

# Climate Change and Agronomonic Issues for Caneberry

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

# 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\*



# 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

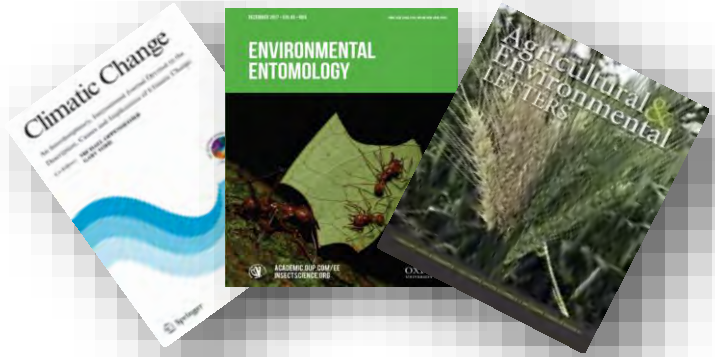
## Assessments and Syntheses

\*delivering relevant information\*



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**



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

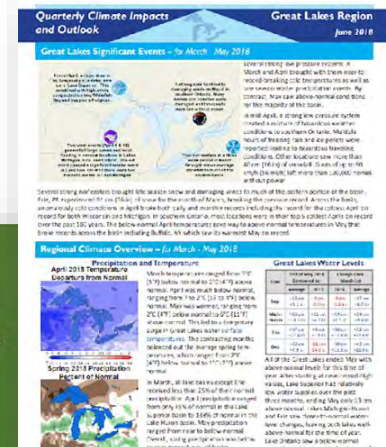
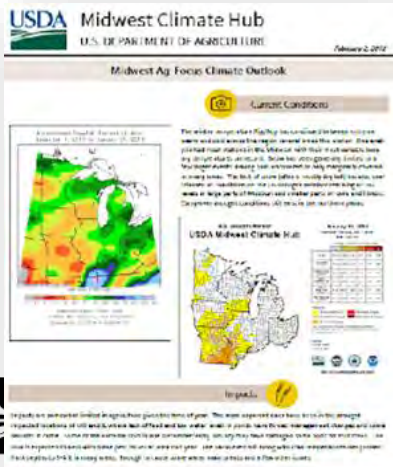
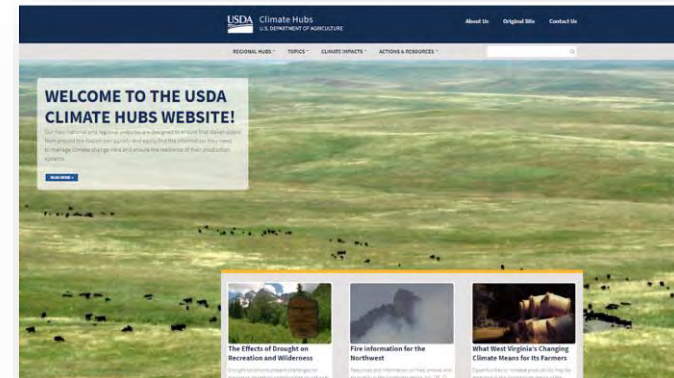
# MCH Thematic Areas

## Outreach and Education

\*enabling climate-informed decisions\*

MAC-T

Midwest Agriculture and Climate  
Team



How are changes impacting your plants?

# **CROP-CLIMATE ISSUES**

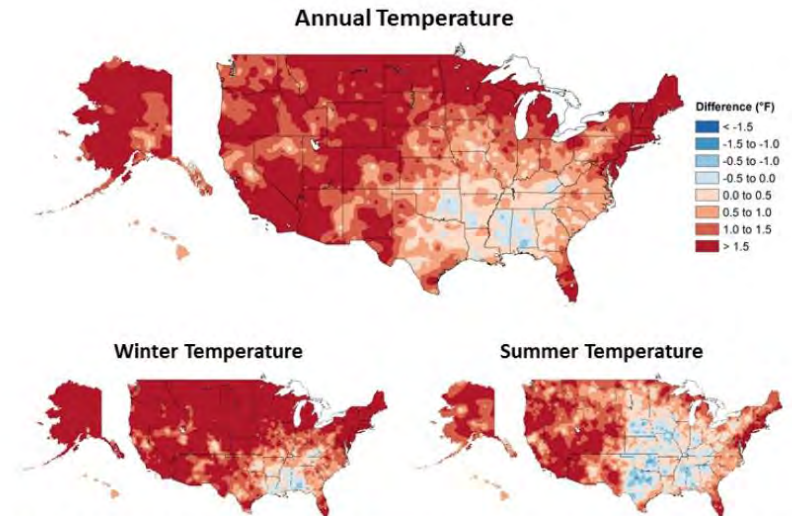


# Climate-Impacted Issues for Agriculture

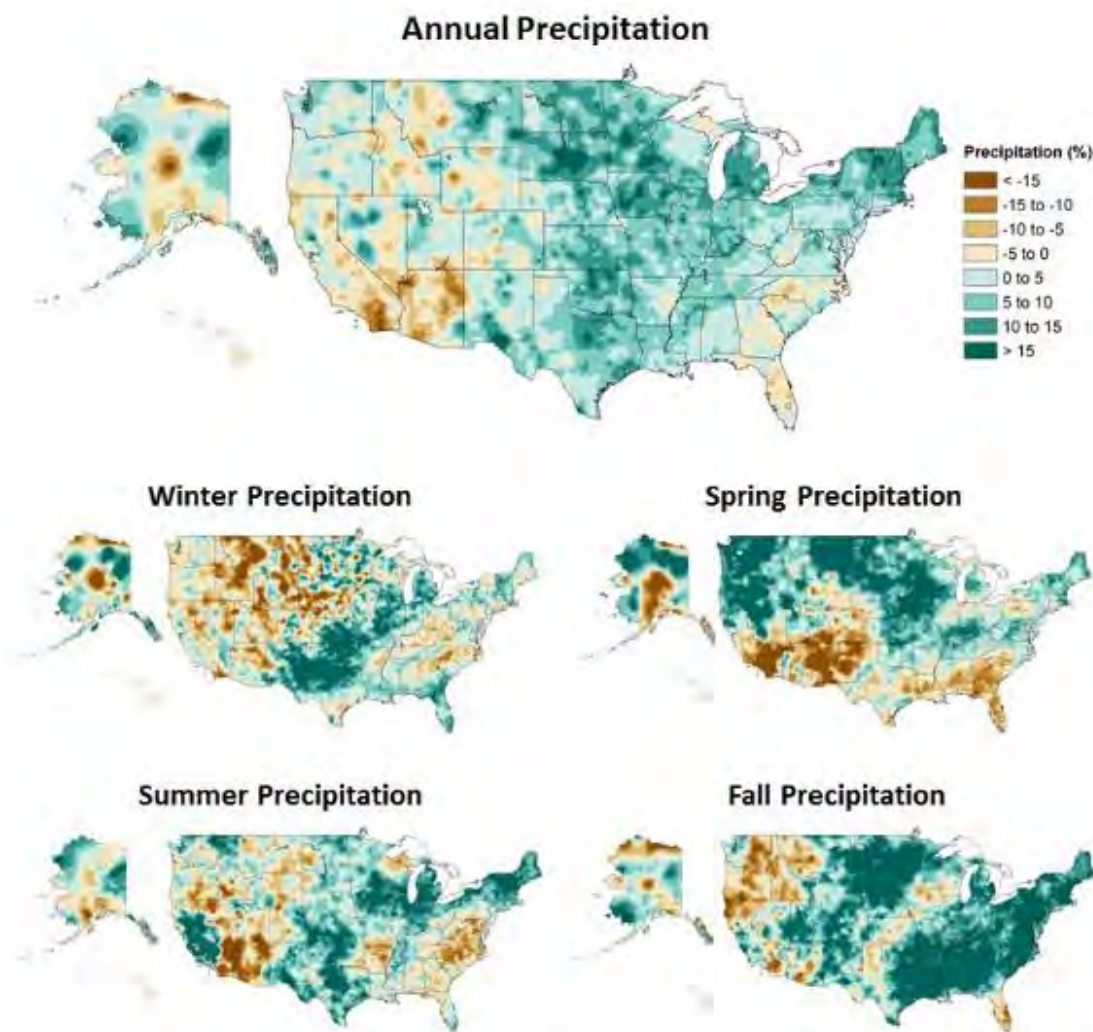
- Changing field work times
- Disease/insect/weed pressures
- More extremes
- Nutrient loss
- Increased variability (seeming)

