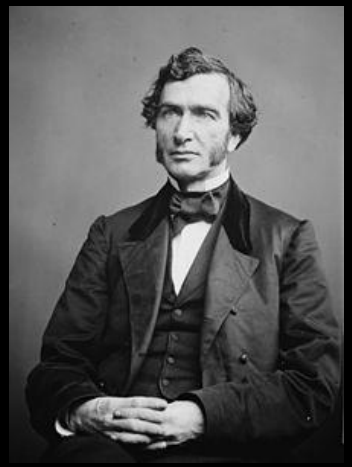
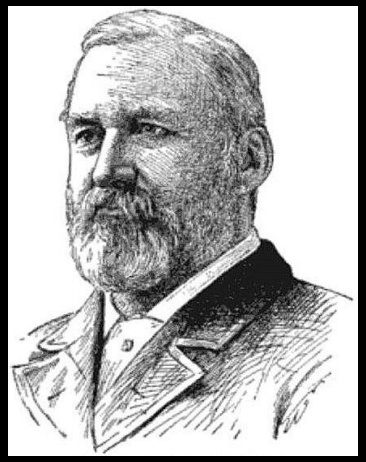
What would Morrill, Hatch, Smith, and Lever think about climate change?



Senator Justin Smith Morrill



Congressman William Henry Hatch

Senator Michael Hoke Smith

Congressman Asbury Francis Lever

Ivan J. Fernandez
University of Maine

Northeast Management Officers (NEMO) Annual Meeting
October 6-8, 2013

What is "climate change"?

"Climate change is long-term shifts in the statistics of weather."
(NOAA)

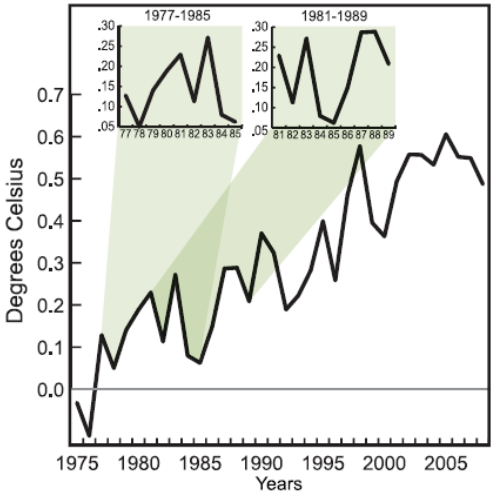


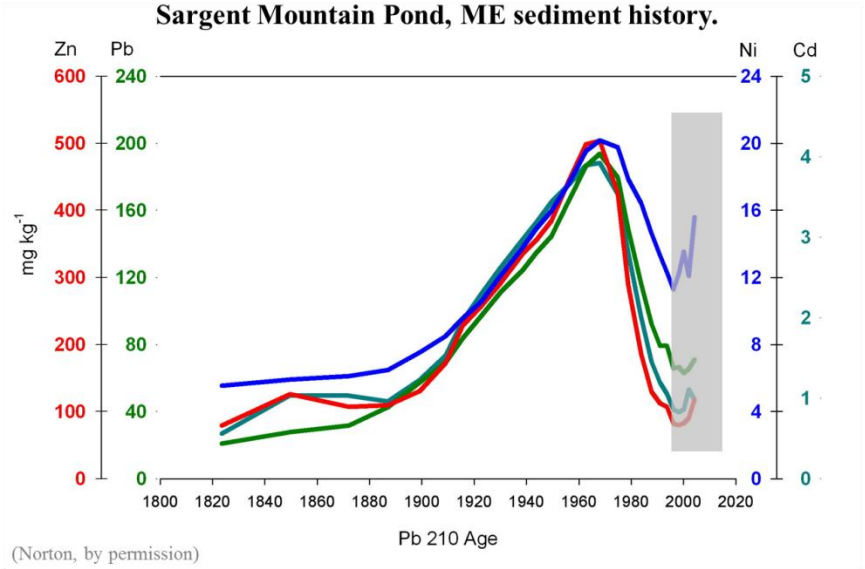
Figure 1. Globally averaged surface air temperature for land and ocean based on the data set by *Smith et al.* [2005].

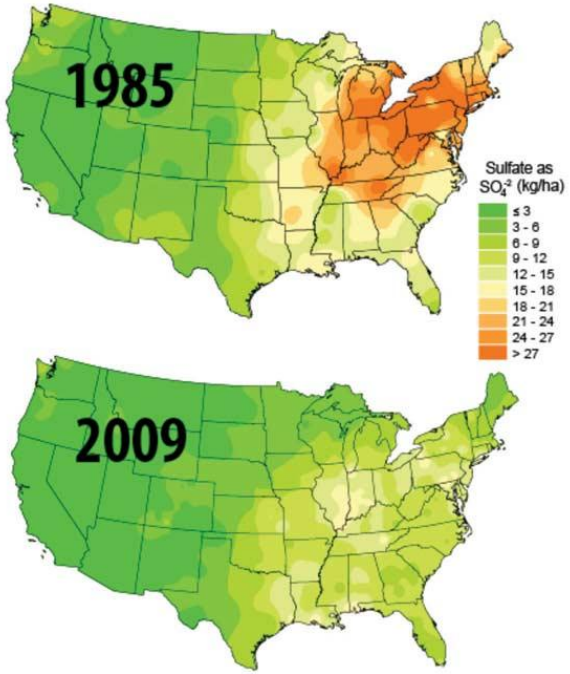
From Easterling and Wehner 2009

National Climate Assessment and Development Advisory Committee *Draft* US Climate Assessment Report (http://ncadac.globalchange.gov/)

