Climate Change and Agronomonic Issues for Caneberry

- Dennis Todey, Director
- North American Blackberry and Raspberry Conference
- St. Louis, MO
- 5 March 2020

USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Topics/Agenda

- A brief Background of USDA Climate Hubs
  - Partners, Executive Committee and Steering Committee
  - More on the Midwest Climate Hub
- Various ag-climate impacts
  - Diseases
  - Weeds
  - Insects
  - Soils
- For More Information
  - Website
  - Contact Info

Intro to Climate Hub Work

Assessments and Syntheses
delivering relevant information

Outreach and Education
enabling climate-informed decisions

Technical Support
facilitating engagement, discovery and exchange

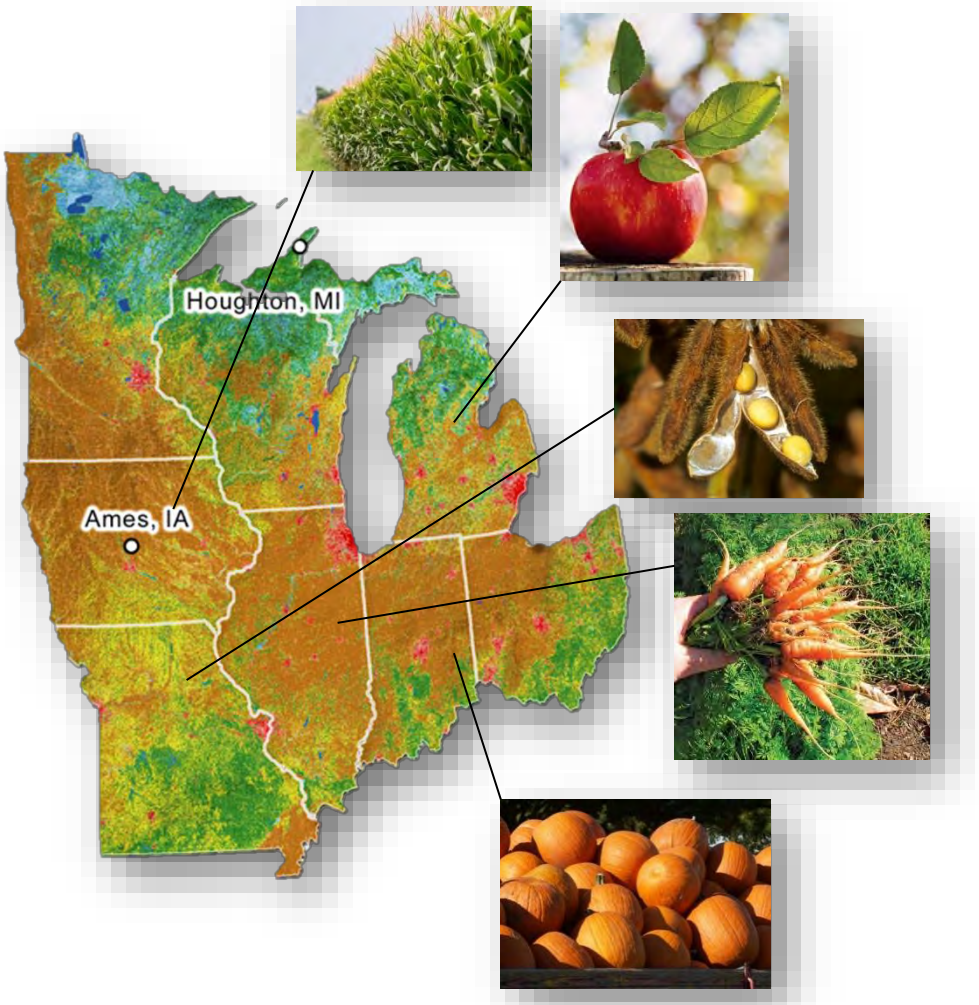
Agricultural Research Service

NRCS

Partners

Steering Committee

Here in the Midwest…



Our Goal

To provide information to help producers cope with climate change through **linkages of research, education and partnerships** in a region that represents one of the **most intense areas of agricultural production** in the world.

MCH Thematic Areas

Assessments and Syntheses
delivering relevant information

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

AMERICAN FRUIT GROWER

U.S. Global Change Research Program
National Climate Assessment

AMERICAN Vegetable GROWER

USDA Midwest Climate Hub
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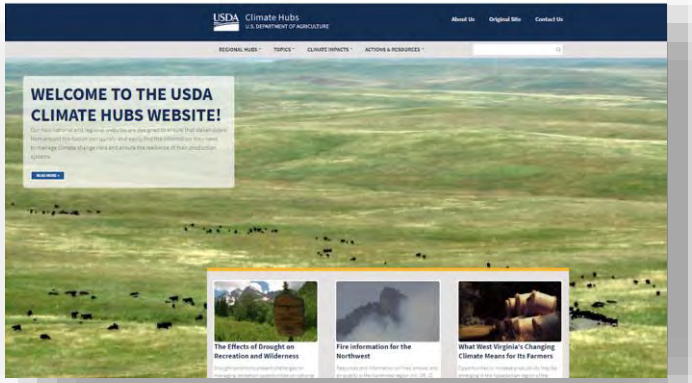
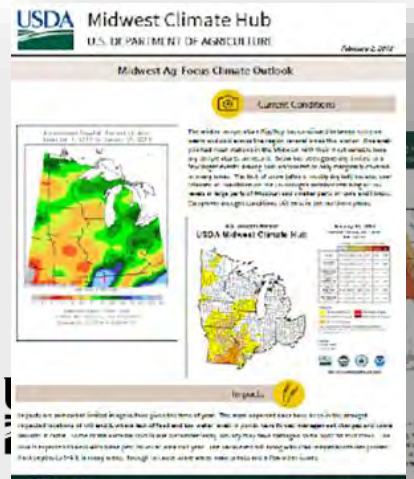
MCH Thematic Areas

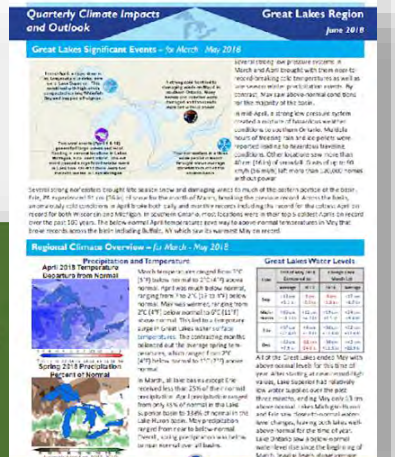
Outreach and Education
enabling climate-informed decisions

MAC-T

Midwest Agriculture and Climate Team







How are changes impacting your plants?

CROP-CLIMATE ISSUES

Climate-Impacted Issues for Agriculture

- Changing field work times
- Disease/insect/weed pressures
- More extremes
- Nutrient loss
- Increased variability (seeming)

Temperature Change

- Warming
  - Winter
  - Nights
- Added human stress
- Push GDD accumulation/phenological state
- Does help increase frost free season period

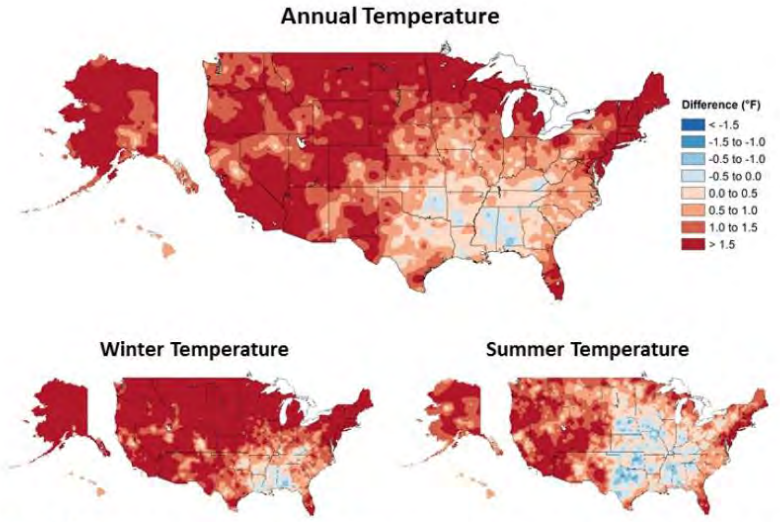


Figure 6.1. Observed changes in annual, winter, and summer temperature (°F). Changes are the difference between the average for present-day (1986–2016) and the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawai'i). Estimates are derived from the nClimDiv dataset.[1,2] (Figure source: NOAA/NCEI).