# 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.<sup>1,2</sup> (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,<sup>78</sup> © American Meteorological Society. Used with permission; [bottom four panels] NOAA NCEI, data source: nCLIMDiv].

# Issues from Precipitation 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<sub>2</sub> fertilization

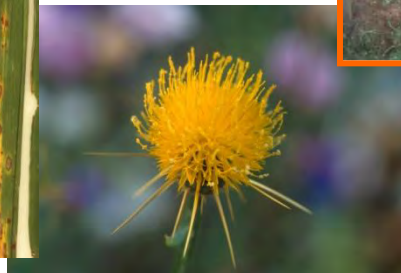
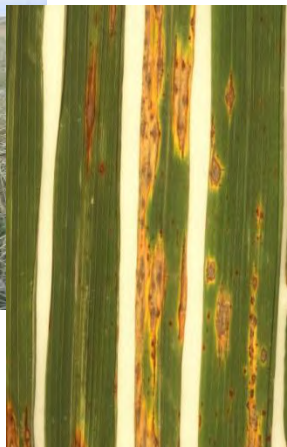
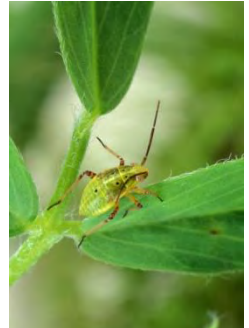
*Weeds, vines, invasive plants*

*Insects*

*Pathogens*

*Animals*

C:N ratio + lodging?



Herbicide effectiveness??

Nutrient poor forage?