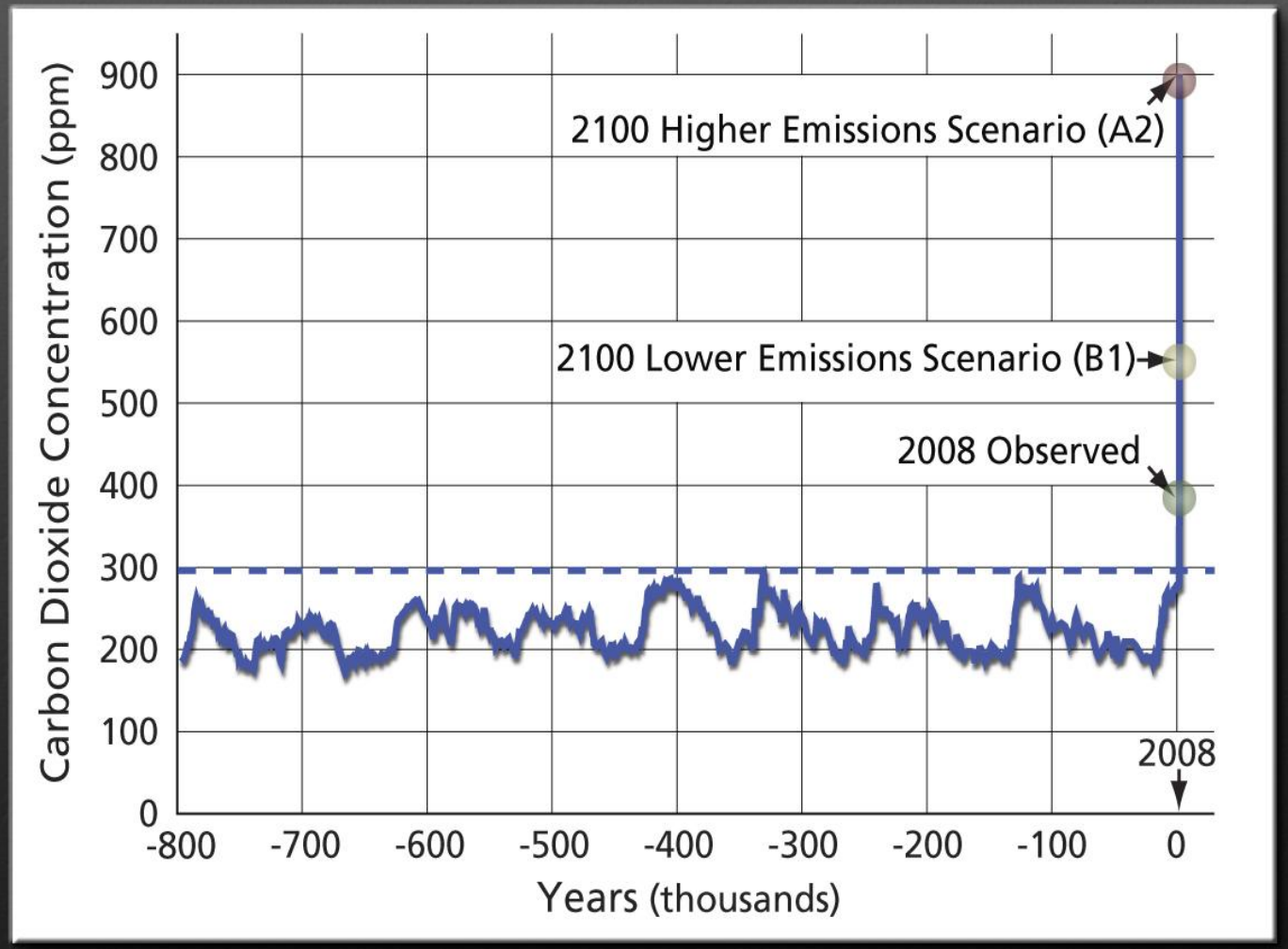
Some 20th Century Air Pollution Issues

- Lead in Gasoline – CAA 1970, Regs 1973
- CFCs – Montreal Protocol 1987
- Sulfur in Acid Rain – CAA reauth. 1990
- Greenhouse Gas Emissions?

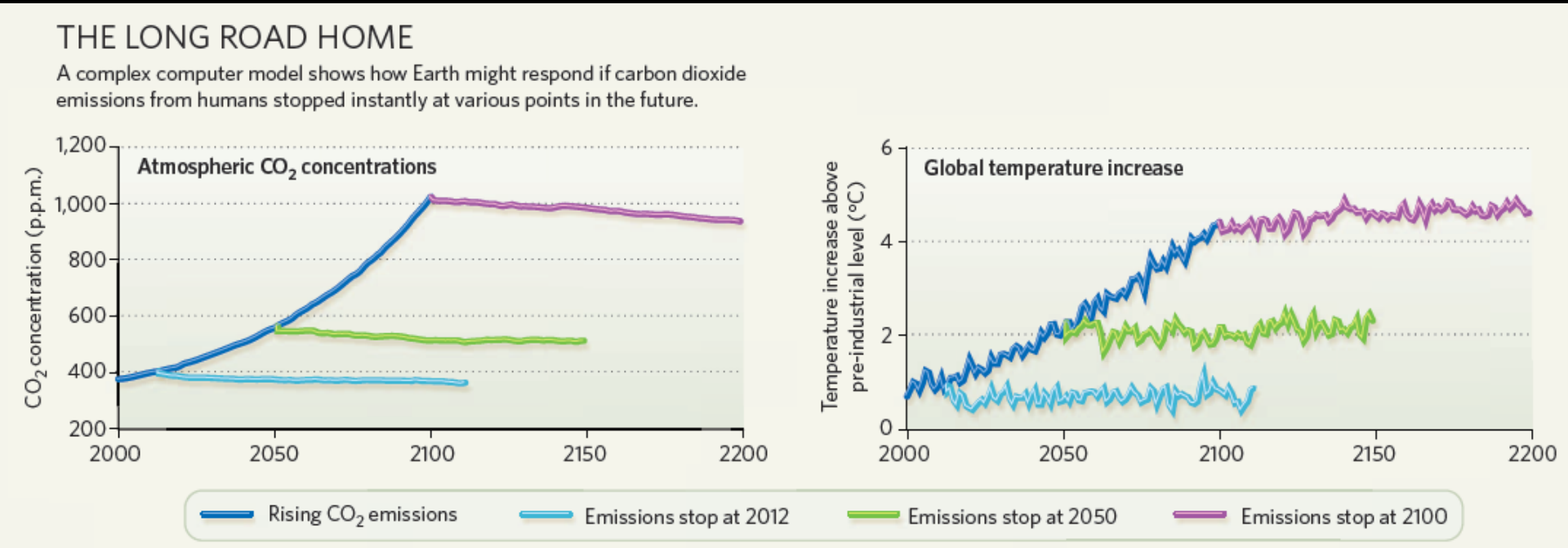




800,000 Years of CO_2 Concentrations



Why are we beyond "Climate Change" the issue?



