

# Regional Tools and Information for Agriculture

- **Dennis Todey, Director**
- **ICM**
- **30 November 2022**



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

# 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

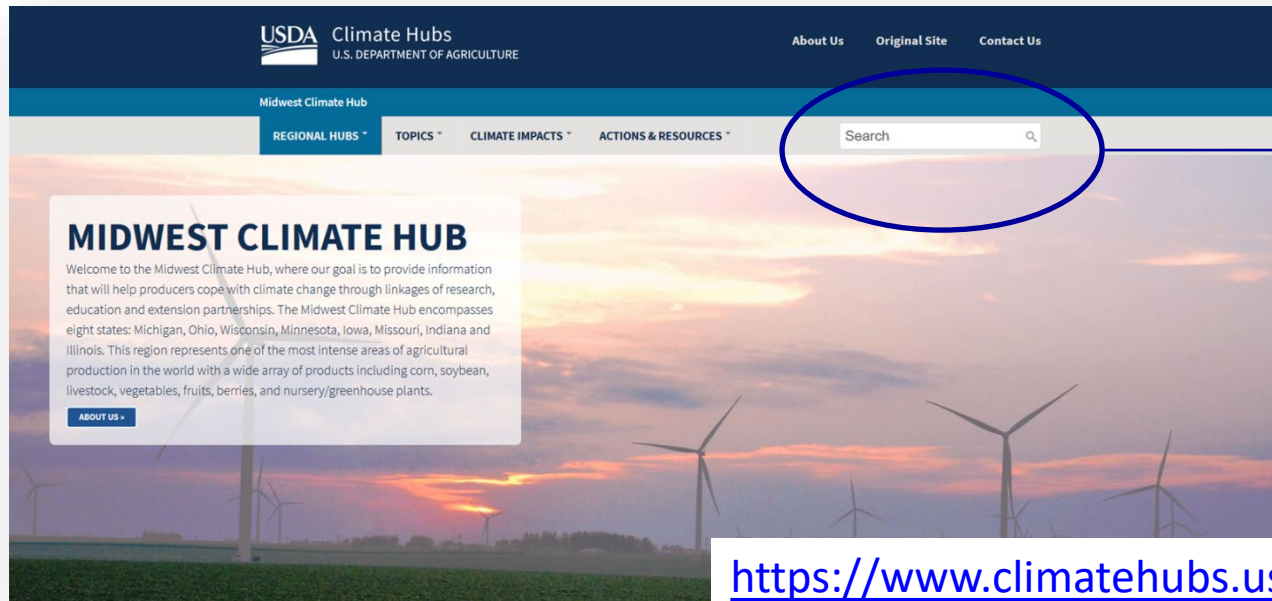


# Stakeholders

Crop Consultants  
Commodity Organizations  
Soil and Water  
Conservation Districts  
Other USDA Agencies  
Cooperative Extension  
Land Grant Universities  
Farmers  
Ranchers  
Forest Land Owners  
Specialty Crop Growers  
...And Many Others



# Resources: Website



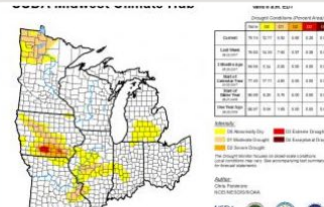
Search for tools,  
research and events  
by Region, Topic,  
type of crop, or  
climate Impact.

