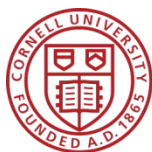


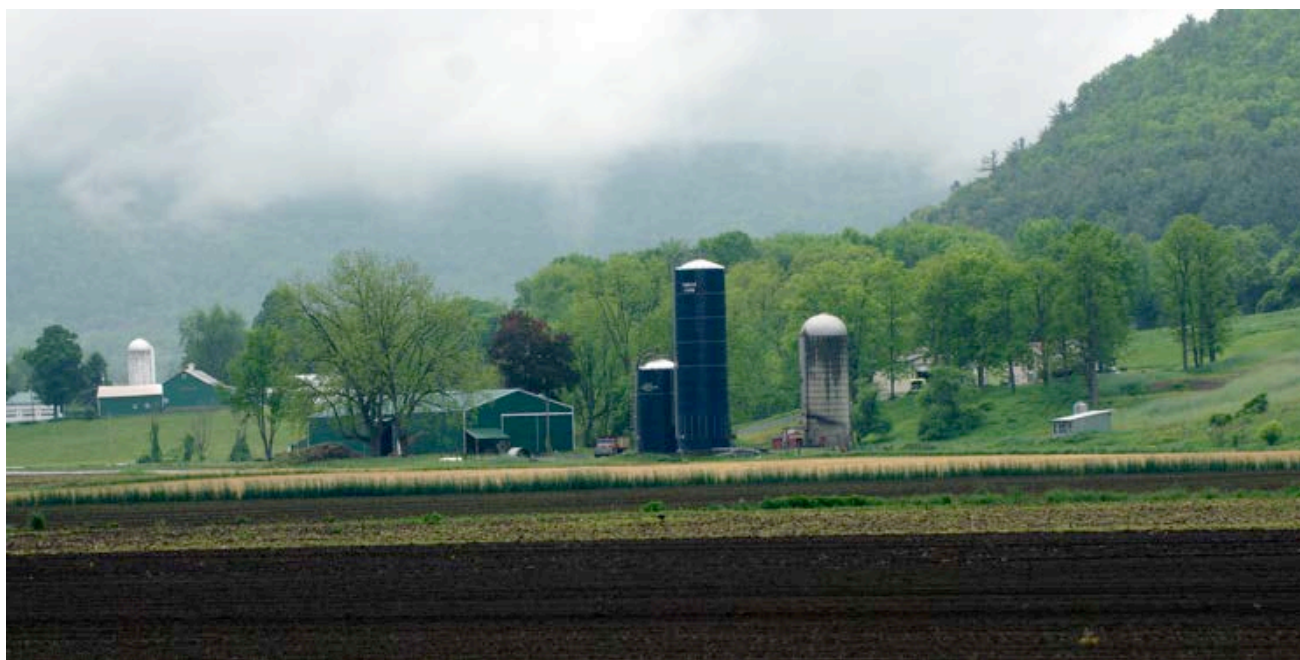
Cornell's Climate Smart Farming Program: Research, Tools, and Extension Support for Farmers in New York & the Northeast

Dr. Allison Chatrchyan and Dr. Art DeGaetano
Cornell Institute for Climate Change and Agriculture
Presentation for the
USDA NE Climate Hub Webinar Series
May 18, 2016

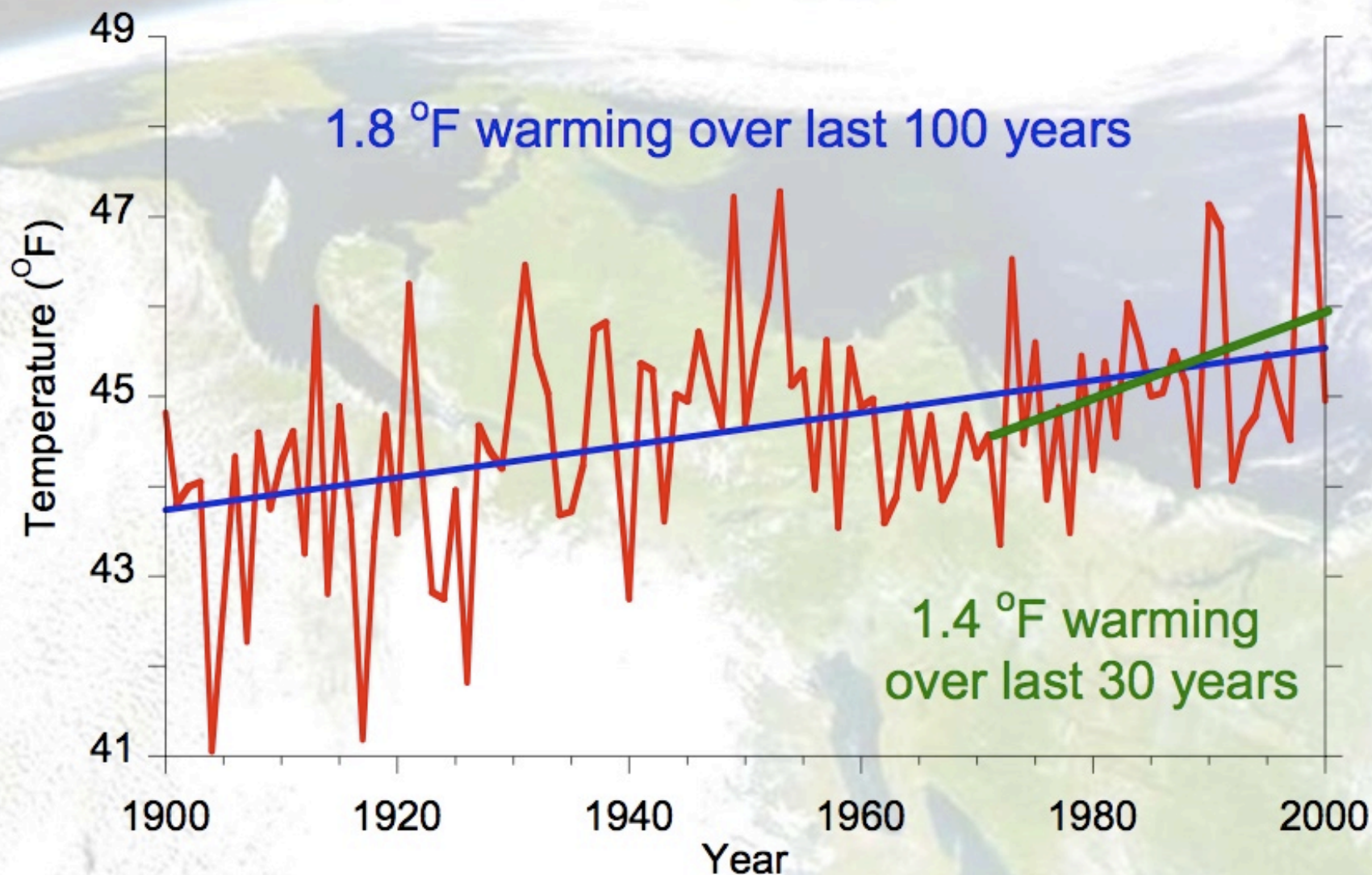


Cornell University

How is Climate Variability and Change Affecting Farmers in the Northeast?



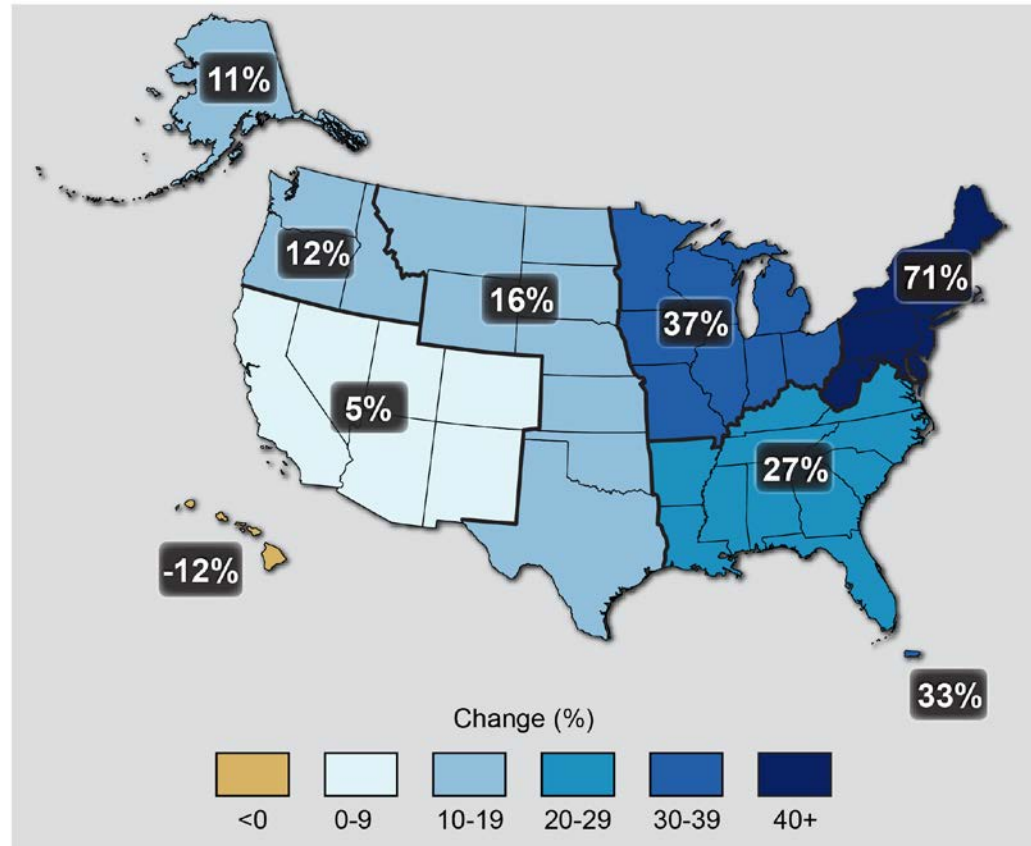
Average Annual Temperature in the Northeast 1899-2000