# Issues with Insects



**1) Expanding geographic ranges northward**

**2) Reducing winter die offs**

**3) Earlier spring emergence**

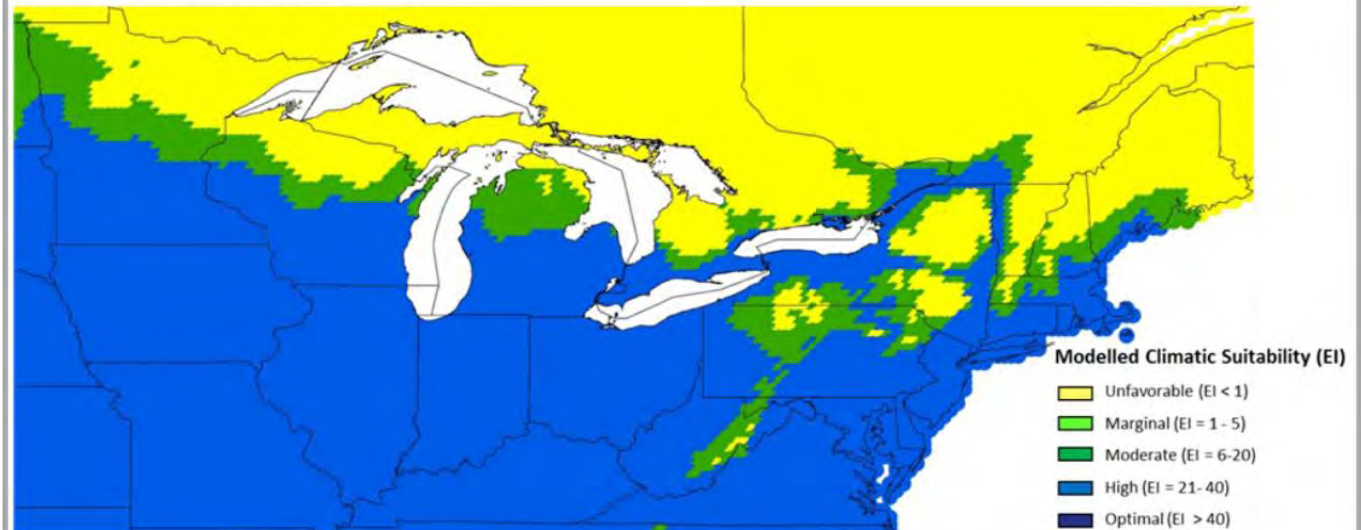
**4) Increased generations per year**

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

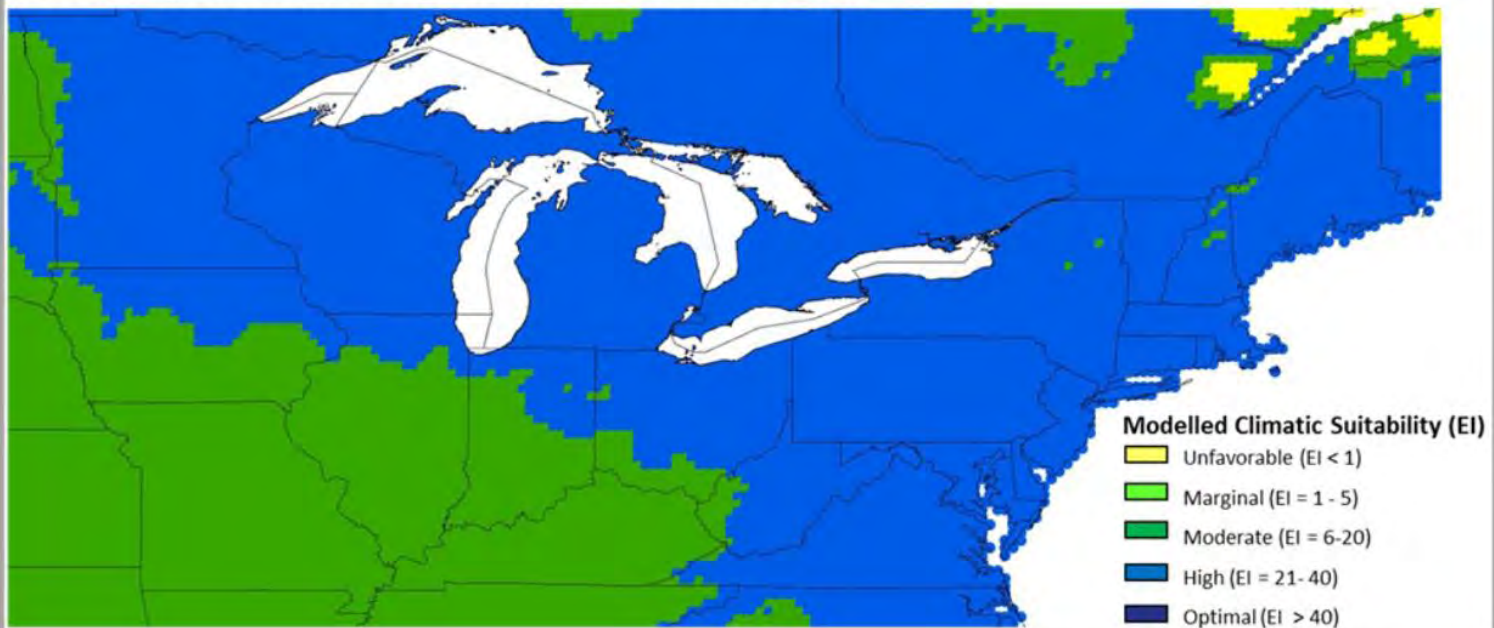


**Figure 1.** BMSB eating an apple. In 2010, the mid-Atlantic apple industry suffered ~ US\$37 million in losses from BMSB feeding damage. Photo by Tracy Leskey, USDA-ARS Appalachian Fruit Research Station

### 1975: Projected BMSB Distribution



### 2100: Projected BMSB Distribution Under A2 Scenario





# Issues with Weeds

- Weeds often more competitive than crops
- CO<sub>2</sub> fertilization
- Many crop CO<sub>2</sub> changes
- Increased cost of production
- Increased management
- More potential crop loss
- More use of chemicals
  - Also resistance issues



# Issues with Diseases

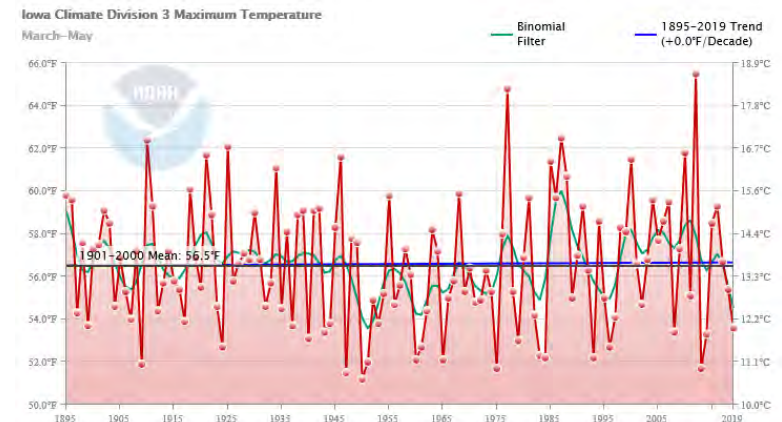
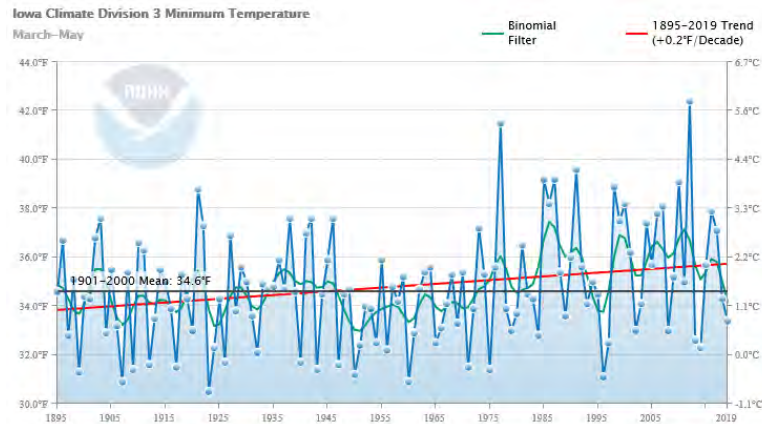
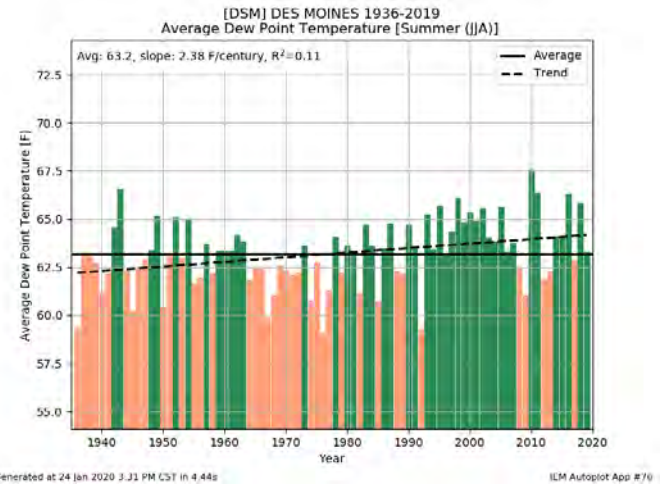
- Changing disease conditions
- Wetter – more likely disease
- Increased precipitation
  - More splash from ground
  - Wetter plants more frequently

Anthraxnose



# Issues with Diseases

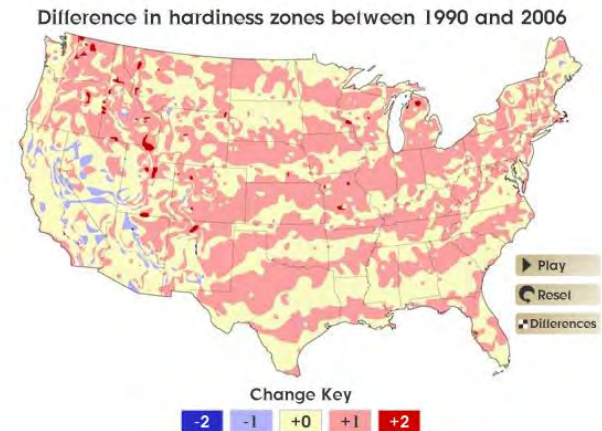
- Higher humidity
  - More moisture in air
  - Changing day-night temps.
  - Longer possible dew periods





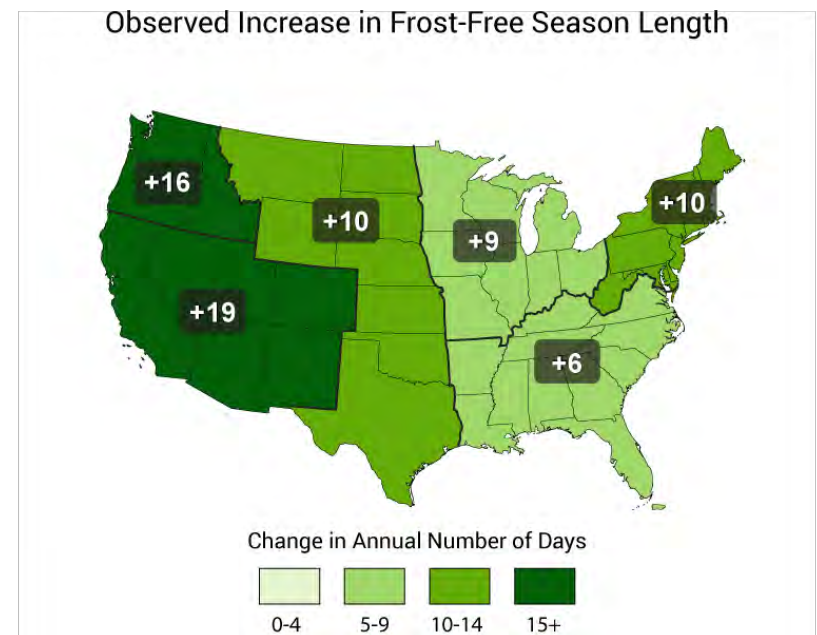
# Other Issues

- 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?