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



## 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.



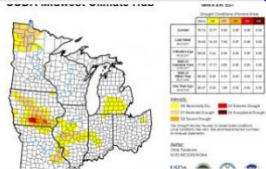
# Resources: Operational Products

## Midwest Ag-Focus Climate outlook



### Agriculture in the Midwest

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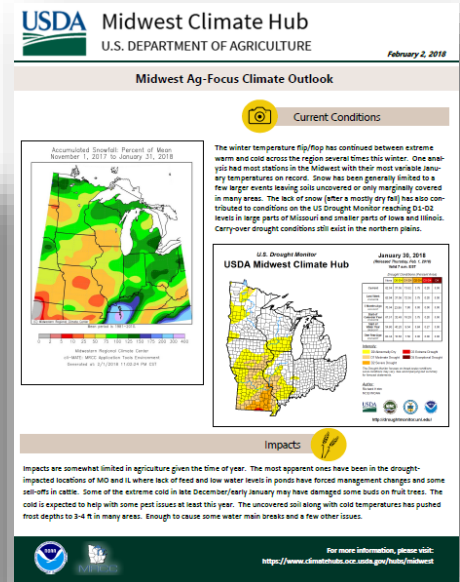
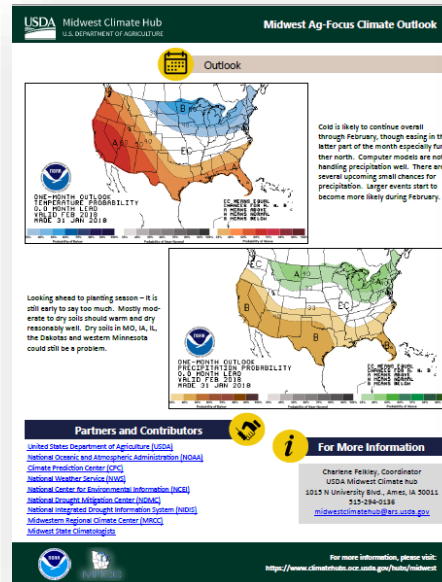
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Specific agriculture information