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

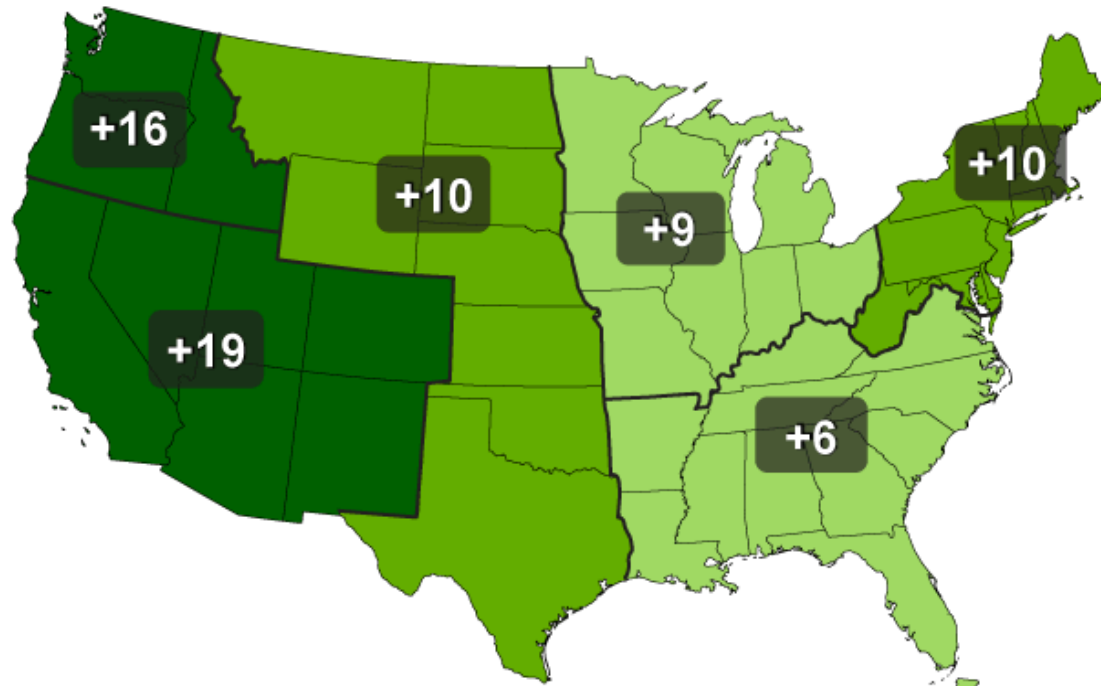
The Northeast has had the greatest increase in heavy precipitation in the United States.

Observed Change in Very Heavy Precipitation

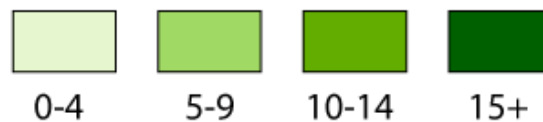


Source: NOAA/NCDC

Observed Increase in Frost-Free Season Length



Change in Annual Number of Days



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.

Climate Change and Northeast Agriculture



Challenges:

- Temperature: Increased frequency of high temperature causes heat stress for both livestock and crops
- Water: Too much or too little; lack of efficient water management
- Pest, Disease & Weed Pressure
- Climate change much more complicated than just “warming”:
Uncertainty, Variability & Extremes

But Also Opportunities:

- Heat stress challenges less severe than some other regions
- Relative to other regions: we have water!
- Longer growing seasons allow farmers to explore with different crop varieties and double-cropping
- Close proximity to many markets: 22% U.S. population



- Formed 2013
- 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
- Farmer, Extension and Stakeholder Input.
- Partnerships @ the state, regional, federal, and international level, including the USDA NE Climate Hub.
- Information Clearinghouse: Decision Tools, Training, Policy Recommendations

climateinstitute.cals.cornell.edu/

Cornell Climate Change Capacity



Strengths in Research, Teaching, and Extension/Outreach:

- New/Adapted Crops
- Pests and IPM
- Animal Agriculture
- Climate Modeling/Extreme Weather
- Communicating Climate Change
- Crop Yield Risks
- Carbon Sequestration & Policy
- Economics
- Northeast Regional Climate Center
- Politics and Policy
- Renewable/Bioenergy
- Stakeholder Assessment & Engagement
- Water Management
- Teaching: Climate change minor and many courses
- Extension: Trusted partners across New York
- Nutrient Management

Climate Smart Farming Program Goals

- Sustainably increase agricultural productivity, farming incomes, and food security
- Increase energy efficiency and renewable energy capacity to reduce operating costs and GHG emissions
- Increase farm resiliency to extreme weather and climate variability through adoption of BMPS for climate change adaptation.

STAKEHOLDER-DRIVEN RESEARCH AND OUTREACH

CUTTING-EDGE RESEARCH

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

DECISION SUPPORT TOOLS

- AgroClimate Models & Forecasts
- Web-based Tools
- Adaptation & Mitigation Practices

EXTENSION PROGRAM OUTREACH

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

How is the changing climate affecting your farm?

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

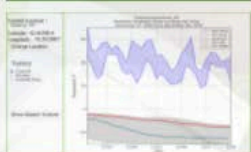
See more Tools

CSF Growing Degree Day Calculator



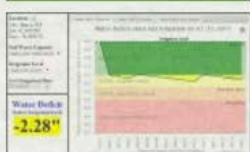
Growing Degree Days (GDD) are a measure heat accumulation used to predict plant development and pest/disease outbreaks.

CSF Freeze Risk Tools




Graphs 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.

Climate Normals - Northeast Regional Climate Center

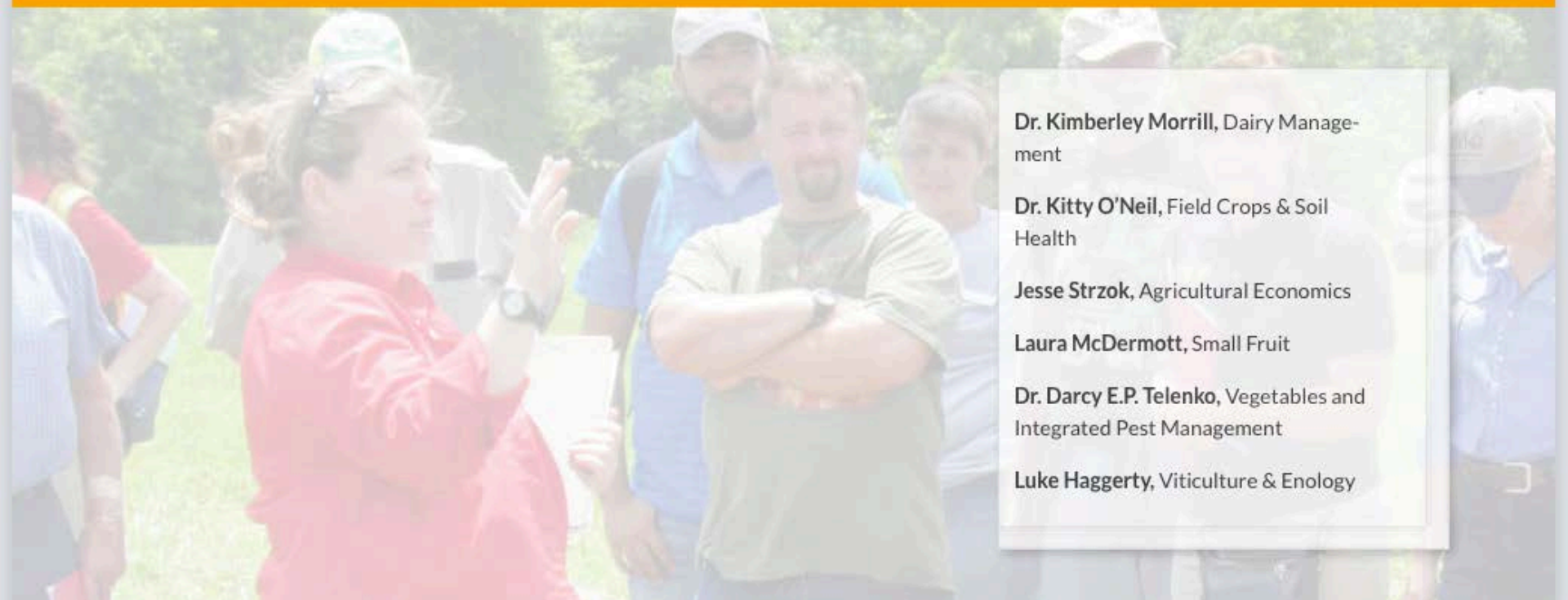


Climate normals are an arithmetic average of a variable such as temperature over a prescribed 30-year period.

Climate Smart Farming Extension Team

Let us help you increase your farm's resiliency and sustainability.

[Read about the Team](#)

A woman in a red shirt is speaking to a group of people outdoors. She is gesturing with her hands. The group consists of several people, including a man in a green shirt with his arms crossed and a man in a blue shirt. They are standing in a grassy area with trees in the background.

