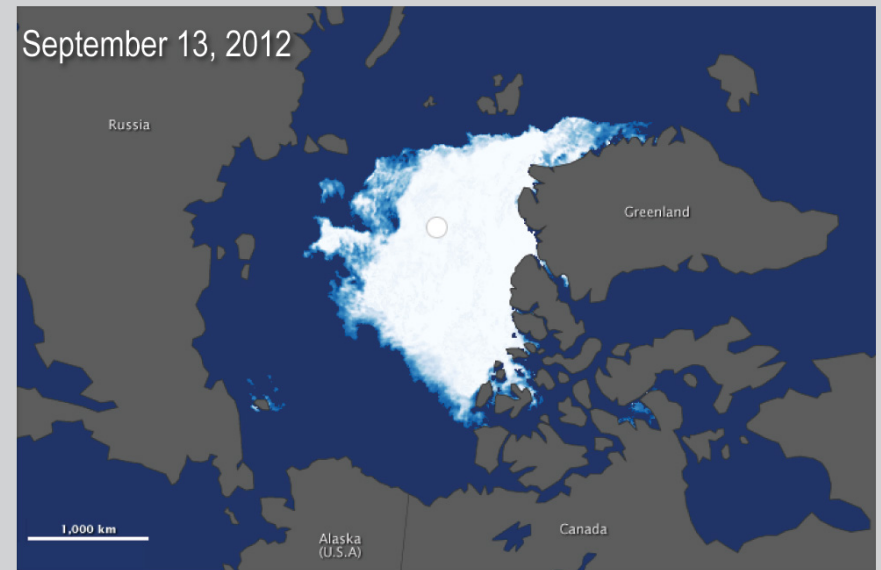
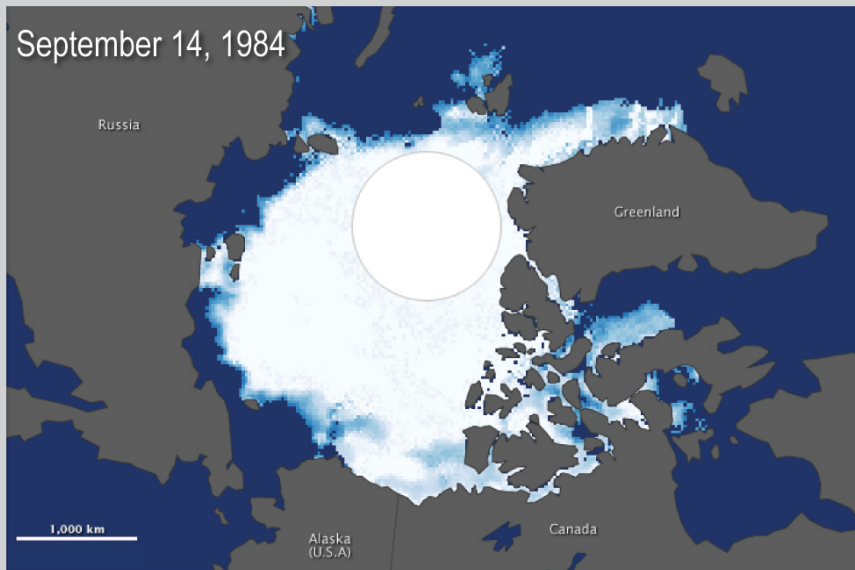
Global Temperature and Carbon Dioxide



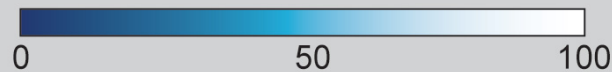
Temperature Change by Decade



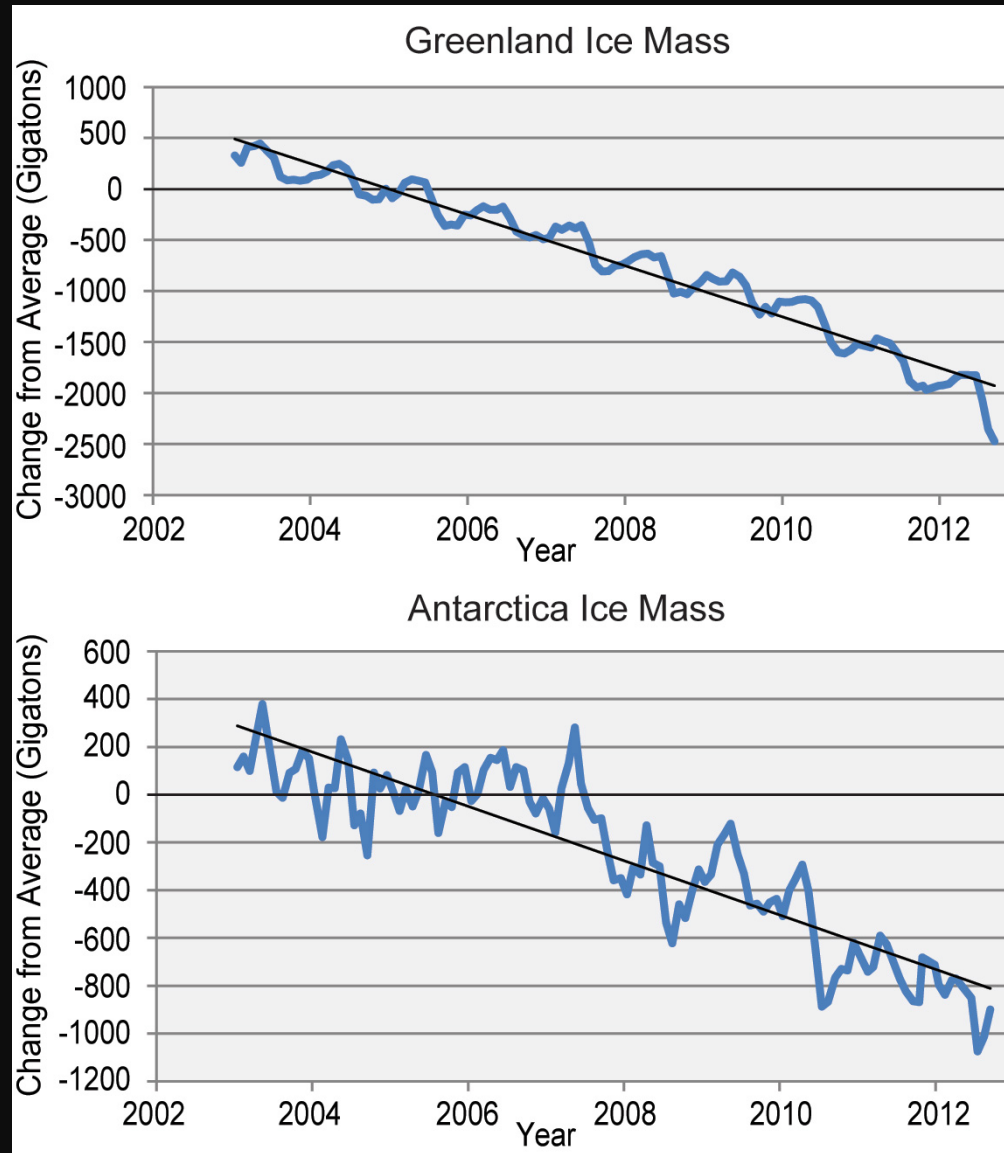
Arctic Sea Ice Decline



Sea Ice Concentration (percent)