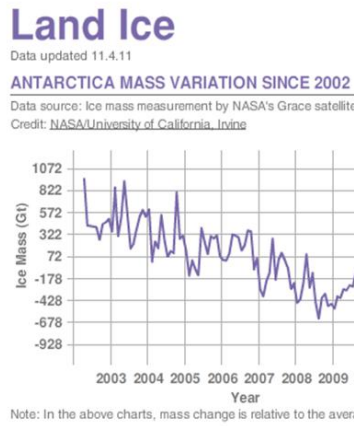
Delayed response increases the difficulty of recovery
(after Lowe et al. 2009. Environmental Research Letters 4: 014012)
fig. used in Monastersky 2009. Nature 458:1091-1094.

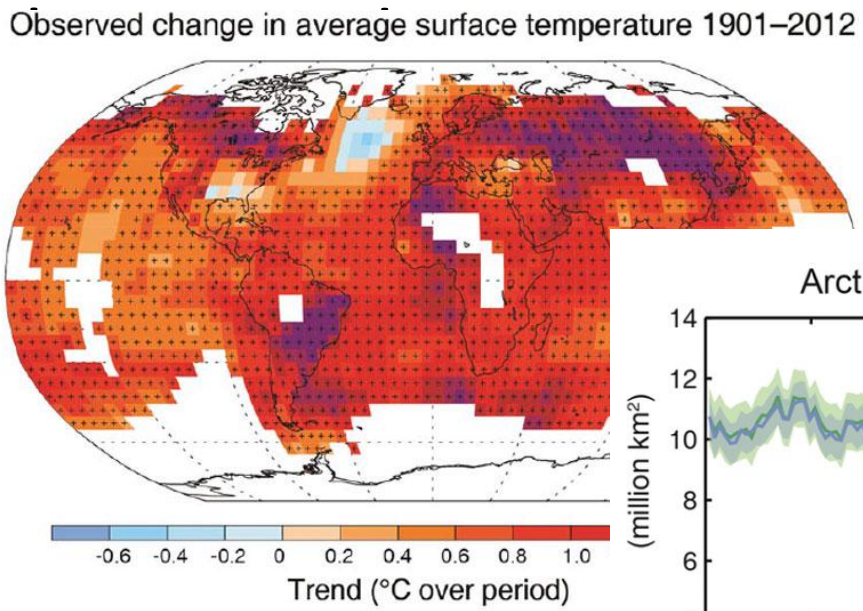
The End of “Climate Change”?

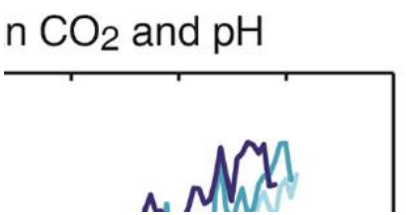
“We need to manage what is unavoidable and avoid what is unmanageable.”

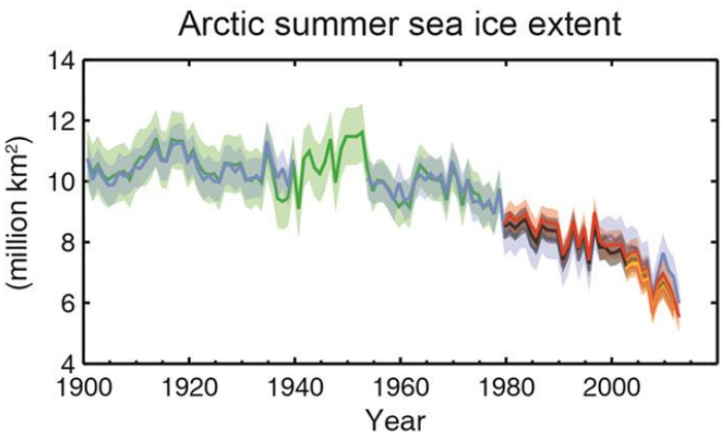
Key Climate Change Trends

- Warming temps/longer growing season
  - Increasing storm intensity/storm surges
  - Increased variability = uncertainty
- Melting









http://climate.nasa.gov/keyIndicators/ and IPCC AR5

The Complexities of Climate Change

- Extreme Climate Events
- Abrupt Climate Change
- Tipping Points and Thresholds
  - Physical and ecological