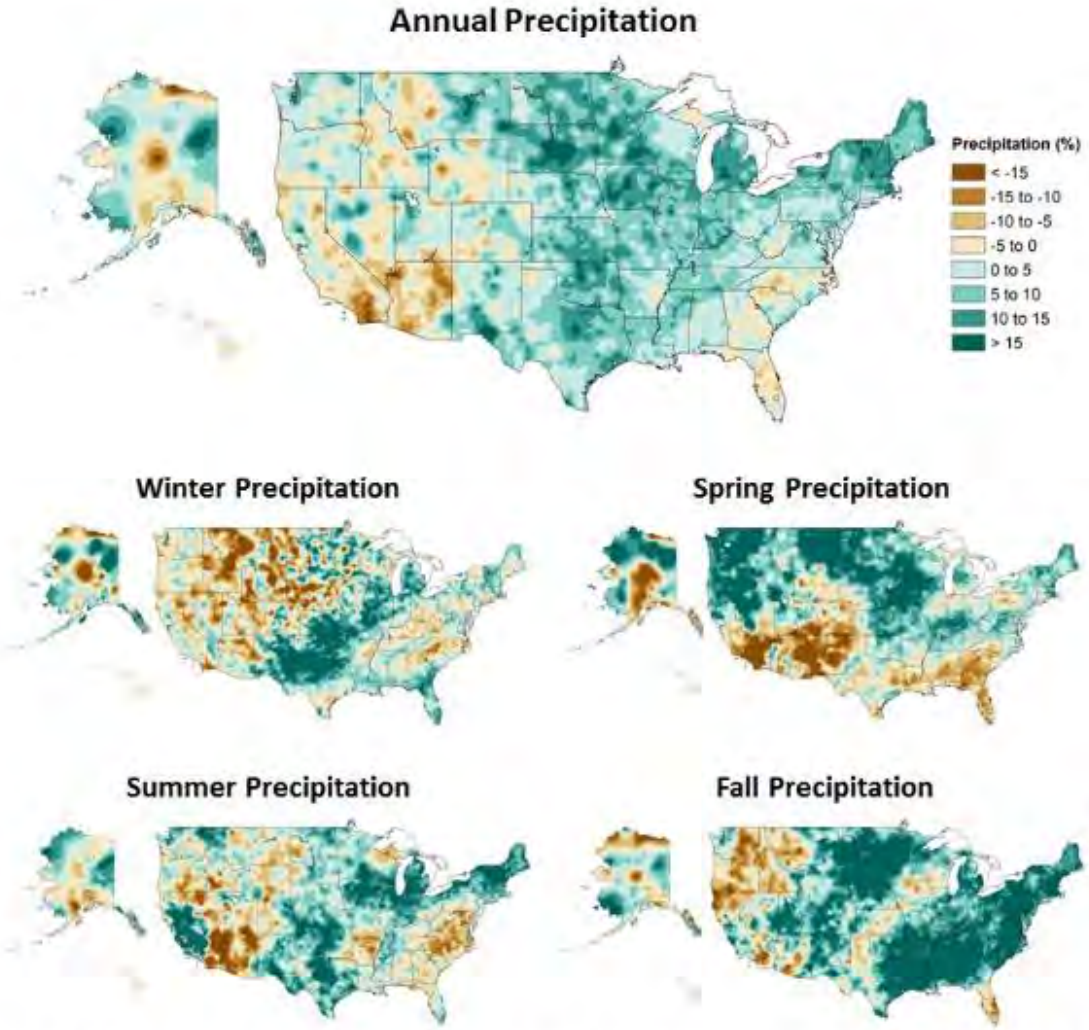


Figure 7.1: Annual and seasonal changes in precipitation over the United States. Changes are the average for present-day (1986–2015) minus the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawai'i) divided by the average for the first half of the century. (Figure source: [top panel] adapted from Peterson et al. 2013,[78] © American Meteorological Society. Used with permission; [bottom four panels] NOAA NCEI, data source: nCLIMDiv].

Issues from Precipication Changes

- Flooding/inundation (extended periods)
- Increasing precip intensity (especially off-season)
- More soil/nutrient loss potential
- Soil loss
  - Reducing tillage
  - Cover crops
- Splash potential
- Drought? – yes

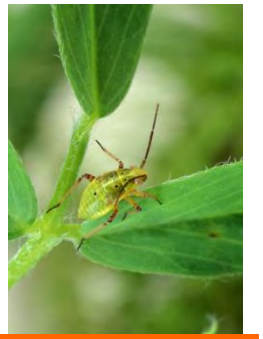
- Location specific

Biotic Impacts

Cheatgrass fire hazard?

- Changing habitats
- Enhanced CO_2 fertilization

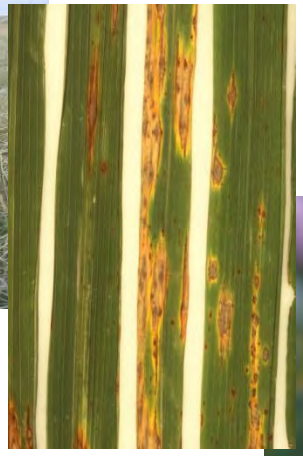
C:N ratio + lodging?

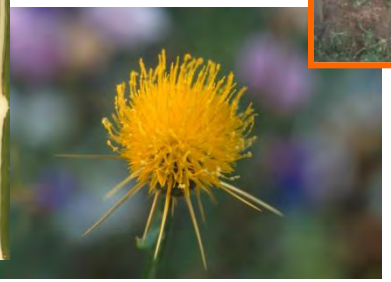


Weeds, vines, invasive plants
Insects
Pathogens
Animals

Herbicide effectiveness??

Nutrient poor forage?