Ice Loss from the Two Polar Ice Sheets



Human activity is the primary cause

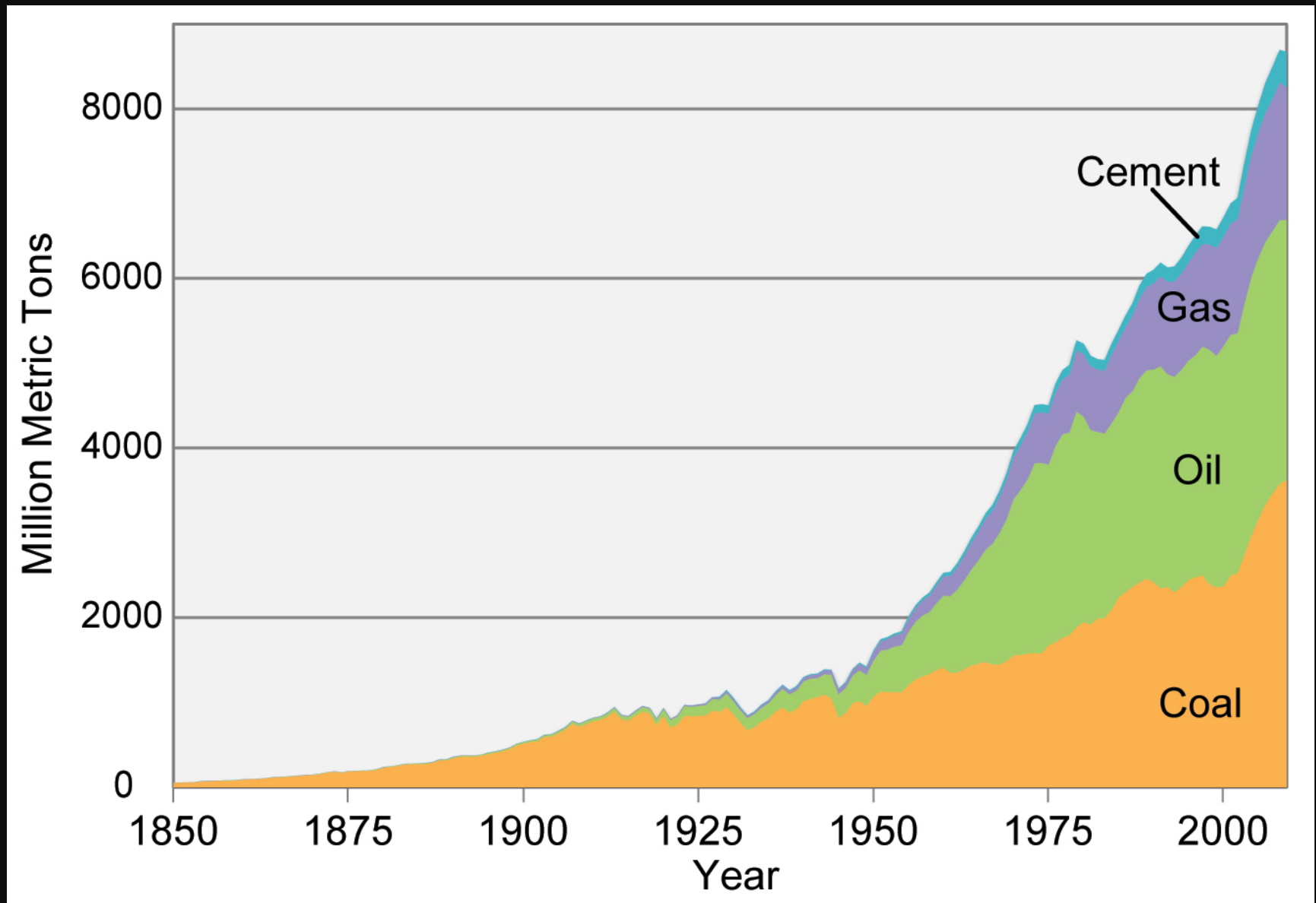


©Tom Mihalak/Reuters/Corbis

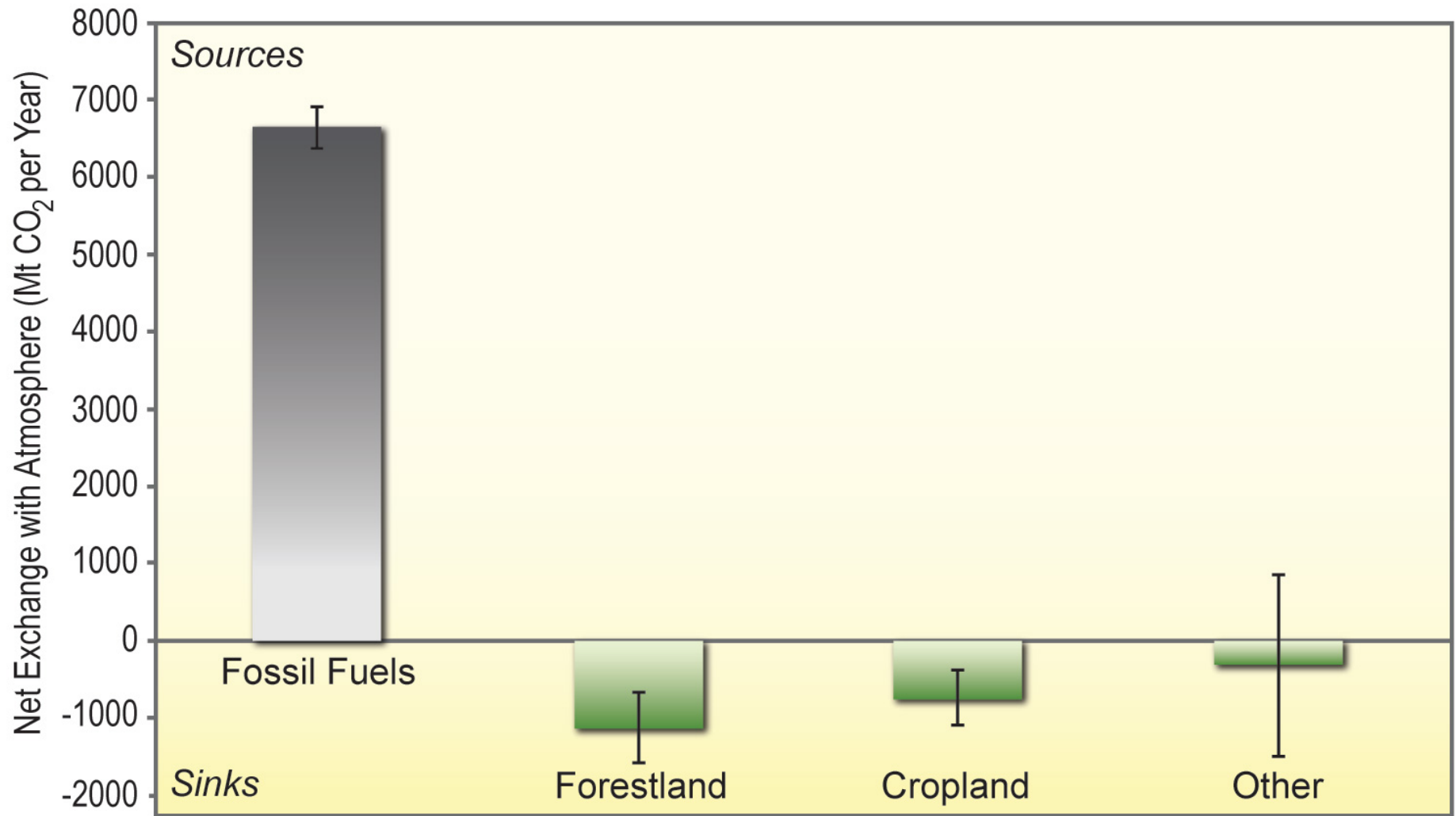


© Phillip J. Redman, U.S. Geological Survey

Carbon Emissions in the Industrial Age



