Climate Smart Farming: New Practices and Tools to Prepare for Climate Variability and Extreme Weather

2016 Empire State Producers Expo
January 21, 2016, Rooms 4-6
Oncenter Convention Center, Syracuse, NY

Session Organized By:
Allison Chatrchyan, Cornell University
Laura McDermott, CCE Eastern NY Commercial Horticulture Program and CSF Team
and Darcy Telenko, CCE Cornell Vegetable Program and CSF Extension Team

Cornell University

Welcome

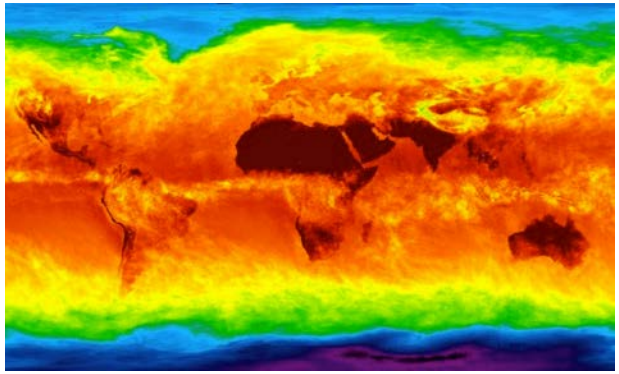
- Introductions
- Key Questions for the Session:
  - How have extreme weather events or climate change affected your farming operation?
  - What new tools and resources are being developed to help agricultural producers in the Northeast, and what is needed?

Session Outline

- 9:00am: Climate Science and Impacts to Agriculture in the Northeast
- 9:30am: Farmer Panel: Darcy Telenko
  - Larry Eckhardt, Kinderhook Creek Farm, Stephentown, NY
  - Peter Ten Eyck, Indian Ladder Farms, Altamont, NY
  - Mark Zittel, Amos Zittel and Sons, Hamburg, NY
- 10:10am: Climate Smart Farming Resources and Decision Support Tools
- 10:40am: Questions and Discussion

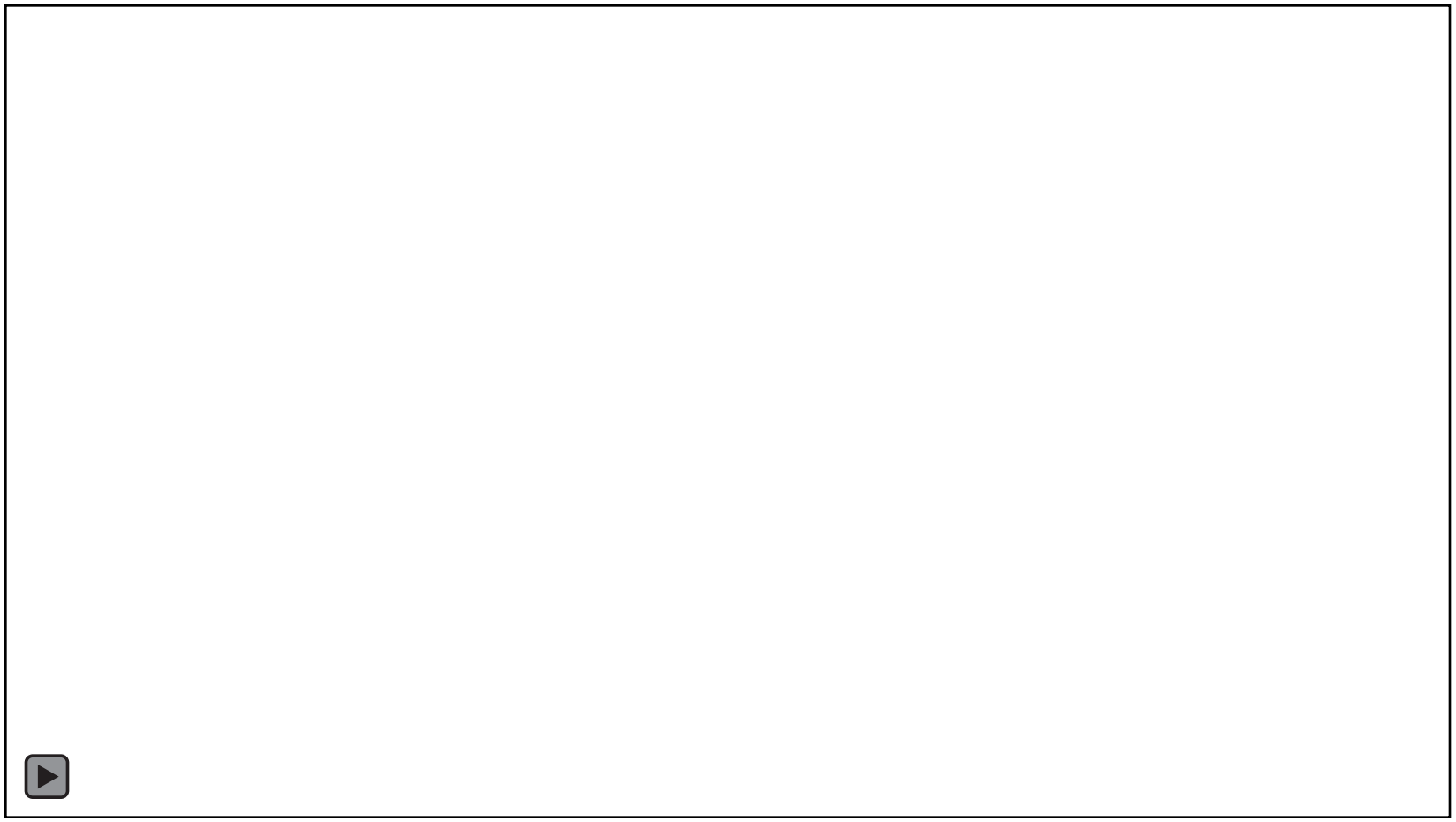
The Changing Climate…

- 1.5°F increase globally in temperatures since 1880
- US average temp has increased 1.3°F to 1.9°F since 1895, most of the increase since 1970
- Warmest five years: 2011-2015
- Hottest year ever recorded: 2015
- Longer summers, warmer winters
- Business as Usual = +4°F to 10°F by 2100
- The last ice age was 8°F colder