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



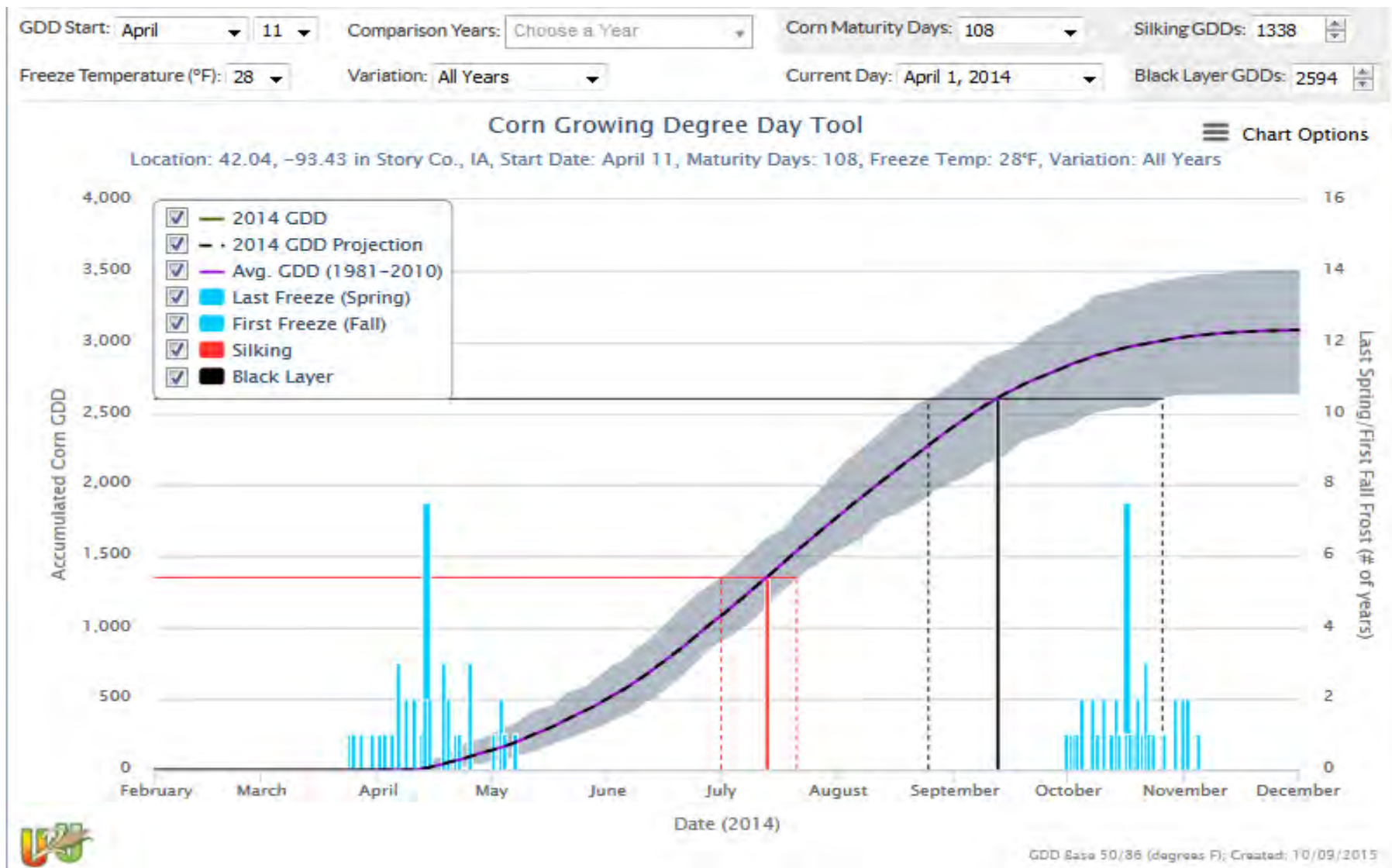
# Corn Growing Degree Days



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

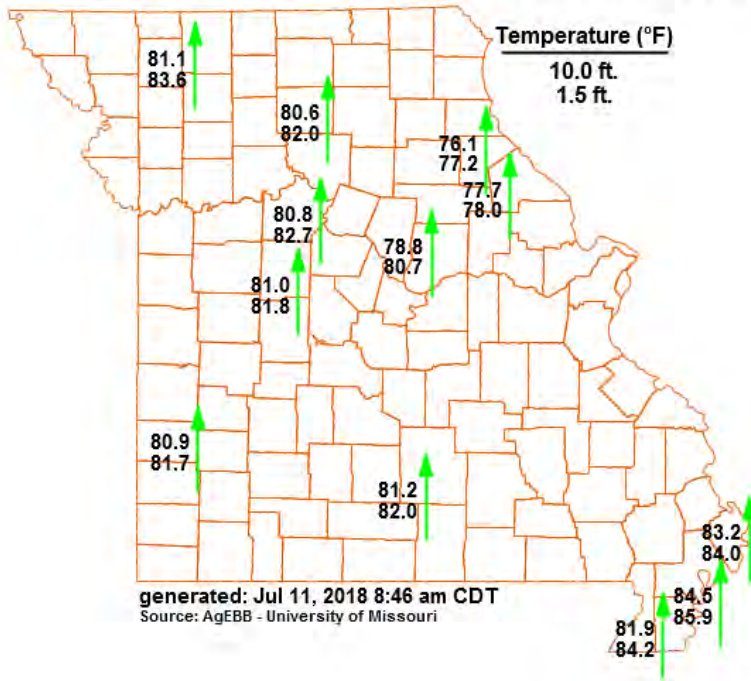


Real data around you

# **MONITORING/DRIFT**

# Inversions and Drift

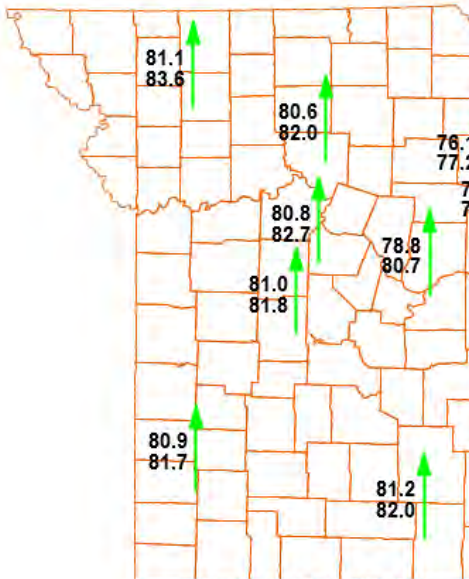
Missouri Mesonet Real-Time Temperature at 10 and 1.5 feet