Issues with Insects

1)Expanding geographic ranges northward

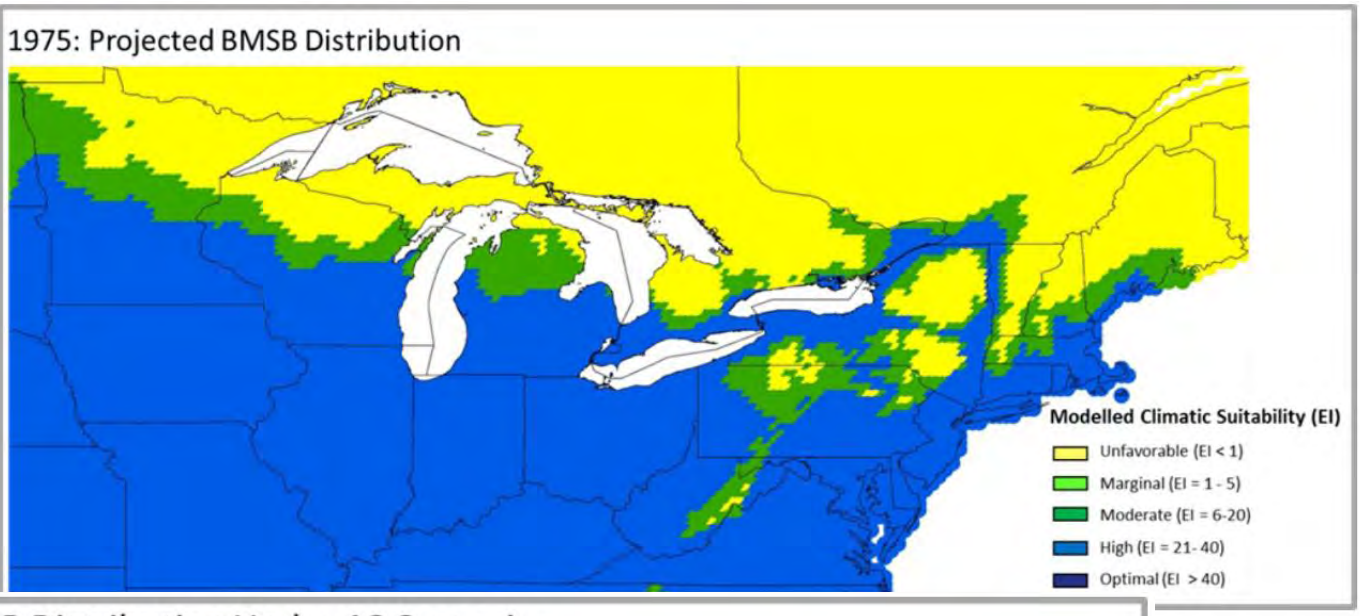
2) Reducing winter die offs

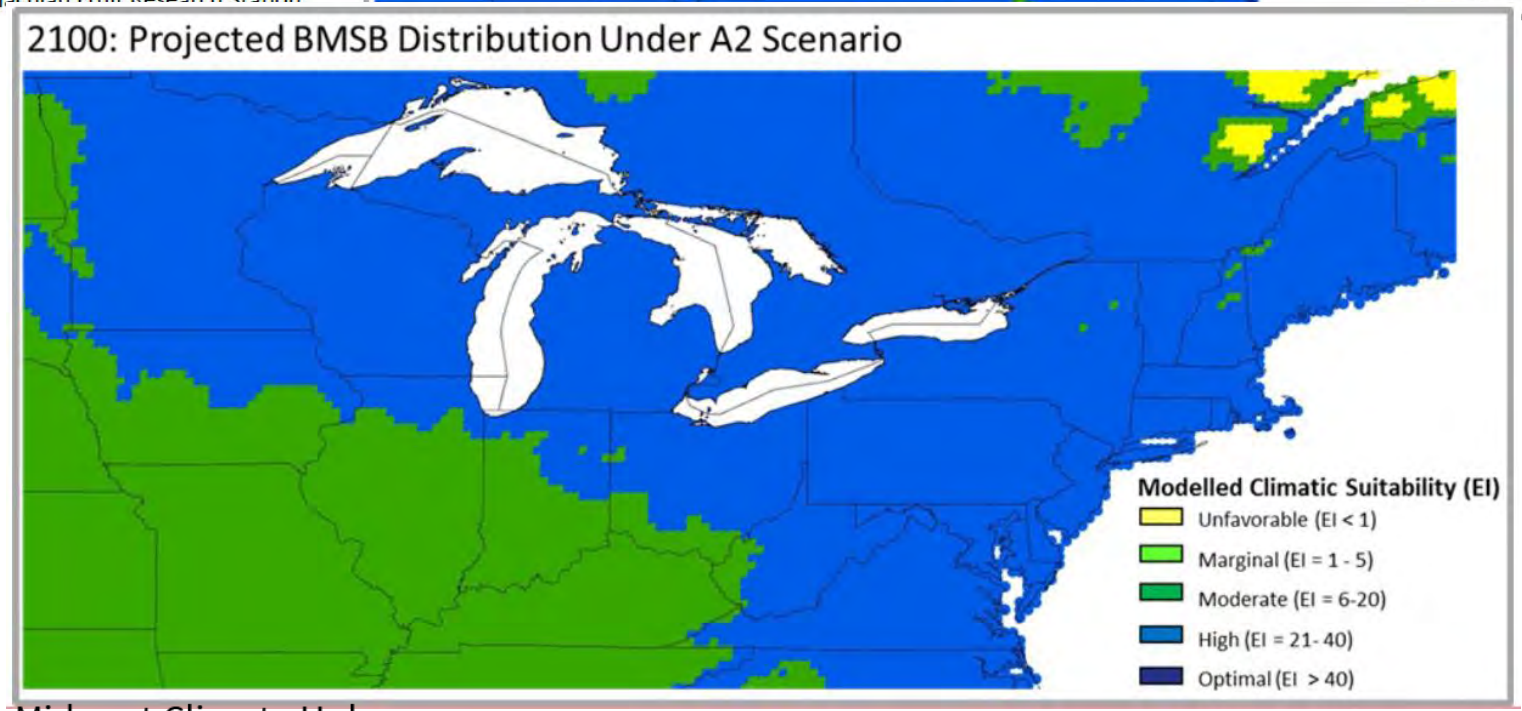
3)Earlier spring emergence

4) Increased generations per year

- **Invasive insects are of particular concern since they often limited more by climate in their non-native ranges (no natural enemies and abundant food)**

Figure 1. BMSB eating an apple. In 2010, the mid-Atlantic apple industry suffered ~ US$37 million in losses from BMSB feeding damage. Photo by Tracy Leskey, USDA -ARS Appalachian Fruit Research Station





http://www.ipcc.ch/report/graphics/index.php?t=Assessment%20Reports&r=AR5%20-%20WG1&f=Chapter%2011

Issues with Weeds

- Weeds often more competitive than crops
- CO_2 fertilization
- Many crop CO_2 changes

- Increased cost of production
- Increased management
- More potential crop loss
- More use of chemicals
  - Also resistance issues

Ziska et al. 1999. Weed Science. 47:608-615, inter alia

Issues with Diseases

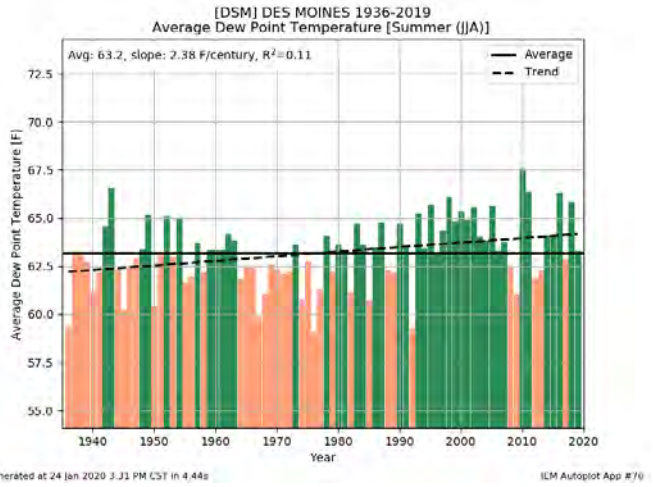
- Changing disease conditions
- Wetter – more likely disease
- Increased precipitation
  - More splash from ground
  - Wetter plants more frequently

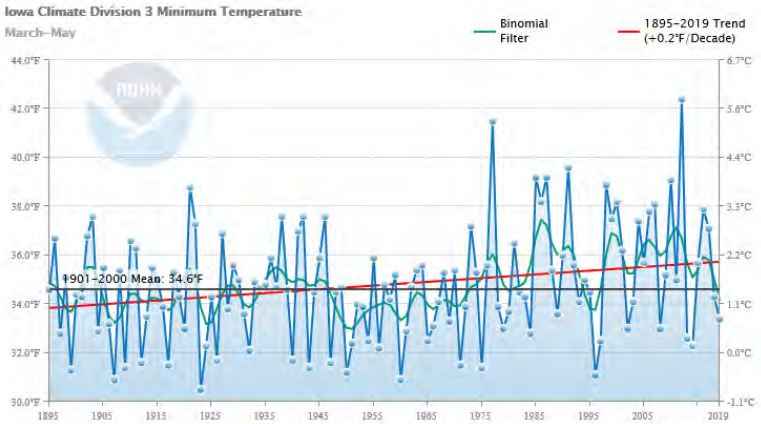
Anthracnose

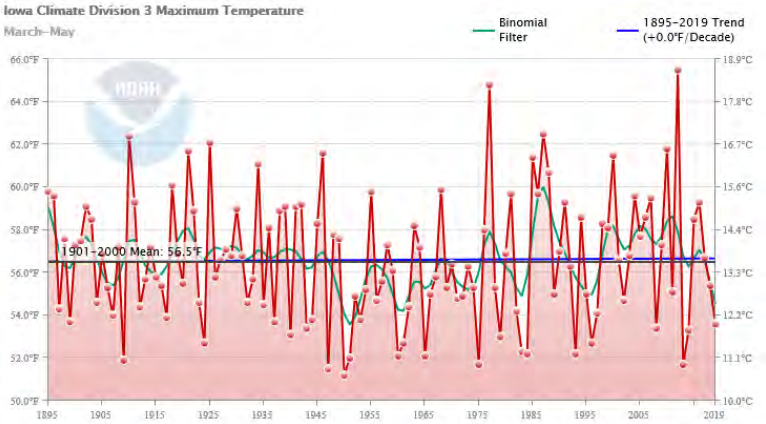
https://ohioline.osu.edu/factsheet/plpath-fru-27

