2012 Regional Climate Change Scenario Development Workshop

RACC
Research on Adaptation to Climate Change

The Future of Agriculture in Vermont

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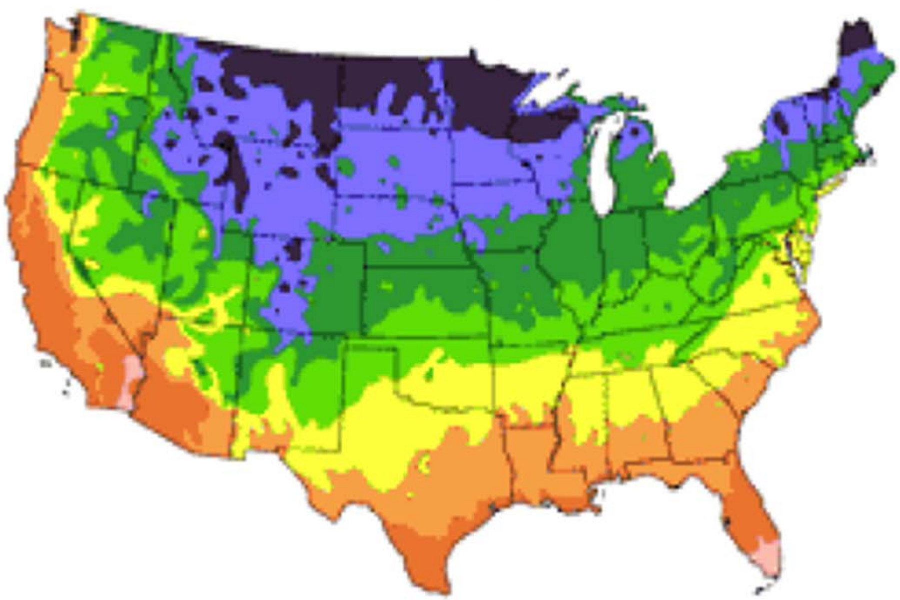
The New “Plant Hardiness Zone Map”

Climate change is already here
(maps based on minimum winter temperatures; prior 15 years of weather station record)

Source: www.arborday.org

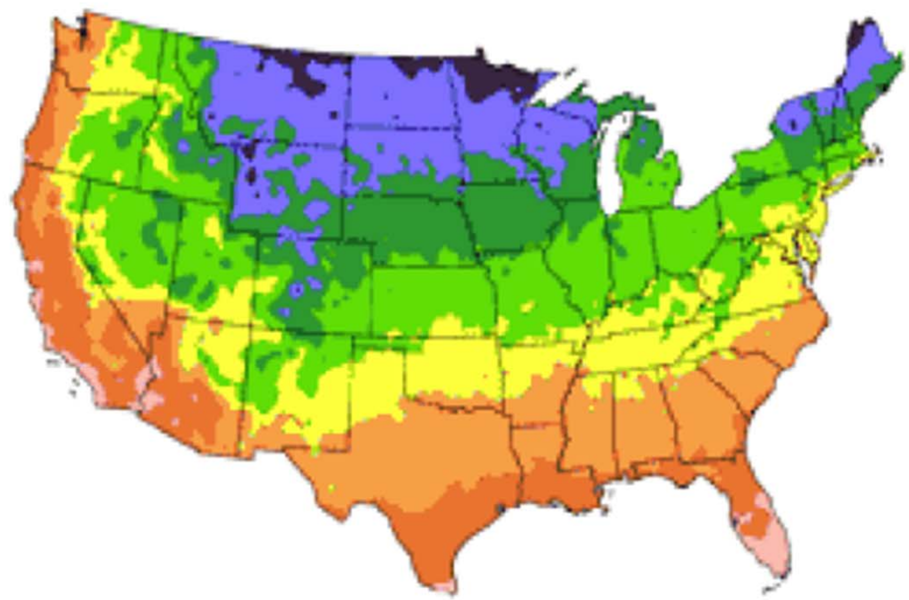
Zone	Avg. Annual Low
2	-40° through -50°
3	-30° through -40°
4	-20° through -30°
5	-10° through -20°
6	0° through -10°
7	10° through 0°
8	20° through 10°
9	30° through 20°
10	40° through 30°