Major North American CO₂ Sources and Sinks

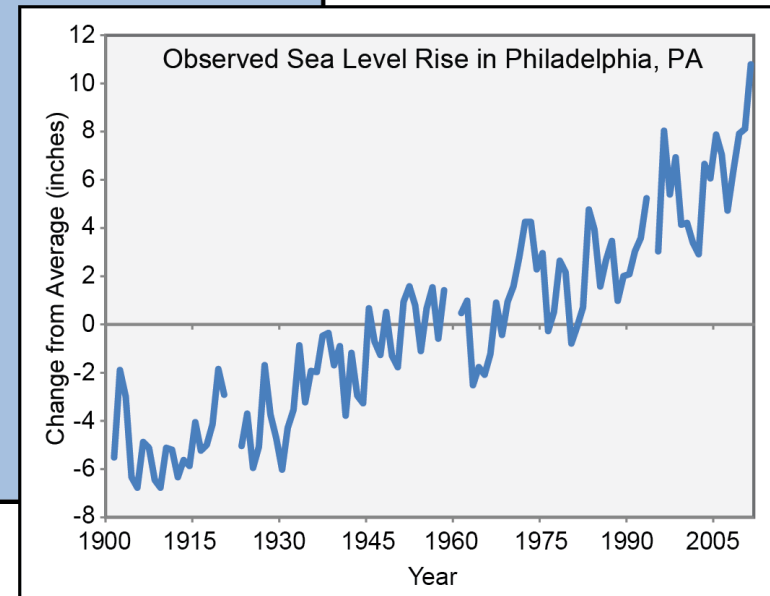
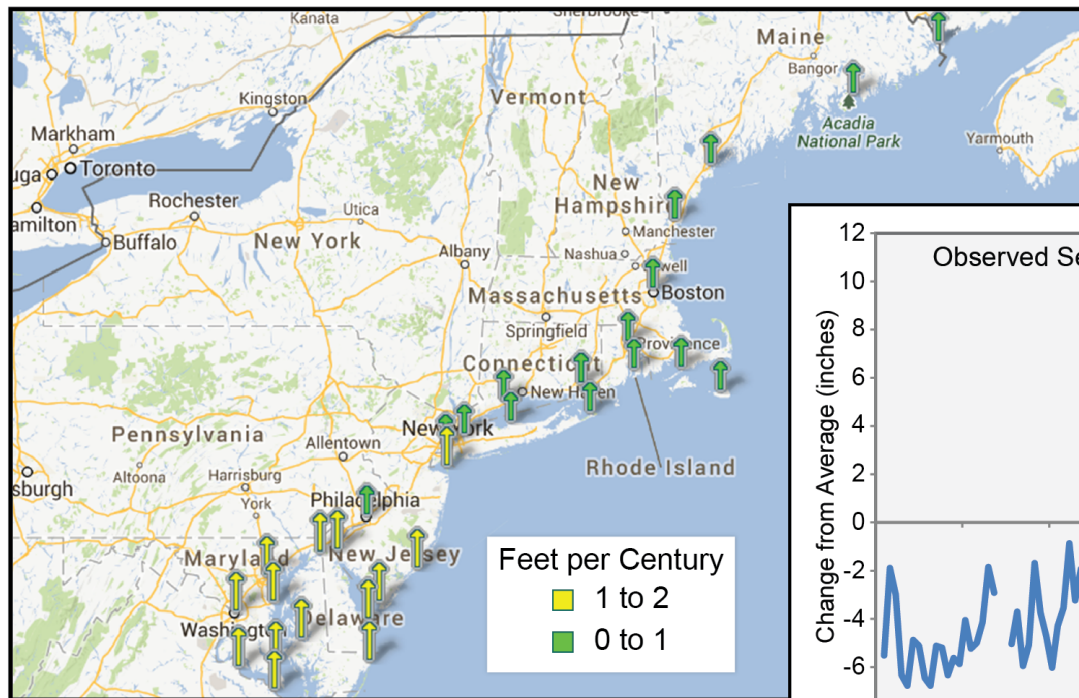


Impacts Are Already Widespread



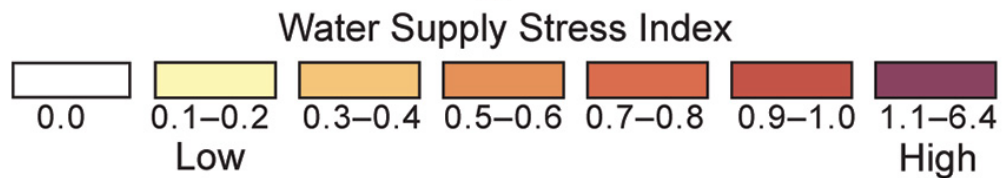
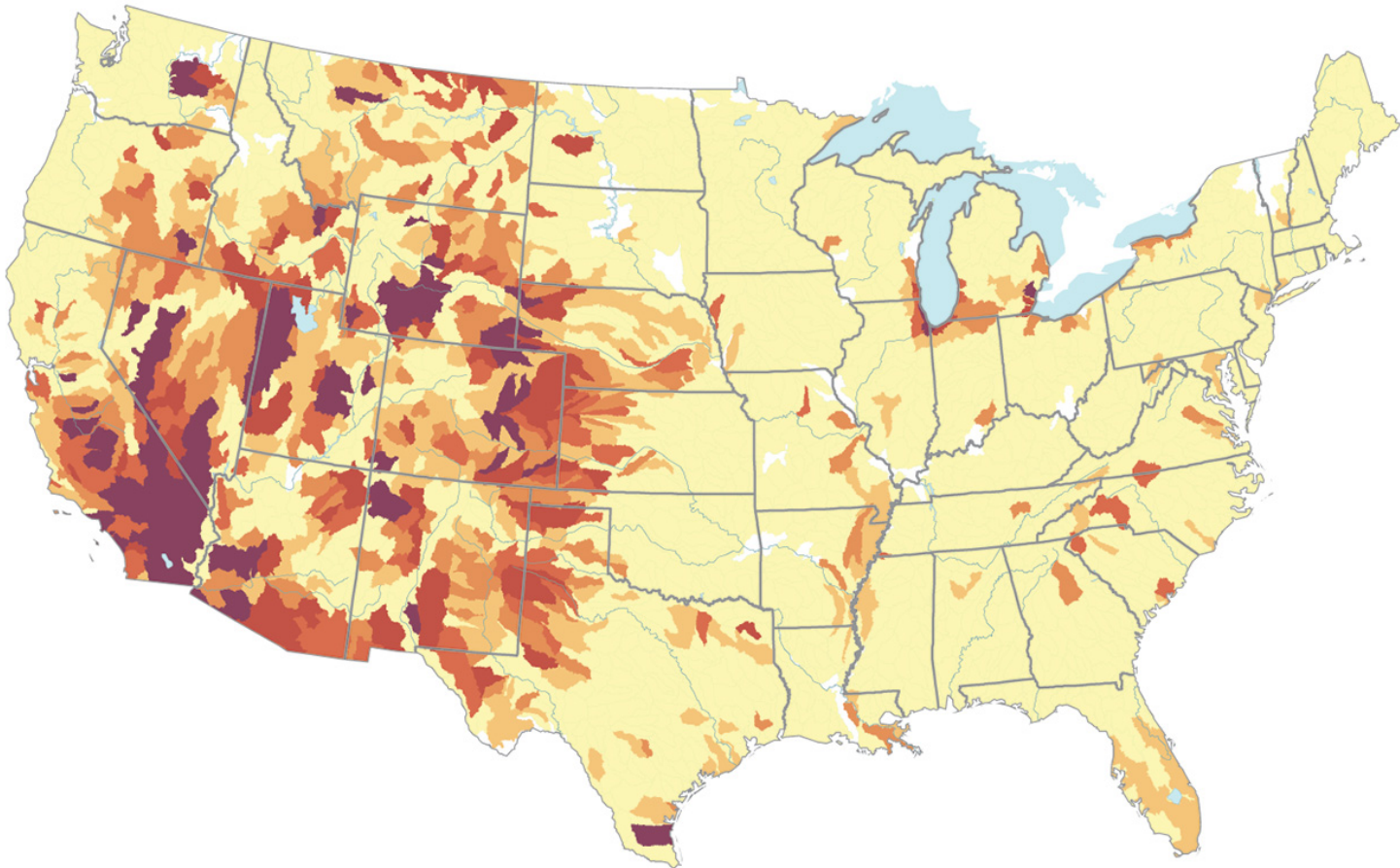
©AP Photo/The Virginian-Pilot, Steve Earley