Dr. Kimberley Morrill, Dairy Management

Dr. Kitty O'Neil, Field Crops & Soil Health

Jesse Strzok, Agricultural Economics

Laura McDermott, Small Fruit

Dr. Darcy E.P. Telenko, Vegetables and Integrated Pest Management

Luke Haggerty, Viticulture & Enology



Climate Smart Farming

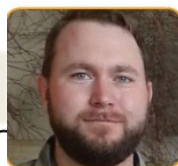
Extension Team



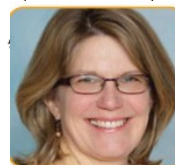
Dr. Kitty O'Neil, Field Crops & Soil Health



Dr. Kim Morrill, Dairy Management



Luke Haggerty, Viticulture



Laura McDermott, Small Fruit

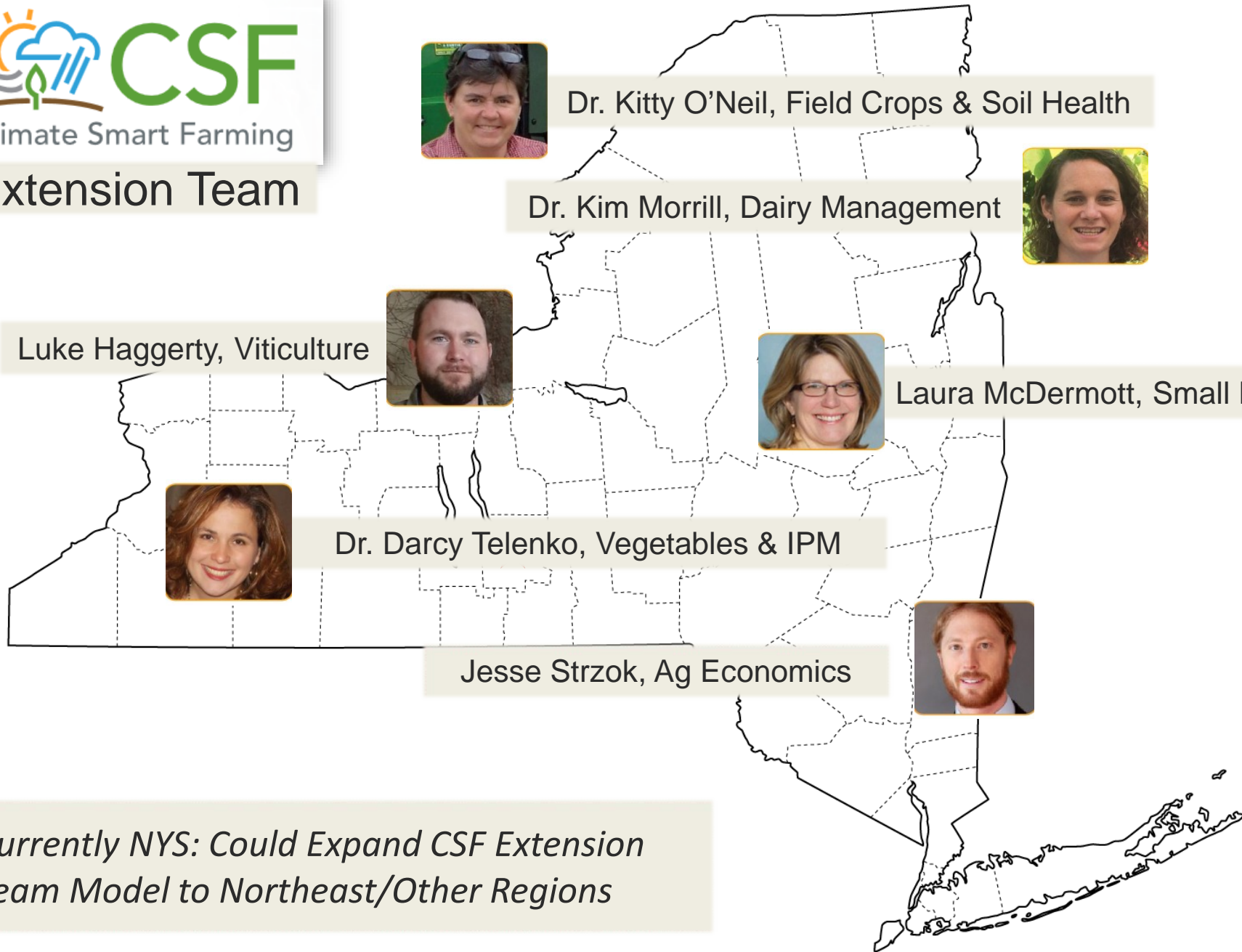


Dr. Darcy Telenko, Vegetables & IPM



Jesse Strzok, Ag Economics

Currently NYS: Could Expand CSF Extension Team Model to Northeast/Other Regions



Resources and Best Management Practices

Reduce emissions. Increase resiliency and profitability. Realize opportunities.

[See more Resources](#)

TOP RESOURCES

[About My Woods](#)

[Adaptation Workbook for Forest Management and Conservation](#)

[Anaerobic Digester Business Model and Financing Options](#)

[Animal Agriculture in a Changing Climate](#)

[Annual Phosphorus Loss Estimator](#)

[Building soils for better crops](#)

CLIMATE CHANGE & AGRICULTURAL IMPACTS

- 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.

Agricultural Products	Climate Change Impacts	Toolkit of Adaptation & Mitigation Practices
Dairy and Livestock	Heat stress, water impacts from heavy precipitation	Increased cooling, energy efficiency and renewables, water management
Vegetables and Field Crops	Disease, weed and pest pressure, flooding and short-term drought, longer growing seasons, heat stress	Integrated pest management, drainage or irrigation, soil health, cropping systems, shifting dates and new varieties
Tree Fruit, Berries, and Grapes	Unexpected freeze, short-term drought, reduced winter chill	Monitoring weather and protecting crops, siting, soil health and cropping systems, new varieties
Maple Syrup	Changing seasons, variable weather, contamination, tree health	Earlier tapping, new technologies, shifting production

CSF Resources and Best Management Practices

Climate

Tools

Team

Resources

Forum

Videos

Categories

Agricultural Sectors

- Dairy, Poultry, and Livestock
- Field Crops
- Grapes
- Greenhouse, Nursery, and Sod
- Maple
- Specialty Crops
- Tree Fruit and Berries
- Vegetables

Media Types

- Decision Support Tool
- Fact Sheet
- Online Courses
- Reports and Studies
- Videos
- Weather Map
- Workshop Presentations

Vulnerability Types

- Drought
- Flooding
- Frost Risk
- Heat Stress
- Insects
- Multiple Vulnerabilities
- Weeds

Adaptation Strategies

- Conservation Tillage
- High-Residue Cover Crops
- Irrigation

Science for a Hungry World



The NASA, "Science for a Hungry World" video series covers the challenges surrounding feeding an ever growing population and how [Read more >](#)

Maine's Climate Future: Assessment Report



Published by the University of Maine, Maine's Climate Future is a comprehensive assessment of climate change in Maine. The report [Read more >](#)

NRCS Technical Publications



The Plant Materials Program is an extensive listing of technical publications organized by topics such as Climate Change, Cover Crops and [Read more >](#)

Connecticut Ag Impact Report



Published by the Connecticut Governor's Steering Committee on Climate Change, this report analyses the potential impacts of climate change on [Read more >](#)

New Jersey Ag Impact Report



Published by Rutgers Climate Institute, this report examines the potential impacts of climate change on agriculture, aquaculture and fisheries throughout [Read more >](#)

Vermont Ag Impact Report



Published by the Vermont Agency of Natural Resources, this report provides an overview of potential climate change impacts on agriculture [Read more >](#)

Building soils for better crops manual



The third edition of Building Soils

Small Farm Adaptation Guidebooks



Preparing smallholder farm

Cool Farm Tool



Developed by the University of

Climate Smart Farming Multimedia

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

[See more Multimedia](#)



RECENT MULTIMEDIA

[Adaptation and Agriculture](#)

[Apple Growers](#)

[Common Thread Farm](#)

[Cornell Maple](#)

[Farming for Energy](#)

[Fishkill Farms](#)

[Hahn Farm](#)

Climate Smart Farming Forum

Ask questions. Get answers. Share Information.

Join or Search the Forum

RECENT TOPICS

Precipitation changes in NE and other regions?

Details about more frost-free days during the year?

Irrigation on my farm

Installing more renewable energy on my farm

What are the GDD measures for corn?

Soil runoff in large rainfall events

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

Climate Smart Farming Tools

Climate

Tools

Team

Resources

Forum

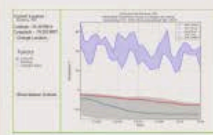
Videos

CSF Growing Degree Day Calculator



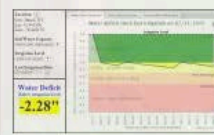
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Climate Normals - Northeast Regional Climate Center



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

1 2 →

U.S. Drought Monitor



The map is based on measurements of climatic, hydrologic and soil conditions as well as reported impacts and observations from more than 350 contributors around the country.

NOAA Seasonal Outlook - Precipitation



A seasonal forecast is the best available prediction of what our climate will be like in the next few months.

NOAA Seasonal Outlook - Temperature



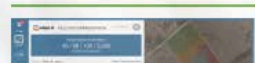
A seasonal forecast is the best available prediction of what our climate will be like in the next few months.

USDA Plant Hardiness Map



The USDA Plant Hardiness Zone Map is the standard by which gardeners and growers can determine which plants are most likely to thrive at a location.