# AG-RELATED TOOLS



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

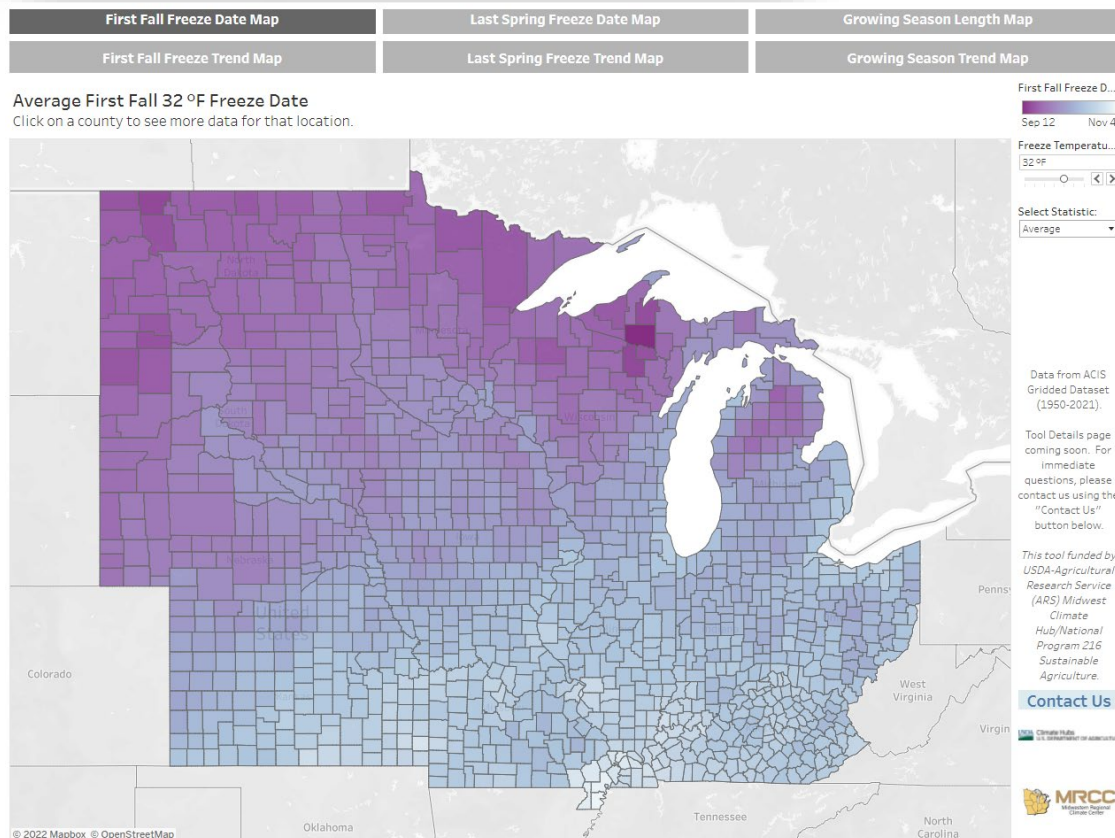
# Common Web Sites

- Iowa – Iowa Environmental Mesonet
- <https://mesonet.agron.iastate.edu/>
- Regional – Midwestern Regional Climate Center/High Plains Regional Climate Center
- Frost-freeze <https://mrcc.purdue.edu/freeze/freezedatetool.html>
- GDD tracker <https://mrcc.purdue.edu/U2U/>



# Ongoing Projects

**Assessments and Syntheses, ctd.**  
*Delivering relevant information*



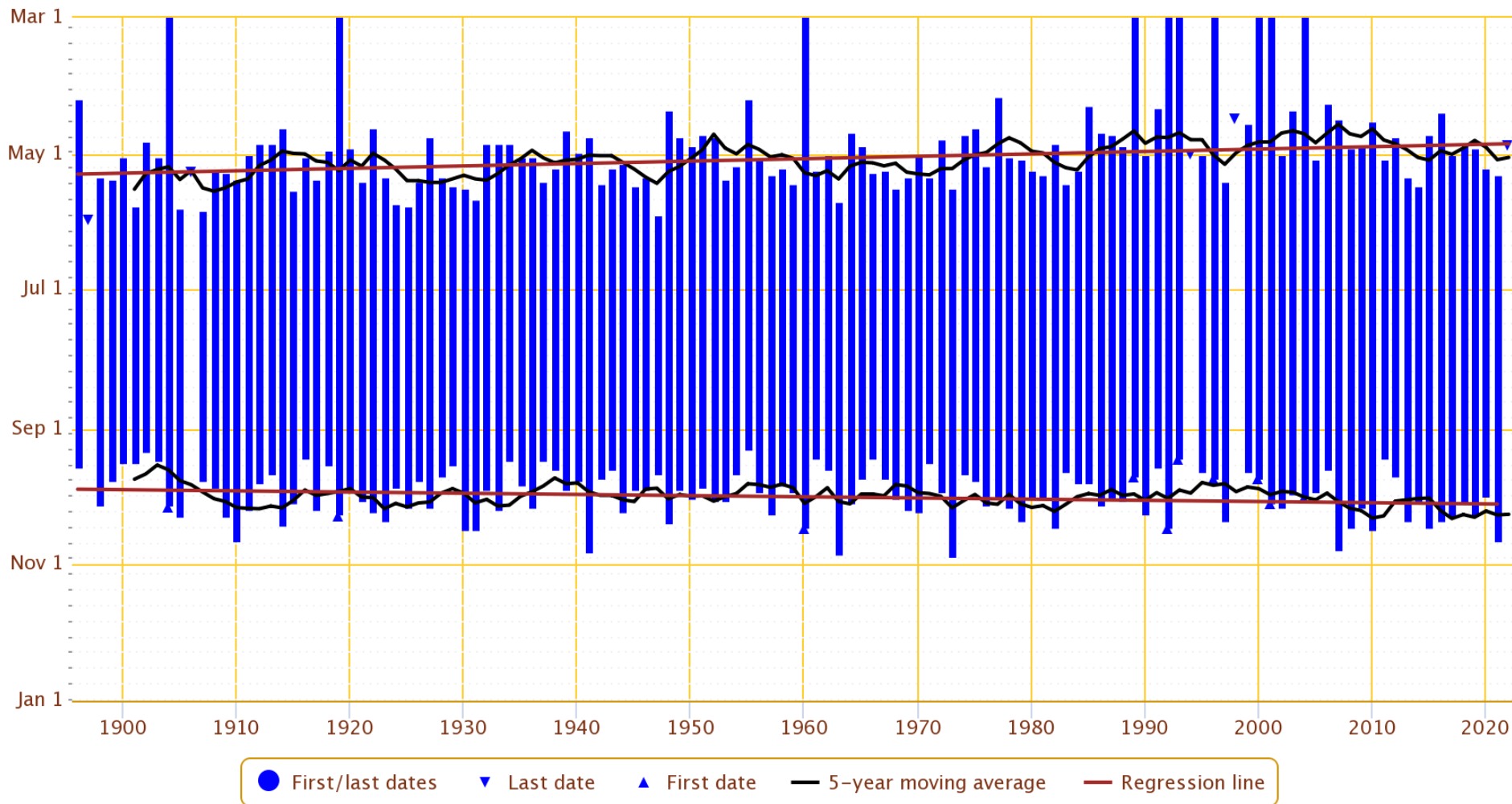
Publicizing new visualization tool for county-level changes in frost-freeze dates