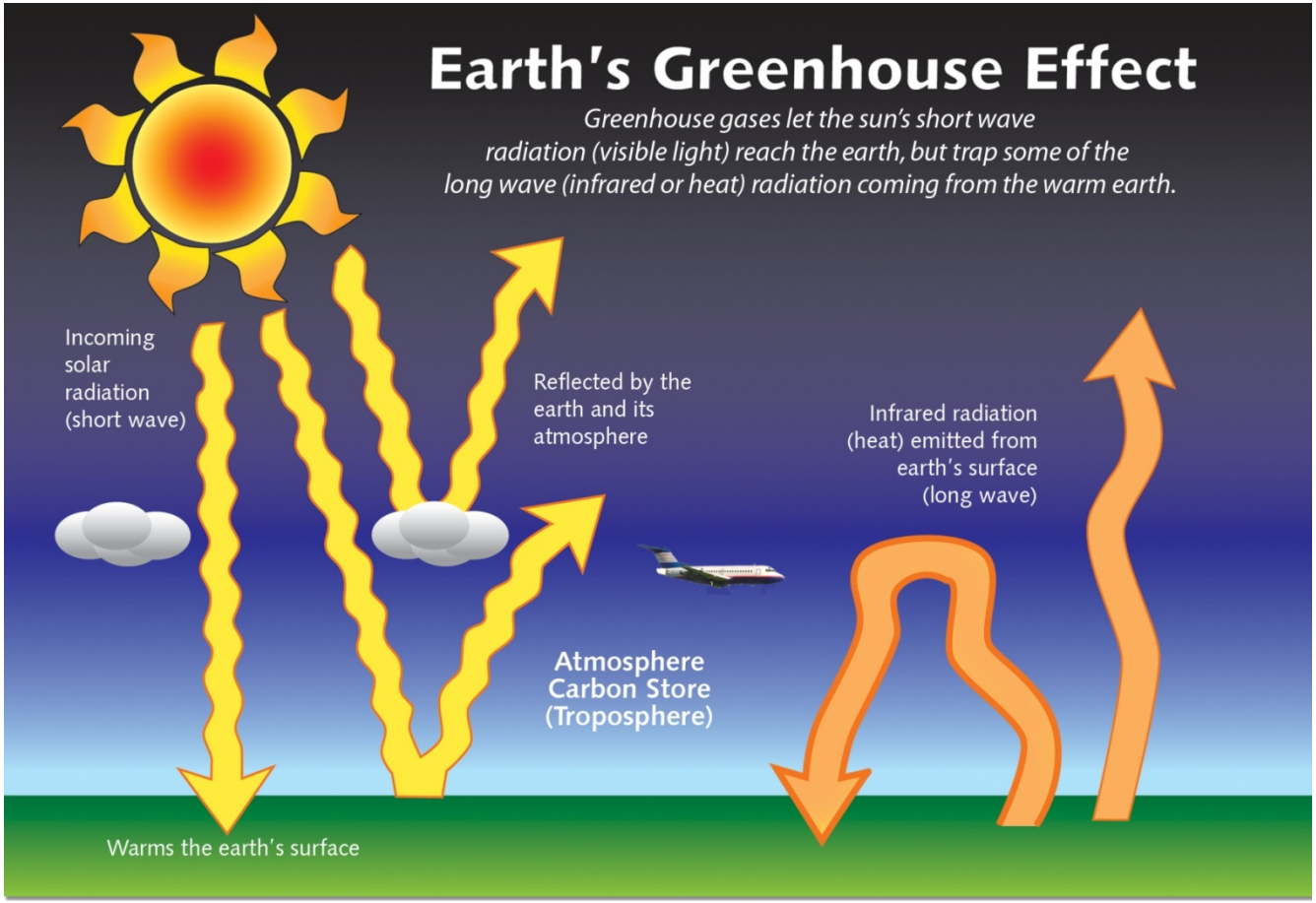
= A Real Challenge

NASA, NOAA Analyses Reveal Record-Shattering Global Warm Temperatures in 2015



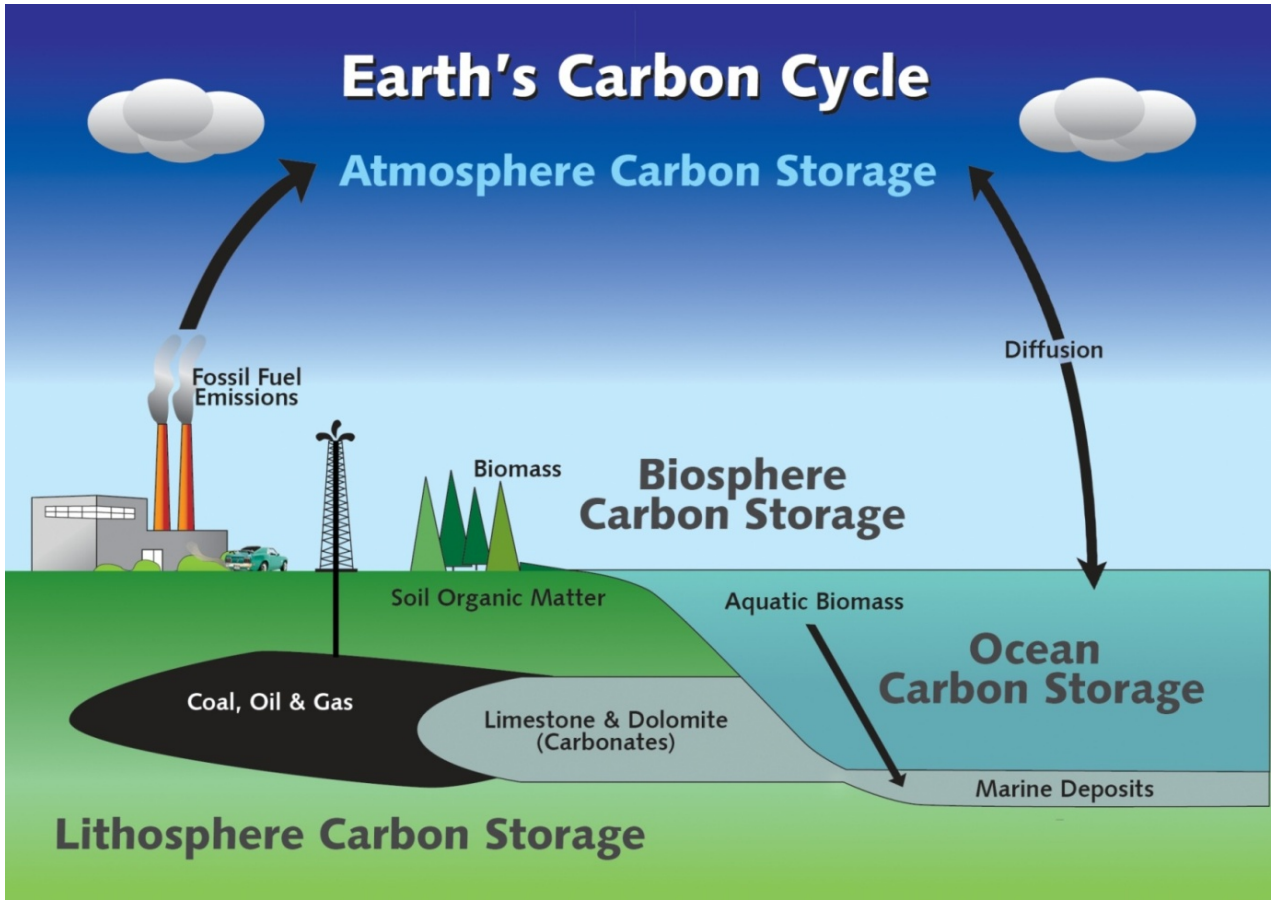
www.nasa.gov: https://youtu.be/gGOzHVUQCw0 (posted January 20, 2016)

Greenhouse Gases Trap Excess Heat in the Earth's System

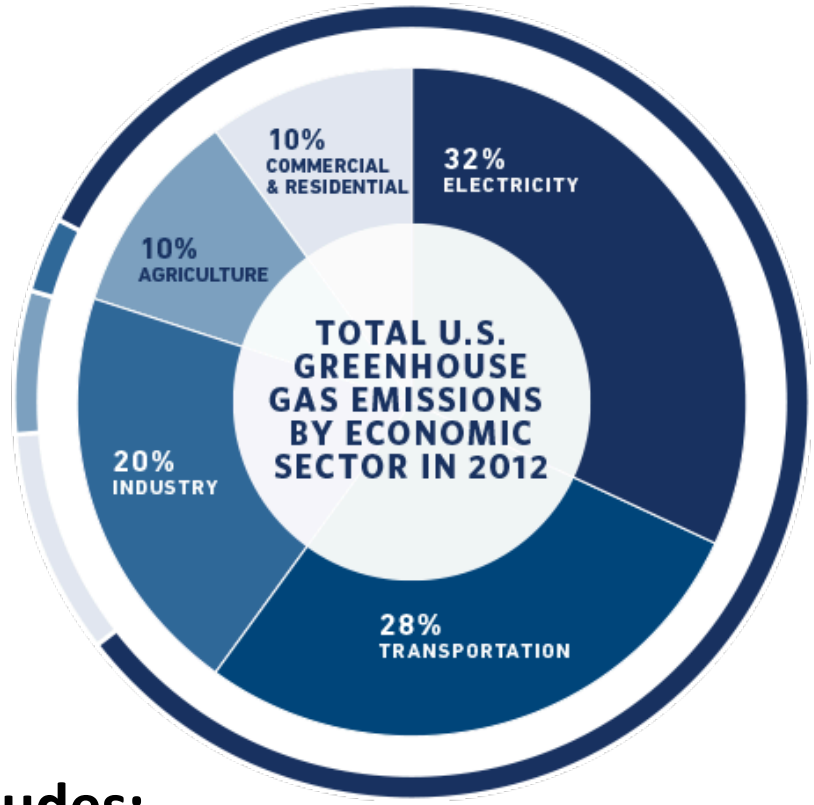


Source: http://www.dec.ny.gov/energy/63848.html

Long-Stored Carbon is Moving into the Atmosphere



Source: http://www.dec.ny.gov/energy/76572.html



US GHG Pollution Includes:

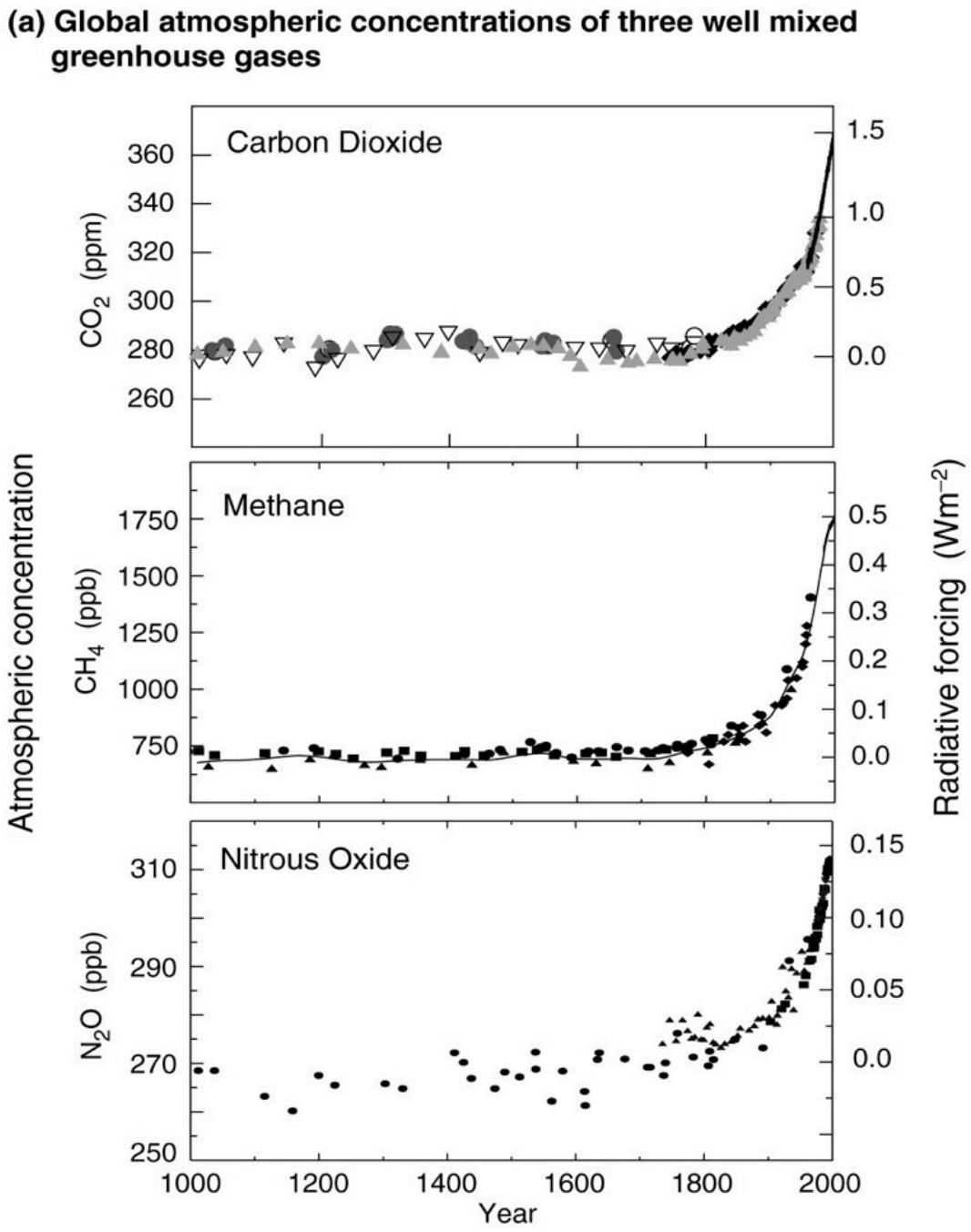
- Carbon Dioxide (CO_2), 82%
- Methane (CH_4), 9%
- Nitrous Oxide (N_2O), 6%
- Fluorinated Gases, 3%
- Source: EPA

Greenhouse Gases:

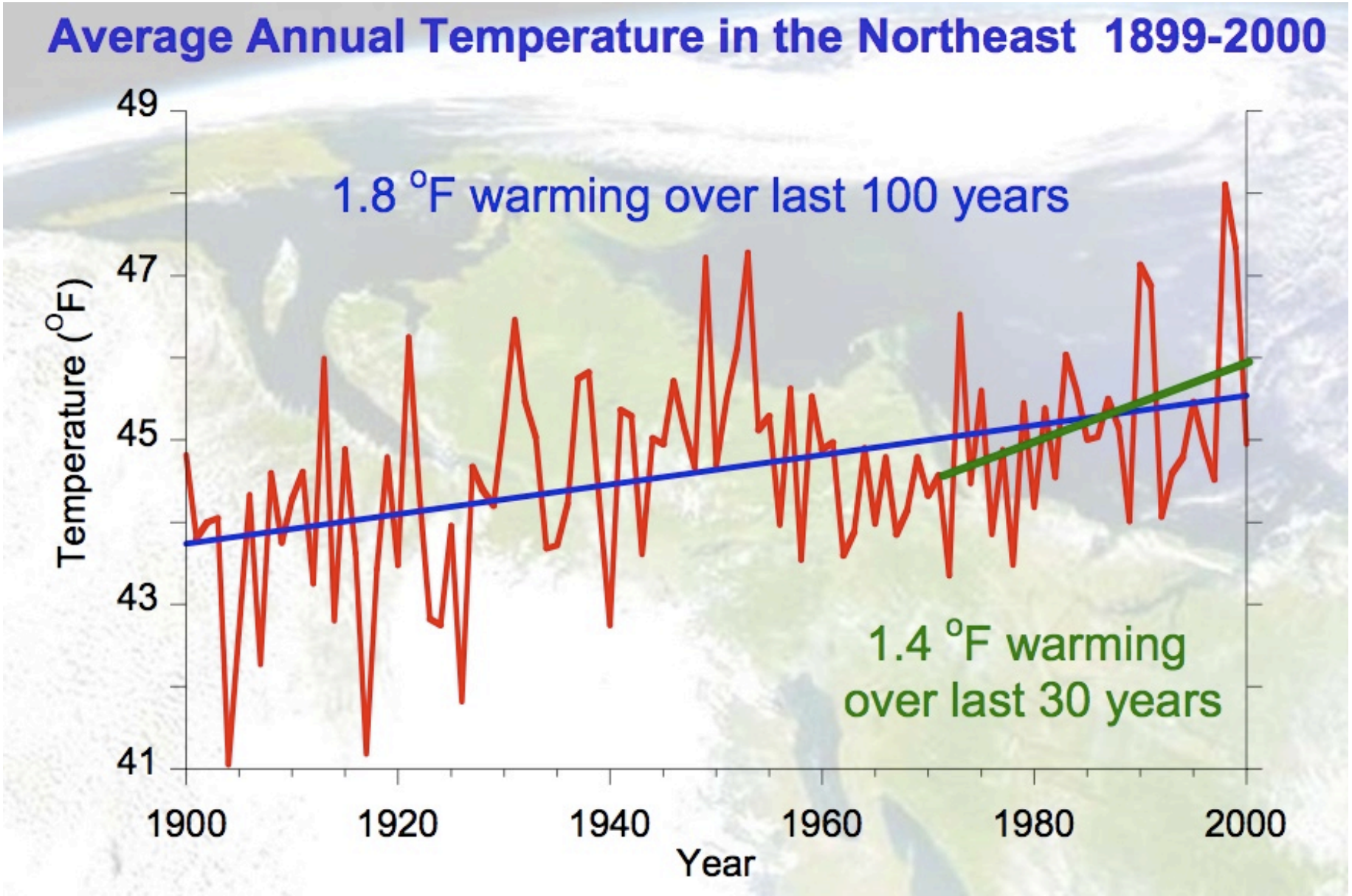
CO_2 Concentrations:

- 1800: 270 ppm
- 2014: 402 ppm*
- 2100: 900+ ppm
- ^{12}C from fossil fuels

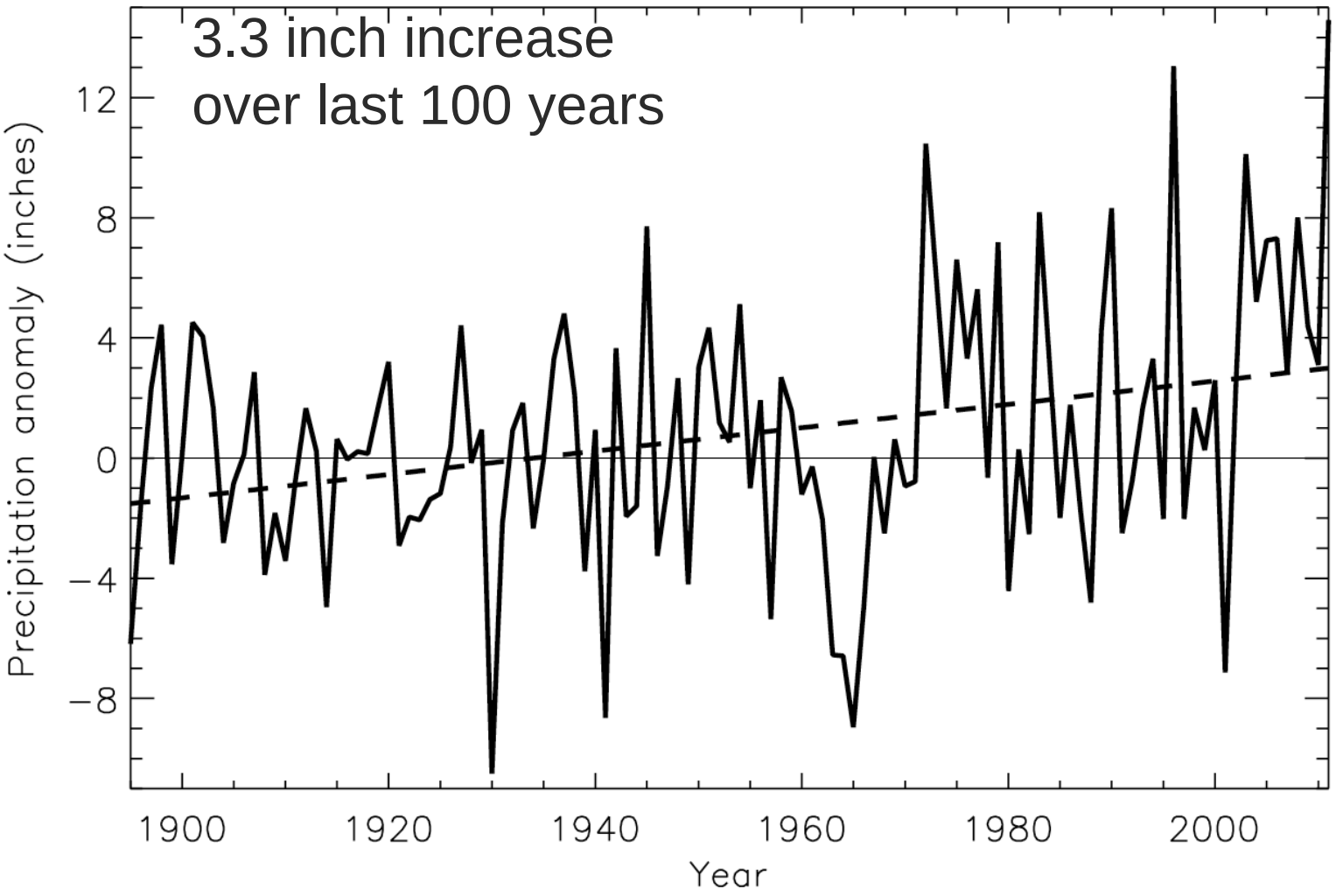
*Highest in 2 million years



Observed Weather Data and Impacts


Average Annual Temperature in the Northeast 1899-2000
1.8 °F warming over last 100 years
1.4 °F warming
over last 30 years
Temperature (°F)
49
47
45
43
41
1900
1920
1940
1960
1980
2000
Year