Adapt-N Nitrogen Management Tool



COMET-Farm GHG Accounting 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.
- Farmers/Advisors 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 GDD Tool

Current Location :

34 Voorhees Ave
Somerset, NJ 08873
Latitude: 40.4832016
Longitude: -74.4841461

Change Location

Planting Date:

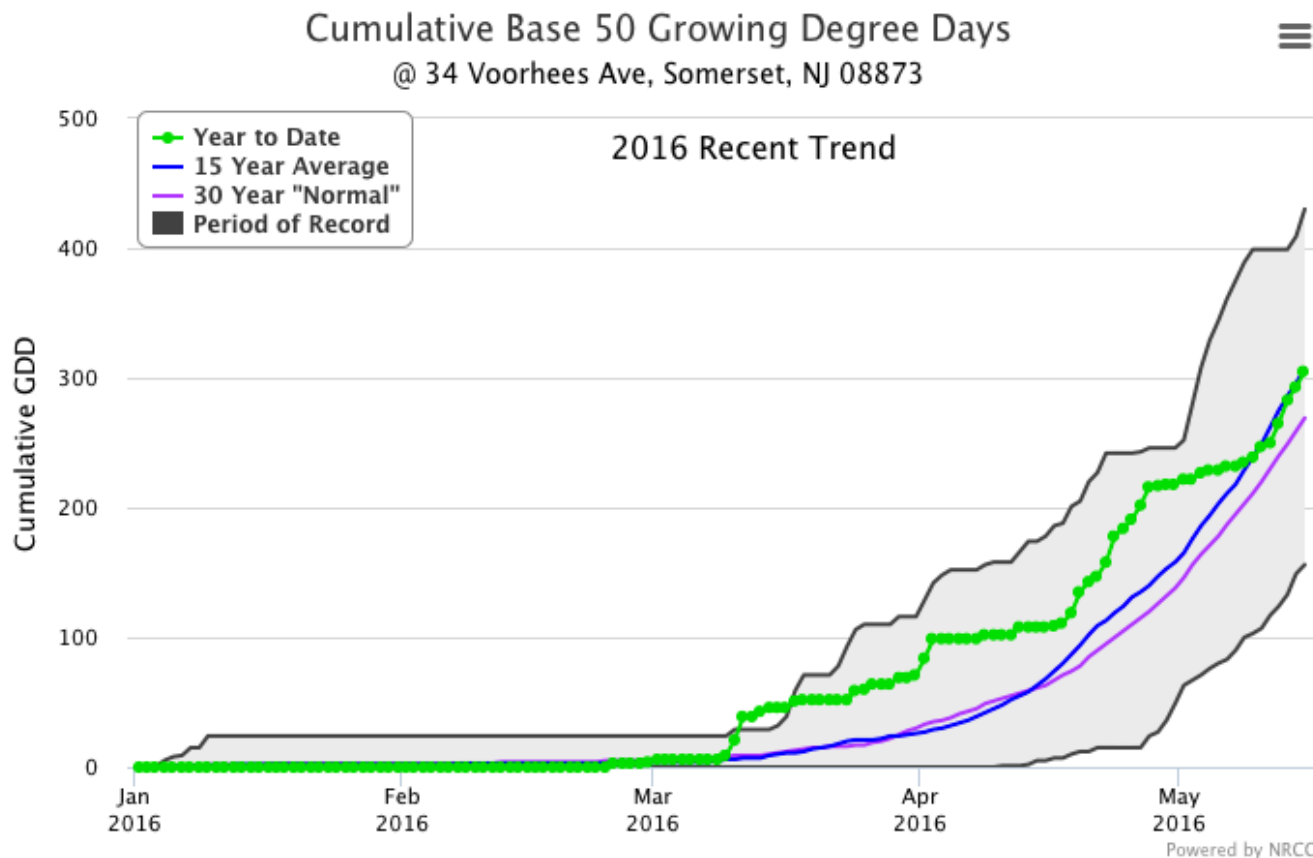
2016-01-01



GDD Threshold

- Base 50
- Base 8650

Season Outlook



© Cornell University, 2016. Credits: Tool Developed by Art DeGaetano & Rick Moore.

CSF GDD Tool

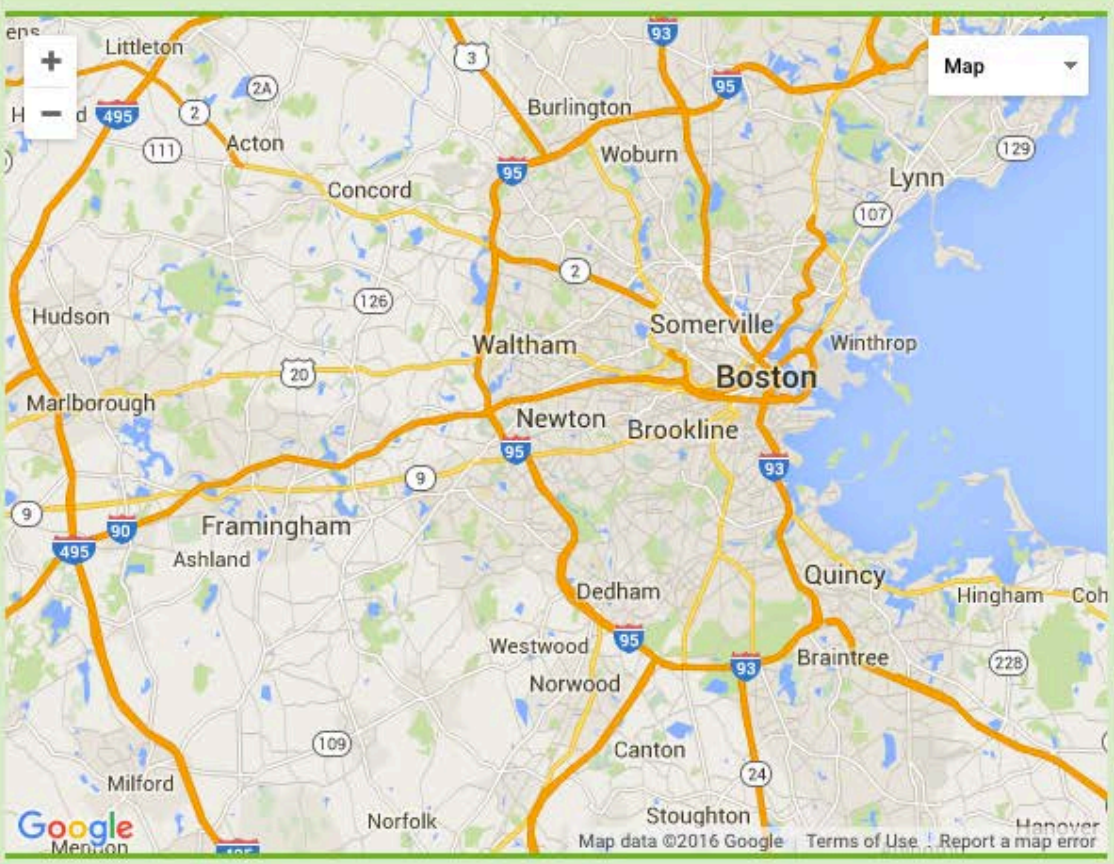
Location Map Dialog

Current Location :
34 Voorhees Ave
Somerset, NJ 08873
Latitude : 40.4832016
Longitude : -74.48414