1990 Map



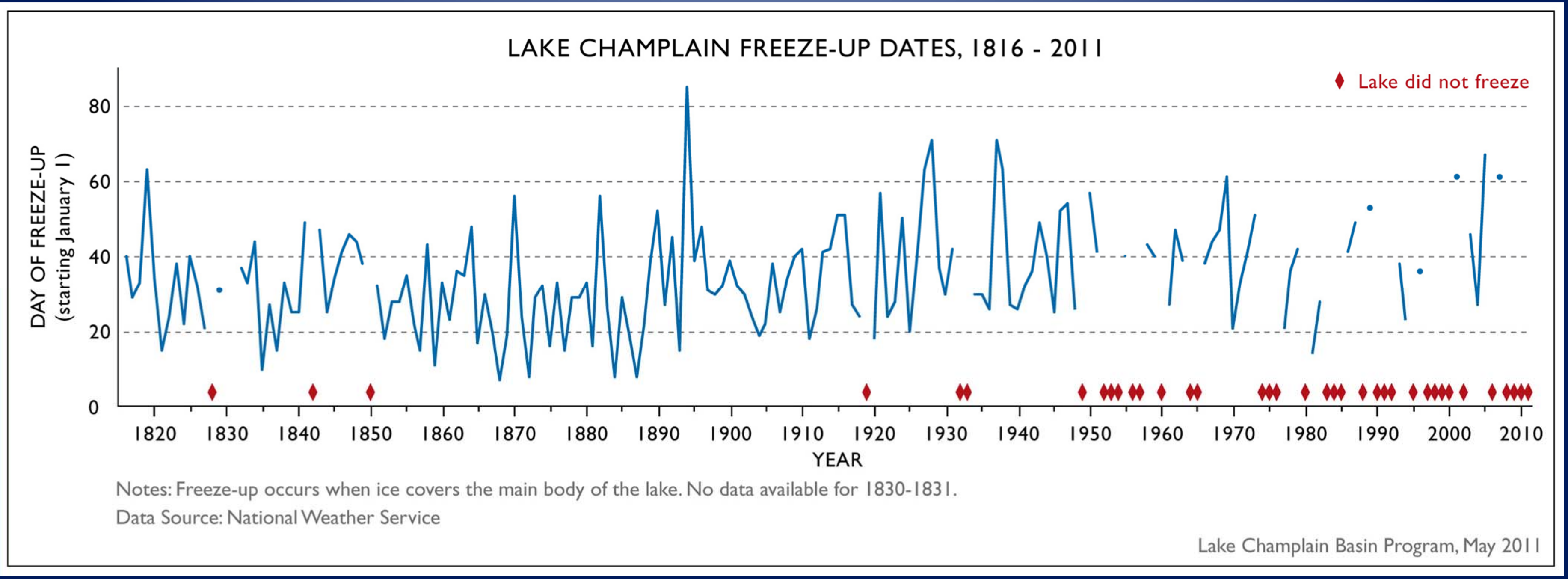
After USDA Plant Hardiness Zone Map, USDA Miscellaneous Publication No. 1475, Issued January 1990.