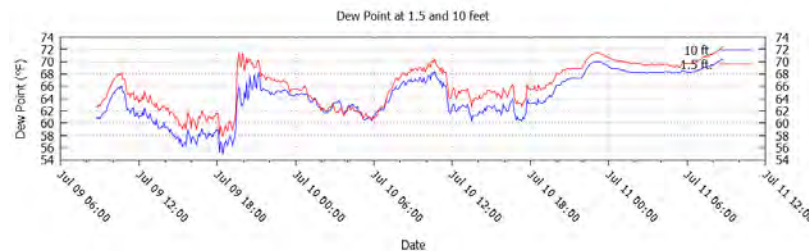
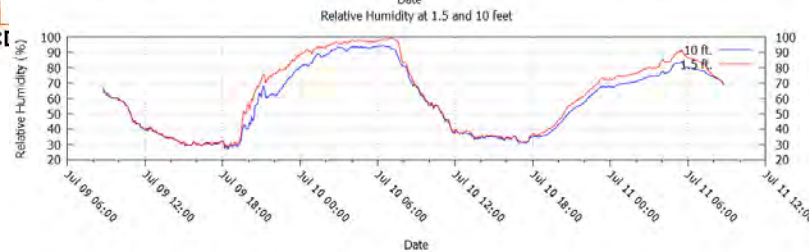
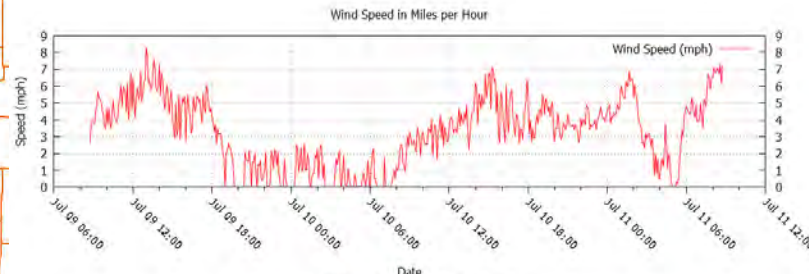
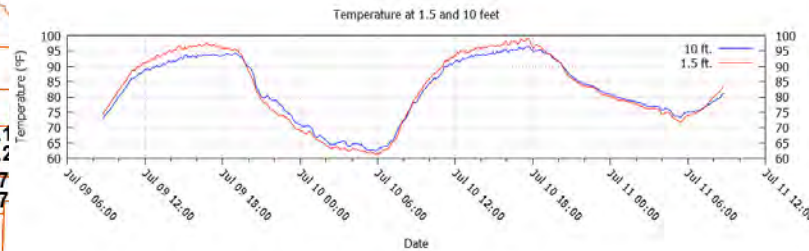
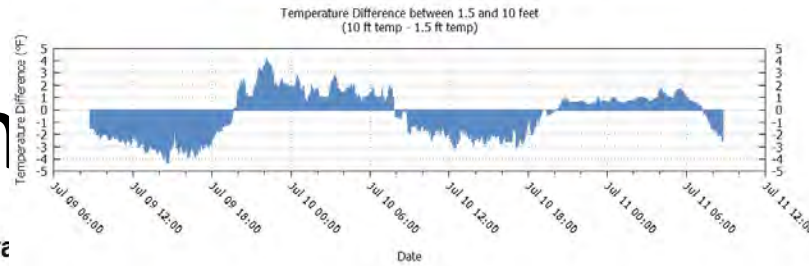
- Developing regional inversion potential for drift issues
- Missouri first
- Six additional states and Dakotas now adding
- Measuring low level inversion potential and timing

In it

## Missouri Mesonet Real-Time Tempera



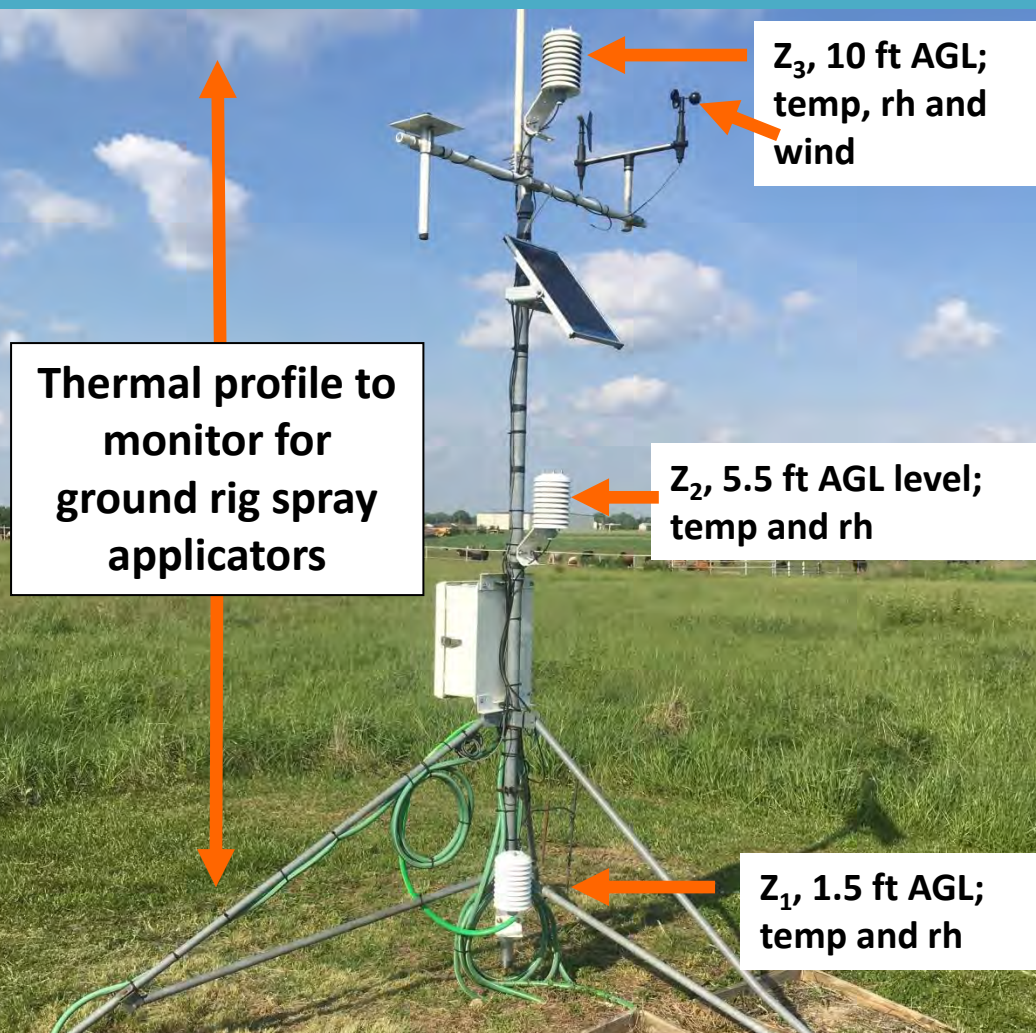
generated: Jul 11, 2018 8:46 am CDT  
Source: AgEBB - University of Missouri