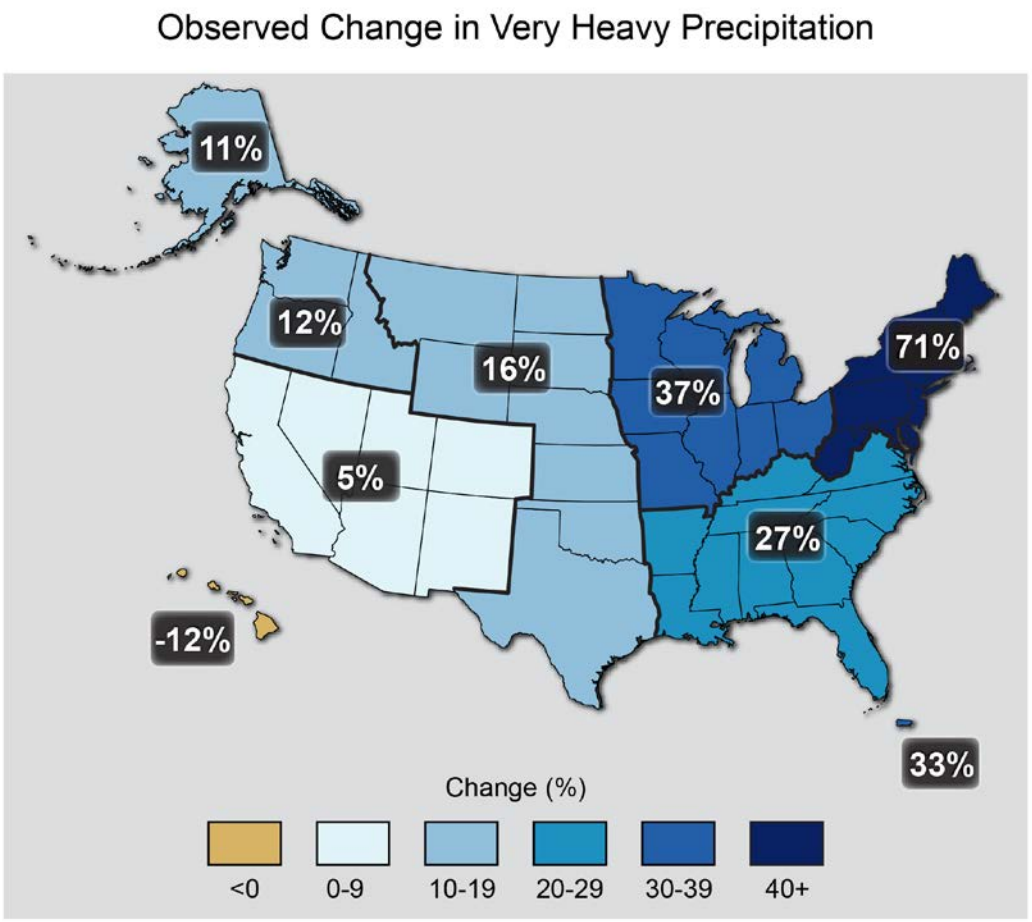
Annual Total Precipitation



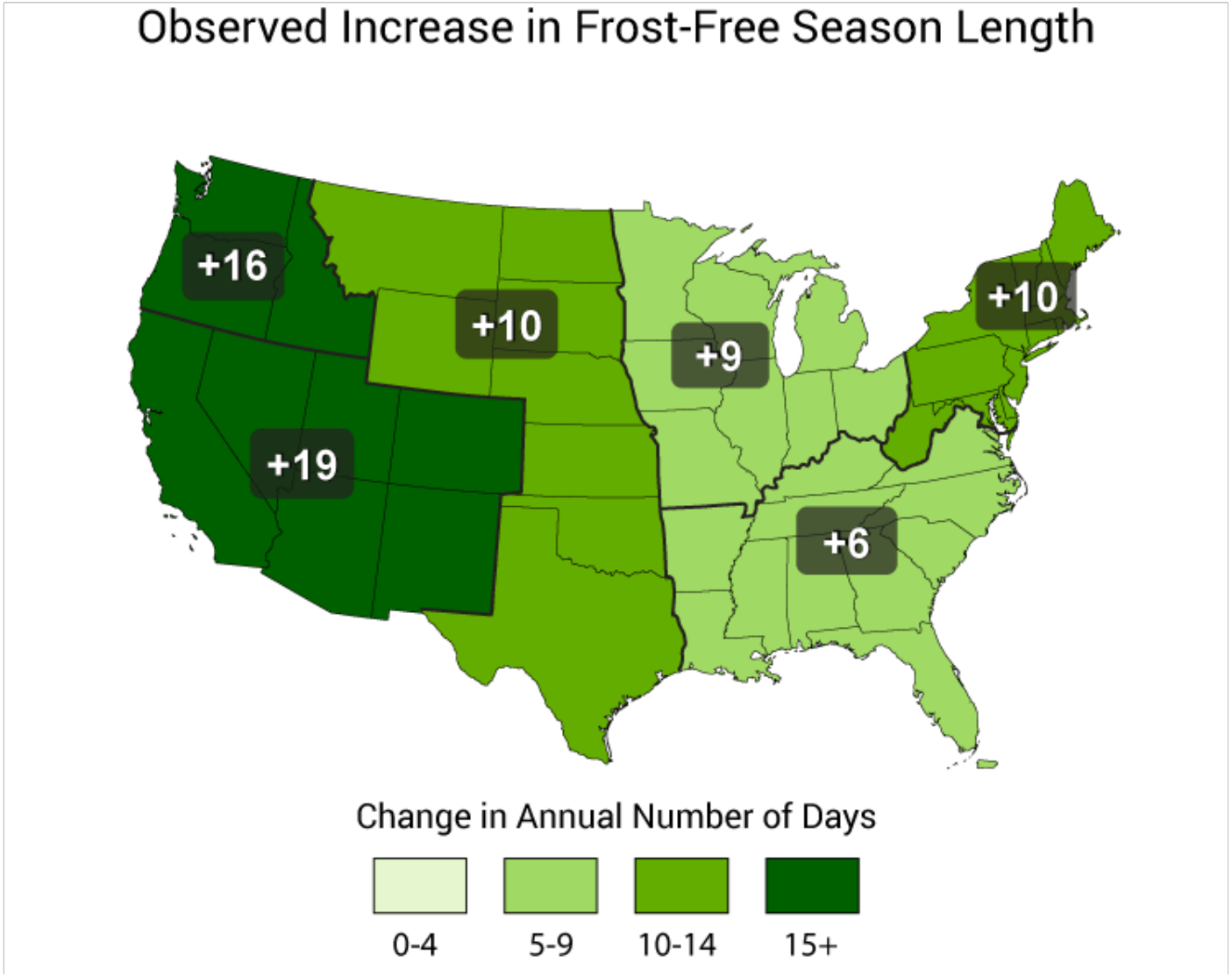
Source: Art DeGaetano, NRCC, Cornell University

Observed Trends in 1-day Very Heavy Precipitation (1958 to 2012)

The Northeast has had the greatest increase in heavy precipitation in the United States

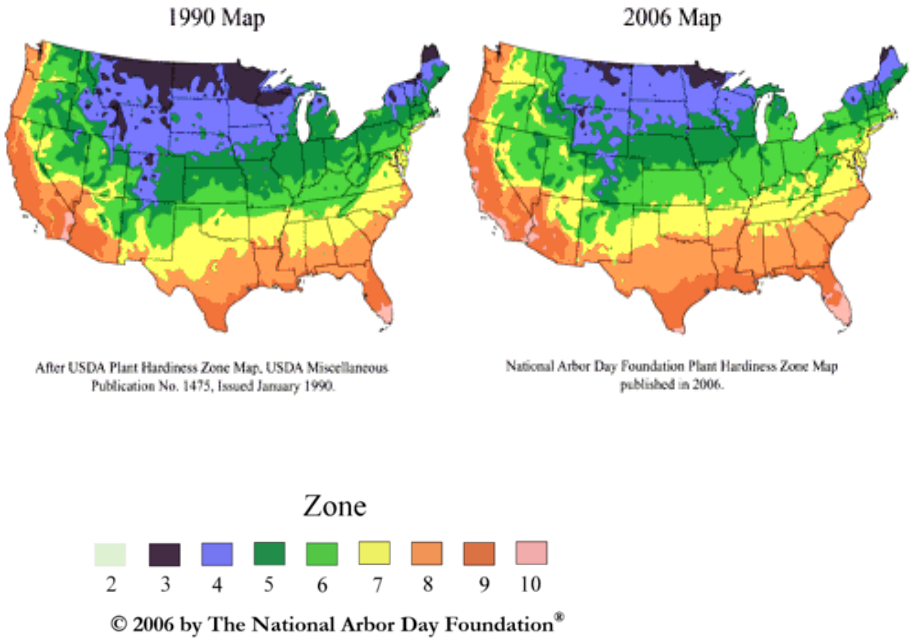


Source: NOAA/NCDC



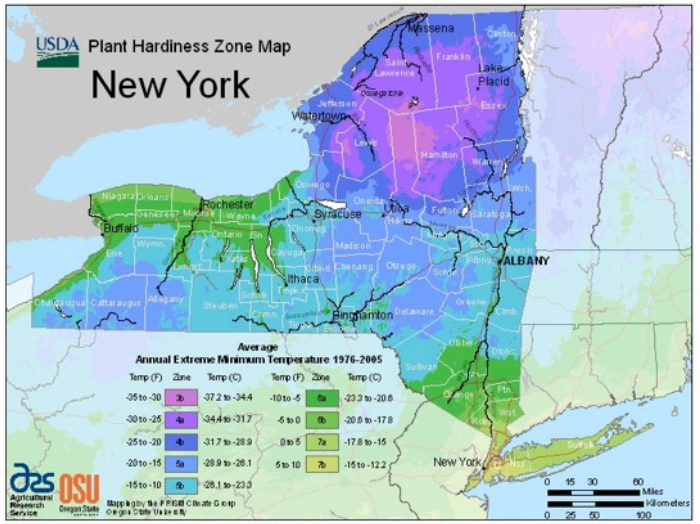
The period between the last occurrence of 32˚ F in the spring and the first occurrence of 32˚ F in the fall, has increased in each U.S. region during 1991-2012 relative to 1901-1960. NOAA/NCDC / CICS-NC.

Changes in Plant Hardiness Zones



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

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



New USDA Plant Hardiness Zone Map 2012

Source: http://www.arborday.org/media/zones.cfm

Phenological Responses:

Grapes are blooming 6 days earlier

Apples are blooming 8 days earlier than they were in the 1960s

Lilacs are blooming 4 days earlier

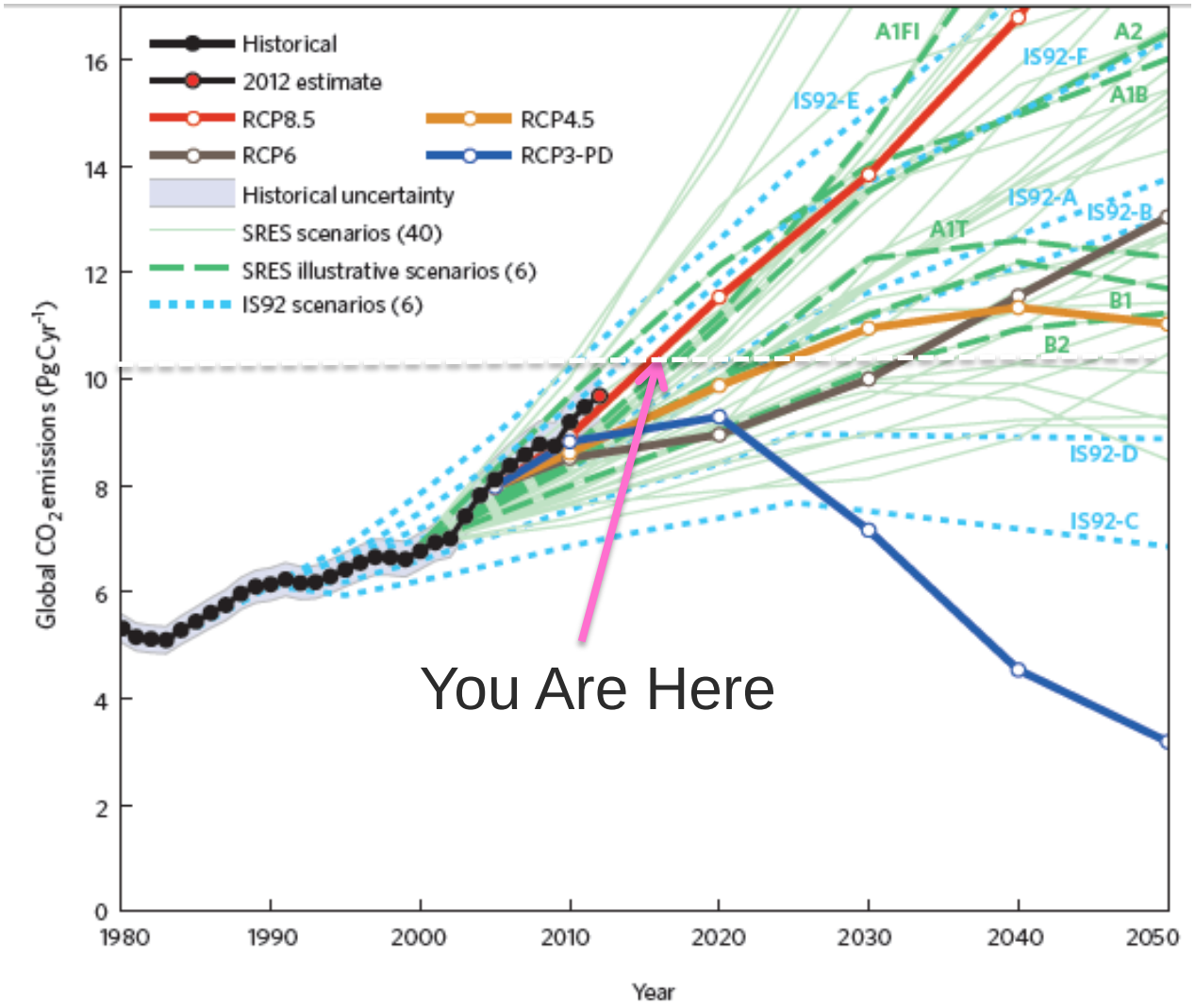
Spring arrival dates of 103 migrant birds in NY and MA arriving 4 to 13 days earlier 1951-1993 compared to 1903-1950 (Butler 2003)