2006 Map

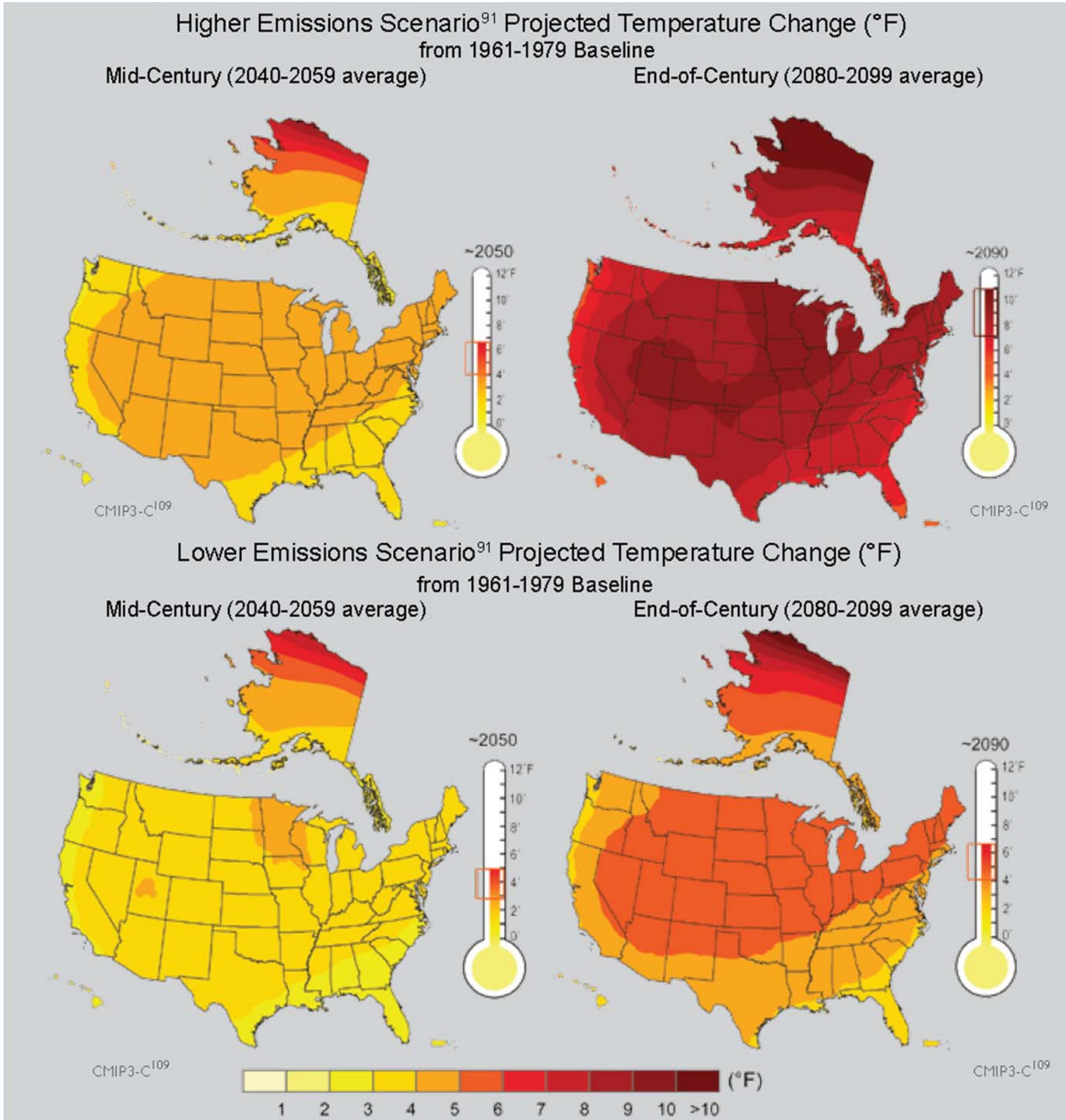


National Arbor Day Foundation Plant Hardiness Zone Map published in 2006.

Changes in the Champlain Valley



The average annual air temperature in the region increased by 2.1° F (1.2° C) from 1976 to 2005 (Stager and Thill 2010).