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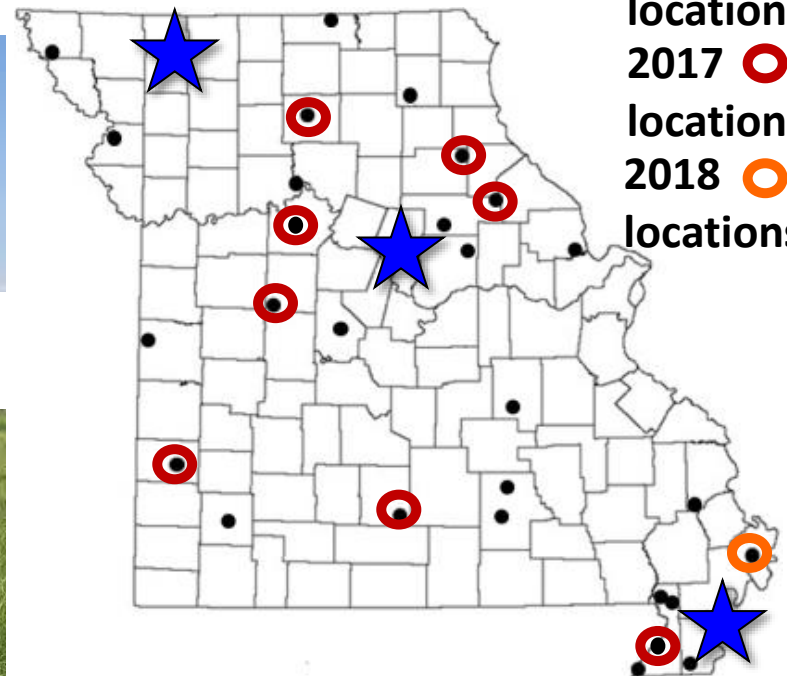
# Surface Temperature Inversion Project



## Inversion Criteria

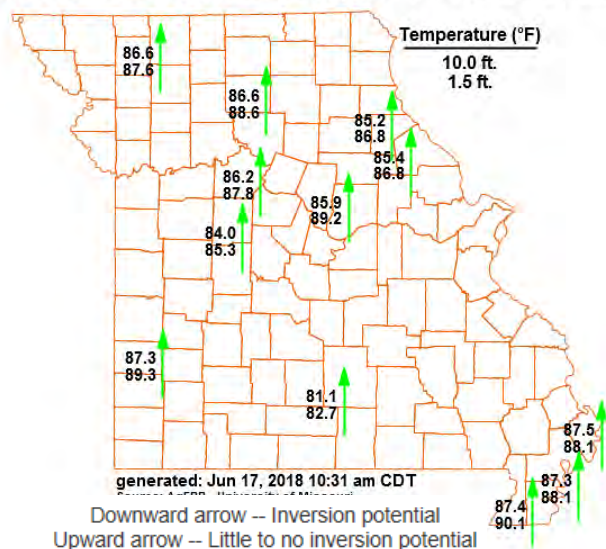
- $Z_1 < Z_2$ , and  $Z_1 < Z_3$
- Temperatures remained inverted  $\geq 1$ -hr
- $>1.2^\circ\text{C}$  temp difference occurred at some point during the inversion event between 10' and 1.5'

## Missouri Mesonet



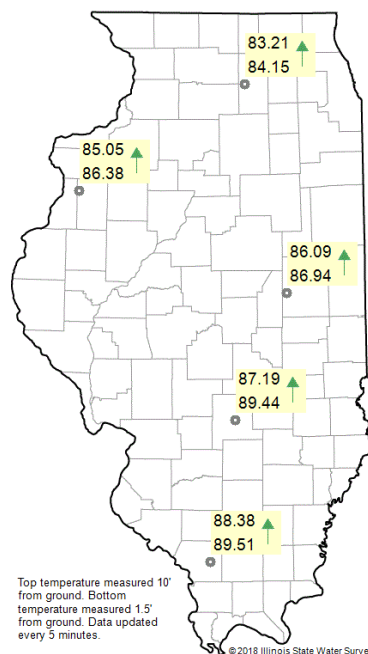
# Thanks to funding from the USDA Midwest Climate Hub, Missouri's inversion monitoring protocol was imitated in IL, MI, KY, OH and IN

Missouri Mesonet Real-Time Temperature at 10 and 1.5 feet

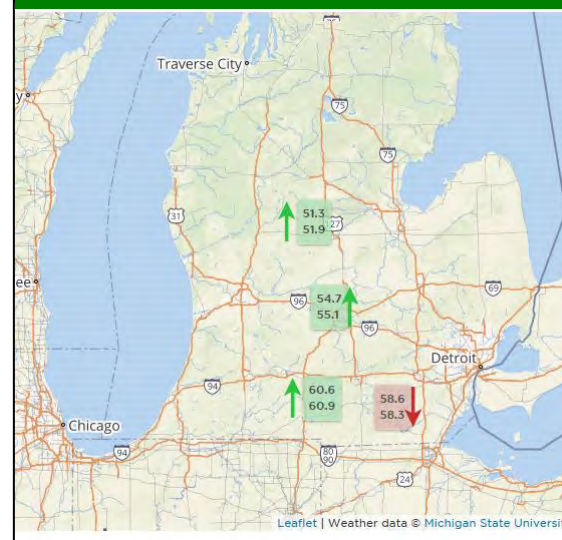


June 17, 2018

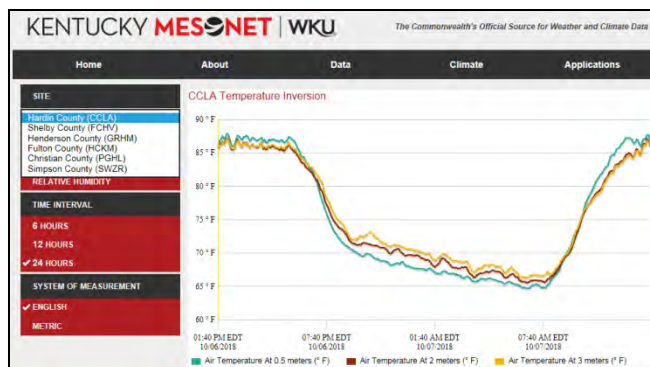
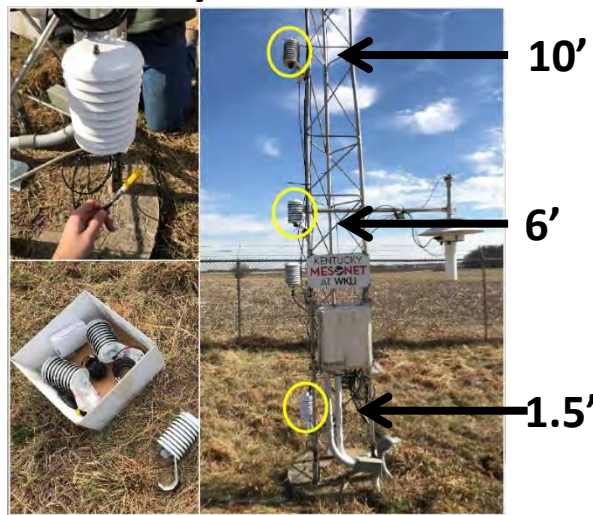
Air Temperature Inversion (°F) at 10:30 AM



Temperature Inversion Potential:  
Real-time temperature at 10 ft and 1.5 ft



## 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

Director – USDA Midwest  
Climate Hub

Nat'l Lab. for Ag. and Env.

