Cornell's Climate Smart Farming Program: Research, Tools, and Extension Support for Farmers in New York & the Northeast

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“Climate, Weather, Data: Protecting Our Crops and Landscapes”
August 15, 2016, CCE Albany County, Voorheesville NY
How is Climate Variability and Change Affecting Farmers in the Northeast?
Time-series represents an areally weighted average of data from 56 stations in the Northeast that have been in operation continuously since 1900. Data from the NOAA-NCDC (ftp://ftp.ncdc.noaa.gov/pub/data/ushcn).

Average Annual Temperature in the Northeast 1899-2000

1.8 °F warming over last 100 years

1.4 °F warming over last 30 years
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.
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
August 9, 2016
(Released Thursday August 11, 2016)
Valid 8 a.m. EDT

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought
Weather vs. Climate

- **Weather** = The conditions of the atmosphere in terms of temperature, atmospheric pressure, wind, and moisture, that happen over hours or days.
- **Climate** = average weather conditions in a place over many years (usually at least 30 years)
- **Climate Change** = Long-term change in Earth's climate
- **Climate variability** = The way climate fluctuates yearly above or below a long-term average value.
- **Extremes** = Extreme weather includes unexpected, unusual, severe or unseasonal weather; weather at the extremes of the historical distribution.
STAKEHOLDER-DRIVEN RESEARCH AND OUTREACH

CUTTING-EDGE RESEARCH
- Climate Change Data and Impact Assessments
- Agroecological Research
- Stakeholder Surveys & Interviews

EXTENSION PROGRAM OUTREACH
- Climate Smart Farming Extension Team
- Training and Outreach
- Farmer Videos and Case Studies
- Farmer Forum to Share practices

DECISION SUPPORT TOOLS
- AgroClimate Models & Forecasts
- Web-based Tools
- Adaptation & Mitigation Practices

FARMER-COMMUNITY ENGAGEMENT
- Farmer Advisory Panel
- Pilot Testing Materials & Tools
- Partnerships with Agencies and NGOs

CLIMATE SMART FARMING
- Increased Agricultural Resiliency
- Reduced GHG Emissions
- Increased Sustainable Agricultural Productivity
Listening to Stakeholders

• Farmer Advisory Committee

• Climate Smart Farming Stories:
  – Multimedia Project: NYS Farmers in their Own Words

• Focus Groups & Surveys:
  – Focus Groups with Producers & Advisors: with Penn State and UW Madison (2016-2017 with USDA NE Hub and Dairy CAP)
Climate Smart Farming Program Goals

• Increase farm resiliency to extreme weather events, climate variability and change, through assessing risk & adopting BMPs (adaptation).

• Increase energy efficiency and renewable energy capacity to reduce GHG emissions and operating costs, and utilize BMPs (mitigation).

• Sustainably increase agricultural productivity and farming incomes, to contribute to regional & global food security.
Agriculture in the Northeast is characterized by a diversity of products and production systems, scales of operations, and landscapes. Farmers need a variety of specific practices and tools to help them with climate change adaptation and mitigation.
How is the changing climate affecting your farm?

Climate Smart Farming Decision Tools
Cutting-edge tools to help farmers manage climate risk.

CSF Growing Degree Day Calculator
Growing Degree Days (GDD) are a measure of heat accumulation used to predict plant development and pest/disease outbreaks.

CSF Freeze Risk Tools
Graphs hardness 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.

Climate Normals - Northeast Regional Climate Center
Climate normals are an arithmetic average of a variable such as temperature over a prescribed 30-year period.

http://climatesmartfarming.org/
CSF Practices

Resources and Best Management Practices
Reduce emissions. Increase resiliency and profitability. Realize opportunities.

http://climatesmartfarming.org/resources/
http://climatesmartfarming.org/resources/
http://climatesmartfarming.org/tools/
Climate Data & Models: Partnering with the NRCC & Researchers

- Models and Tools are Free to Use
- Available for farmers throughout the Northeast, from National Weather Service Daily Data
- Temperature data: interpolated to a 5km X 5km grid from NWS Cooperative Observer Network
- Precipitation data: interpolated to a 5km X 5km grid from NWS radar data
- Giving data for the grid point nearest their location (@2.5km)
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.