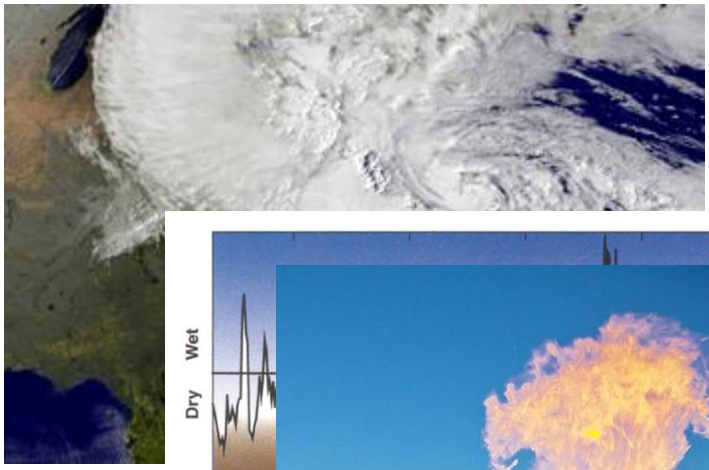


Fig. 2. Sa
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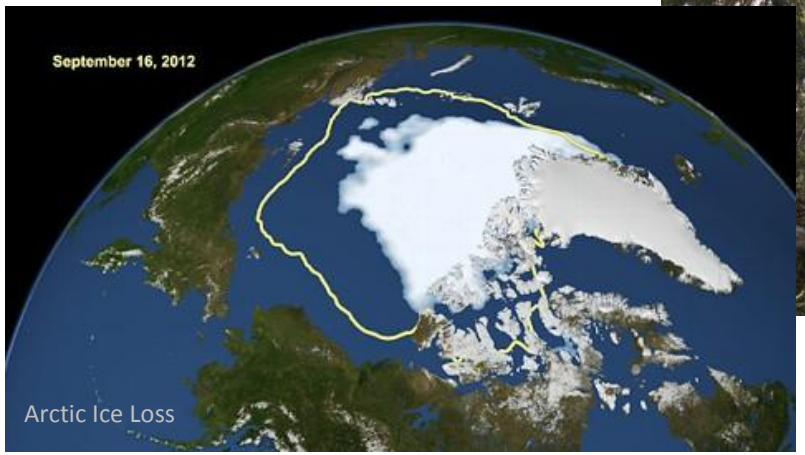
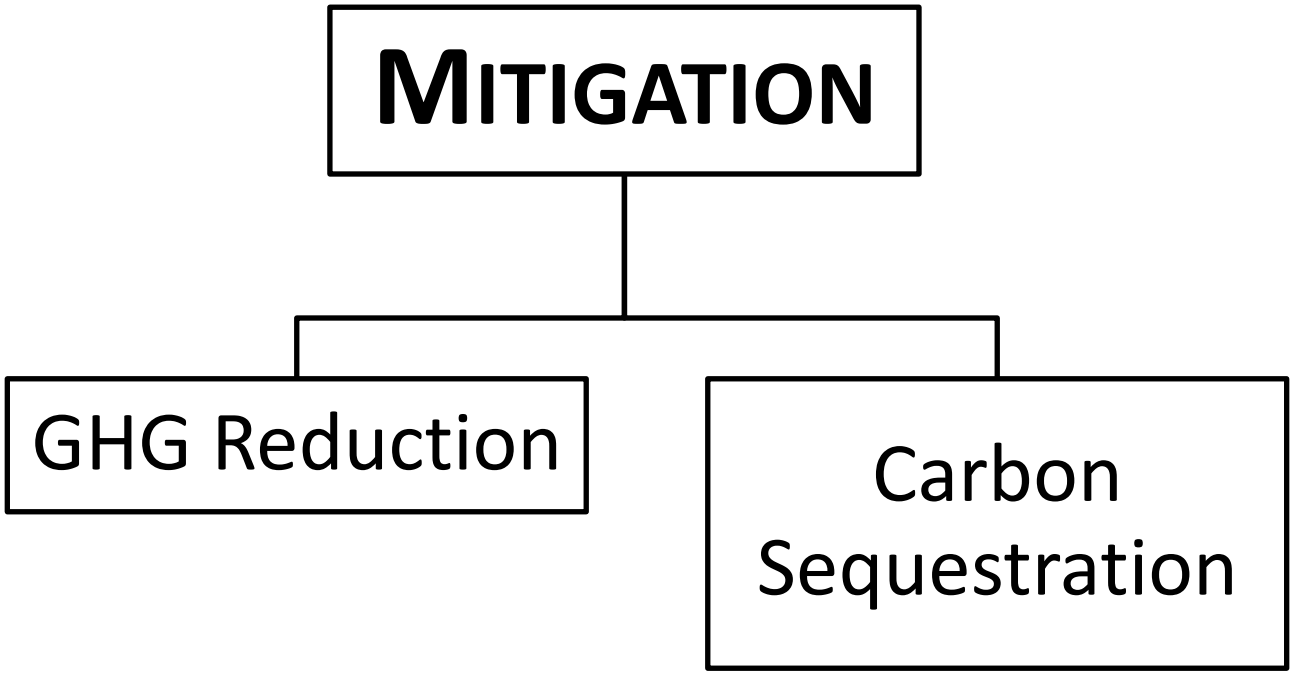
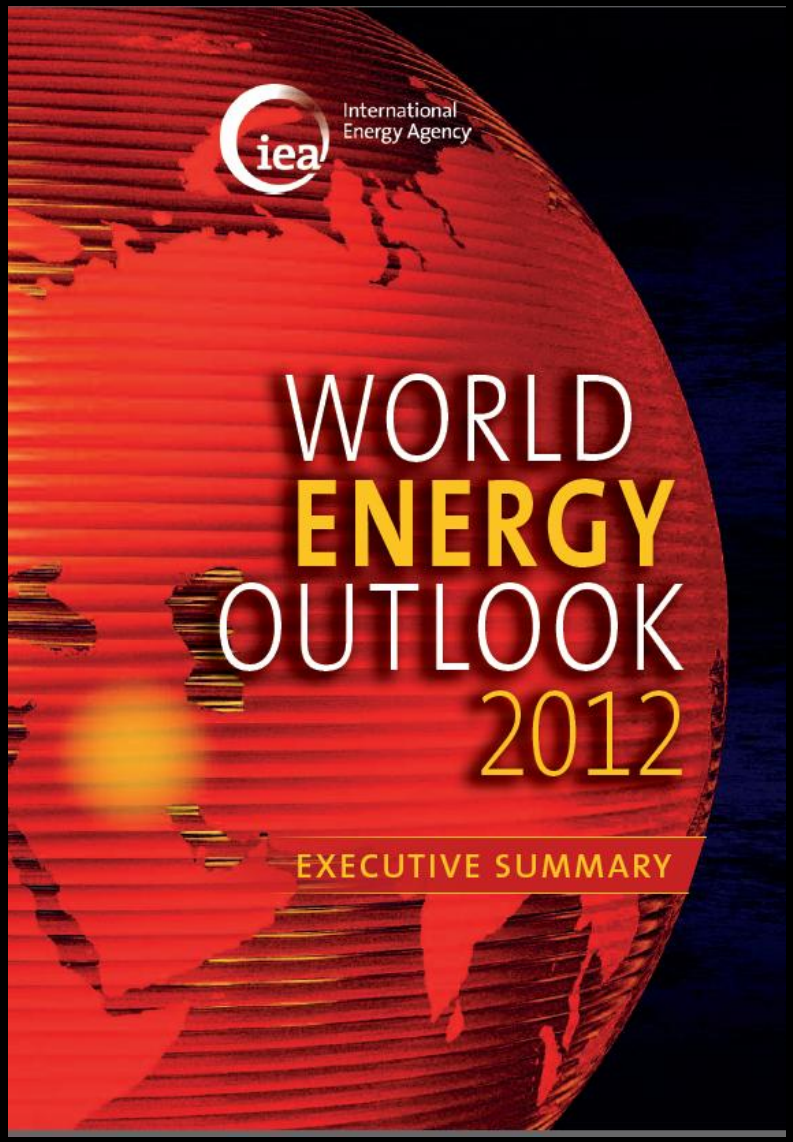