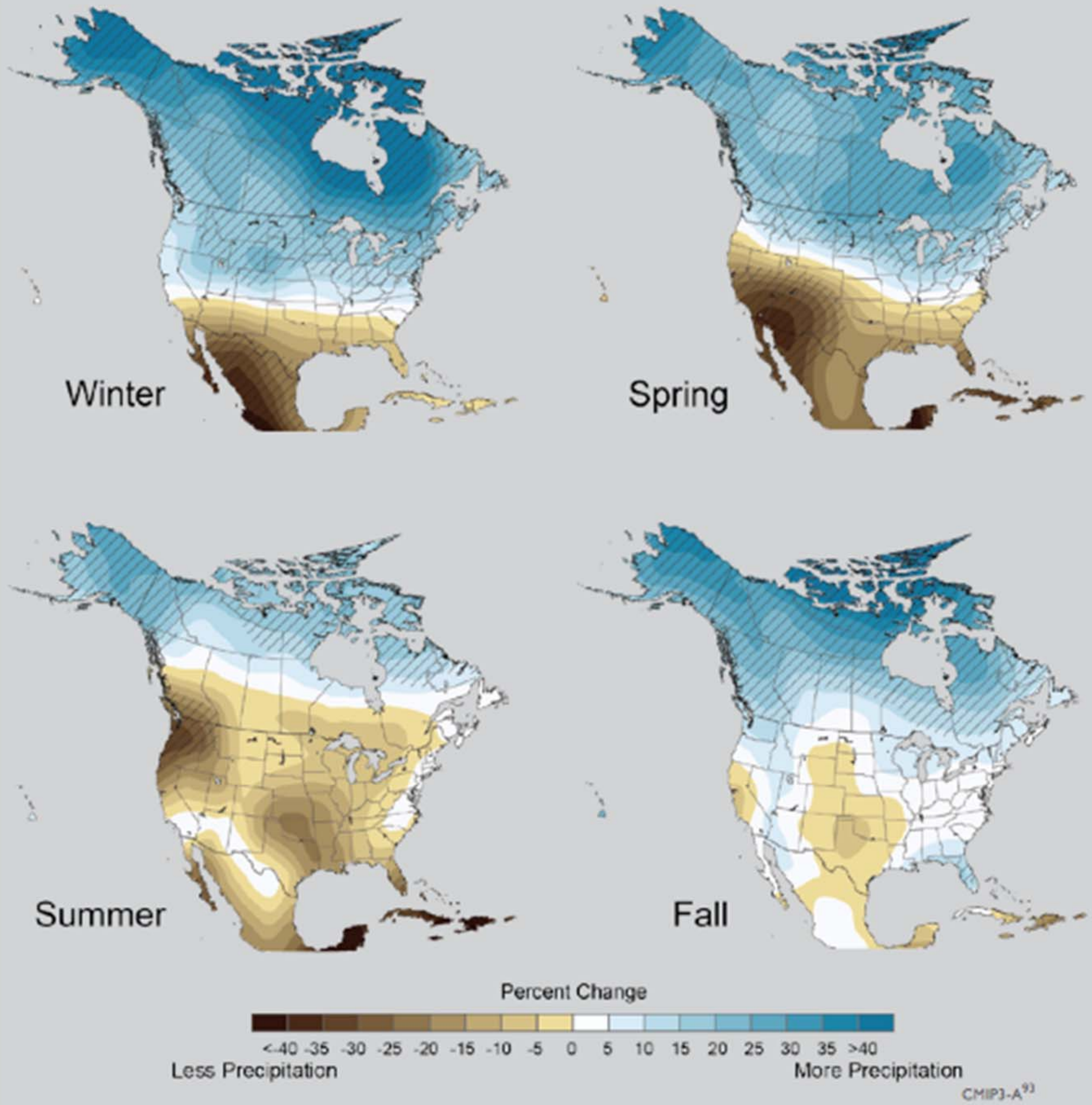


The maps on this page and the previous page are based on projections of future temperature by 16 of the Coupled Model Intercomparison Project Three (CMIP3) climate models using two emissions scenarios from the Intergovernmental Panel on Climate Change (IPCC), *Special Report on Emission Scenarios* (SRES).[91] The "lower" scenario here is B1, while the "higher" is A2.[91] The brackets on the thermometers represent the likely range of model projections, though lower or higher outcomes are possible. Additional information on these scenarios is on pages 22 and 23 in the previous section, *Global Climate Change*. These maps, and others in this report, show projections at national, regional, and sub-regional scales, using well-established techniques.[110]

United States Global Change Research Program

www.globalchange.gov/usimpacts

Projected Change in North American Precipitation
by 2080-2099



The maps show projected future changes in precipitation relative to the recent past as simulated by 15 climate models. The simulations are for late this century, under a higher emissions scenario.[91] For example, in the spring, climate models agree that northern areas are likely to get wetter, and southern areas drier. There is less confidence in exactly where the transition between wetter and drier areas will occur. Confidence in the projected changes is highest in the hatched areas.