Issues with Diseases

- Higher humidity
  - More moisture in air
  - Changing day-night temps.
  - Longer possible dew periods



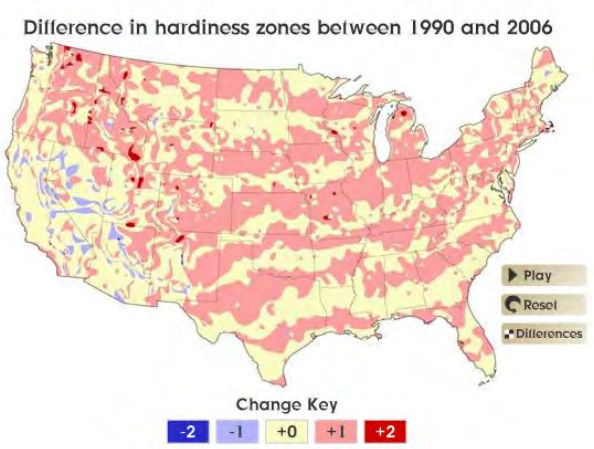




https://www.ncdc.noaa.gov/cag

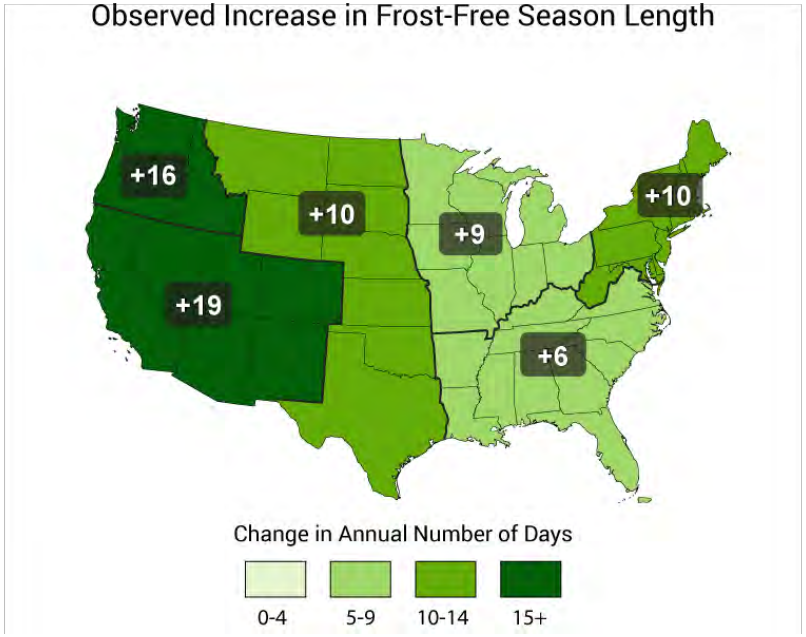
Other Issues

- Annual versus perennial crops (time frames)
- Changing springs impacts perennials
- Winter injury
  - Cold extremes happen (less frequency)
  - Variability



Other Issues (spring)

- Warming nights and winters – shorter frost-free season. *But highly variable*
- Warming winters reduces chilling hours for tree fruits
- Early dormancy break
- Freeze issues
  - 2007, 2012, 2017, etc.
- Solutions?



http://nca2014.globalchange.gov/

What are your needs/Can we work together?

DECISION-MAKING/TOOLS

Needs for Decision-Making

- Data – monitoring
- Current conditions
  - Where are crops in phenology?
  - What issues are they having?
- Outlooks – what is going to happen?
- Decisions that need to be made and how to make them?
  - Are there tools to help in the decisions?

Needs for Decision-Making

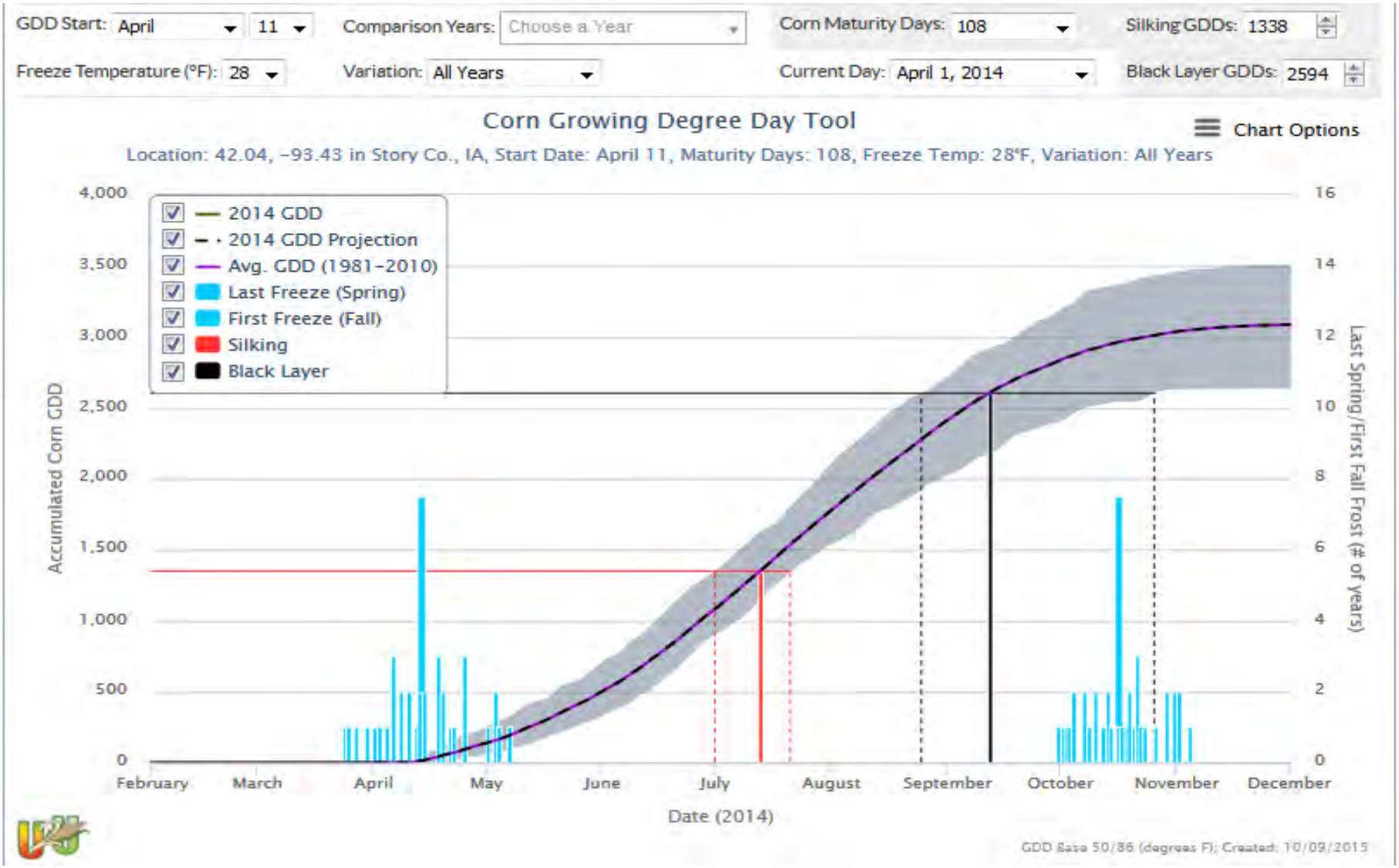
- Ability to make decisions – other influences.
- Willingness to change actions based on tools/data available
- Access to information about decision-making
- Trusting data/information

Corn Growing Degree Days

This tool puts current conditions into a 30-year historical perspective and offers trend projections through the end of the calendar year. Growing Degree Day (GDD) projections, combined with analysis of historical analog data, can help you make decisions about:

- Climate Risks – Identify the likelihood of reaching maturity before frosts/freezes.
- Activity Planning – Consider corn hybrid estimated physiological maturity requirements, along with GDD projections when making seed purchasing and other growing season decisions.
- Marketing – Look at historical and projected GDD when considering forward pricing and crop insurance purchases.