Climate Change Mitigation is …

"with respect to climate change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks."



IPCC 2007



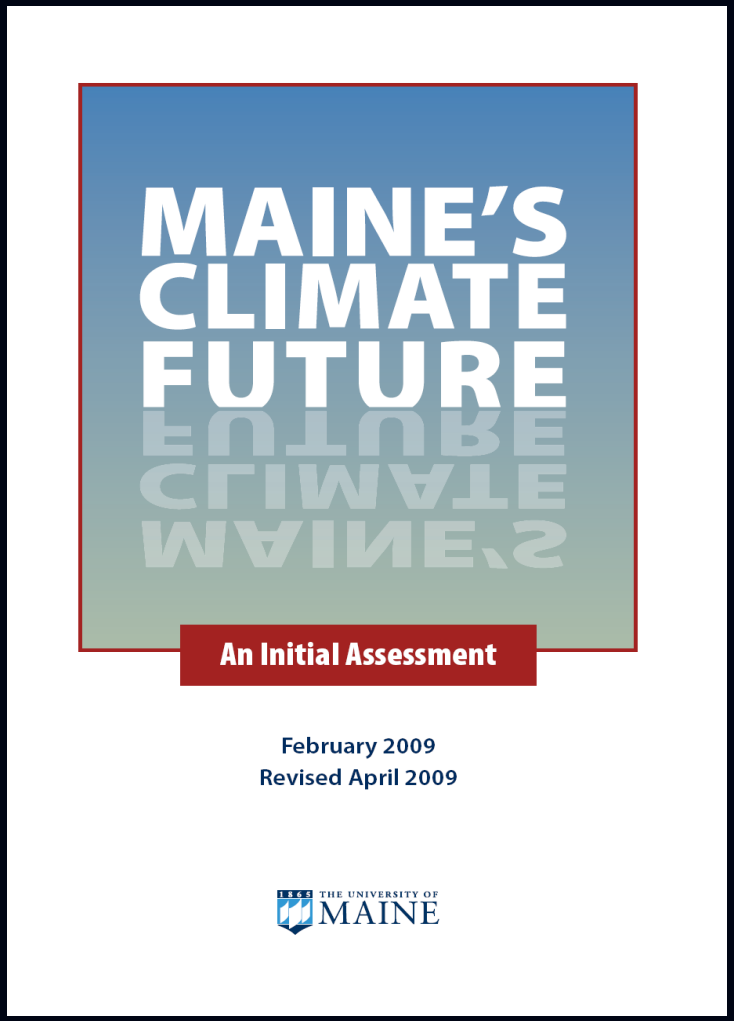
"**No more than one-third of proven reserves of fossil fuels can be consumed prior to 2050 if the world is to achieve the 2°C goal**, unless carbon capture and storage (CCS) technology is widely deployed."

Climate Change Adaptation is …

"adjustment in natural and human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."

A Maine Example

Maine Climate Change Assessment Report 2009



Initial Maine Climate Change Stakeholder Adaptation Report 2010

TOC for Full Report

TABLE OF CONTENTS

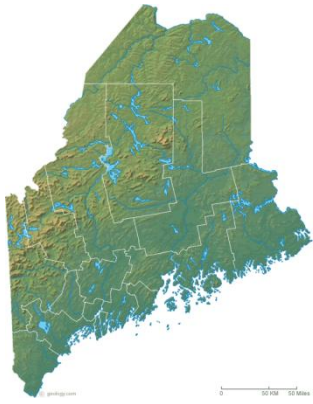
http://climatechange.umaine.edu/research/publications/climate-future