- Spring/fall freeze dates
- Growing season length change
- Uses different temperature cut-offs

# Station Freeze Dates – Le Mars, IA

Frost/Freeze Dates for LE MARS, IA

Min Temperature  $\leq$  32 Aug 1 to Jul 31



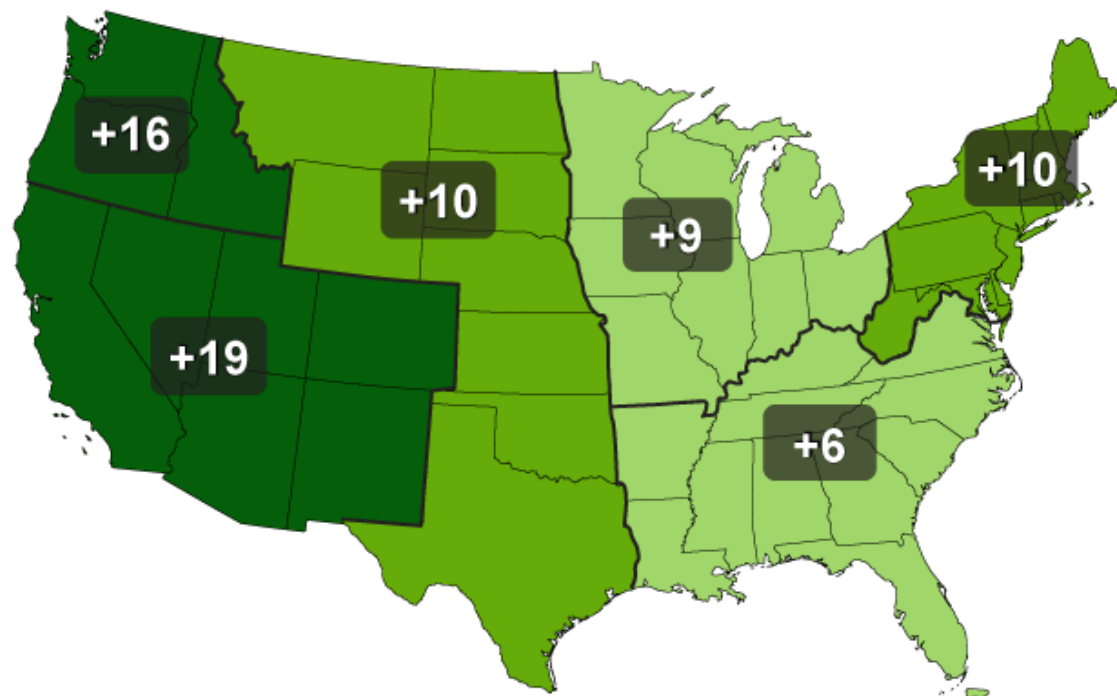
Powered by ACIS



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

# Regional Frost-Free Season Change

Observed Increase in Frost-Free Season Length



Change in Annual Number of Days



0-4



5-9



10-14



15+



# Interesting Freeze Date Features

- Trend varies by location
- Trend varies by temperature cut-off

# Climate-Impacted Issues for Agriculture

- Freeze cause of loss – RMA indemnity payments 1989-2020
  - Minnesota
    - Row crop
    - Late season
  - Michigan
    - Specialty (food) Crops
    - Early season