Planting Date:
2016-01-01

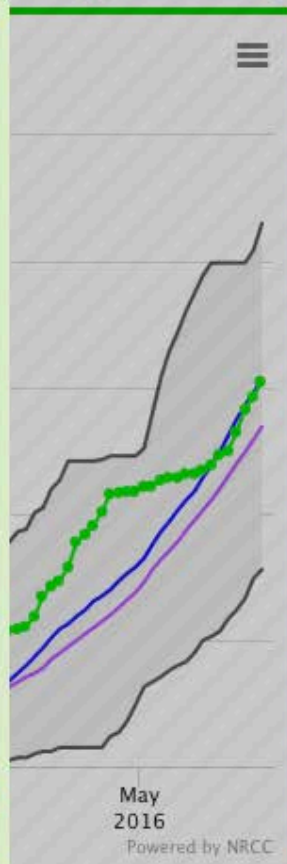
GDD Threshold
 Base 50
 Base 8650

Map

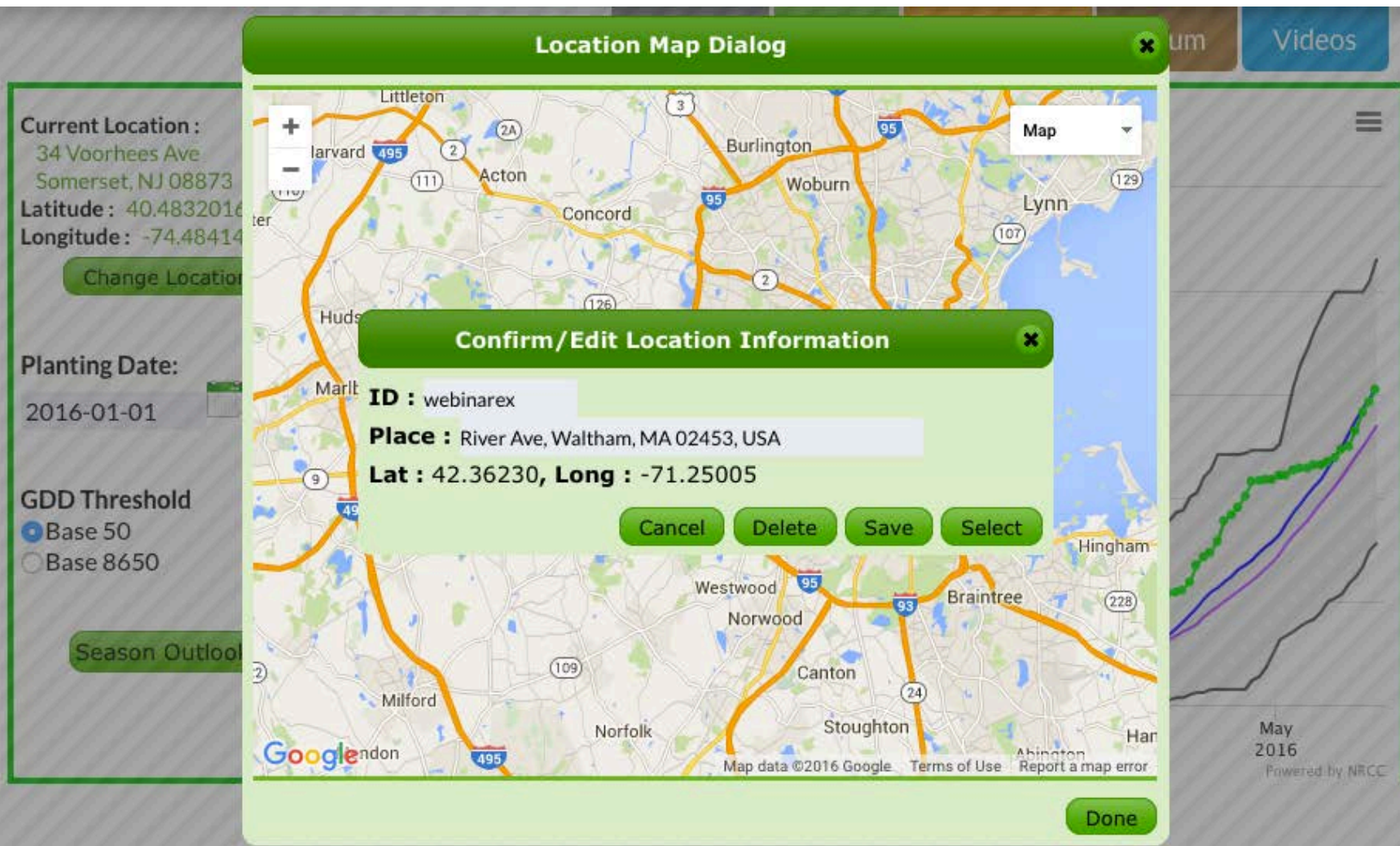


Done

May 2016
Powered by NRCC



CSF GDD Tool



Location Map Dialog

Confirm/Edit Location Information

ID : webinarex
Place : River Ave, Waltham, MA 02453, USA
Lat : 42.36230, **Long :** -71.25005

Buttons: Cancel, Delete, Save, Select

Map data ©2016 Google. Terms of Use. Report a map error.

Done

Current Location :
34 Voorhees Ave
Somerset, NJ 08873
Latitude : 40.4832016
Longitude : -74.48414

Change Location

Planting Date:
2016-01-01

GDD Threshold
 Base 50
 Base 8650

Season Outlook

May 2016
Powered by NRCC

CSF GDD Tool

Location Map Dialog

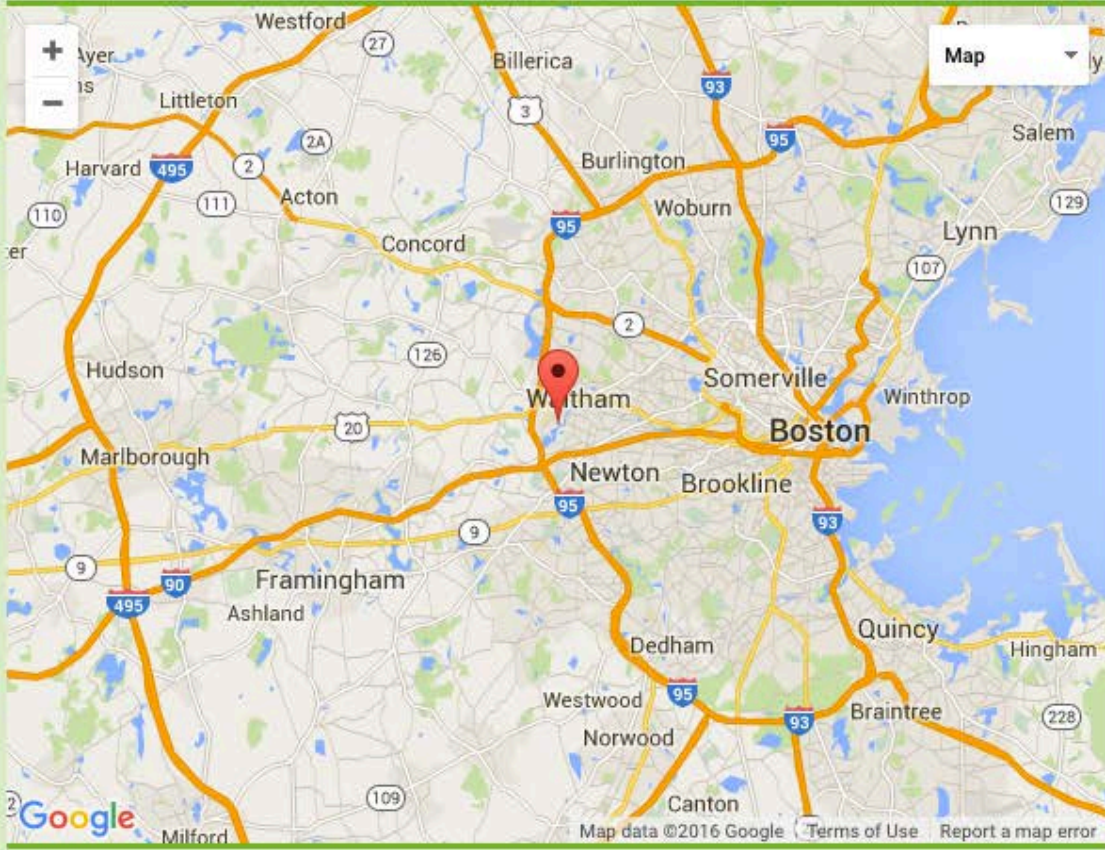
Current Location :
River Ave
Waltham, MA 02453
Latitude : 42.3622985
Longitude : -71.25004