KEY QUESTIONS FOR MAINE TODAY

1. Is there evidence of ***climate change*** in Maine?

2. Is there evidence of climate change ***effects*** in Maine?

3. What do we do about it?!!



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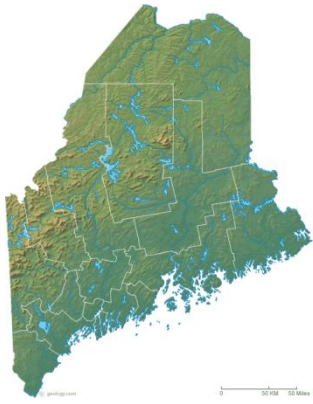
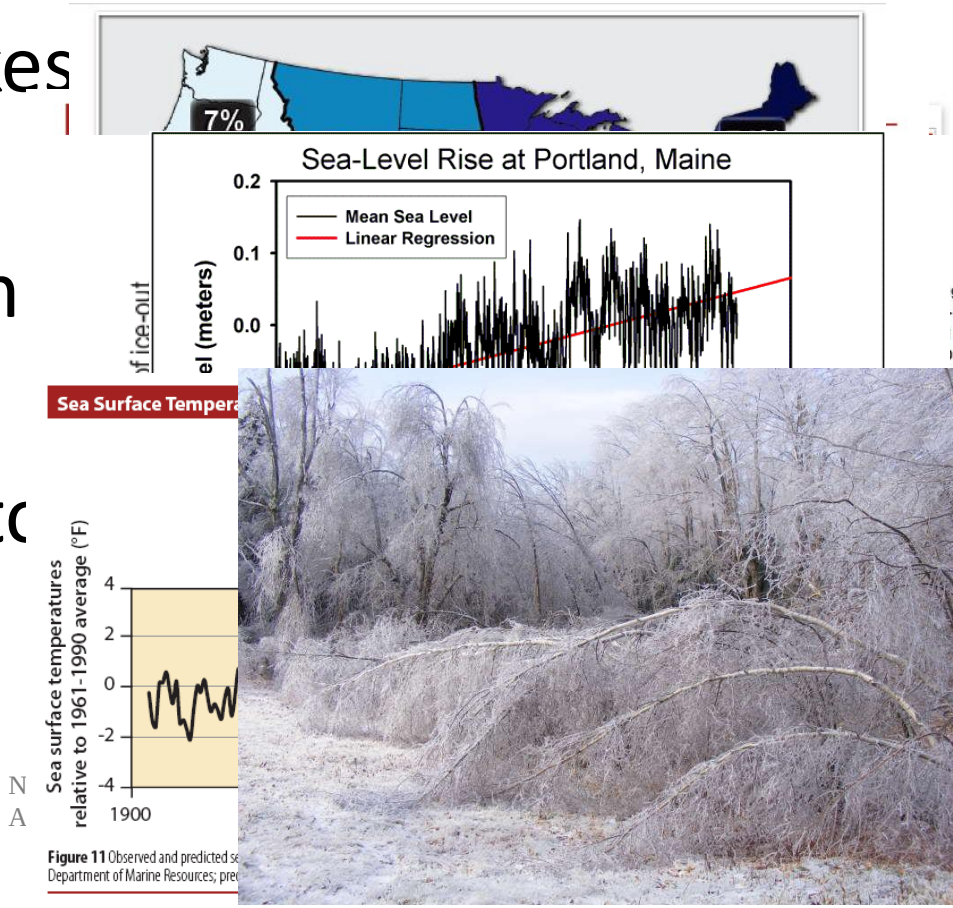


Yes, Maine has…

- Warming temperatures
- A longer growing season
- Increasing storm intensity/storm surges
- Earlier ice-out in lakes
- Rising sea level
- Warming ocean tem

…among other indicato



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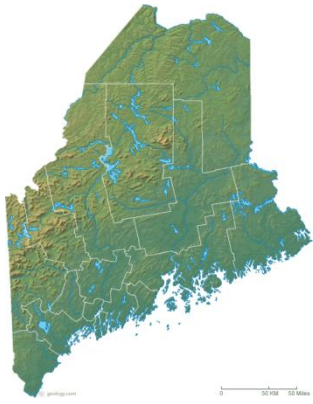


Climate Change Effects in Maine?

Human Health

- Lyme disease
- Heat stress/respiratory distress
- Allergies

Biodiversity

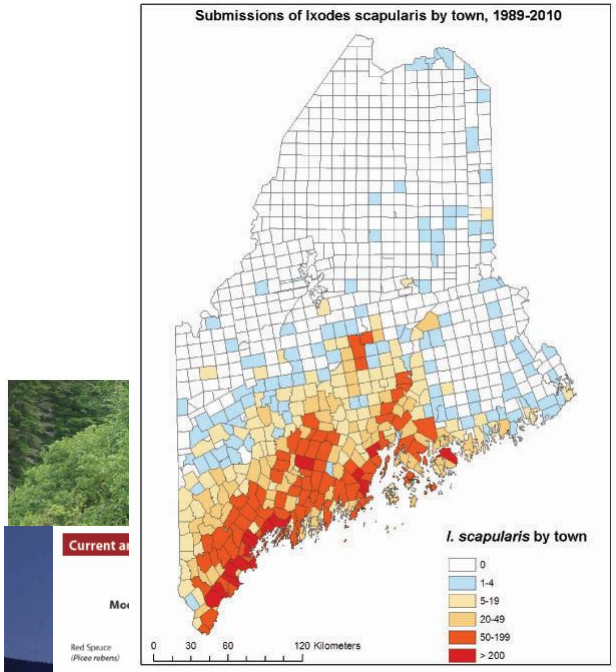
- Iconic species (salmon, moose, loon)
- Ranges, habitats, connectivity

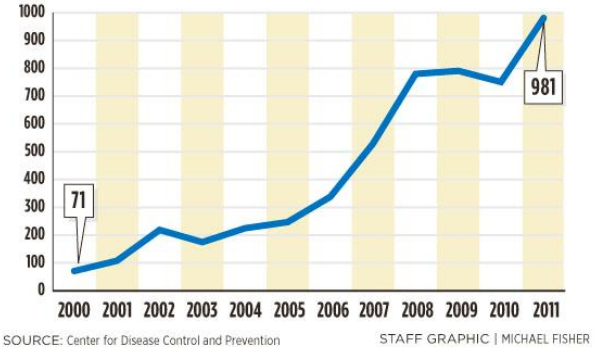
Recreation and Tourism

- Snow (ski industry, snowmobiles)
- Fish and game management (seasons, permits)
- Tourism seasonality

Forestry

- Species and growth rates
- Insects and disease
- Operability (roads, mud season, frozen ground)



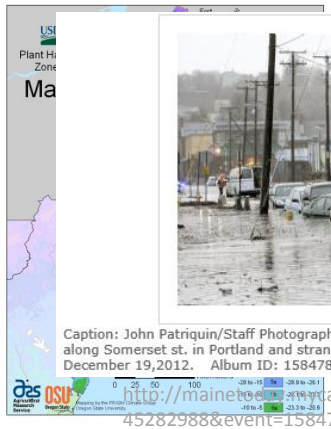


Climate Change Effects in Maine?