Ames, IA

[dennis.todey@ars.usda.gov](mailto:dennis.todey@ars.usda.gov)

515-294-2013

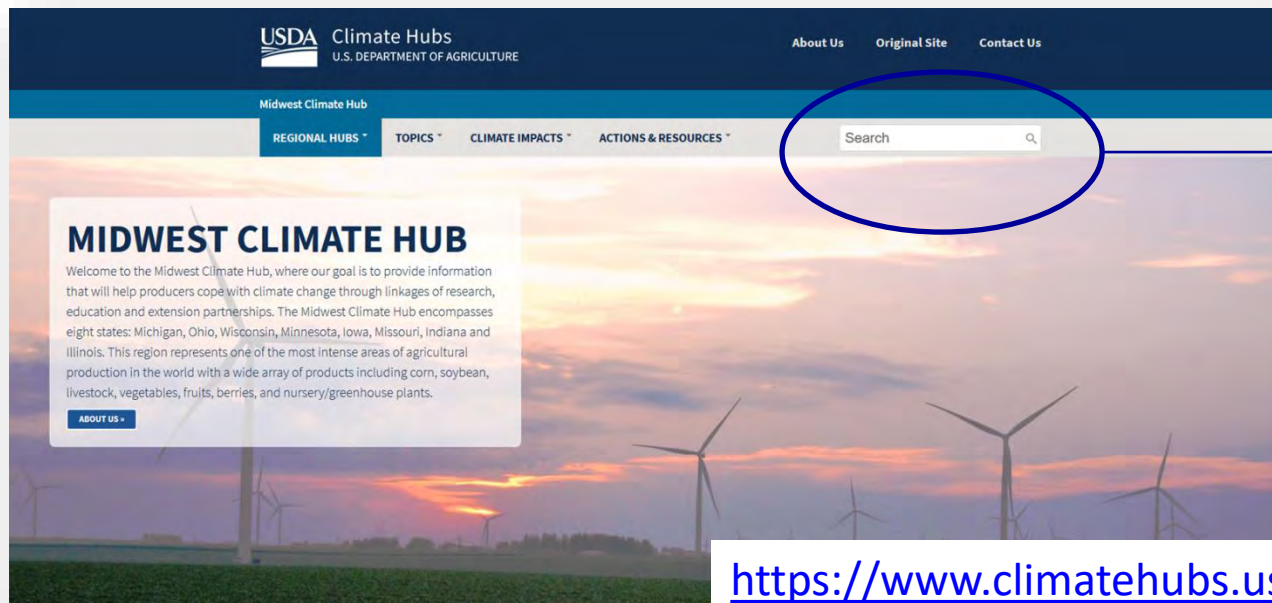


**AASC**  
AMERICAN ASSOCIATION OF  
STATE CLIMATOLOGISTS



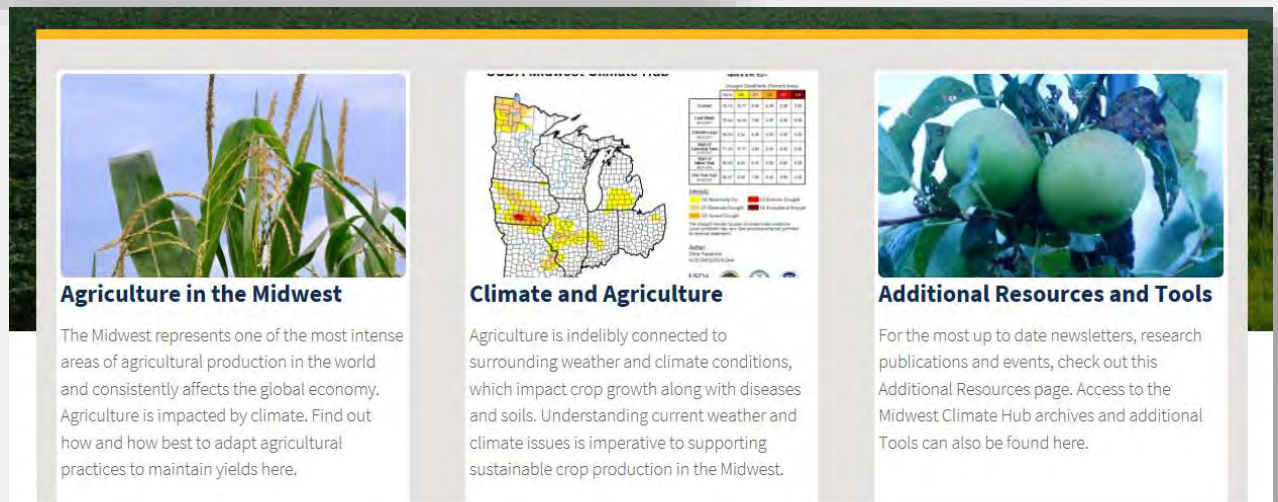
**United States Department of Agriculture**  
**Midwest Climate Hub**

# 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



**Agriculture in the Midwest**

The Midwest represents one of the most intense areas of agricultural production in the world, and consistently affects the global economy. Agriculture is impacted by climate. Find out how and how best to adapt agricultural practices to maintain yields here.

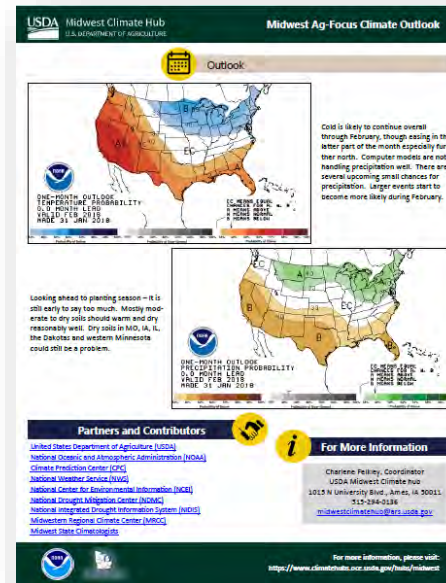
**Climate and Agriculture**

Agriculture is indelibly connected to surrounding weather and climate conditions, which impact crop growth along with diseases and soils. Understanding current weather and climate issues is imperative to supporting sustainable crop production in the Midwest.

**Additional Resources and Tools**

For the most up to date newsletters, research publications and events, check out this additional Resources page. Access to the Midwest Climate Hub archives and additional Tools can also be found here.

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



**USDA Midwest Climate Hub**  
U.S. DEPARTMENT OF AGRICULTURE

**Midwest Ag-Focus Climate Outlook**

**Outlook**

Cold is likely to continue overall through February, though easing in the latter part of the month especially further north. Computer models are not handling precipitation well. There are several upcoming small chances for precipitation. Larger events start to become more likely during February.

Looking ahead to planting season – it is still early to say too much. Mostly moderate to dry soils should warm and dry reasonably well. Dry soils in MO, IA, IL, the Dakotas and western Minnesota could still be a problem.