Planting Date:
2016-04-15

GDD Threshold
 Base 50
 Base 8650

Recent Trend

Done



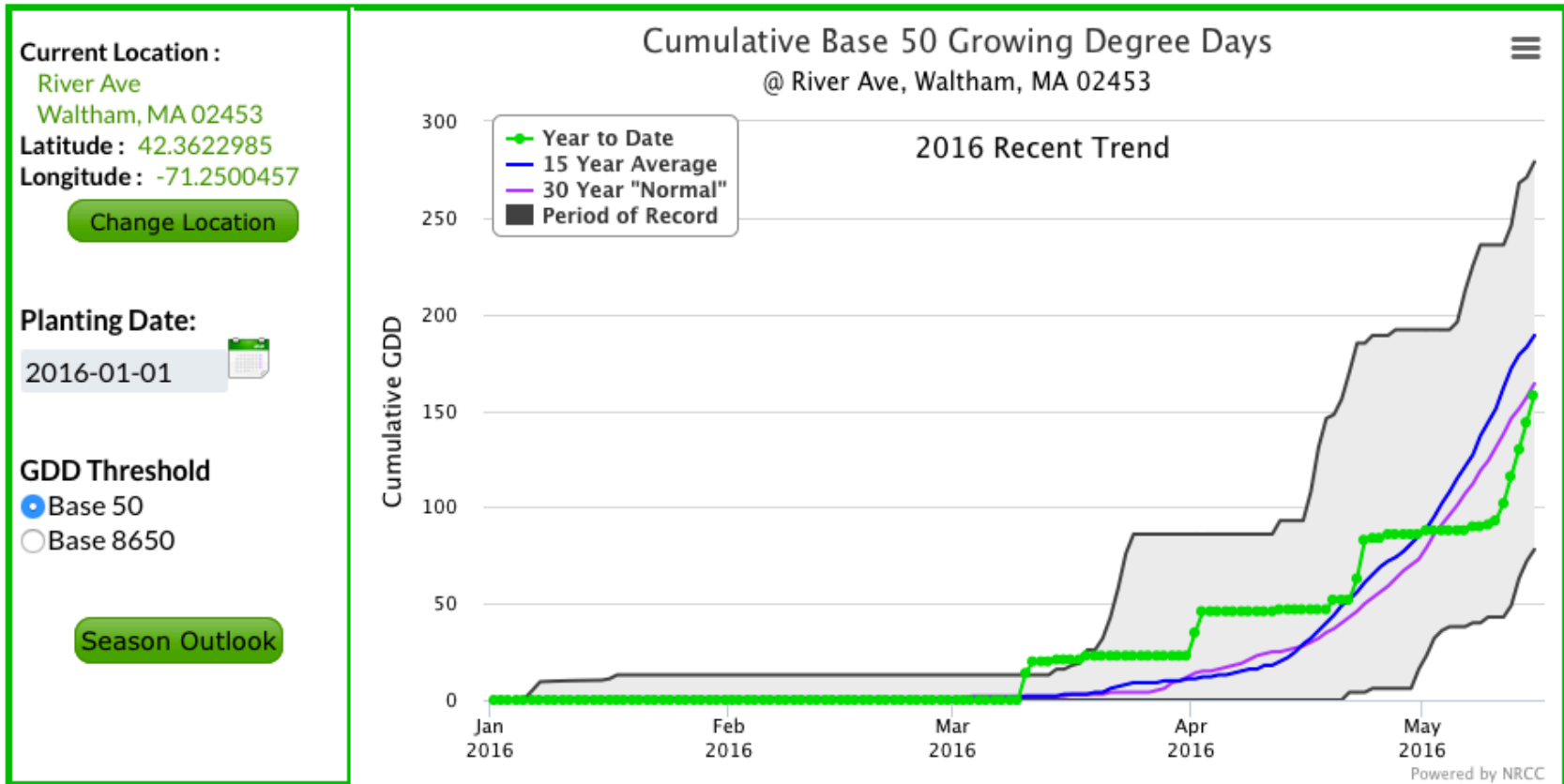
Map

Map data ©2016 Google Terms of Use Report a map error

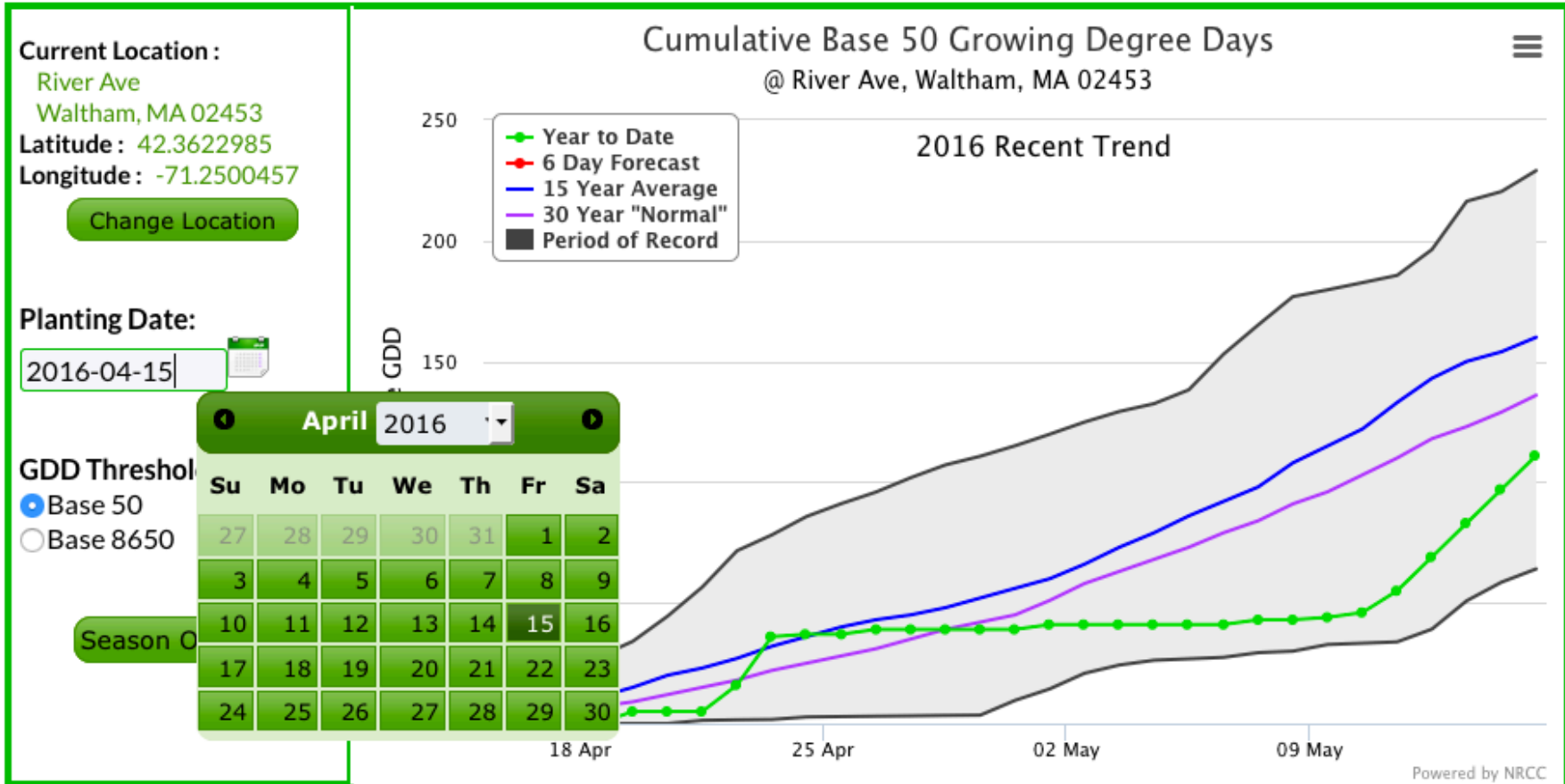
Oct 2016 Nov 2016
Powered by NRCC

um Videos

CSF GDD Tool




CSF GDD Tool



CSF GDD Tool

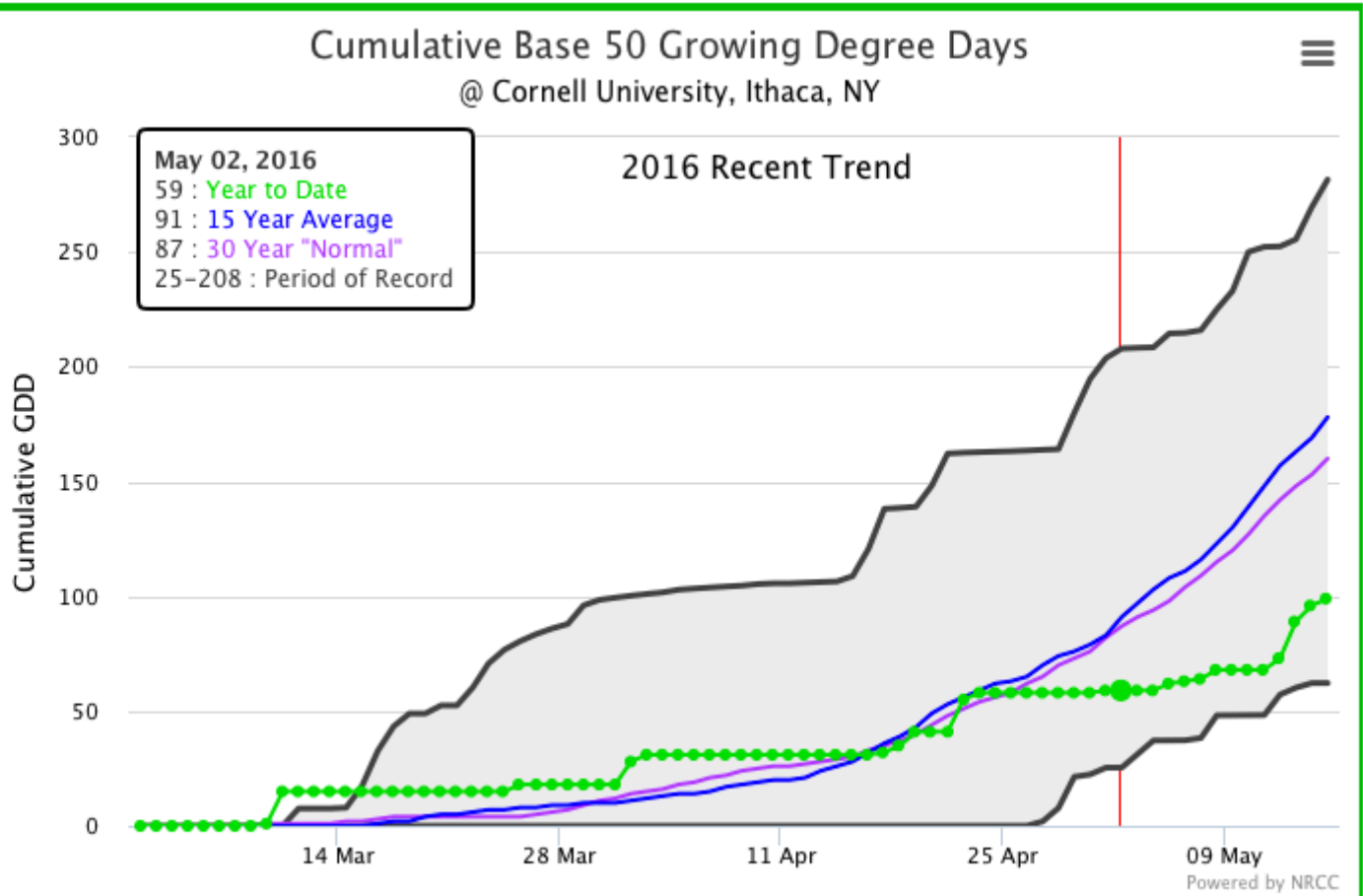
Current Location :
 Cornell University
 Ithaca, NY
Latitude : 42.4500000
Longitude : -76.4800000

[Change Location](#)

Planting Date:
 2016-03-01 

GDD Threshold
 Base 50
 Base 8650

[Season Outlook](#)



© Cornell University, 2016. Credits: Tool Developed by Art DeGaetano & Rick Moore.