Sea Level is Rising

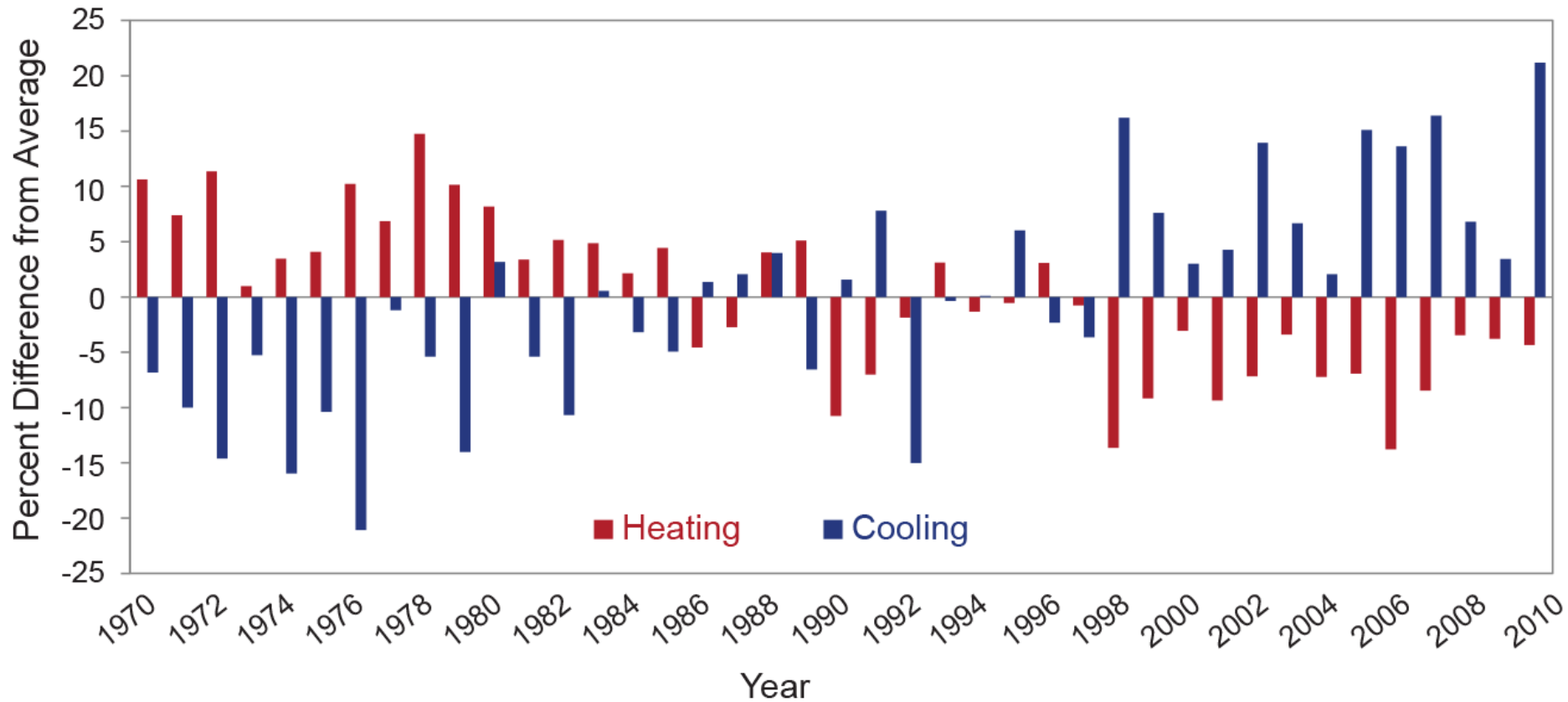


Data from Permanent Service for Mean Sea Level

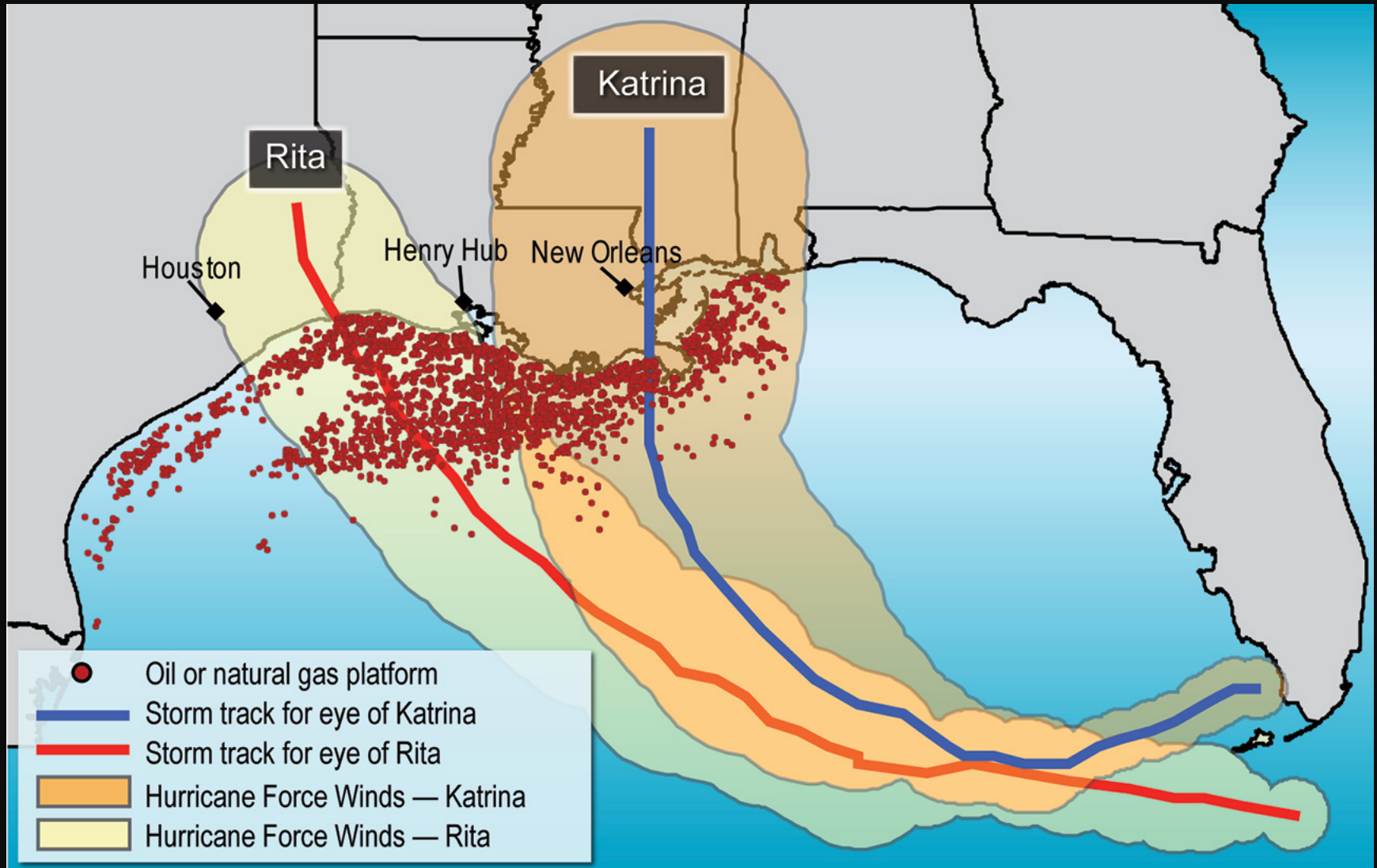
Water Stress in the U. S.



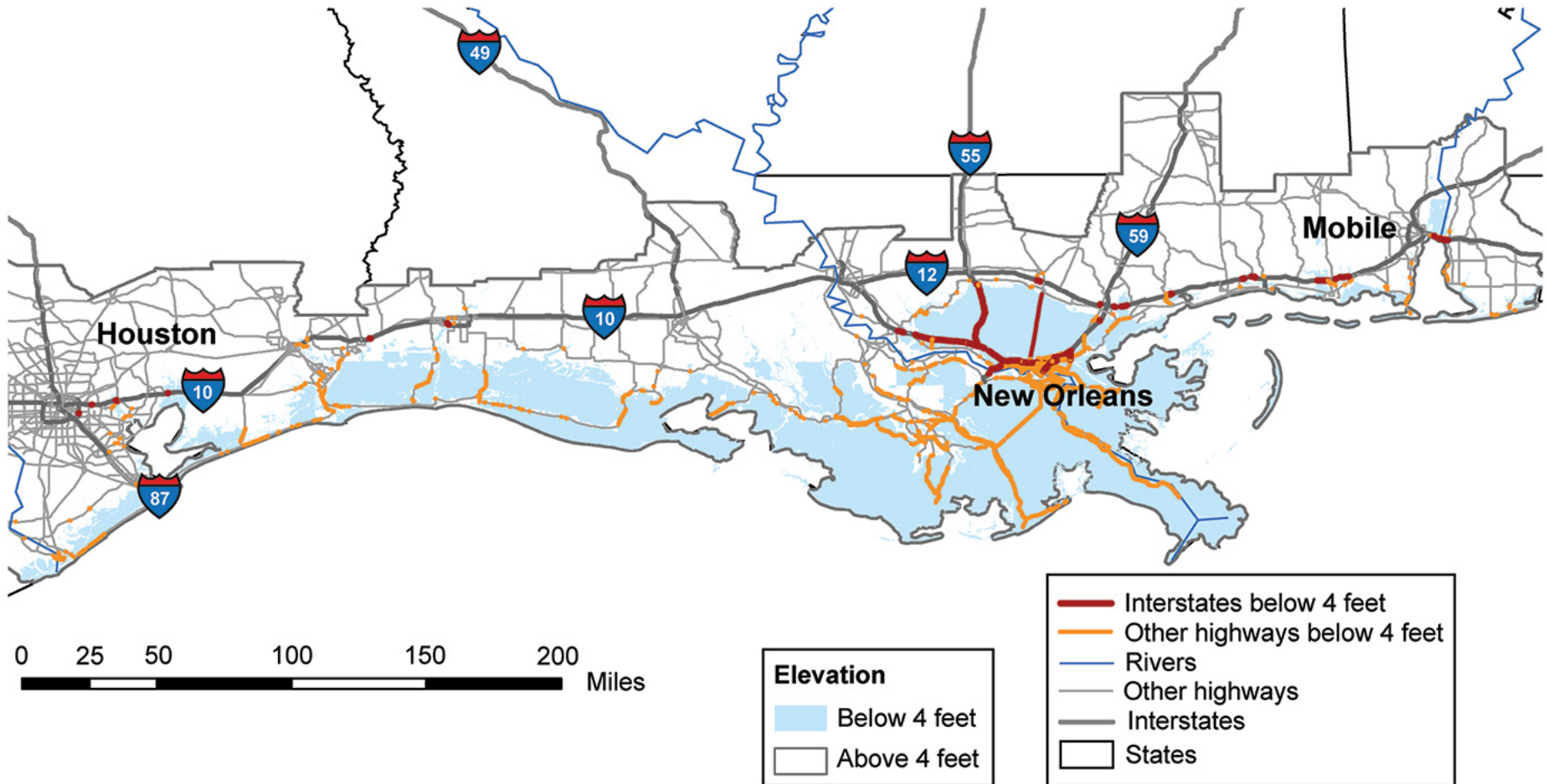
Increase in Cooling Demand and Decrease in Heating Demand