[Source: Wolfe DW et al. 2005. Internat J Biometeor 49:303-309.]
National Phenology Network: http://www.usanpn.org

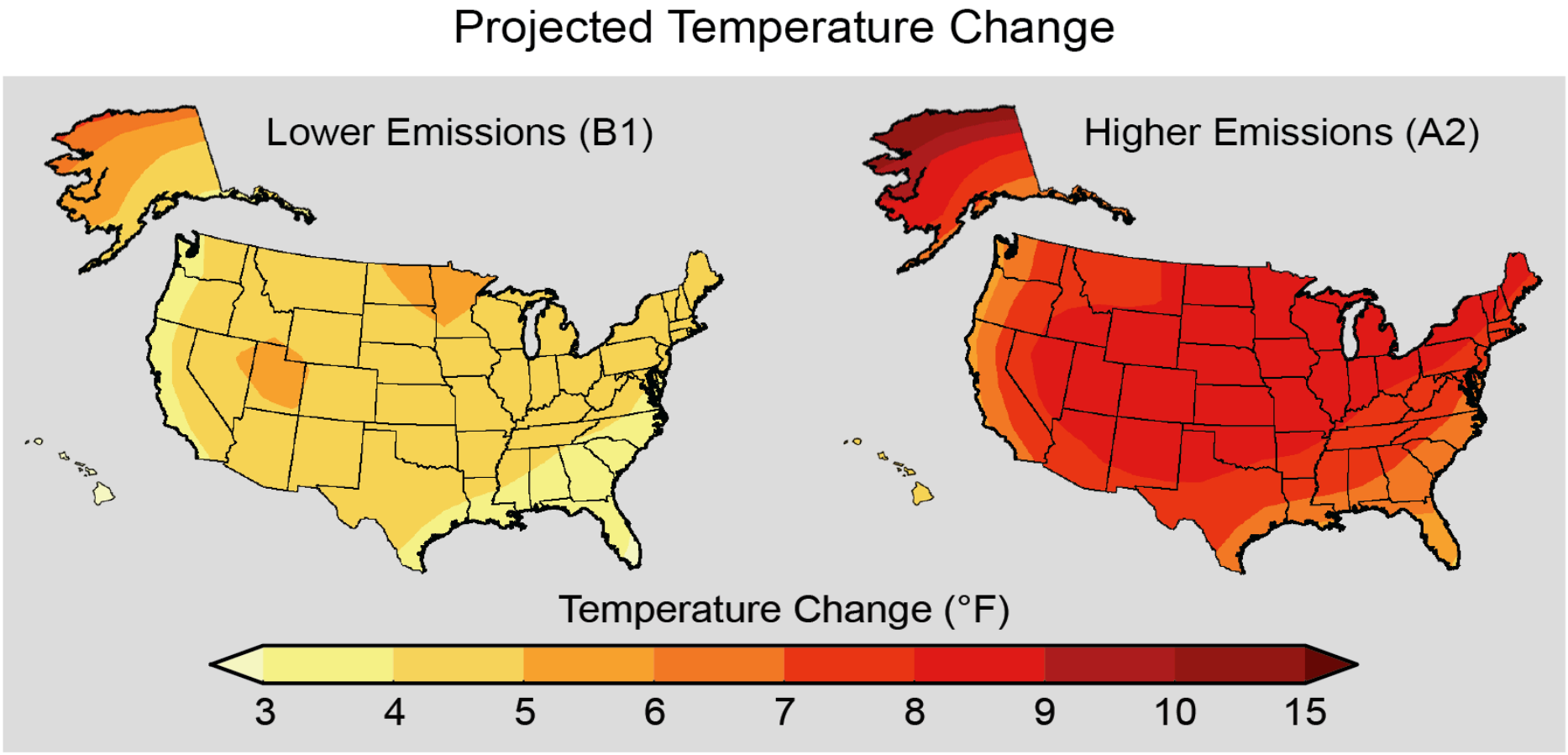

Positive proof of global warming.
18th Century
1900
1950
1970
1980
1990

Future Climate Change Projections

It All Depends…



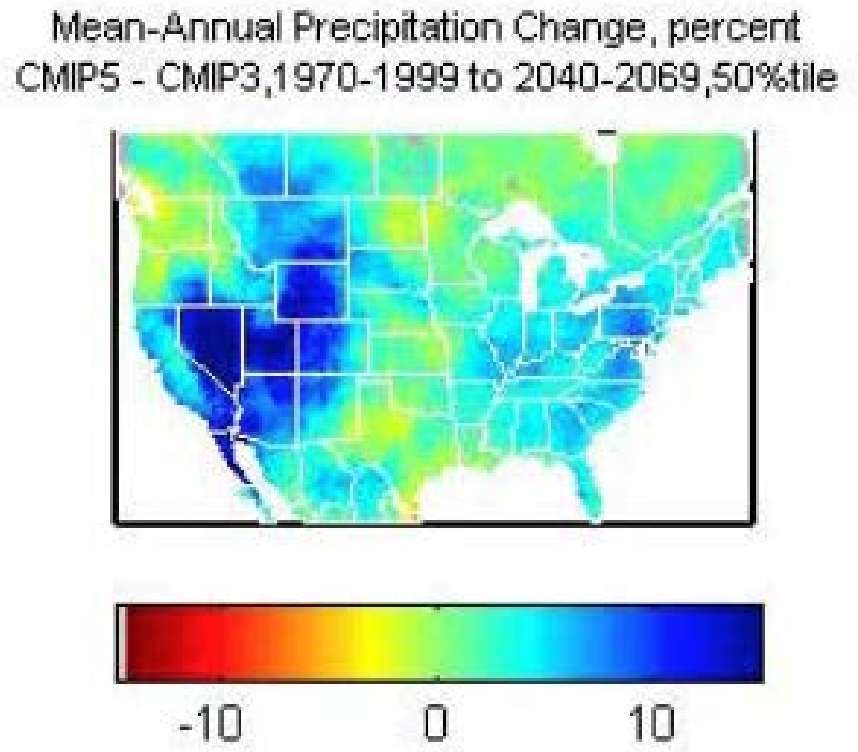
It Gets Even Warmer

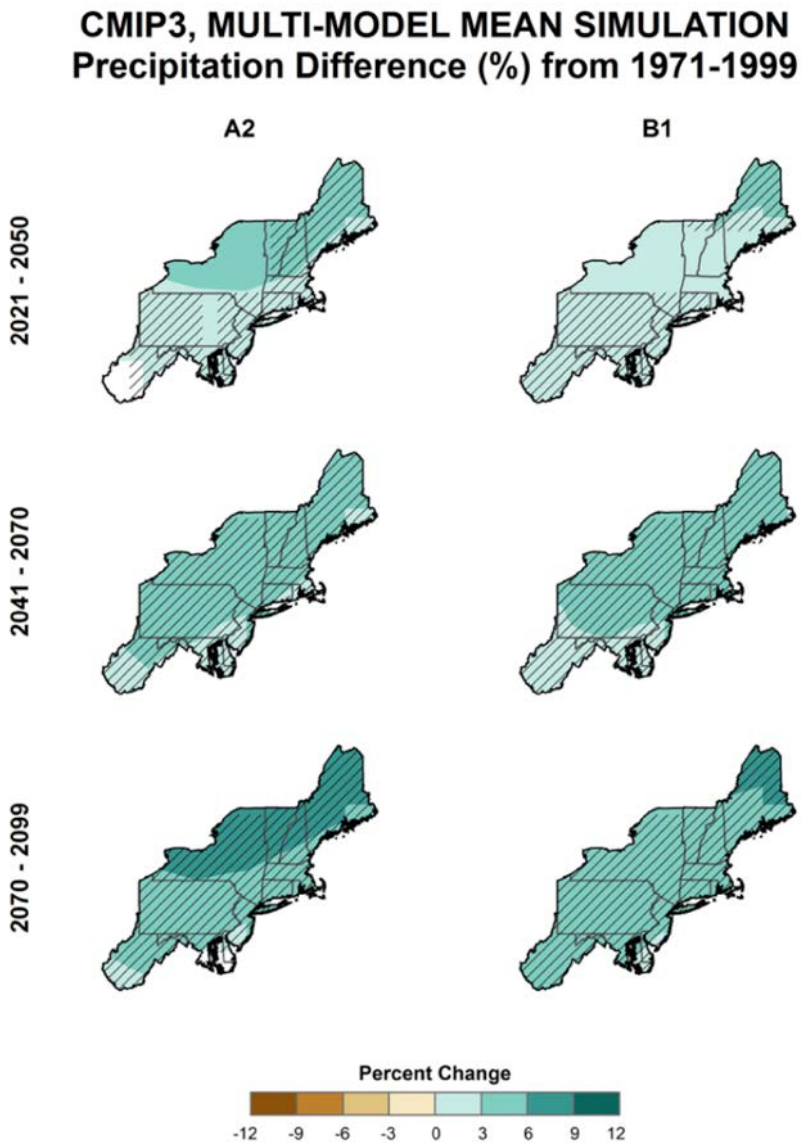


U.S. Global Change Research Program
National Climate Assessment

Business as Usual = +4°F to 10°F+ by 2099

Up to 10% More Rain





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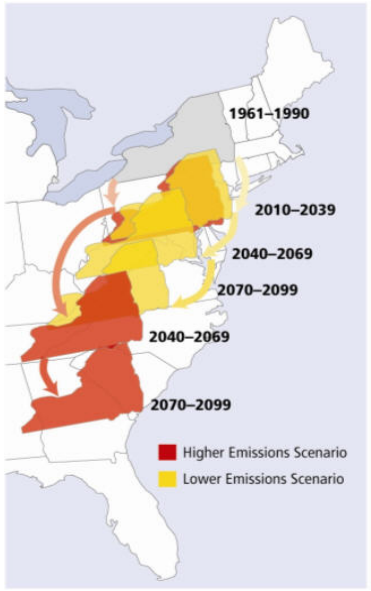
What does this all means for us?
Challenges & Potential Opportunities for NE Farmers