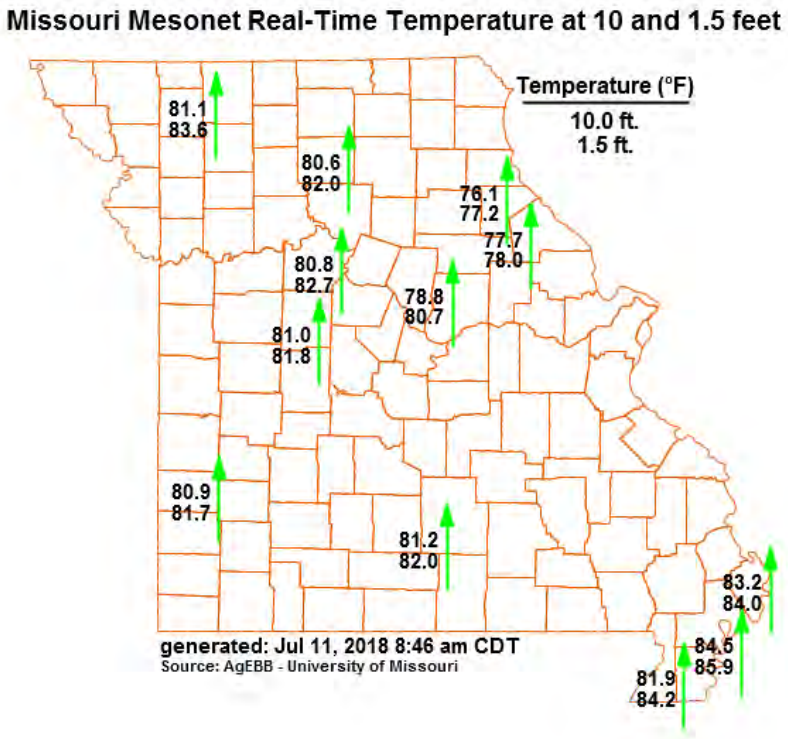
GDD Graph


GDD Start: April 11
Comparison Years: Choose a Year
Corn Maturity Days: 108
Silking GDDs: 1338
Freeze Temperature (°F): 28
Variation: All Years
Current Day: April 1, 2014
Black Layer GDDs: 2594
Corn Growing Degree Day Tool
Chart Options
Location: 42.04, -93.43 in Story Co., IA, Start Date: April 11, Maturity Days: 108, Freeze Temp: 28°F, Variation: All Years
2014 GDD
2014 GDD Projection
Avg. GDD (1981-2010)
Last Freeze (Spring)
First Freeze (Fall)
Silking
Black Layer
Accumulated Corn GDD
Last Spring/First Fall Frost (# of years)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
16
14
12
10
8
6
4
2
0
February
March
April
May
June
July
August
September
October
November
December
Date (2014)
GDD Base 50/86 (degrees F); Created: 10/09/2015

Real data around you

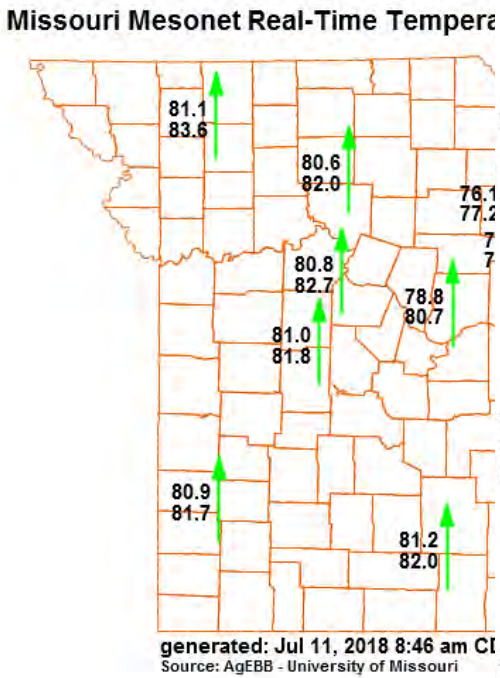
MONITORING/DRIFT

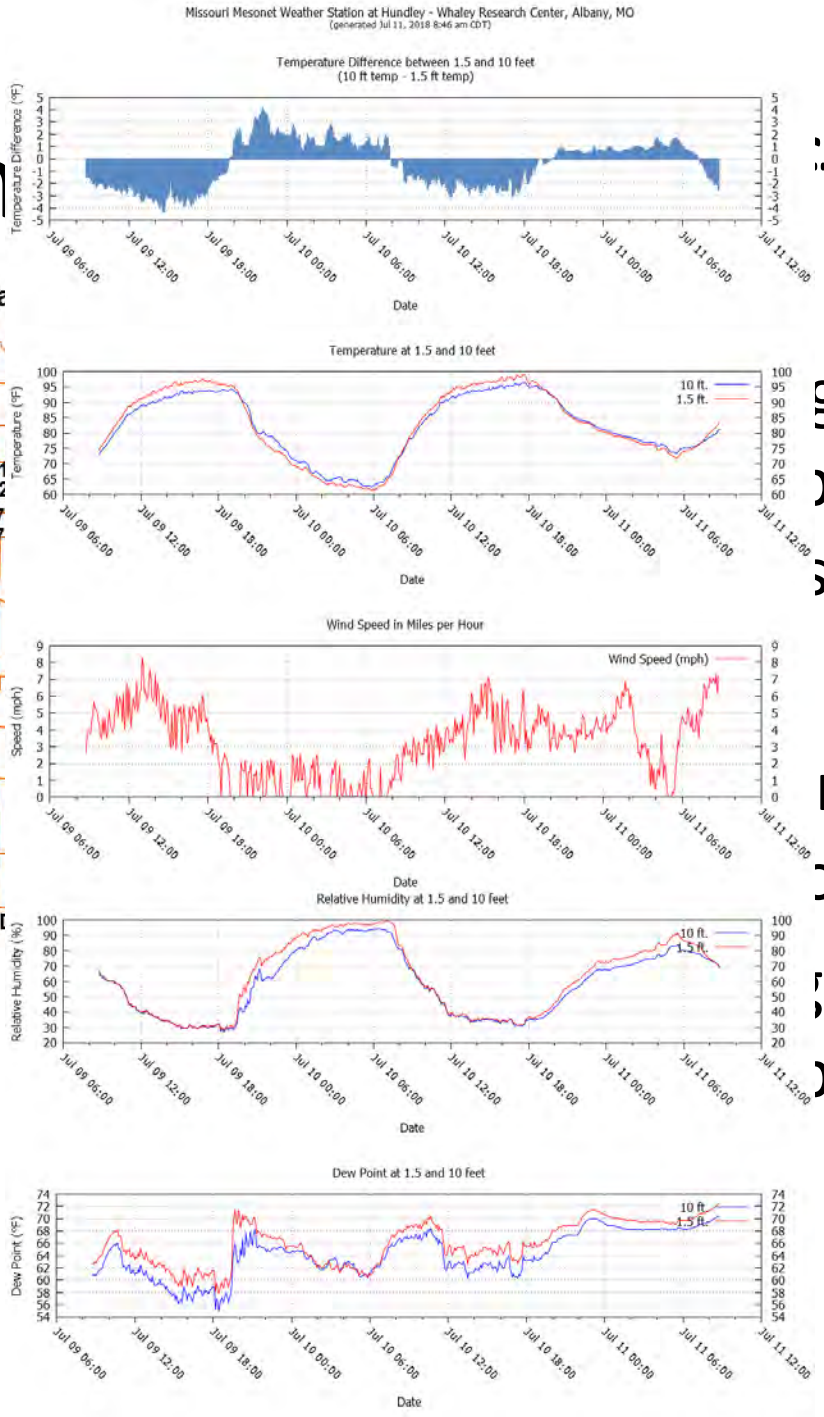
Inversions and Drift



- Developing regional inversion potential for drift issues
- Missouri first
- Six additional states and Dakotas now adding
- Measuring low level inversion potential and timing