**Minnesota: 175,970,016.83**

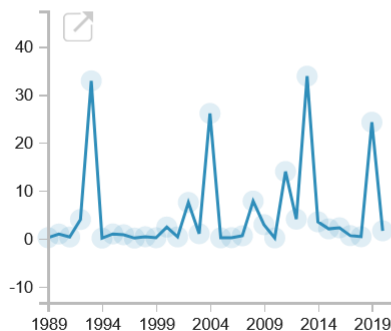


Click on line chart points or bar chart bars or labels to narrow data

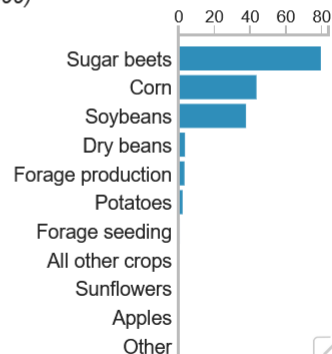
## Payment indemnity by commodity

Annual totals, all commodities  
(x 1,000,000)

1989–2020 totals by commodity  
(x 1,000,000)



← → Clear selection



Clear selection

**Michigan: 153,784,173.22**

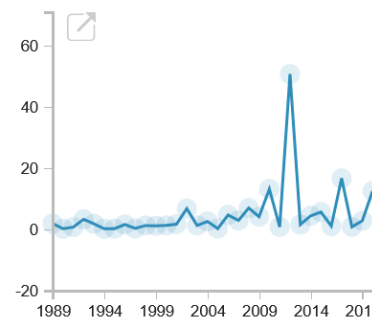


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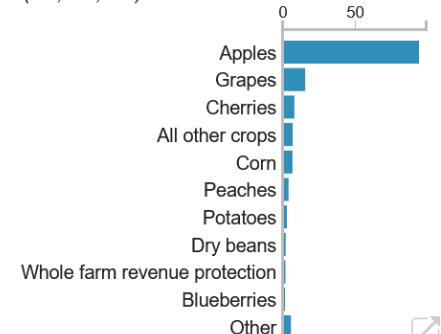
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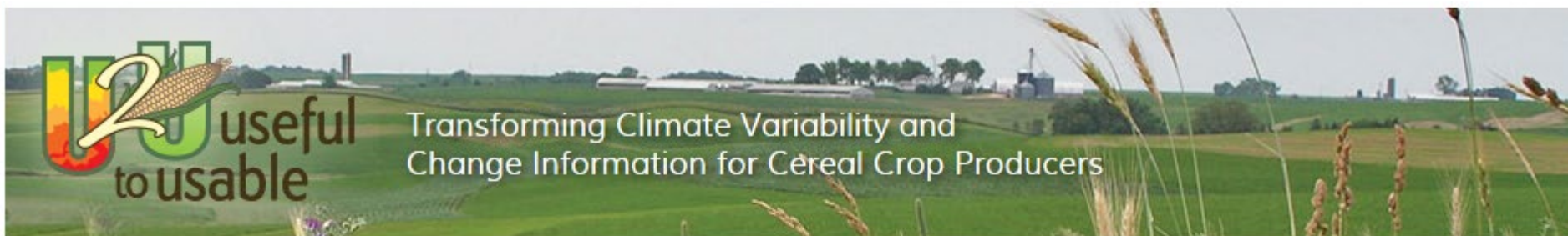


← → Clear selection



Clear selection

# Decision Dashboard



DECISION DASHBOARD

MEDIA CENTER

NEWSLETTER

ABOUT US

## Decision Dashboard

U2U<sub>DST</sub> Suite

Other Decision Resources

Agro-Climate Reports

Weather/Climate Maps

Drought Info

Climate Outlooks

Helpful Links

### U2U<sub>DST</sub> SUITE



#### AgClimate View<sub>DST</sub>

A convenient way to access customized historical climate and crop yield data for the U.S. Corn Belt. View graphs of monthly temperature and precipitation,



#### Corn GDD<sub>DST</sub>

Track real-time and historical GDD accumulations, assess spring and fall frost risk, and guide decisions related to planting, harvest, and seed selection.