Continued Climate Change Impacts for New York Agriculture

- **Increasing Avg. Annual Temperatures**
  - Heat Stress and Heat Waves
- **Precipitation: Opportunity in the NE?**
  - Increase in overall precipitation amounts
  - Increase in Intense storms
  - Periods of Short-term Drought
- **Ecosystem & Agriculture Impacts**
  - Changing Growing Seasons
  - Pollinators
  - Increases in Pests and Diseases
- **Health Impacts**
- **Sea Level Rise/Storm Surge**



Climate Change and NE Agriculture

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Challenges:

- Increased frequency of high temperature stress hurts crops and dairy industry
- Both too much and too little water for crops, and less predictable
- Increased and changing pest, disease, weed pressure
- Climate change is much more complicated than just “warming”: variability, Extremes

Opportunities:

- New heat stress challenges less severe than some competing regions
- Relative to other regions- we have water!
- Longer frost-free period allows exploring higher yielding crop varieties; double-cropping
- Near to markets – 22% U.S. population

Farmer Panel

- Darcy Telenko, Facilitator
- Larry Eckhardt, Kinderhook Creek Farm, Stephentown, NY
- Peter Ten Eyck, Indian Ladder Farms, Altamont, NY
- Mark Zittel, Amos Zittel and Sons, Hamburg, NY

CICCA

Cornell Institute for Climate Change & Agriculture

- Formed 2013
- 140+ Cornell researchers working on climate change
- Vision: Empower farmers and their communities to respond to increasing climate variability and change, take advantage of opportunities, and lessen their impacts on the climate.
- Climate Smart Farming Program: Launched 2015
- Partnerships: Farmer Involvement, NYS, UDSA
- Information Clearinghouse: Decision Tools, Training, Policy Recommendations

climateinstitute.cals.cornell.edu/

Cornell Climate Change Capacity

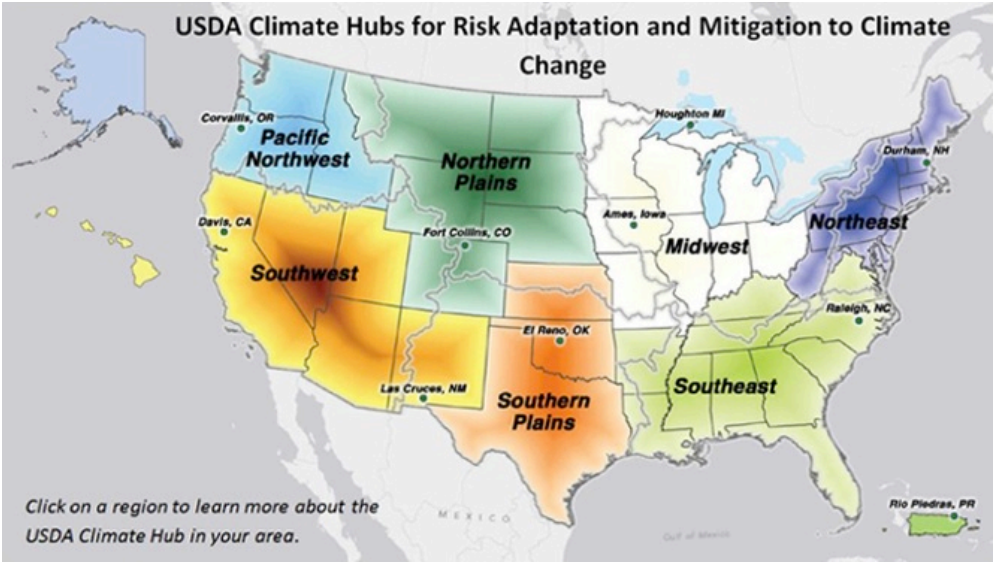
Research, Teaching and Extension:

- New/Adapted Crops
- Pests and IPM
- Animal Agriculture
- Climate Modeling/Extreme Weather
- Communicating Climate Change
- Crop Yield Risks
- Carbon Sequestration & Policy
- Northeast Regional Climate Center
- Water Management
- Renewable/Bioenergy
- Nutrient Management
- Stakeholder Risks & Needs
- Teaching: Climate Change Minor and Courses

And Many Partnerships: NYS Ag and Markets, DEC, NRCS, SWCC, USDA Climate Hubs, NGOs and Foundations.

CICCA Partnering with the USDA Northeast Climate Hub

- Mission: to develop and deliver science-based, region-specific information and technologies to agricultural and natural resource managers that enable climate-smart decision-making.
- Technical Support
- Regional Assessments
- Outreach and Education



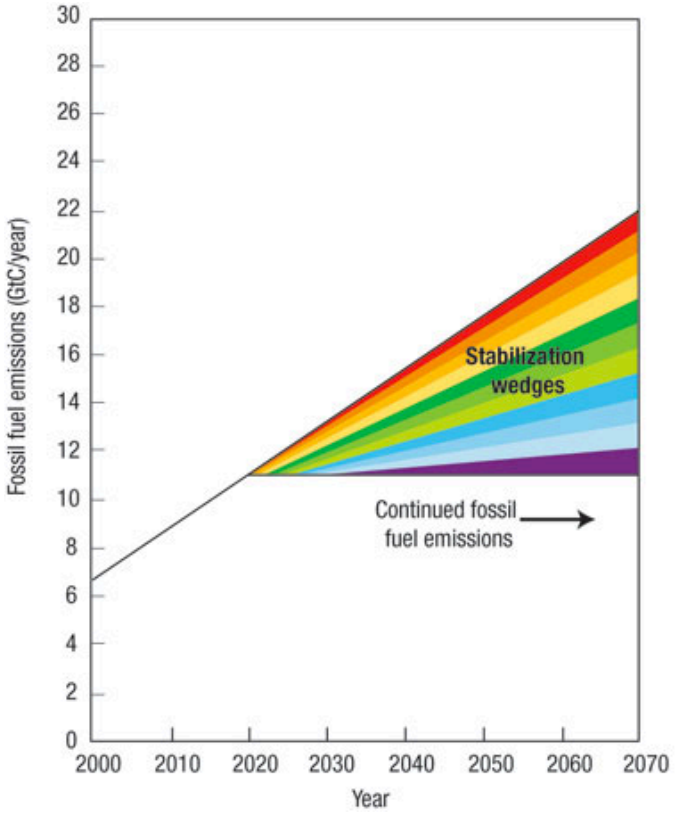
http://climatehubs.oce.usda.gov/northeast-hub

Cornell Climate Smart Farming

- Increase agricultural productivity and farming incomes sustainably
- Reduce GHG emissions from agricultural production through adoption of BMPs, increased energy efficiency and use of renewable energy
- Increase farm resiliency to extreme weather and climate variability through adoption of BMPS for climate change adaptation.

Climate Change Mitigation

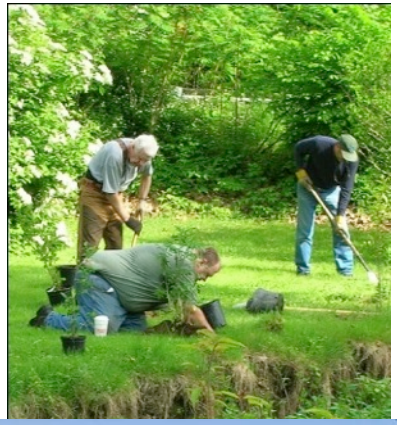
Actions that will reduce the ultimate magnitude of climate change.



- Coal: 800 gigawatt-sized plants with all the carbon captured and permanently sequestered
- Nuclear: 700 new gigawatt-sized plants (plus replacement plants)
- Concentrated solar thermal electric: 1,600 gigawatts peak power
- Solar photovoltaics: 3,000 gigawatts peak power
- Efficient buildings: savings totalling 5 million gigawatt-hours
- Efficient industry: savings totalling 5 million gigawatt-hours, including co-generation and heat recovery
- Wind power: 1 million large wind turbines (2 megawatts peak power)
- Vehicle efficiency: all cars 60 miles per US gallon
- Wind for vehicles: 2,000 gigawatts wind, with most cars plug-in hybrid electric vehicles or pure electric vehicles
- Cellulosic biofuels: using up to one-sixth of the world's cropland
- Forestry: end all tropical deforestation

Climate Change Adaptation

- Reduce the level of physical, social, or economic impact of climate change and variability
- Take advantage of new opportunities emerging from climate change



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Dr. Kitty O'Neil, Field Crops & Soils

Dr. Kim Morrill, Dairy Management

Luke Haggerty, Viticulture

Laura McDermott, Small Fruit

Dr. Darcy Telenko, Vegetables

Bob Weybright, Ag Marketing

http://climatesmartfarming.org/

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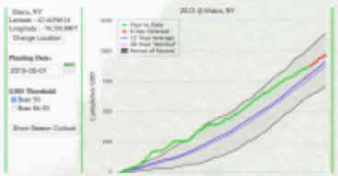
Climate Smart Farming Decision Tools

Cutting-edge tools to help farmers manage climate risk.