In t





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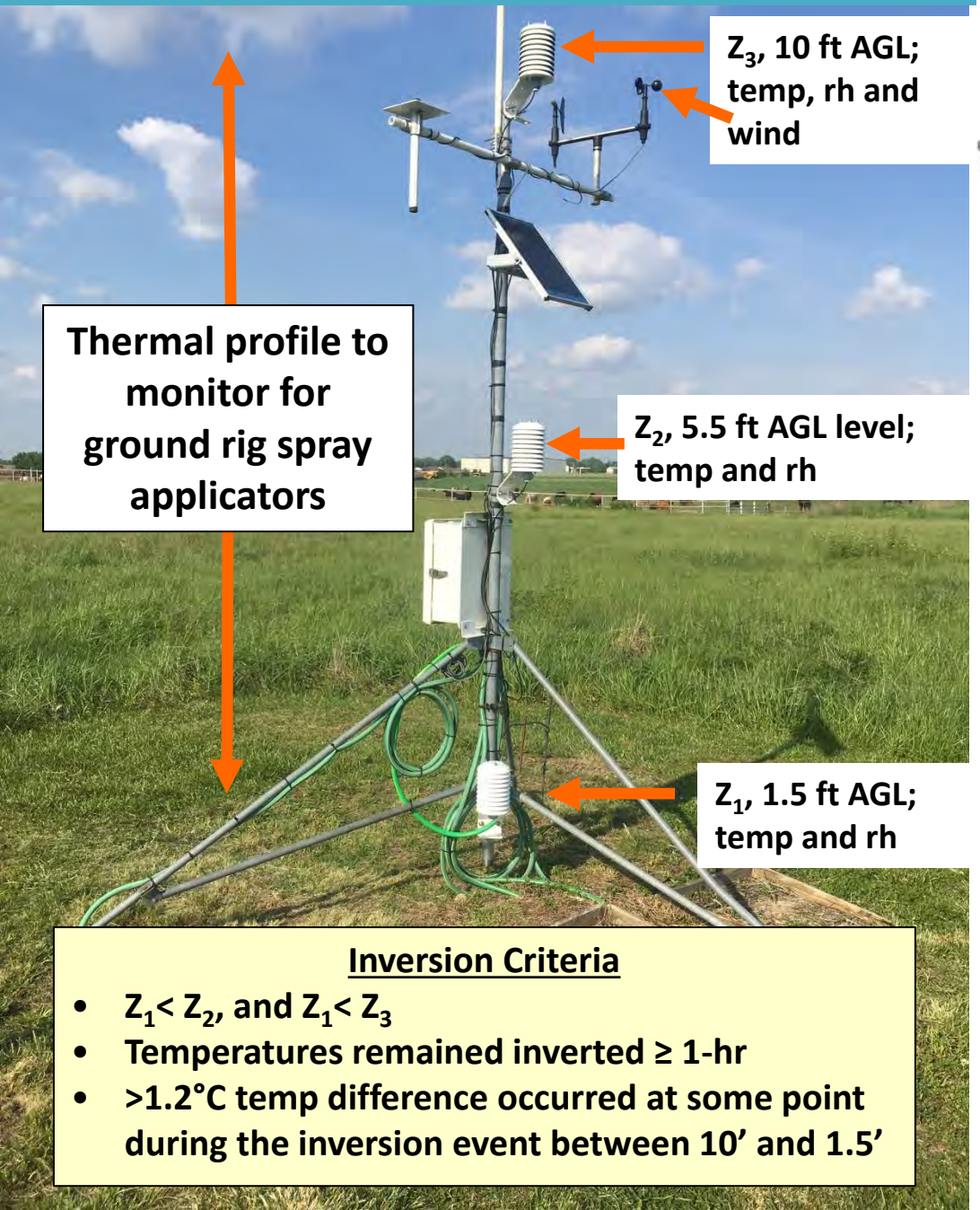
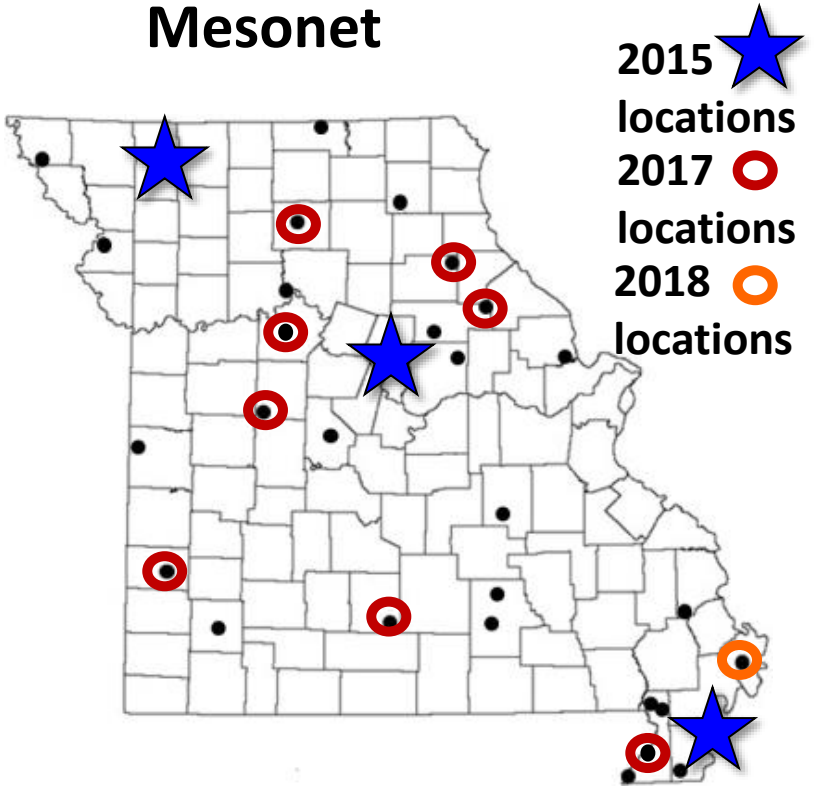
Surface Temperature Inversion Project



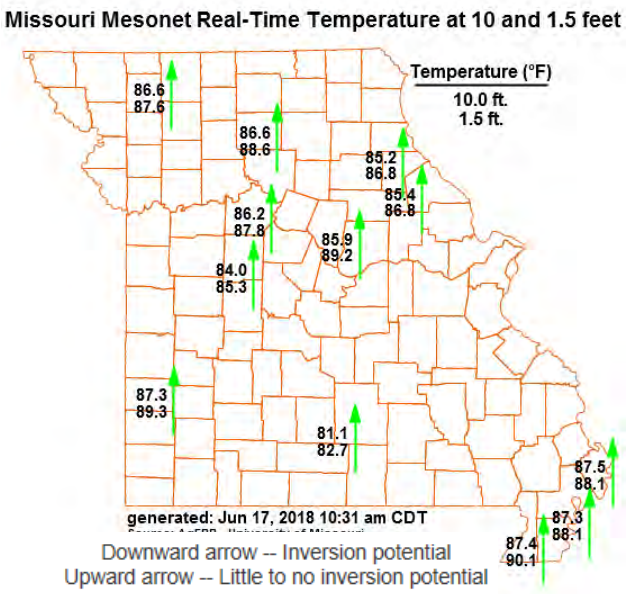
Inversion Criteria

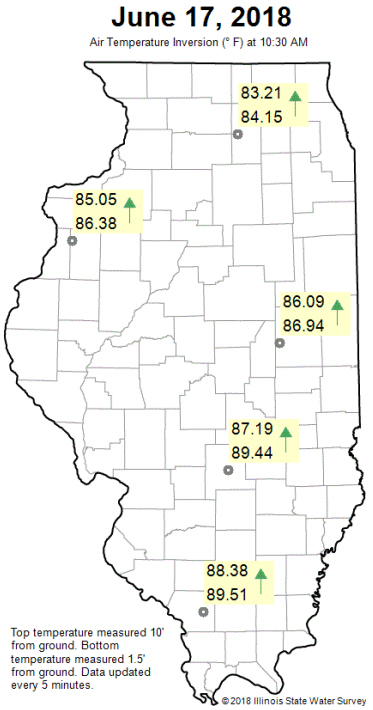
- $Z_1 < Z_2$, and $Z_1 < Z_3$
- Temperatures remained inverted ≥ 1-hr
- >1.2°C temp difference occurred at some point during the inversion event between 10' and 1.5'