• The CSF Tool: 15 year average more accurate representation of recent climate change

• Farmers & Advisors can use the tool to:
  – Predict important stages in plant growth
  – Predict pest and disease outbreaks
  – Help with planning for and response to seasonal variability
CSF Growing Degree Day (GDD) Tool

Current Location:
Cornell University
Ithaca, NY
Latitude: 42.450000
Longitude: -76.480000
Change Location

Planting Date:
2016-05-01

GDD Threshold
- Base 50
- Base 8650

Season Outlook

Cumulative Base 50 Growing Degree Days
@ Cornell University, Ithaca, NY

2016 Recent Trend

CSF GDD Tool: Change Location

Cumulative Base 50 Growing Degree Days
@ 268-320 Altamont Rd, Voorheesville, NY 12186

- Year to Date
- 6 Day Forecast
- 15 Year Average
- 30 Year "Normal"
- Period of Record
- Period of Record

Current Location:
268-320 Altamont Rd
Voorheesville, NY 12186
Latitude: 42.653598
Longitude: -73.971577

Planting Date:
2016-01-01

GDD Threshold
- Base 50
- Base 8650

Season Outlook

CSF GDD Tool: Seasonal Outlook

Current Location:
268-320 Altamont Rd
Voorheesville, NY 12186
Latitude: 42.653598
Longitude: -73.971577
Change Location

Planting Date:
2016-01-01

GDD Threshold
- Base 50
- Base 8650

Cumulative Base 50 Growing Degree Days
@ 268-320 Altamont Rd, Voorheesville, NY 12186

2016 Season Outlook

CSF Growing Degree Day (GDD) Tool

- Improvements to Location Picker
- Additional GDD Thresholds
- Save Location; Multiple Fields on the Farm
- Near-Term Goal: Compare Current situation and Seasonal Outlook, to Projected Long-term Changes in Climate
CSF Freeze Risk Tools

• Climate Change = Shifting Seasons, Warmer Winters
• Spring blooming trees are flowering earlier. Increases risk of damage from a spring frost when buds are highly susceptible.
• Developing Grape and Apple Tools.
• Farmers/Advisors Can Use the Tools to:
  – Determine the level of freeze risk to crops due to sub-freezing temperatures
  – Monitor the level of freeze tolerance of crops through time
  – Track the phenological stage of development
CSF Freeze Risk Tools

• Using the Tools:
  – Input crop variety and location
  – Toggle between observed temperature and seasonal outlook 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

• Farmers/Advisors use the tool to:
  – Optimize watering (minimize plant stress and conserve water)
  – Contextualize current water deficits, given historical data and climate change
CSF Irrigation Scheduler

Using the Tool:

– Customize Output by Specific Location, Soil Water Capacity, Crop Type, Plant Greenup Date, and Last Date of Irrigation
– Tool produces a Graph with water deficit, forecast, and budget.
CSF Irrigation Scheduler

- Change Location. Customize Output by Soil Water Capacity, Crop Type, Plant Greenup Date, and Last Date of Irrigation.
Regional Data

GDD Difference from Normal (GDD)  
March 15 - May 16, 2016

Total Precipitation (inches)  
August 7-13, 2016
NOAA Seasonal Outlook

http://www.cpc.ncep.noaa.gov/products/predictions/30day/
Currently NYS: Could Expand CSF Extension Team Model to Northeast/Other Regions
CSF Farmer Stories

Climate Smart Farming Multimedia
Gain first-hand knowledge via farmer success stories and demos.

http://climatesmartfarming.org/videos/
CSF Forum: Sharing Practices

Create a Free Account: Get Answers, Share Information!
climatesmartfarming.org/forum/
Training & Outreach

• 2015-2016: Building out the Climate Smart Farming Program, Extension Team, Resources and Website Tools

• 2016: Introducing CSF to extension and farmers at agriculture conferences: NYS Ag Society; Empire Farm Days!

• 2016-2017: Training for extension and farmers – Feedback & Improvement: **What other information & tools do farmers need??**
Collaborative Infrastructure

- Researchers, Staff & Students
- **Data & Models:** Northeast Regional Climate Center & partners with NEWA: Art DeGaetano, Keith Eggleston
- **Agriculture & Extension Expertise:** CALS Faculty, CSF Extension Team, Farmer Advisory Committee
- **Computer Programmers:** Rick Moore & Brian Belcher
- **Website Design & Programming:** Knowledge Town
- **Support:** USDA Federal Formula Hatch & Smith Lever Funds, and the New World Foundation (2016)
Questions & Answers?
Feedback from Farmers, Extension Specialists, and Partners
Thank You!

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