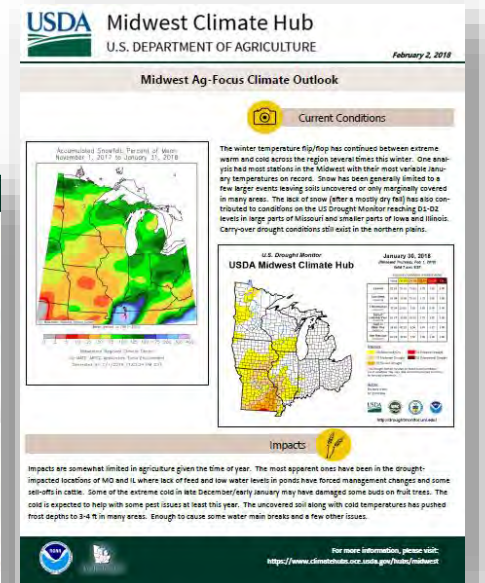
**Partners and Contributors**

- United States Department of Agriculture (USDA)
- National Oceanic and Atmospheric Administration (NOAA)
- Climate Prediction Center (CPC)
- National Weather Service (NWS)
- National Center for Sustainable Agriculture (NCSA)
- National Drought Mitigation Center (NDMC)
- National Integrated Drought Information System (NIDIS)
- Midwestern Regional Climate Center (MRCC)
- Midwest State Climatologists

**For More Information**

Cherene Peckley, Coordinator  
USDA Midwest Climate Hub  
1015 N University Blvd., Ames, IA 50011  
515-284-2148  
[midwestclimate@usda.gov](mailto:midwestclimate@usda.gov)

For more information, please visit:  
<https://www.climatehubs.usda.gov/midwest/>



**USDA Midwest Climate Hub**  
U.S. DEPARTMENT OF AGRICULTURE

**Midwest Ag-Focus Climate Outlook**

**Current Conditions**

Accumulated rainfall: Total of Nov. 1, 2017 to Jan. 2, 2018

The winter temperature flip-flop has continued between extreme warm and cold across the region several times this winter. One anomaly has most stations in the Midwest with their most variable January temperatures on record. Snow has been generally limited to a few larger events leaving soils uncovered or only marginally covered in many areas. The lack of snow (after a mostly dry fall) has also contributed to conditions on the US Drought Monitor reaching 63-odd levels in large parts of Missouri and smaller parts of Iowa and Illinois. Carry-over drought conditions still exist in the northern plains.

**U.S. Drought Monitor**  
January 30, 2018  
Official Release: Feb. 1, 2018  
New York, NY

**Impacts**

Impacts are somewhat limited in agriculture given the time of year. The most apparent ones have been in the drought-impacted locations of MO and IL where lack of feed and low water levels in ponds have forced management changes and some sell-offs in cattle. Some of the extreme cold in late December/early January may have damaged some buds on fruit trees. The cold is expected to help with some pest issues at least this year. The uncovered soil along with cold temperatures has pushed frost depths to 3-4 ft in many areas. Enough to cause some water main breaks and a few other issues.

For more information, please visit:  
<https://www.climatehubs.usda.gov/midwest/>

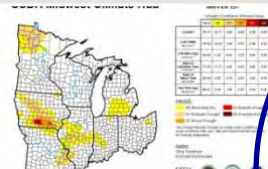
# For More Information

To our Newsletter,  
Resources,  
Publications and  
One-Pagers



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## Climate and Agriculture

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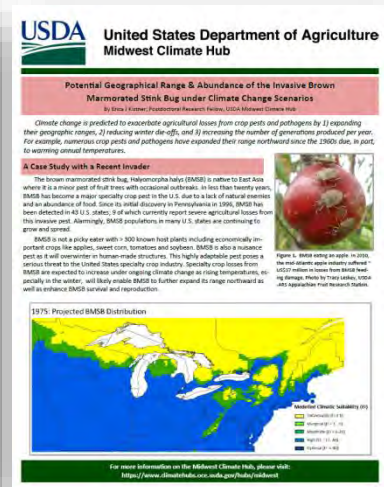
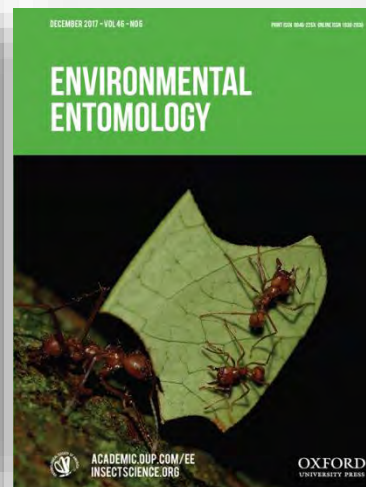
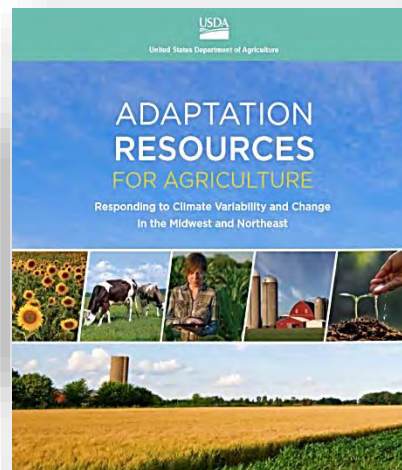
USDA Midwest Climate Hub  
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## Midwest CHU

Climate Hub Update

Winter 2018

Promoting Climate-Informed Decisions Since 2014.





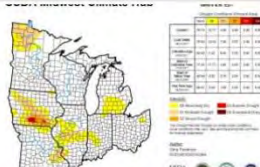
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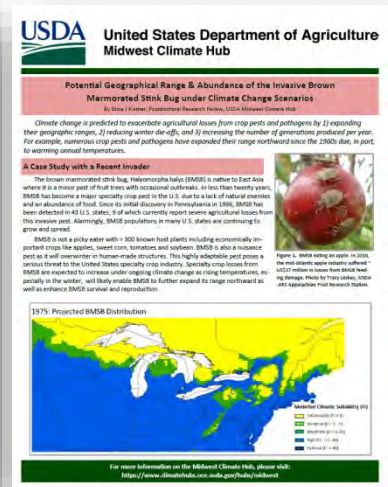
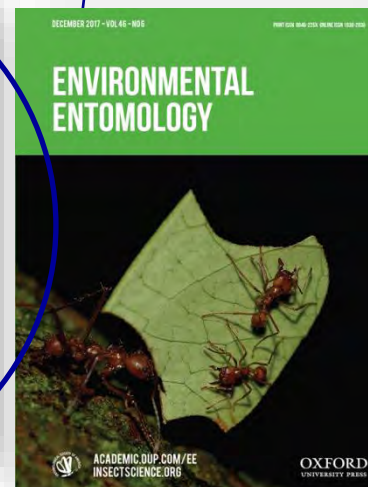
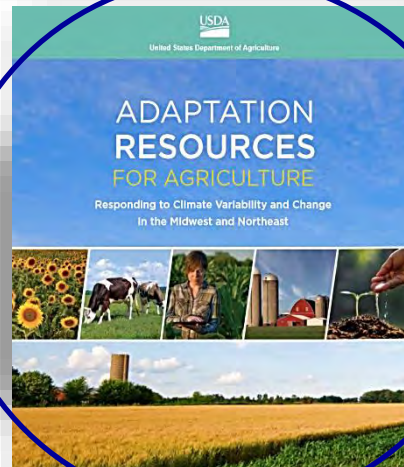
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# For More Information



Midwest Climate Hub



@USDAClimateHubs  
@dennistoday



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



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

**National Laboratory for Agriculture and the Environment**

Attn: Midwest Climate Hub  
1015 N University Blvd  
Ames, Iowa 50011-3611



**Dennis Todey, Director**

515-294-2013

[Dennis.todey@usda.gov](mailto:Dennis.todey@usda.gov)

**Charlene Felkley, Coordinator**

515-294-0136

[Charlene.felkley@usda.gov](mailto:Charlene.felkley@usda.gov)

**Erica Kistner, Fellow**

515-294-9602

[Erica.kistnerthomas@usda.gov](mailto:Erica.kistnerthomas@usda.gov)