[www.AgClimate4U.org](http://www.AgClimate4U.org)



# Decision Support Tools

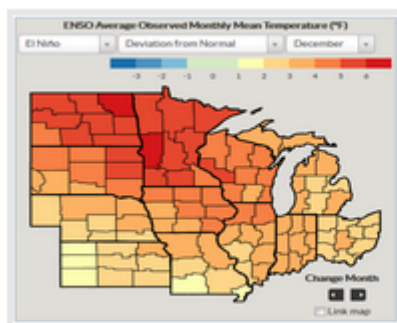


## U2U<sub>DST</sub> SUITE



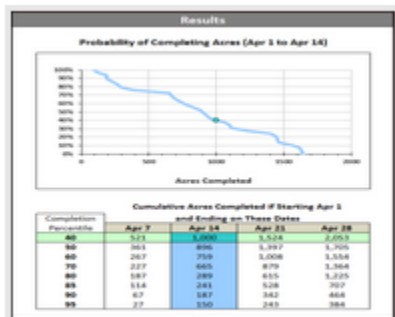
### AgClimate View<sub>DST</sub>

A convenient way to access customized historical climate and crop yield data for the U.S. Corn Belt. View graphs of monthly temperature and precipitation, plot corn and soybean yield trends, and compare climate and yields over the past 30 years.



### Climate Patterns Viewer<sub>DST</sub>

Discover how global climate patterns like the El Niño Southern Oscillation (ENSO) and Arctic Oscillation (AO) have historically affected local climate conditions and crop yields across the U.S. Corn Belt.



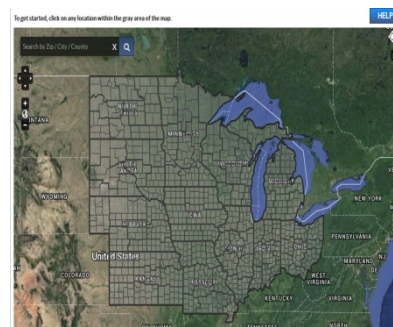
### Probable Fieldwork Days<sub>DST</sub>

This spreadsheet-based tool uses USDA data on Days Suitable for Fieldwork to determine the probability of completing in-field activities during a user-specified time period. This product is currently available for Illinois, Iowa, Kansas, and Missouri. (Hosted by the University of Missouri)



### Corn GDD<sub>DST</sub>

Track real-time and historical GDD accumulations, assess spring and fall frost risk, and guide decisions related to planting, harvest, and seed selection. This innovative tool integrates corn development stages with weather and climate data for location-specific decision support tailored specifically to agricultural production.



### Corn Split N<sub>DST</sub> (NEW!)

Determine the feasibility and profitability of using post-planting nitrogen application for corn production. This product combines historical data on crop growth and fieldwork conditions with economic considerations to determine best/worst /average scenarios of successfully completing nitrogen applications within a user-specified time period.