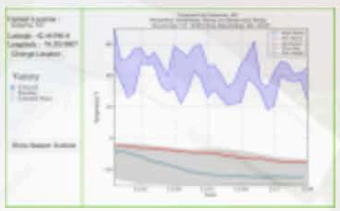
Use the Climate Smart Tools

CSF Growing Degree Day Calculator



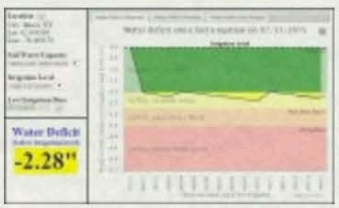
Measure heat accumulation to predict plant development and pest/disease outbreaks.

CSF Freeze Risk Tool



Graph hardiness vs. observed temperature for several crop varieties over a specific date range to determine freeze risk.

CSF Irrigation Scheduler



Monitor current and forecasted soil water deficit at your location to allow smart scheduling of irrigation.

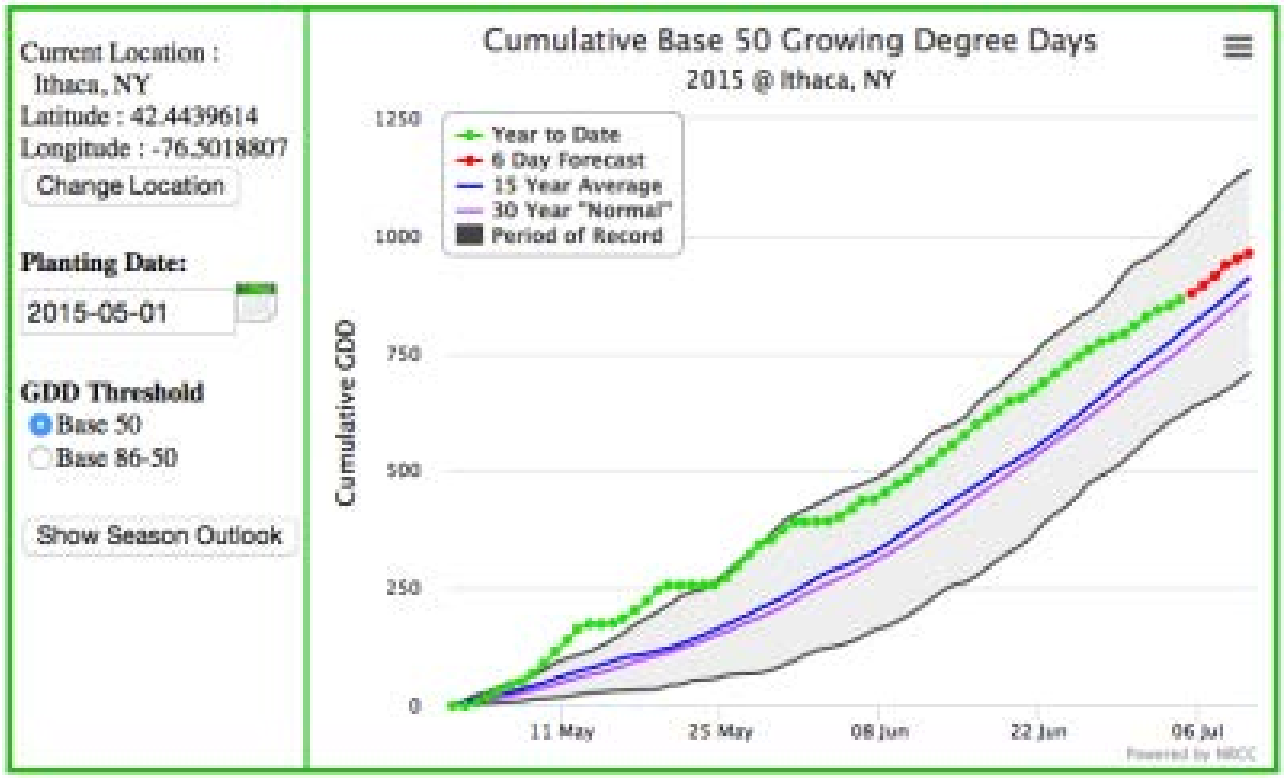
http://climatesmartfarming.org/tool/

CSF Growing Degree Day (GDD) Tool

- GDD:
  - Measures heat accumulation (development in plants is temperature-dependent)
- GDD Calculation:
  - (Average of Daily Min and Max Temp) – (Base Temp)
- You can use this tool:
  - To predict important stages in plant growth
  - To predict pest and disease outbreaks
  - In planning for and response to seasonal variability

CSF GDD Tool

- Using the Tool:
  1. Input location, planting date, and GDD threshold
  2. Toggle between graphs of observed data and seasonal outlooks

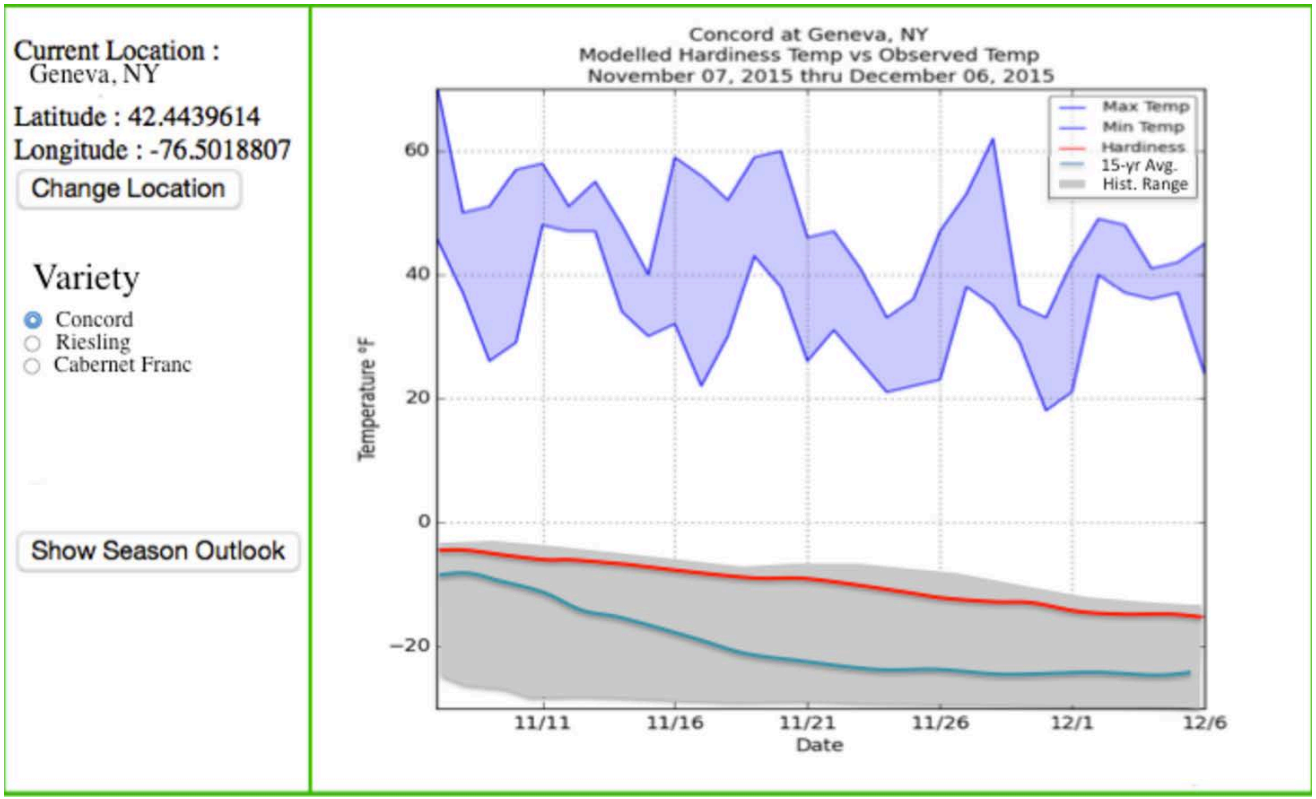


CSF Freeze Risk Tool

- Spring frosts are not receding as quickly as flowering is advancing, with climate change
- Increased risk of frost/freeze damage
- You can use this tool:
  - To determine the level of freeze injury to crops due to sub-freezing temperatures
  - To monitor the level of freeze tolerance of crops through time
  - To track the phenological stage of development

CSF Freeze Risk Tool

- Using the tool:
  - Input crop variety and location
  - Toggle between seasonal outlook and observed temperature graphs of hardiness vs temperature

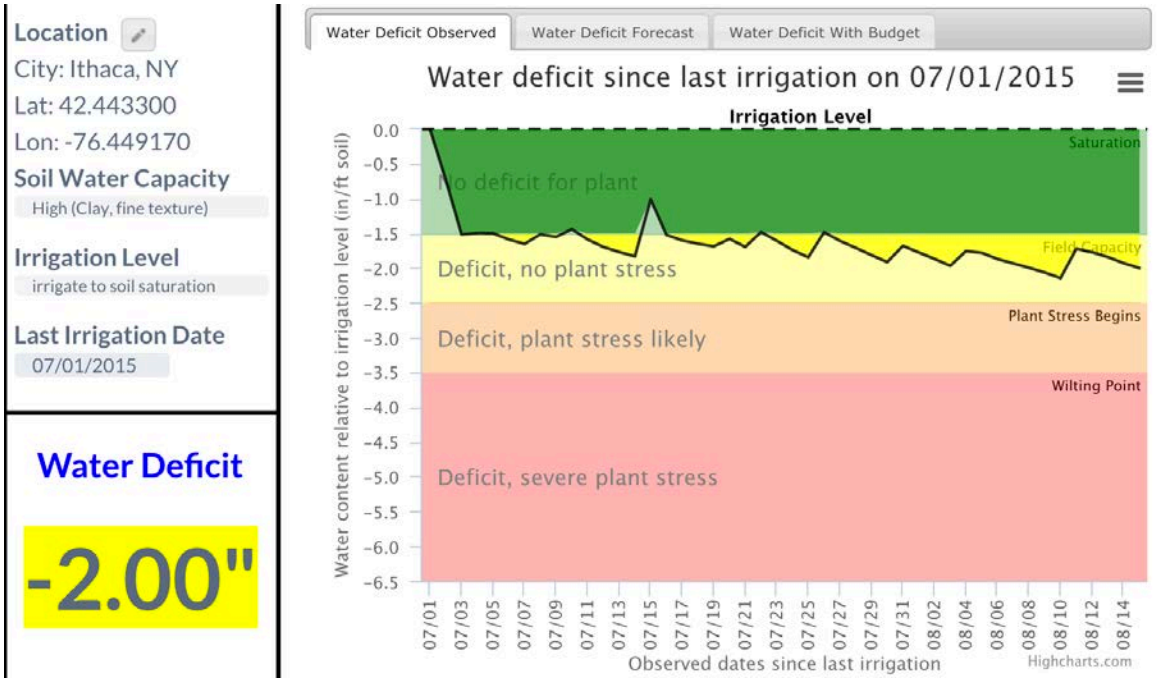


CSF Irrigation Scheduling Tool

- Used to determine optimum frequency and duration of watering
- The tool estimates soil water content to create an outlook of current and future water deficits
- You will be able to use this tool:
  - To optimize watering (minimize plant stress and conserve water)
  - To contextualize current water deficits, given historical data and climate change