CSF GDD Tool

Current Location :

River Ave
 Waltham, MA 02453
 Latitude : 42.3622985
 Longitude : -71.2500457

Change Location

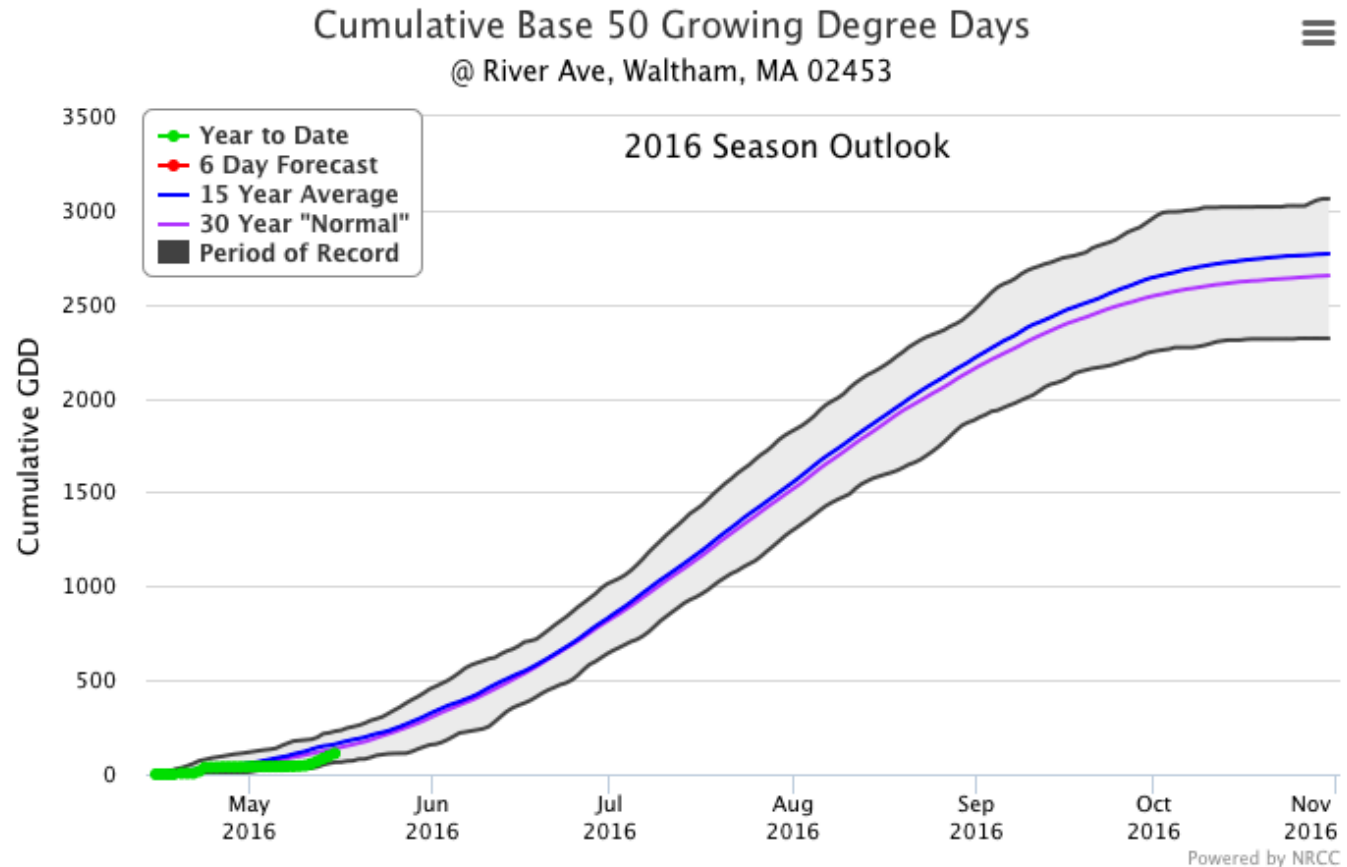
Planting Date:

2016-04-15 

GDD Threshold

Base 50
 Base 8650

Recent Trend

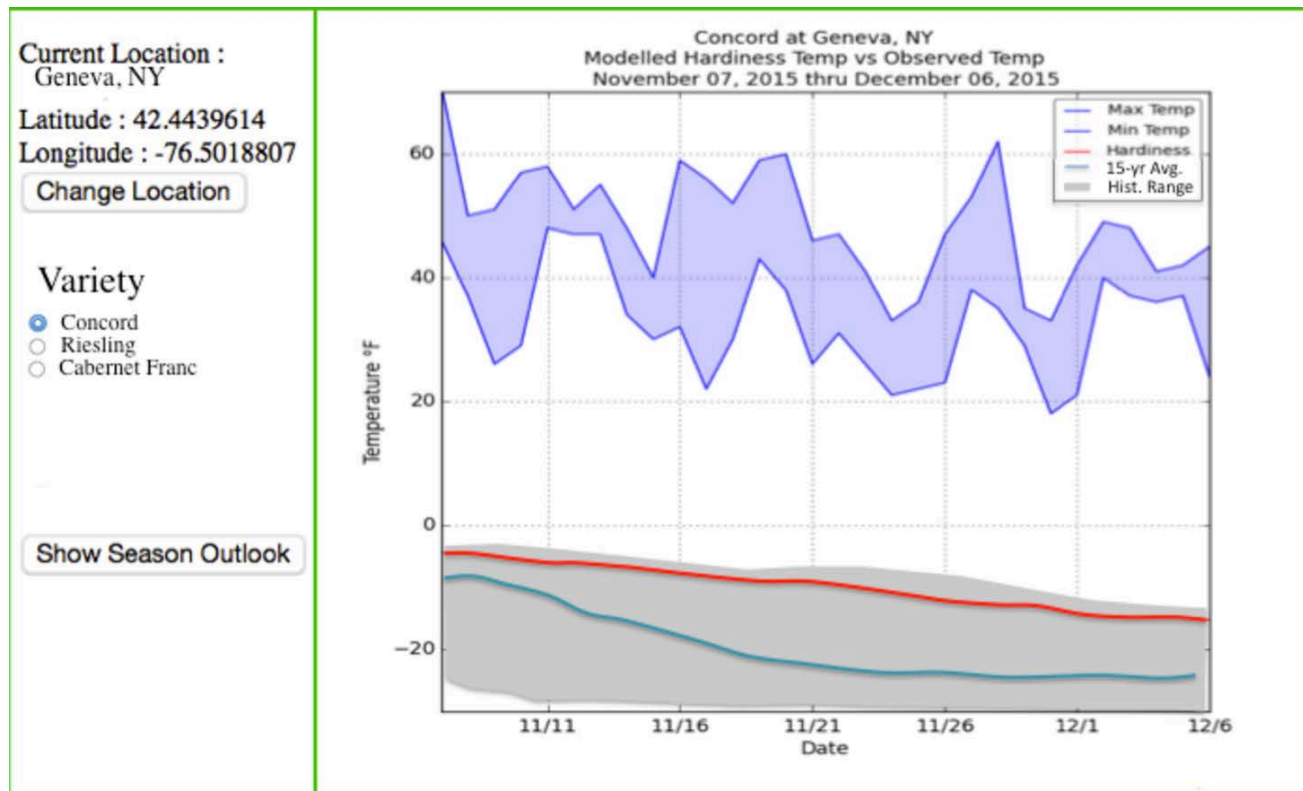


CSF Freeze Risk Tools

- Spring frosts are not receding as quickly as flowering is advancing, with climate change: Increased risk of frost/freeze damage
- Farmers/Advisors Use the Tools to:
 - Determine the level of freeze injury 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 seasonal outlook and observed temperature graphs of hardiness vs temperature