Paths of Hurricanes Katrina and Rita Relative to Oil and Gas Production Facilities



Gulf Coast Transportation Hubs at Risk





California Power Plants Potentially at Risk from Sea Level Rise

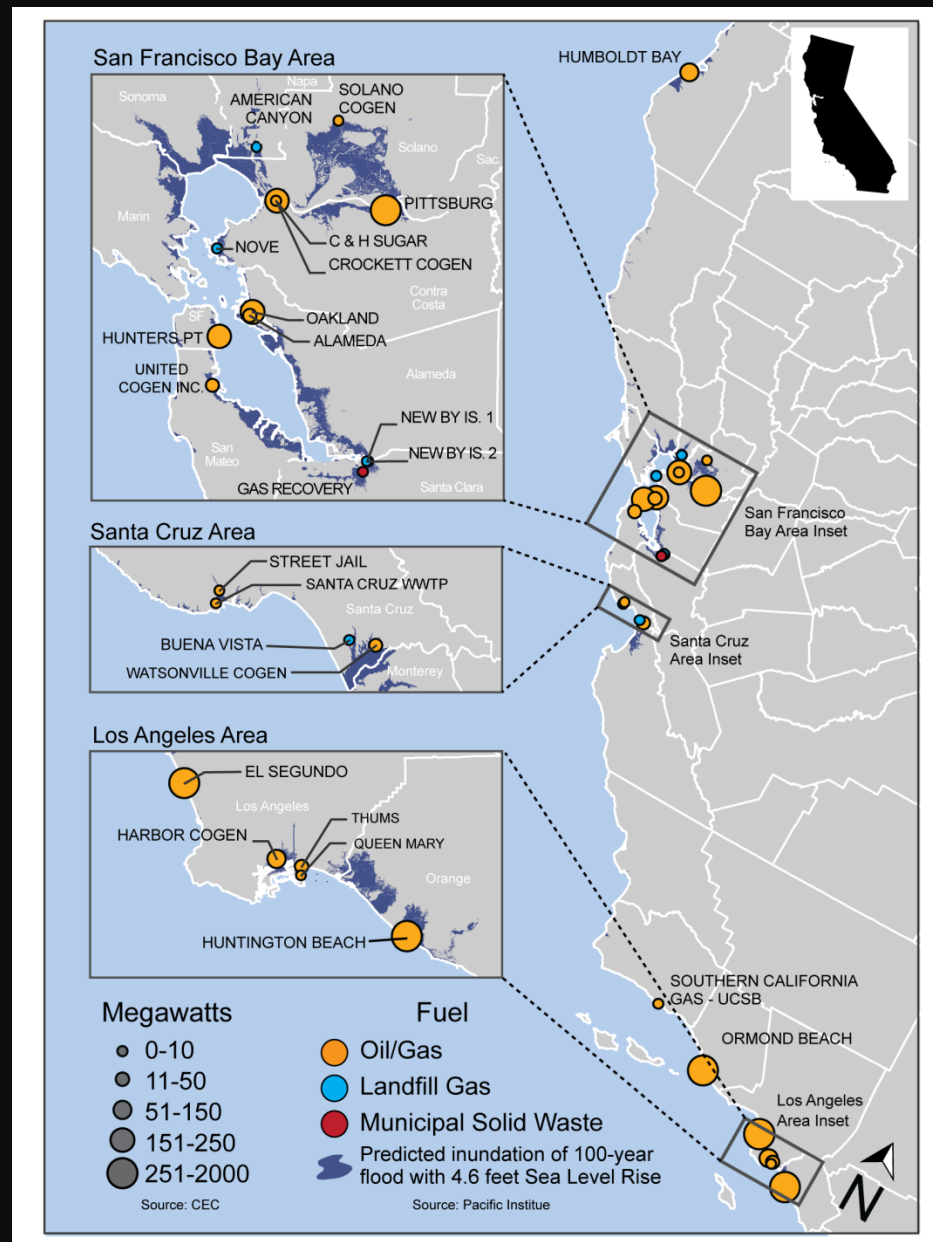
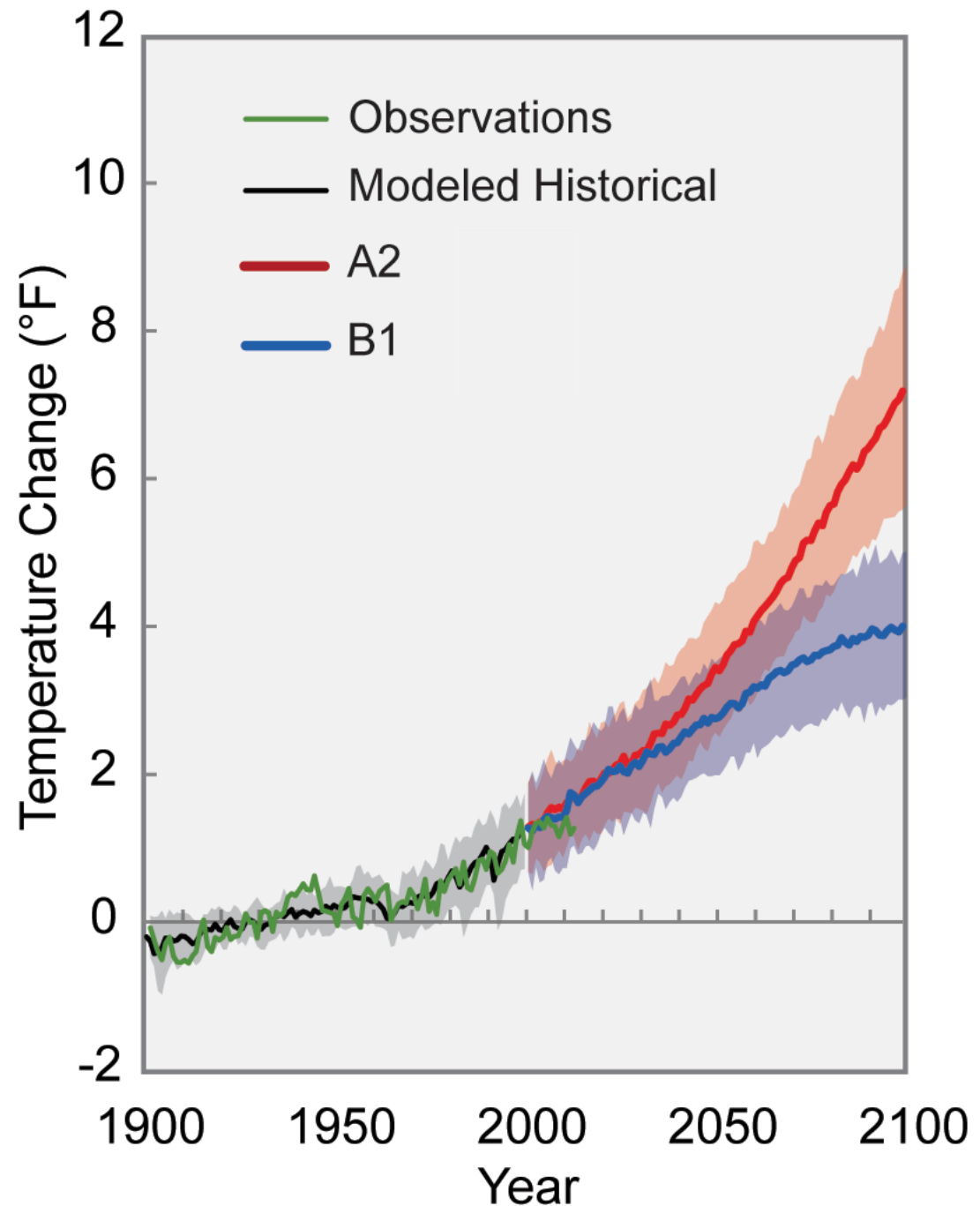