Missouri Mesonet

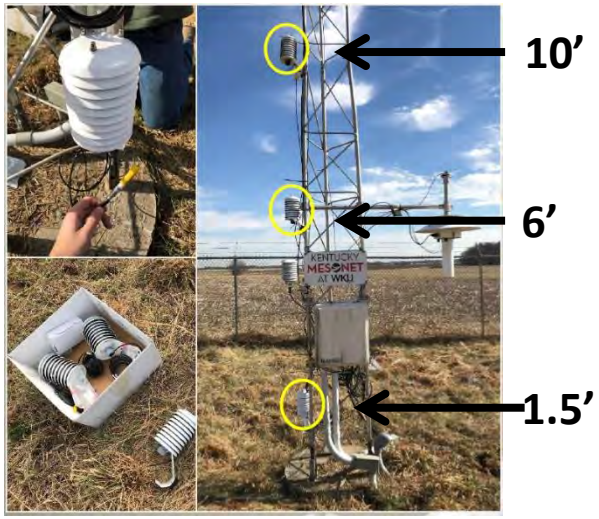


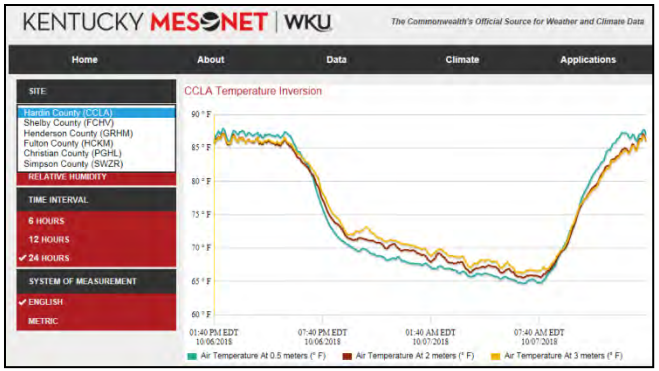
Thanks to funding from the USDA Midwest Climate Hub, Missouri's inversion monitoring protocol was imitated in IL, MI, KY, OH and IN





Kentucky Mesonet





-Same Sensors
-Same Components
-Same Heights
-Same Programming

https://www.drought.gov/drought/dews/midwest/reports-assessments-and-outlooks

Midwest and Great Plains Climate-Drought Outlook 15 September 2016

Dr. Dennis Todey

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515-294-2013

National Drought Mitigation Center

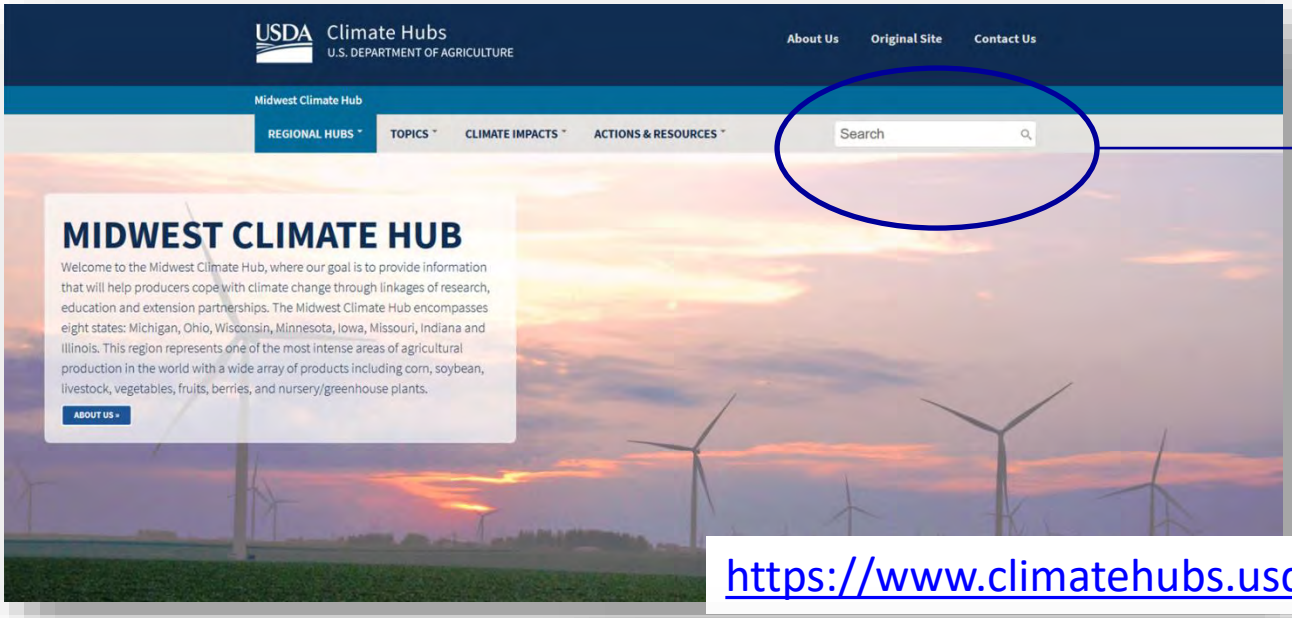
NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Regional Climate Centers

AASC American Association of State Climatologists

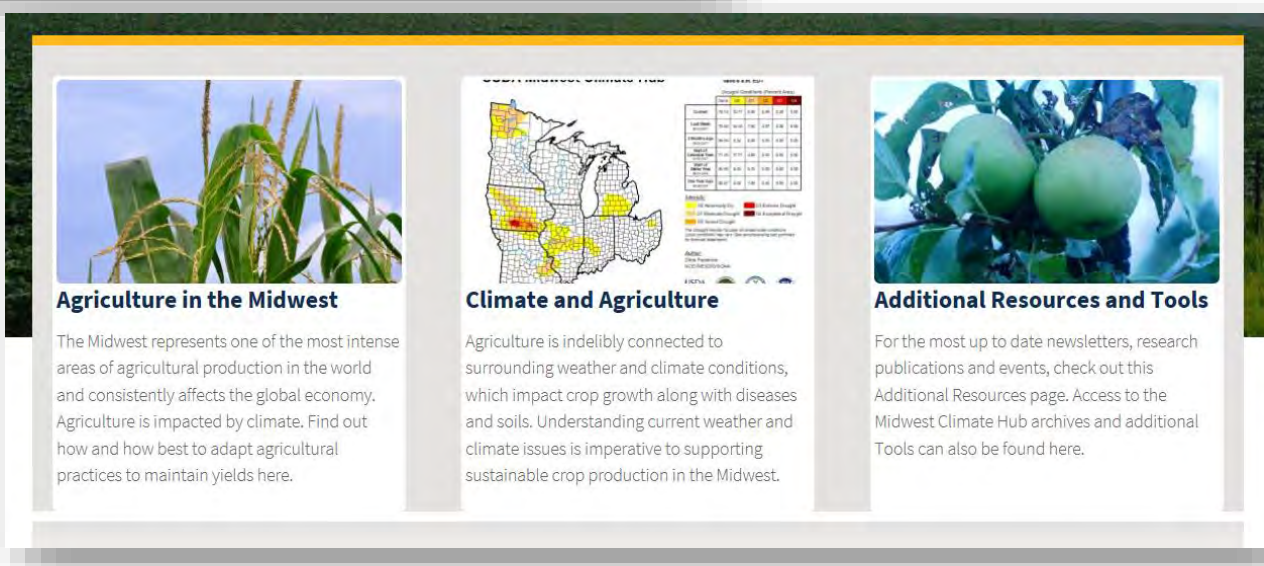
USDA United States Department of Agriculture Midwest Climate Hub