Marine Resources

- Warming waters, early lobster peak, depressed prices
- Warming waters, less ice = ↑green crabs, ↓shellfish
- Coastal community infrastructure

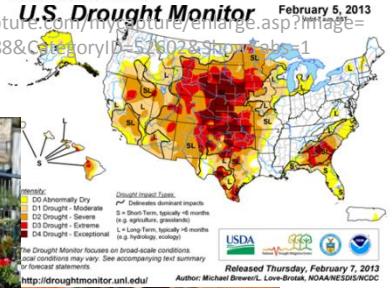
Agriculture (crops, ornamentals)



Caption: John Patriquin/Staff Photographer: A water main break added to heavy rain that caused flooding along Somerset st. in Portland and stranded at least one motorist on his way to work Wednesday, December 19,2012. Album ID: 1584788 Photo ID: 45282982

http://mainetoday.imagecapture.com/myGallery/enlarge.asp?image=45282988&event=1584788&CategoryID=52602&ShowTabs=1

- Longer growing seasons (risk AND opportunity!)
- Early spring/late frost risks are increasing
- Changing pest/pathogen pressures
- Irrigation and other infrastructure
- Dynamic and changing role of crop insurance
- All of the above, but somewhere else!
  - e.g., 2012 midwest drought vs Maine dairy



Towns and Cities

- Stormwater management
- Disaster relief (hurricanes, ice storms, floods)
- Food security

http://www.pressherald.com/home/Farmers_Markets.html

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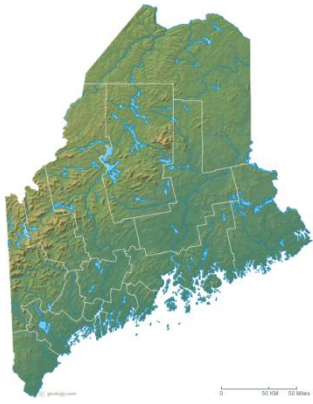
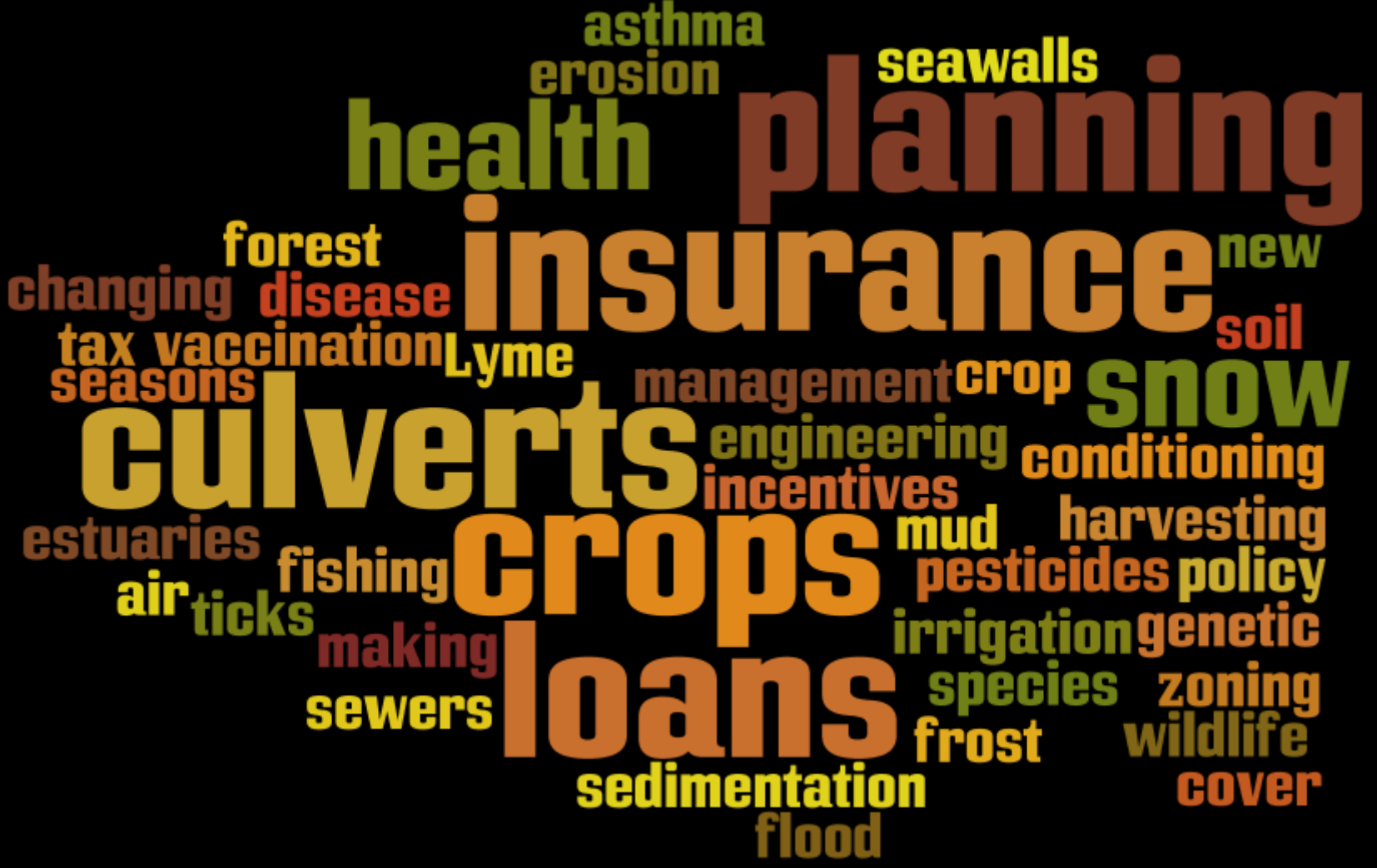


Thinking about "Adaptation"