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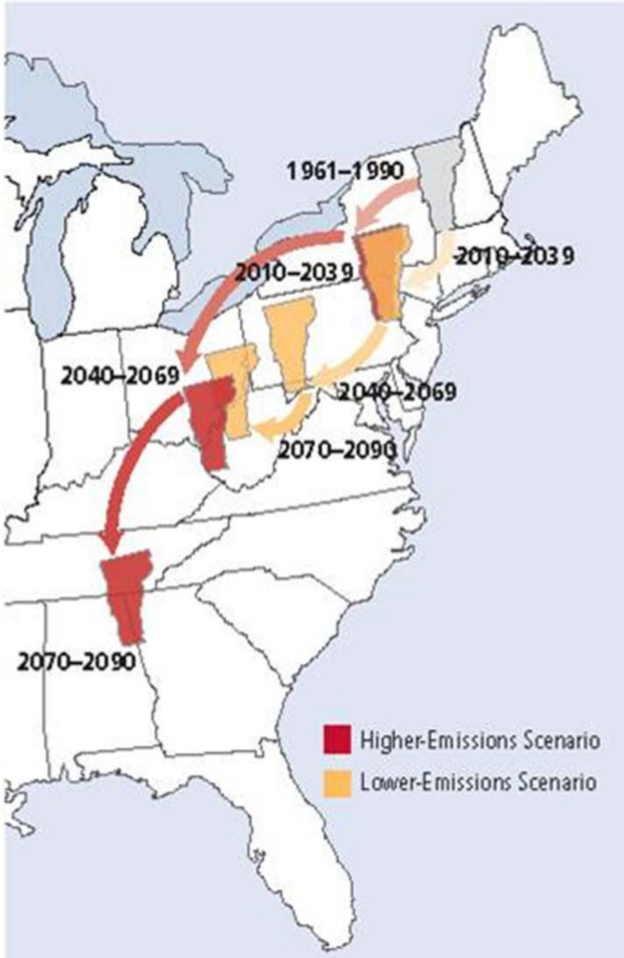