Figure source: Sathaye et al. 2011

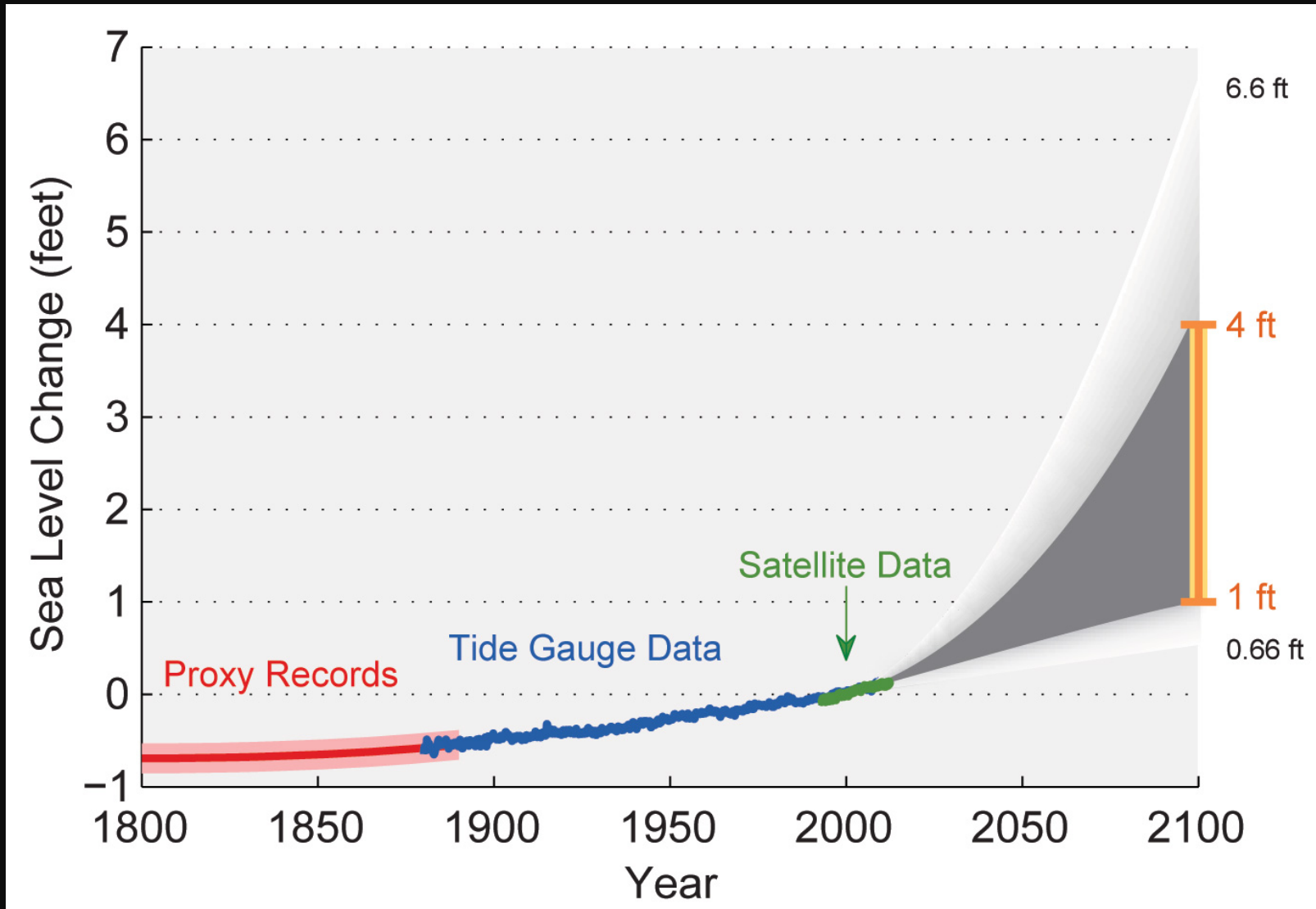
Impacts are Projected to Increase




Projected Global Temperature Change



Past and Projected Changes in Global Sea Level





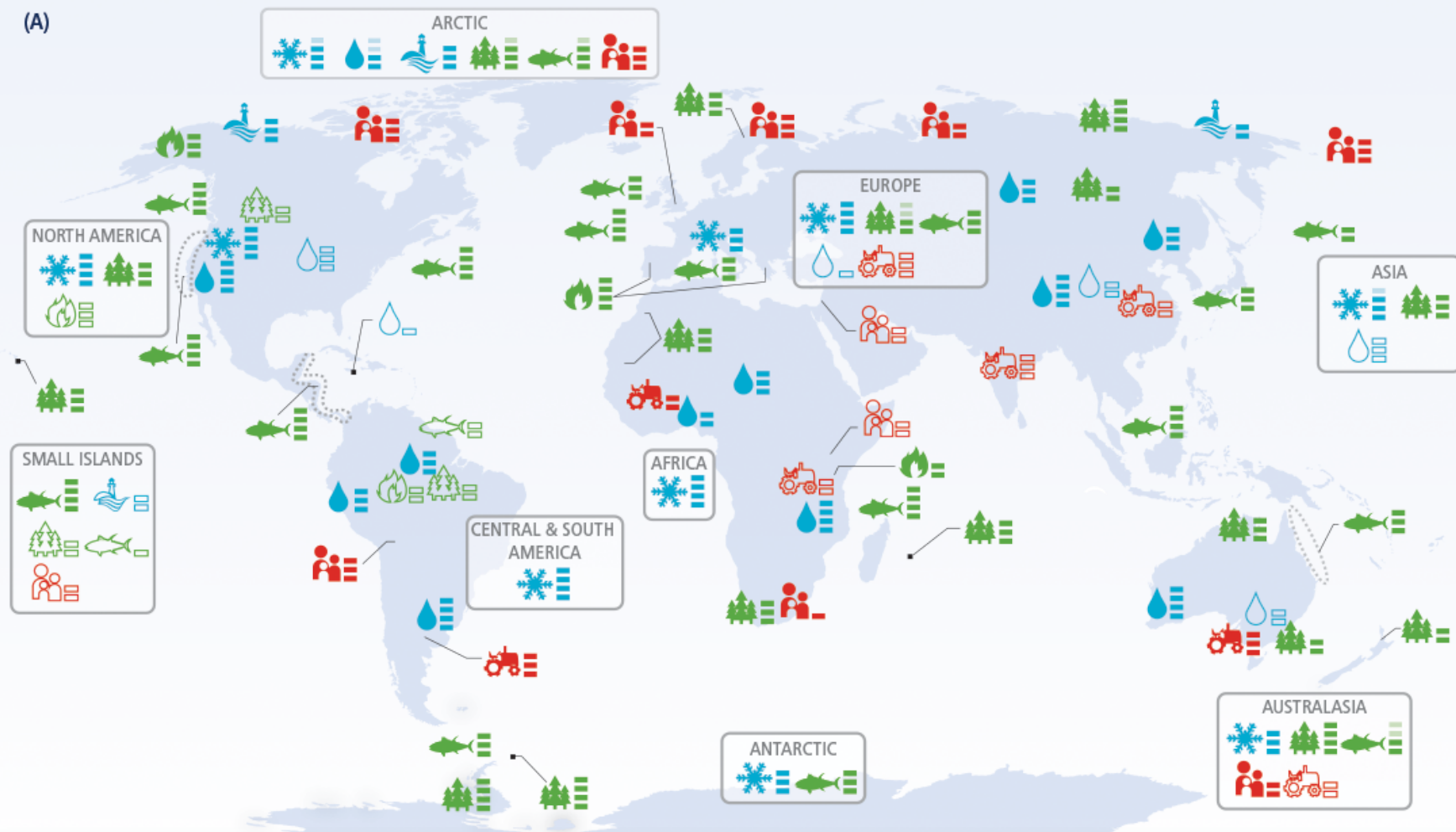
The international process has led
to strikingly similar conclusions



CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY



(A)



Confidence in attribution to climate change

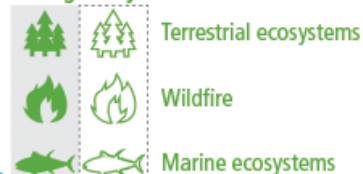


Observed impacts attributed to climate change for

Physical systems



Biological systems



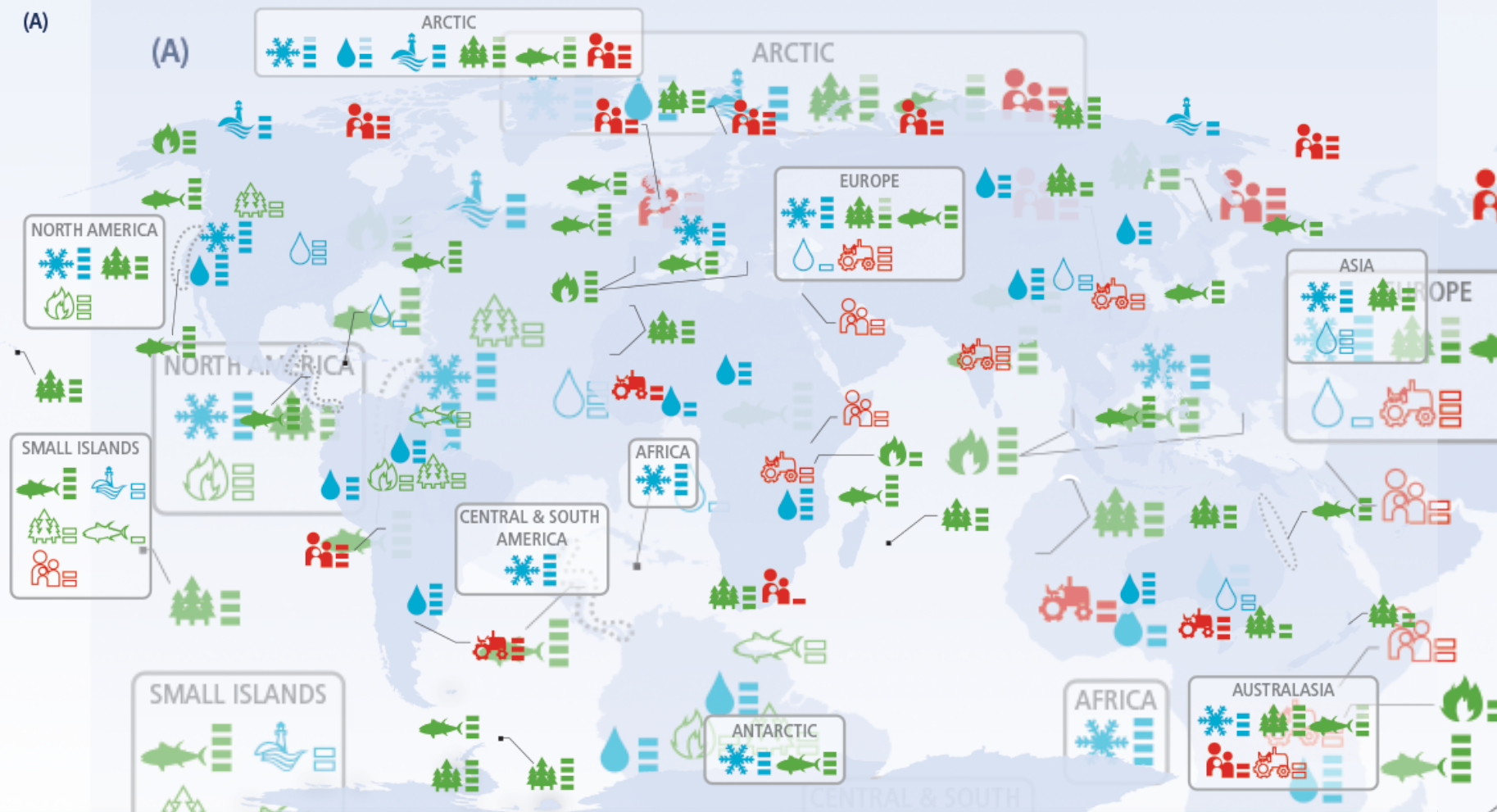
Human and managed systems



Regional-scale impacts

Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

(A)



Confidence in attribution to climate change

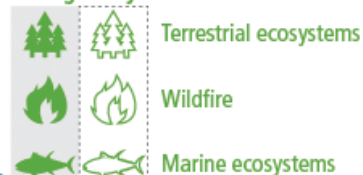


Observed impacts attributed to climate change for

Physical systems



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Human and managed systems



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Outlined symbols = Minor contribution of climate change
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So What Do We Do?



Responses

There are important opportunities to reduce future warming by reducing greenhouse gas emissions and increasing carbon dioxide uptake.

There are also actions we can take to prepare for impacts that are already unavoidable.

Some actions are already underway.

Mitigation



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© Najlah Feanny/Corbis

Future Climate Change Depends Primarily on Emissions Levels



© Jim West/Imagebroker/Corbis



Mitigation

<http://nca2014.globalchange.gov/report/response-strategies/mitigation>

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Key Message 1

- Carbon dioxide is removed from the atmosphere by natural processes at a rate that is roughly half of the current rate of emissions from human activities.
- Mitigation efforts that only stabilize global emissions will not reduce atmospheric concentrations of carbon dioxide, but will only limit their rate of increase.
- The same is true for other long-lived greenhouse gases.

Adaptation



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FEMA photo by Wendell A. Davis Jr.

Lots of Local Action



CITY OF GRAND RAPIDS



FY 2011 through FY 2015
(7/1/2010 - 6/30/2015)

SUSTAINABILITY PLAN

As Amended June 21, 2011

Managing the Economic, Social, and Environmental
Resources of the City through a Framework
of Sustainability Outcomes and Targets

CHICAGO CLIMATE ACTION PLAN

OUR CITY. OUR FUTURE.