Elements of a State Climate Change Adaptation Plan

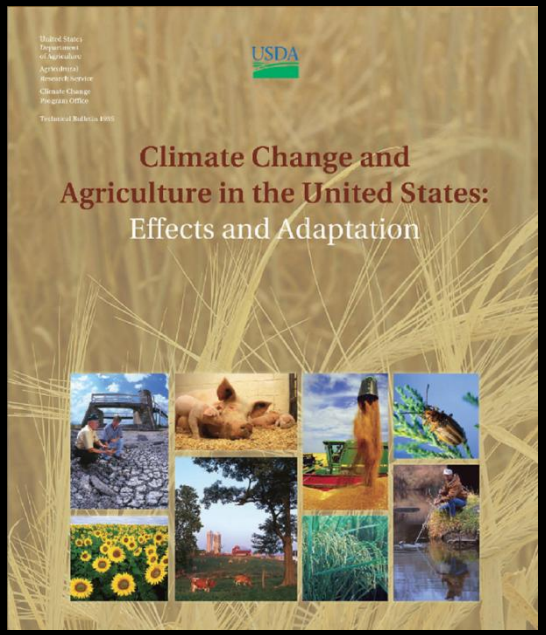
- Integrate Adaptation into **State Agency Planning and Activities**
  - Refocusing, Re-evaluating and Coordination
- Build **Community Resilience** to Climate Change
  - Food Systems, Human Health, Energy, Emergency Systems
- Improve **Access/Coordination of Science** for Decision-Making
- Develop Strategies to **Safeguard Natural Resources and Ecosystem Services** to Climate Change Effects
- Integrate Increasingly Dynamic **National and International Trends** into State Decision-Making

After the U.S. National Adaptation Strategy (ICC Adaptation Task Force 2011)

An Example of CC Adaptation Thinking

Sector = Agriculture

Driver = Insect Pests



ADAPTATION STRATEGIES	
Key Adaptation Driver	**Increased pest pressure, Novel pests**
Farm Production Practices	IPM practices, Resistant crop varieties and breeds, farmscaping
Farm Financial Management	Participate in insurance programs
Farm Infrastructure	Purchase improved application technologies, Pest protection structures
Technological Developments	Pest resistant crop varieties, IPM options and early warning information systems, Decision-support tools, Pest suppression technologies
Government Programs and Insurance	Insurance programs, Risk analysis, IPM and weather-based decision-making, Technical advice

From: Walthall, C.L., et al. 2012. Climate Change and Agriculture in the United States: Effects and Adaptation. USDA Technical Bulletin 1935. Washington, DC. page 121. (http://www.usda.gov/oce/climate_change/effects.htm)

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without bold action now, the warming planet threatens to put prosperity out of reach of millions and roll back
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U.S. NAVY

CLIMATE CHANGE ROADMAP

April 2010

This document is sponsored by:

Task Force Climate Change / Oceanographer of the Navy

There are six slow-acting drivers of historical change in our time, as in most of recorded history. A common error is to focus on only one. They are:

1. Technological innovation;
2. The spread of ideas and institutions;
3. The tendency of even good political systems to degenerate;
4. Demographics;
5. Supplies of essential commodities;
6. **Climate change.**

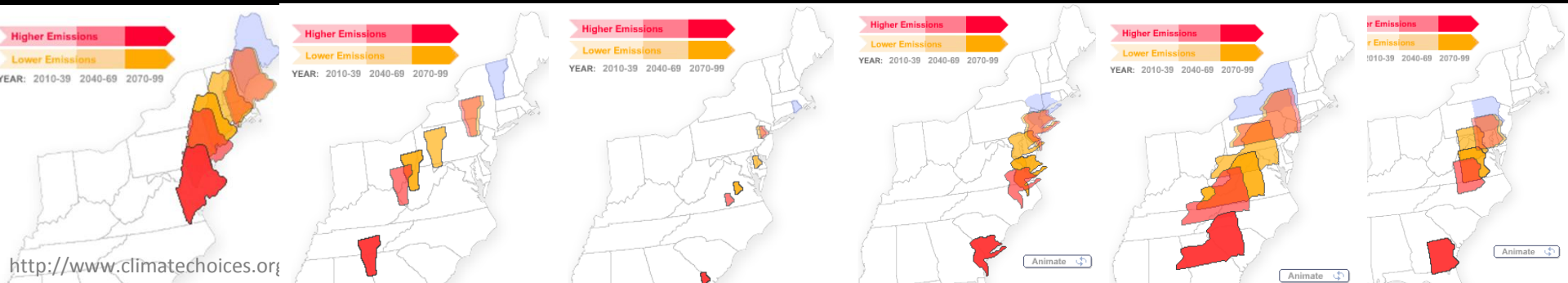

The New York Times
The Opinion Pages
WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION
GLOBAL AGENDA | POLITICS
Turning Points
By NIALL FERGUSON
Published: November 30, 2012

Niall Ferguson

http://www.nytimes.com/2012/11/30/opinion/global/niall-ferguson-turning-points.html?emc=eta1&_r=0

Closing Thoughts

- Land grants are **place-based**, and places are 'moving'!
- The often **local** emphasis of our expertise means that what we know,
  - no longer is quite as good,
  - the **speed** at which we learn is no longer quite as adequate (shifting plant hardiness zones, migrating species, pests and disease).
- As we have tried to do more with less, we have become more efficient at transferring the **accumulated knowledge** of the last century. However, climate change is more than a Facebook page challenge.



The 21st Century Land Grant University?

- More than agriculture and the mechanic arts.
  - Modern Land Grants are addressing food and fiber, energy, health and nutrition, biodiversity, economics, and municipal issues in a framework of coupled social-ecological systems.

- The mandate of sustainability.
  - Many achievements of the 20th century would not survive this filter, and the demands in the 21st century of a planet with 9+ billion people will be greater.

- Traditional (vertical) disciplines should support or be subsumed within horizontal frameworks (e.g., climate change!) – a trend opposed by the status quo in a shrinking funding base.

- Organized around societies 'grand challenges', not something for everyone. The Experiment Stations and Cooperative Extension can be the organizing framework for their home universities and states, not just legislative carryovers from an agrarian economy.

Partially drawn from CSA News, 9/2013

In Conclusion

The 21st century challenges Land-Grant universities with the opportunity for an informed response to the slow motion disaster known as "climate change". We can:

1. Provide **solutions** to new problems, **communicate** that information, and help **implement** solutions in effective and timely ways;

2. provide frameworks to capitalize on **new opportunities** that emerge; and

3. demonstrate to American society the **value** of their long-term investments in the Land-Grant system.

…Are we ready?

Thank you.