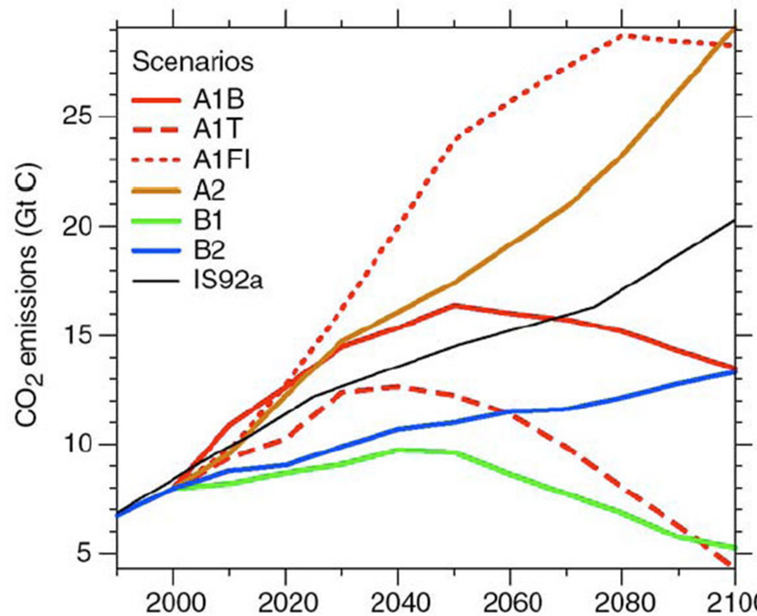
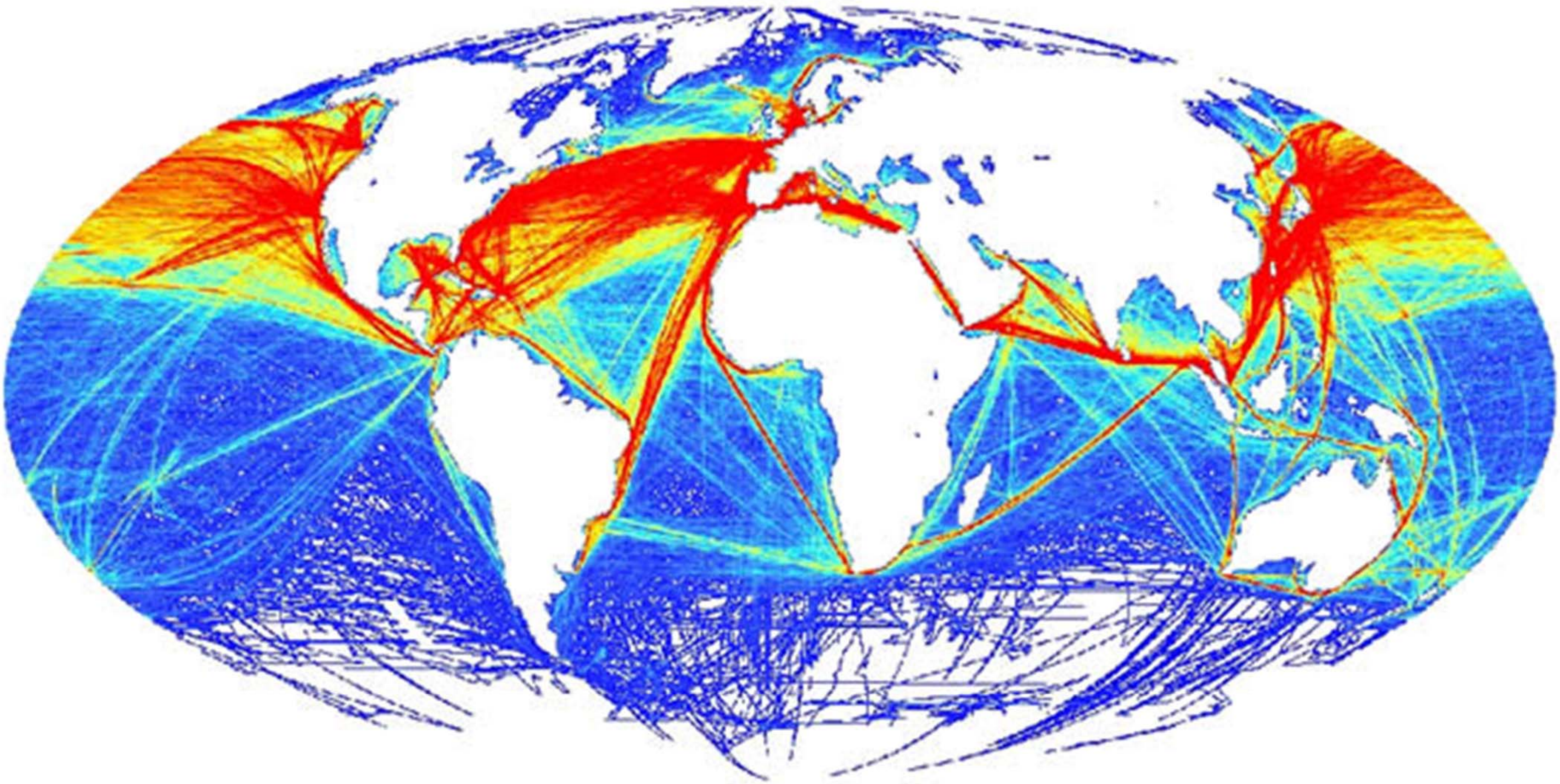