CSF Irrigation Scheduler

- Using the tool:
  - Input location, soil type, and irrigation preferences
  - Graphs with water deficit, forecast, and budget will be created and shown



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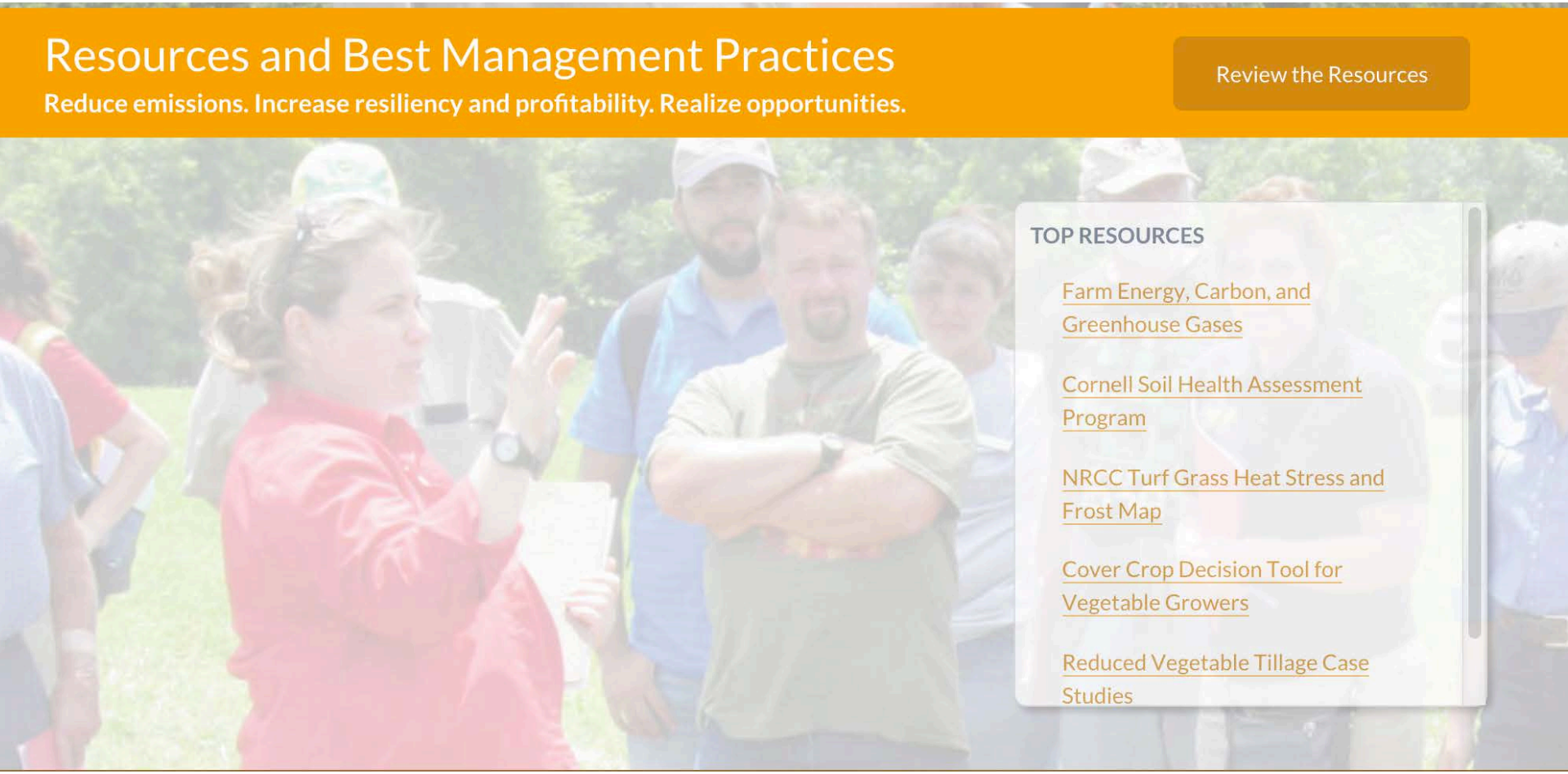

http://climatesmartfarming.org/resource/

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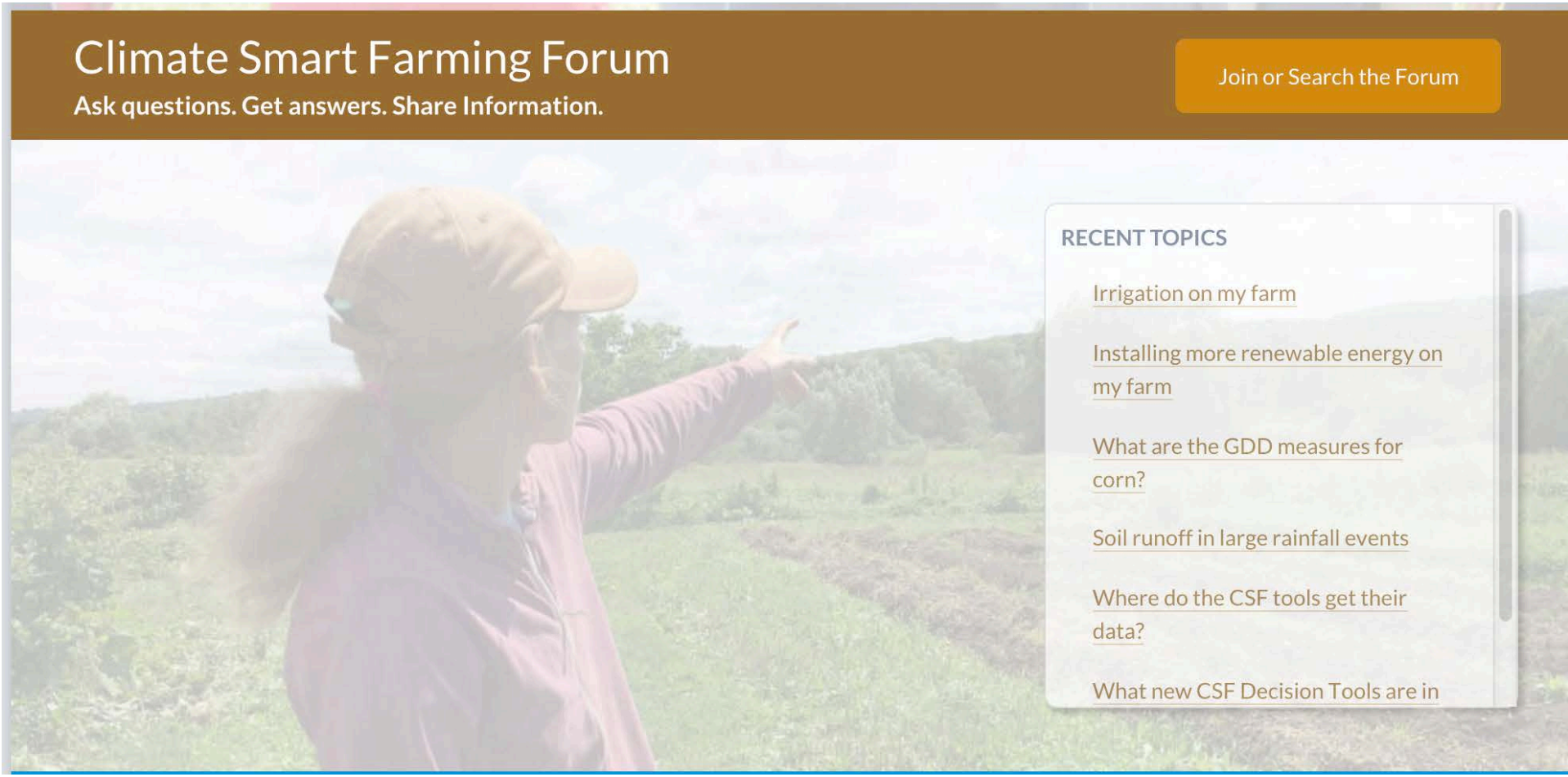

http://climatesmartfarming.org/forum/

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Climate Smart Farming Videos

Gain first-hand knowledge via farmer success stories and demos.

View the CSF Videos

RECENT VIDEOS

- Adaptation and Agriculture
- Apple Growers
- Common Thread Farm
- Cornell Maple
- Farming for Energy
- Fishkill Farms
- Hahn Farm

http://climatesmartfarming.org/video/

Recent & Upcoming Events

- NYS Ag Society Booth, Jan 7, 2016: Come by the Display tomorrow to talk with Toby, Kitty, Mike and Allison
- Fruit and Vegetable Expo, Jan 21, 2016, Oncenter Convention Center, Syracuse, NY: Come by the Display to talk with Allison & Jonathan
- NOFA-NY and PASA Conference
- Regional Dairy Conference
- Empire Farm Days, Aug 2016
- Others?

Question and Answers & Discussion
We want to Hear from You!!

Contacts

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  Web: climatesmartfarming.org

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  Eastern NY Commercial Horticulture Team
  Fruit and Vegetable Specialist
  CCE Climate Smart Farming Extension Team

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  Cornell Vegetable Team, Vegetable and IPM Specialist
  CCE Climate Smart Farming Extension Team