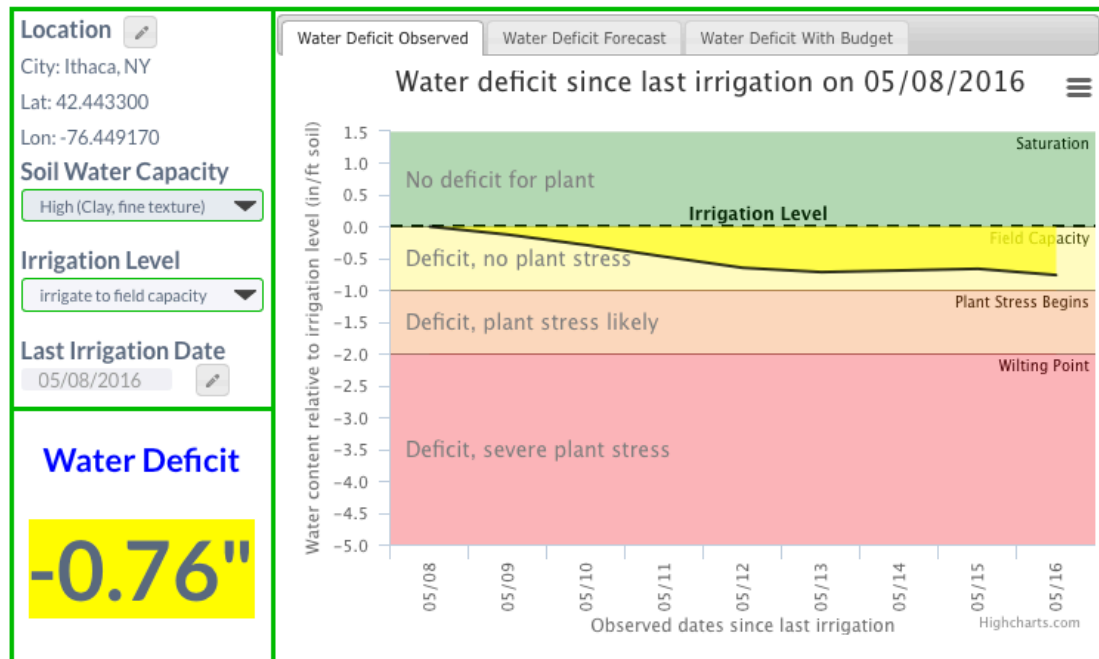


CSF Irrigation Scheduling Tool

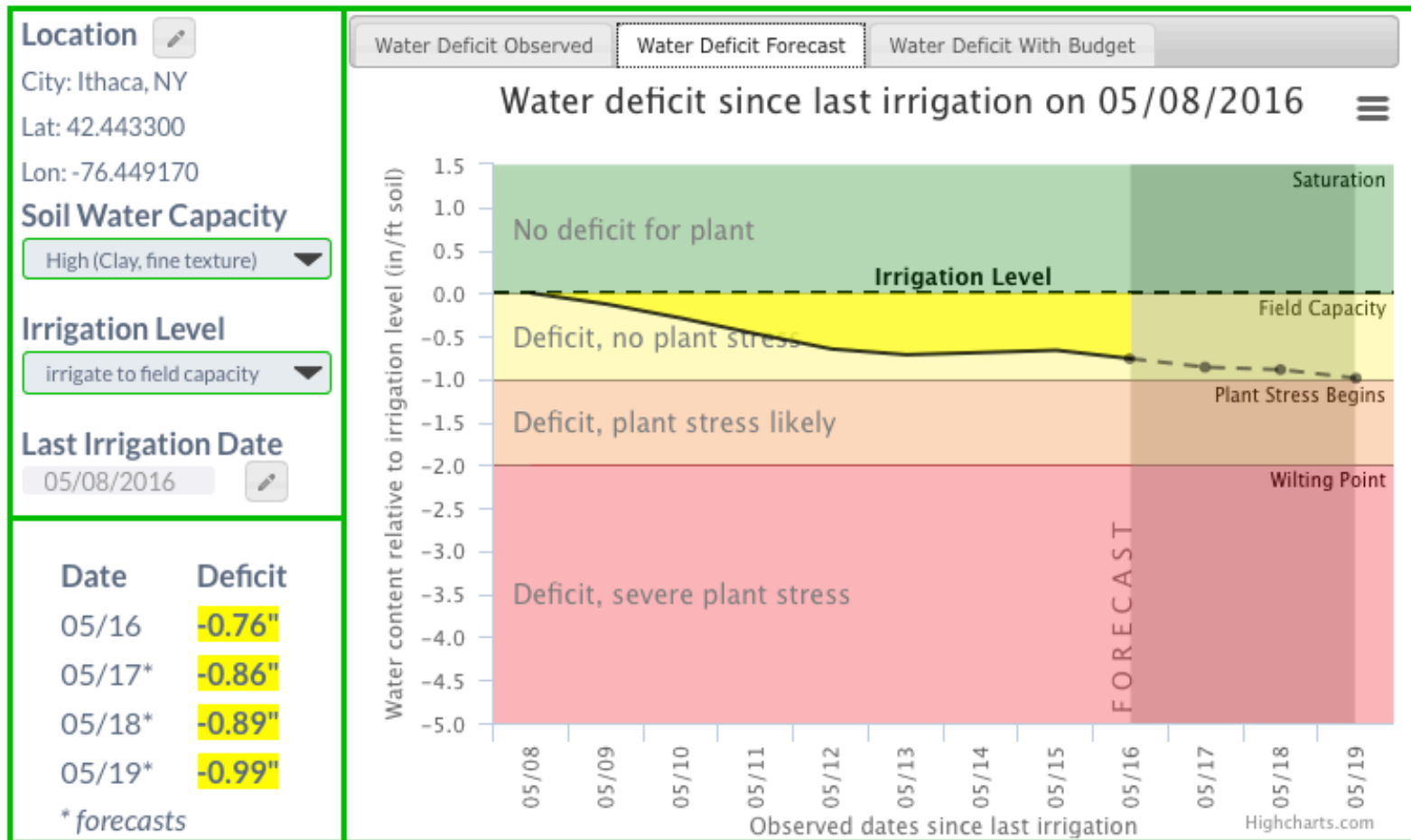
- Used to determine optimum frequency and duration of watering
- The tool estimates soil water content to create an outlook of current and future water deficits
- Farmers/Advisors use the tool to:
 - Optimize watering (minimize plant stress and conserve water)
 - Contextualize current water deficits, given historical data and climate change

CSF Irrigation Scheduler

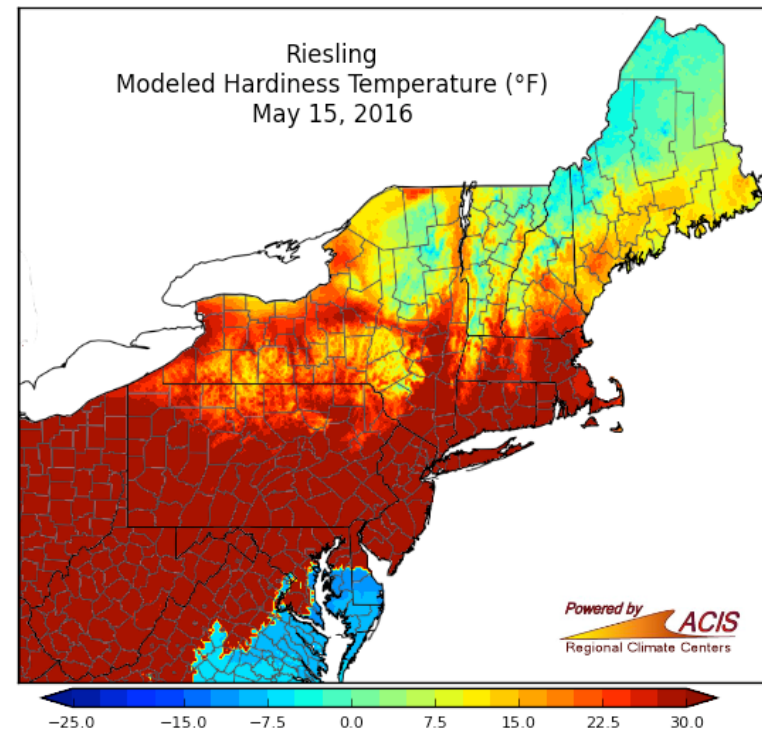
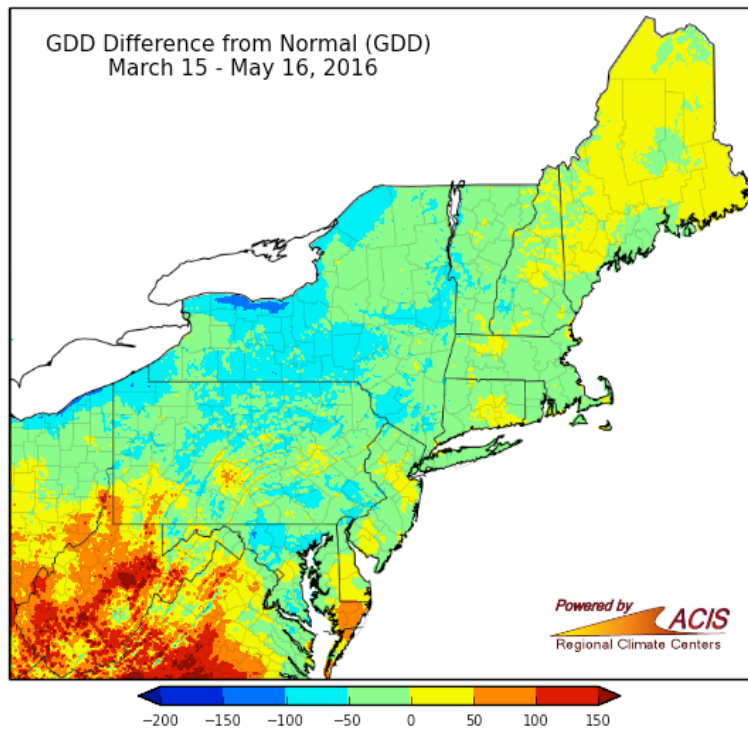
- Using the Tool:
 - Input location, soil type, and irrigation preferences
 - Graphs with water deficit, forecast, and budget will be created and shown



CSF Irrigation Scheduler



Regional Views



Training & Outreach

- 2015-2016: Building out the website functionality, tools, and resources
- 2016 spring: Introducing to extension and farmers at agriculture conferences
- 2016 fall/winter: Training for CSF extension team and ag extension specialists
- 2017: More in-depth training with farmers, building new tools

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 (2016/17 with USDA NE Hub and Dairy CAP)
 - Joining Multi-State Hatch Project: Food, Feed, Fuel, and Fiber: Security Under a Changing Climate: Enhance understanding of how ag stakeholders climate info and tools in their management decision processes (2017-2020).



Collaborative Infrastructure

- **Researchers, Staff & Students:** Allison Chatrchyan, Art DeGeatano, Jonathan Lambert, Trevor Partridge, Joana Chan, Toby Ault, Dave Wolfe, Mike Hoffmann
- **Data & Models:** Northeast Regional Climate Center & partners with NEWA: Art DeGaetano and staff
- **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

Questions & Answers?

Feedback from Farmers, Extension Specialists, and Partners



Thank You!



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Email: amc256@cornell.edu

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Professor, Earth and Atmospheric Sciences
Director, Northeast Regional Climate Center
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Office: 607-255-0385

Email: atd2@cornell.edu

Web: www.climatesmartfarming.org