Migrating State Climate

Changes in average summer heat index—a measure of how hot it actually feels, given temperature and humidity—could strongly affect quality of life in the future for residents of Vermont. Red arrows track what summers in Vermont could feel like over the course of the century under the higher-emissions scenario. Yellow arrows track what summers in the state could feel like under the lower-emissions scenario.



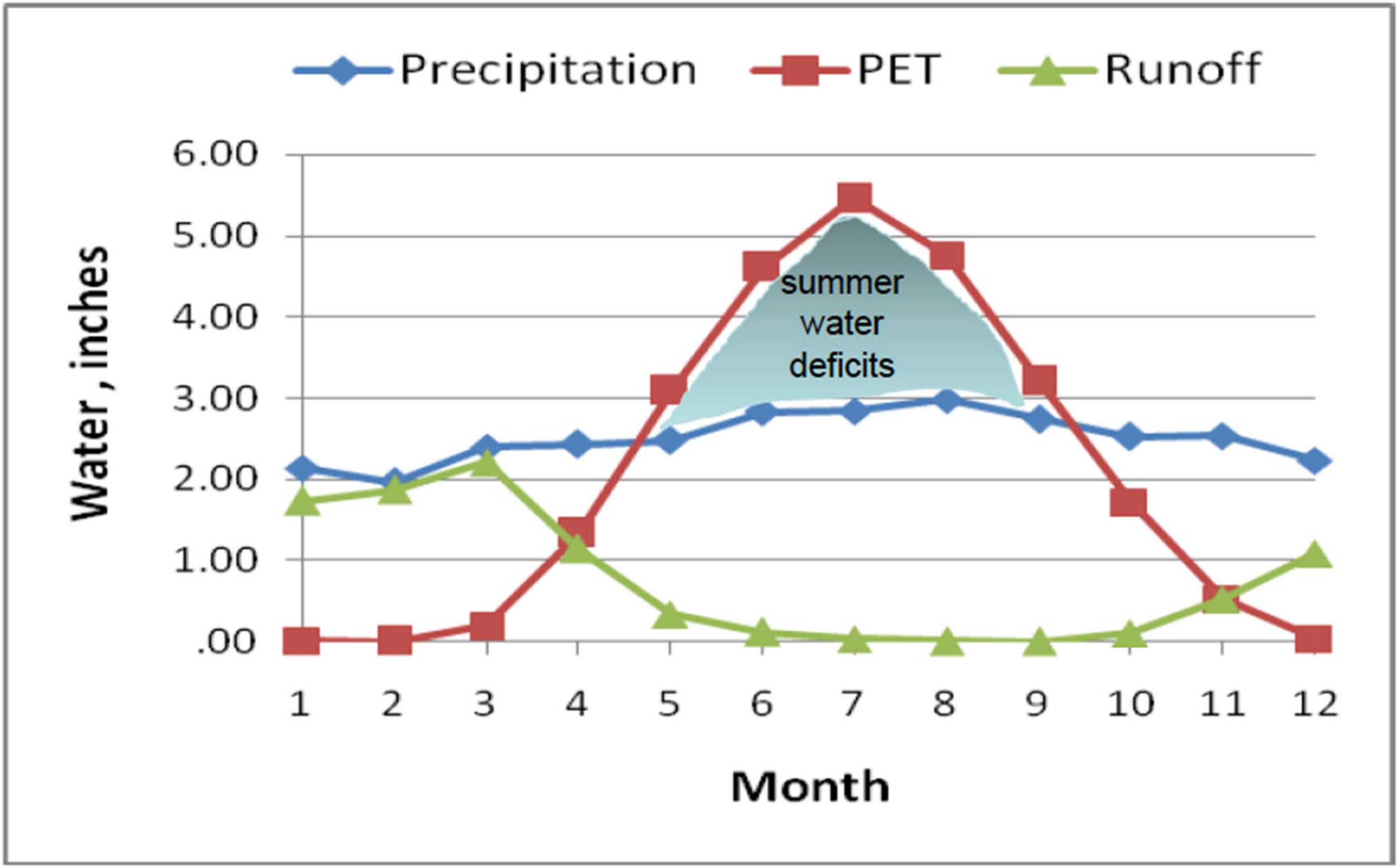


Global Marine Activity (Shipping)

from http://www.nceas.ucsb.edu/GlobalMarine/impacts

Water Management Challenges:

Summer rainfall does not meet crop water needs (Potential Evapotranspiration, PET) today, and this will get worse as summers become warmer



Historical data for Rochester, NY

Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change

Wolfram Schlenker[a,1] and Michael J. Roberts[b] PNAS **September 15, 2009 vol. 106 no. 37**

"Even if we reduce emissions by 50 per cent by 2050 relative to 1991 levels …yields could still fall by between 30 and 46 per cent."