Resources: Web Site

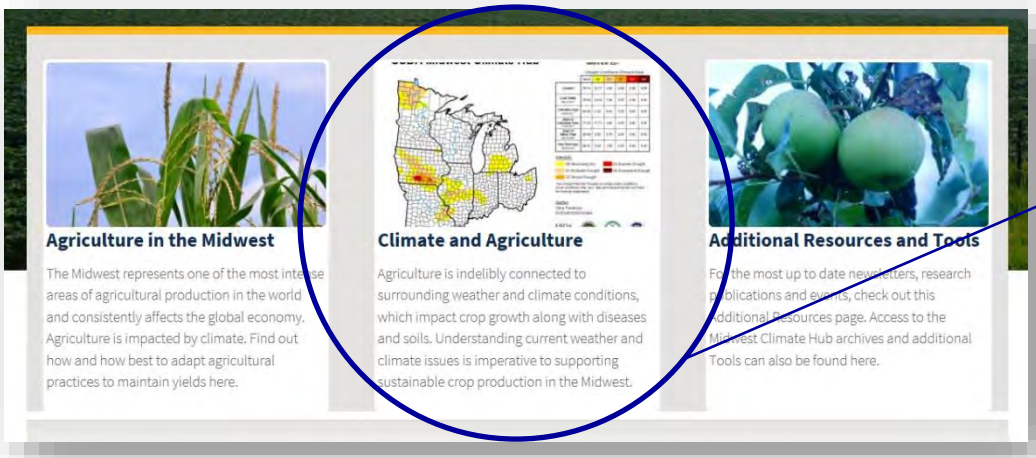


Search for tools, research and events by Region, Topic, type of crop, or climate Impact.

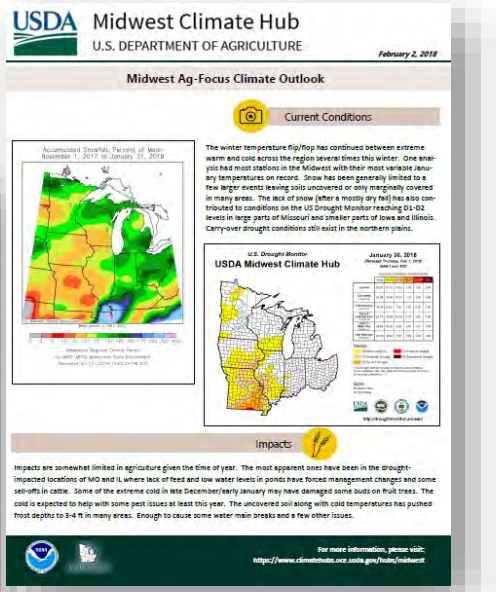
https://www.climatehubs.usda.gov/hubs/midwest

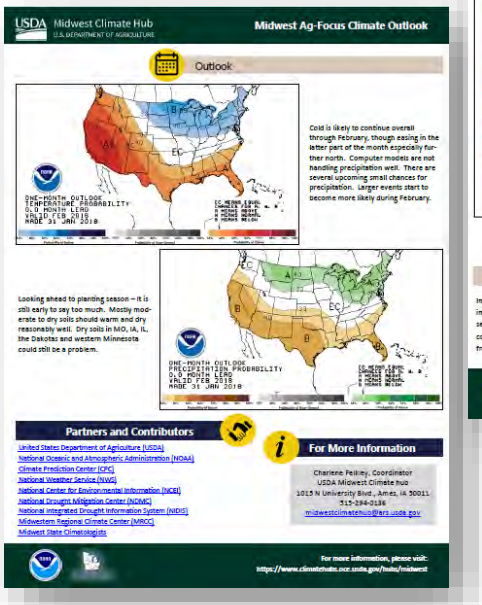


Resources: Operational Products



Midwest Ag-Focus Climate outlook





https://www.climatehubs.usda.gov/hubs/midwest/climate-outlooks

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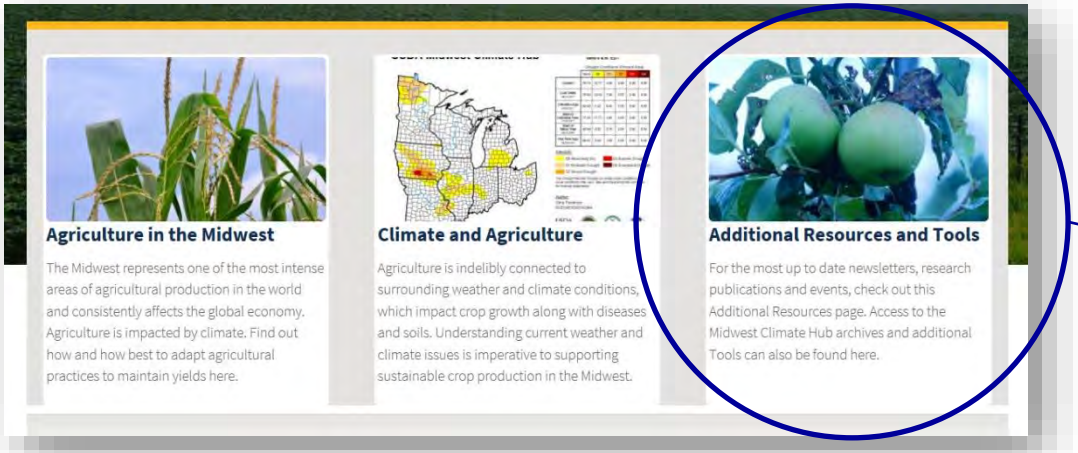

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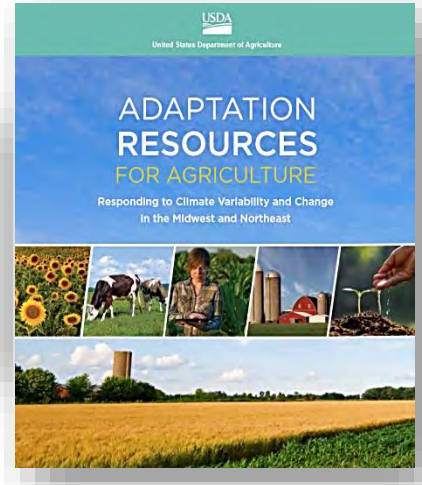

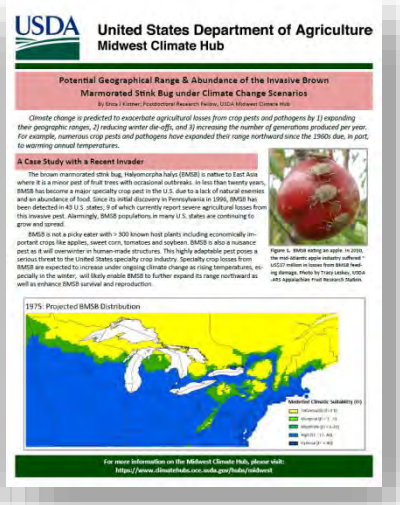

https://www.climatehubs.usda.gov/hubs/midwest

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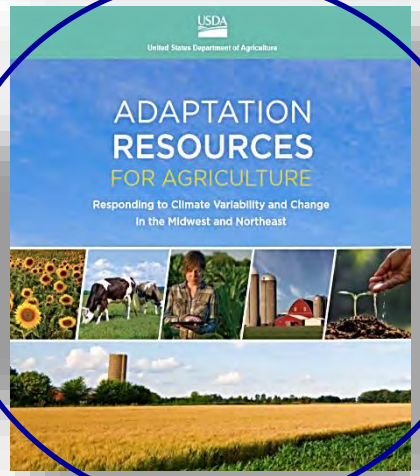

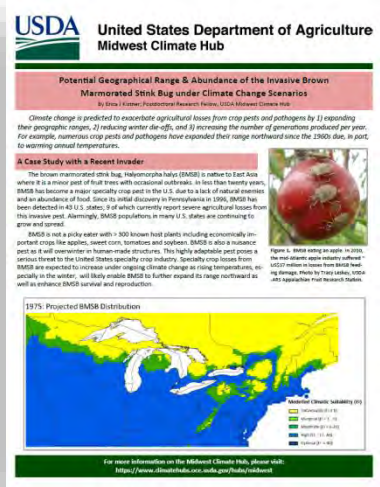

For More Information

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