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

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
Some 20th Century Air Pollution Issues

- CFCs – Montreal Protocol 1987
- Sulfur in Acid Rain – CAA reauth. 1990
- Greenhouse Gas Emissions?
800,000 Years of CO₂ Concentrations

- 2100 Higher Emissions Scenario (A2)
- 2100 Lower Emissions Scenario (B1)
- 2008 Observed

Carbon Dioxide Concentration (ppm)

Years (thousands)
Why are we beyond “Climate Change” the issue?

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

Alley et al. Science 2003

Trapped Methane (UA)

Drunken Forests (Canada)

Arctic Ice Loss
Climate Change Mitigation is ...

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

\[ \text{MITIGATION} \]

\[ \text{GHG Reduction} \]

\[ \text{Carbon Sequestration} \]
“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

Maine’s Climate Future

An Initial Assessment

February 2009
Revised April 2009

The University of Maine

Initial Maine Climate Change Stakeholder Adaptation Report 2010

People and Nature
Adapting to a Changing Climate
Charting Maine’s Course

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**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?!!
**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?!!
Yes, Maine has...

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

...among other indicators.
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?!!
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)

- 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
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?!!
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**

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

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.
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.

http://www.climatechoices.org/ne/impacts_ne/climates_vermont.html
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
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.