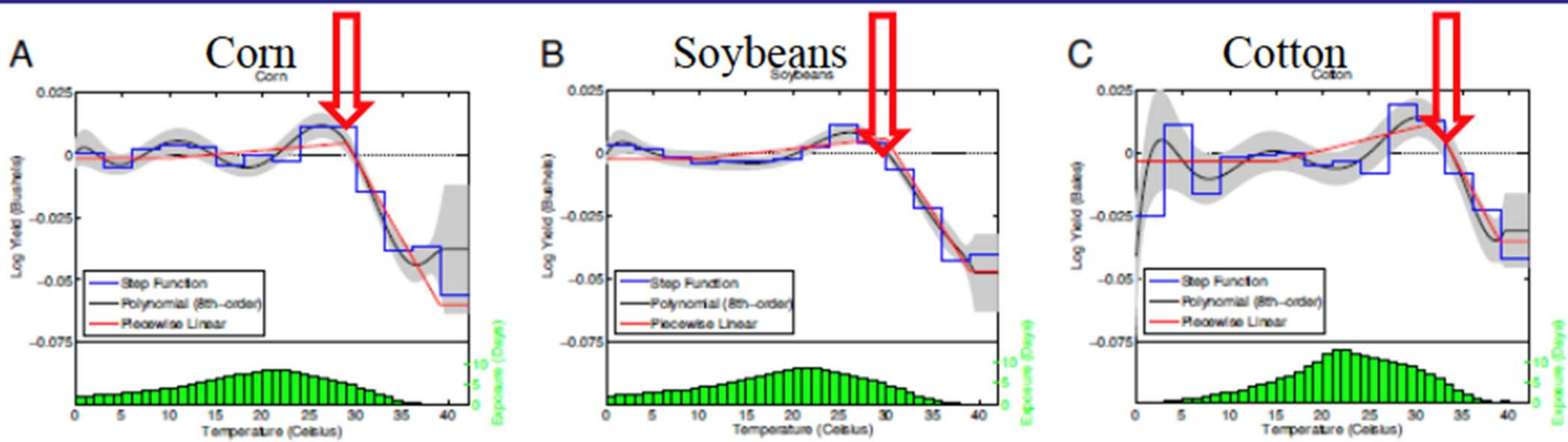


Fig. 1. Nonlinear relation between temperature and yields. Graphs at the top of each frame display changes in log yield if the crop is exposed for one day to a particular 1° C temperature interval where we sum the fraction of a day during which temperatures fall within each interval. The 95% confidence band, after adjusting for spatial correlation, is added as gray area for the polynomial regression. Curves are centered so that the exposure-weighted impact is zero. Histograms at the bottom of each frame display the average temperature exposure among all counties in the data.

Effects to the North

Palliser triangle currently produces most of Canada’s highest quality number 1 hard red spring wheat

General circulation models predict that if warming continues at current rates, this region will be suitable only for livestock grazing (D. Smith, McGill Univ.)

Climate Change: Being Prepared Makes Good Business Sense

- Take advantage of changing market opportunities
- Strategic decisions regarding capital investments such as:
  a) New irrigation and drainage systems
  b) Livestock facilities with adequate cooling capacity
  a) Planting appropriate perennial fruit crop varieties

Climate Change: Being Prepared Makes Good Business Sense

- **Anticipate new weed, disease, insect pests**
- **Avoid unintended consequences, such as:**
  a) **Increased chemical loads to waterways**
  b) **Undesirable land use change and degradation**

Climate Change: Being Prepared Makes Good Business Sense

- **Support sound nutrient management practices**
  No till
  Manure injection
  Biodigester – processing solid byproducts

- **Opportunities for research**
  All levels of the Food System

Climate Change: Being Prepared Makes Good Business Sense

- Promote policies that support farmer needs for adaptation and mitigation
- Taking advantage of energy policy incentive programs or emerging carbon markets
- Protect national interests: ageconomy, food prices, food security

Climate Change: Being Prepared Makes Good Business Sense

- **Build resilience into the Food System**
  - Research (all levels)
  - Outreach
  - Partnerships (everyone)