The City of Lewes Hazard Mitigation and Climate Adaptation Action Plan



June 2011



City of Lafayette Energy Sustainability Master Plan



KING COUNTY

TOWARD A SUSTAINABLE, PROSPEROUS

2011 Annual Report of
King County's Climate Change,
Energy, Green Building, and
Environmental Purchasing Programs



June 2012

King County

CITY OF DETROIT



STORM WATER MANAGEMENT PROGRAM PLAN

Revised
November, 2011



A Region Responds to a Changing Climate

Southeast Florida Regional Climate
Change Compact Counties

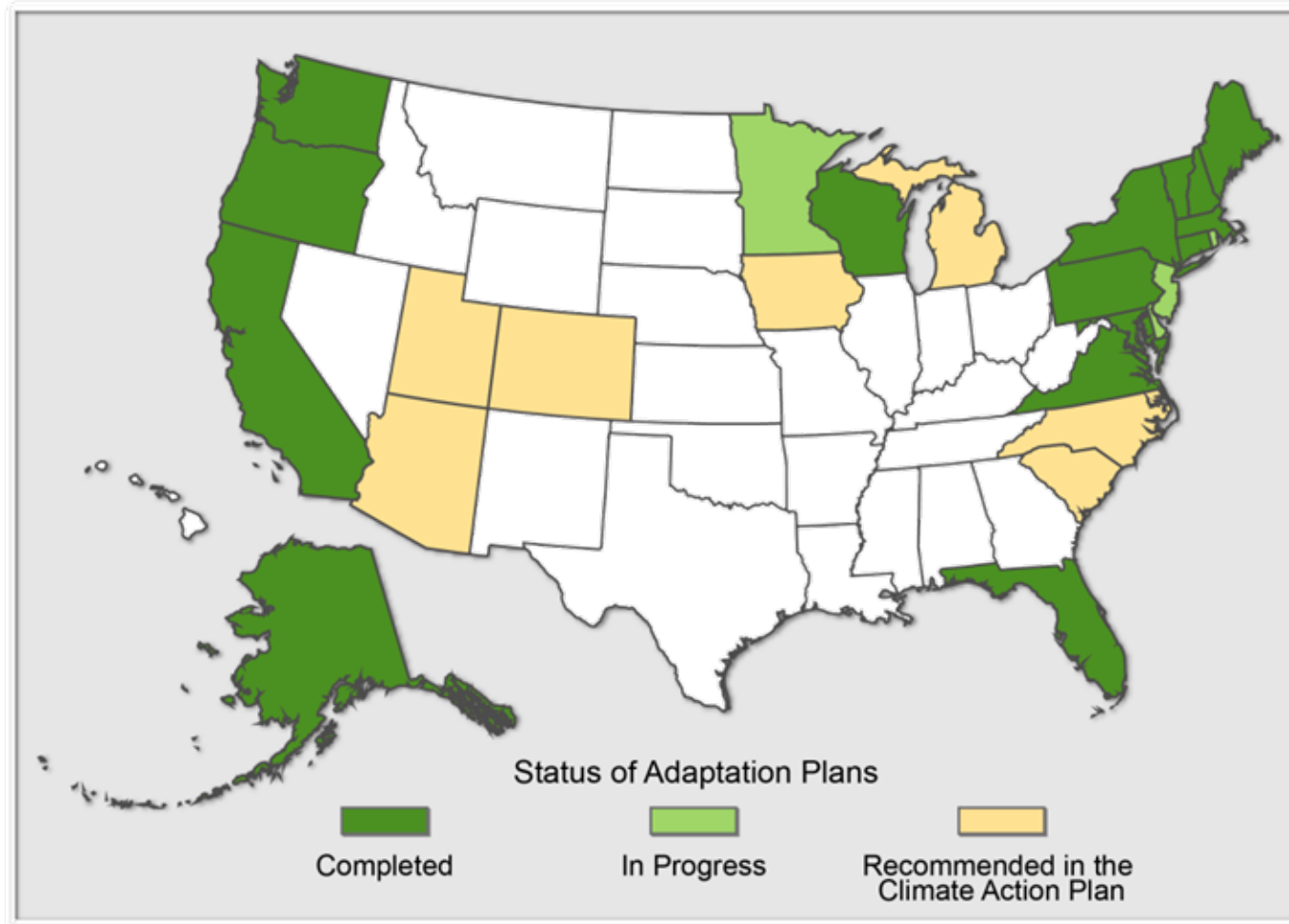
Regional Climate Action Plan

October 2012





Climate Adaptation Plans





Initiative on Cities



The Frederick S. Pardee Center
for the Study of the Longer-Range Future

Sea Level Rise & the Future of Coastal Cities



The Frederick S. Pardee Center
for the Study of the Longer-Range Future

GREENOVATE BOSTON

2014 CLIMATE ACTION PLAN UPDATE



MAYOR MARTIN J. WALSH

PRIORITIES

REDUCE GREENHOUSE GAS EMISSIONS BELOW 2005 LEVELS

- 25 percent by 2020 and 80 percent by 2050
- Expand energy efficiency programs through targeted outreach and new financing mechanisms.
- Increase local and low-carbon energy sources, including expanding district energy and co-generation.
- Re-envision Boston's transportation system to dramatically reduce emissions from this sector.

PROMOTE HEALTHY AND EQUITABLE COMMUNITIES

- Encourage sustainable development that creates opportunities for current and future residents.
- Ensure equitable access to green jobs and facilitate job training.
- Implement Housing a Changing City, the 2015–2021 Open Space plans
- Promote equity in all policies and programs.

MEASURE PROGRESS

- Track and publicly report on the Climate Action Plan's progress year-over-year.
- Use performance measurement, targets and goals to motivate climate action and behavior change.



PREPARE BOSTON FOR THE IMPACTS OF CLIMATE CHANGE

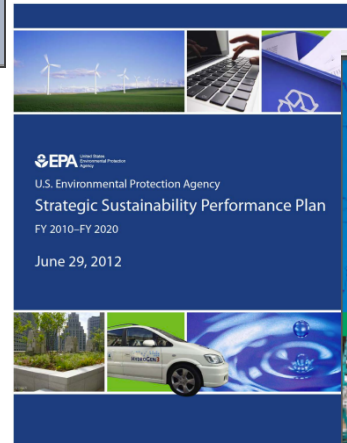
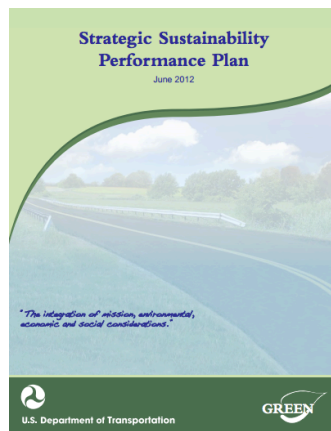
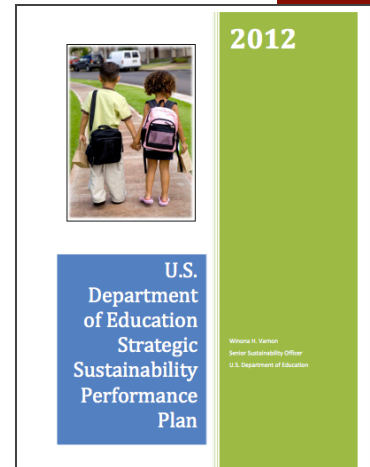
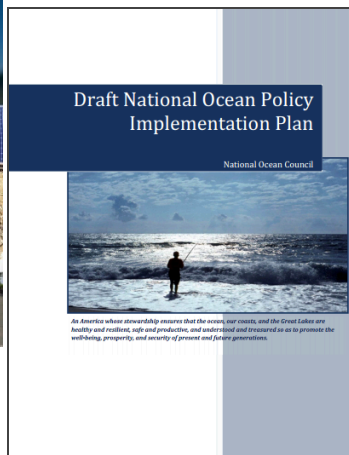
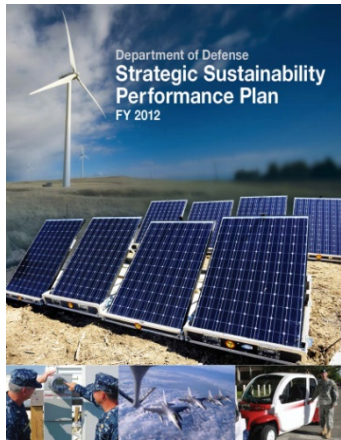
- Work with regional and state agencies, and surrounding communities to align and accelerate regional preparedness planning.
- Incorporate climate preparedness into existing local planning and community engagement efforts.
- Ensure public- and private-sector developments and major capital projects are prepared for expected climate change over their projected life.

INCREASE COMMUNITY ENGAGEMENT

- Support grassroots, community-driven climate action efforts.
- Incorporate sustainability into all aspects of education.



Sustainability Plans for every Federal Agency



Department of the Interior
2012 Strategic Sustainability Performance Plan

Rhonda S. Sullivan
Rhonda S. Sullivan
Assistant Secretary - Policy, Management and Budget
and
The Department's Senior Sustainability Officer

Date JUN 25 2012

Effectiveness?

- Plans more than actions
- Challenge of developing a counterfactual
- Academic knowledge not yet penetrating private and public institutions
- Private and public experience not yet penetrating academic institutions

Where Are We Headed?

- Future assessments clearly need to evaluate where scientific knowledge is moving
- At the same time, keep track of progress on responses to climate change



Keep Your Eye on the Ball



Concluding Thoughts

- We are clearly seeing the consequences of changes in the climate system
- While we typically don't use the phrase "settled science," there is a lot of what we do know that is simply not in serious question
- But we do have a very challenging problem of communicating



Concluding Thoughts

- We need to acknowledge that the world will not wait while we sort out the things we're not so sure about
- We are managing risks as well as seeking to understand the world better
- The very epitome of being useful while being interesting



Thank you...



Analysis for a better tomorrow, today.

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