# 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.

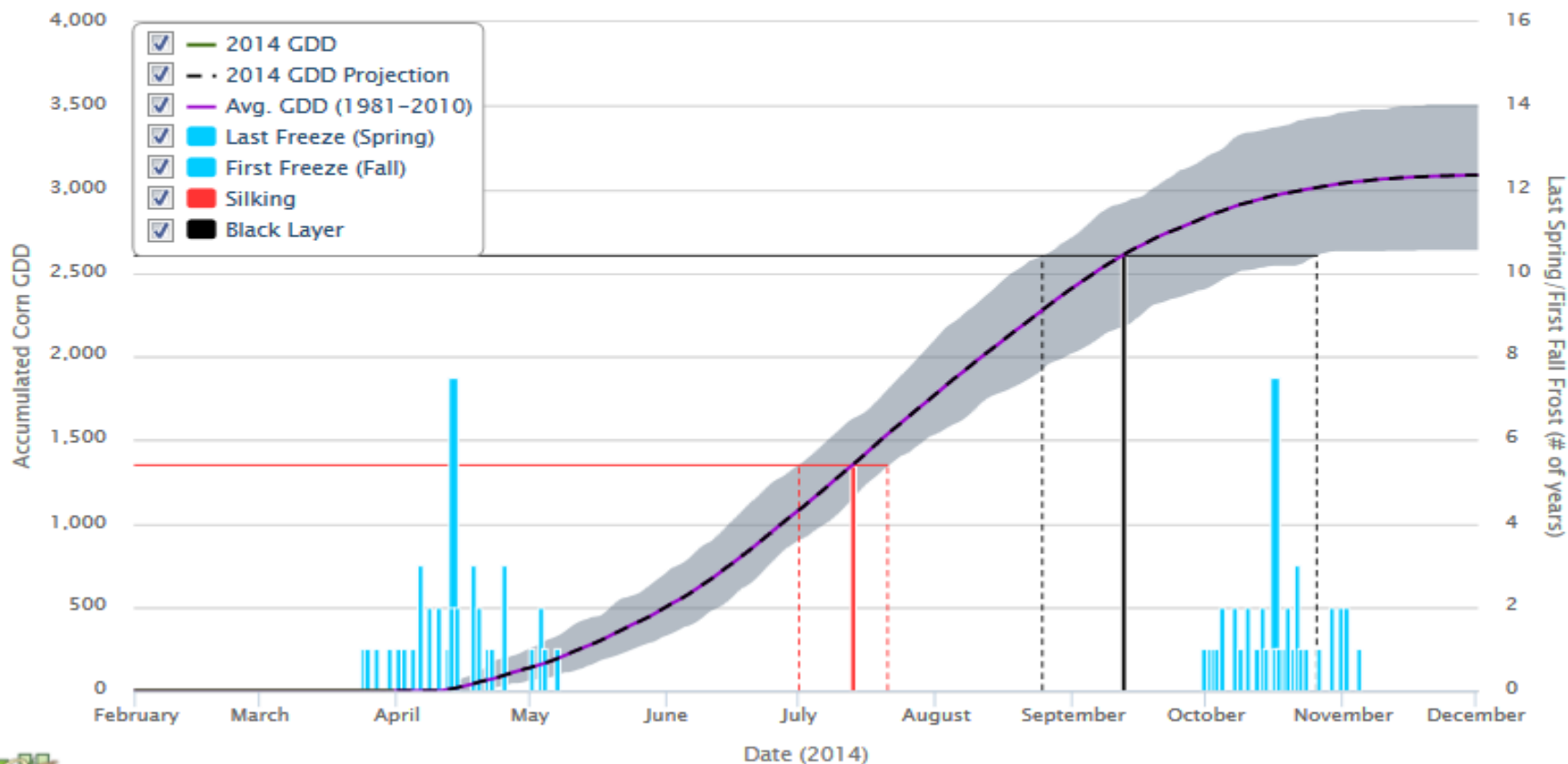
# GDD Graph

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



GDD Base 50/86 (degrees F); Created: 10/09/2015




# Pick Your Location

Map Animations

Feedback? About GDD

To get started, click on any location within the gray area of the map. Use the zoom function for a more accurate selection.

Search by Zip / City / County X Q



United States

States shown: MONTANA, NORTH DAKOTA, MINNESOTA, SOUTH DAKOTA, WISCONSIN, MICHIGAN, VERMONT, NEW YORK, MAINE, CONNECTICUT, PENNSYLVANIA, NJ, MARYLAND, DELAWARE, VIRGINIA, WEST VIRGINIA, OHIO, INDIANA, ILLINOIS, MISSOURI, KANSAS, NEBRASKA, WYOMING, COLORADO, ARIZONA, OKLAHOMA, ARKANSAS, TENNESSEE, NORTH CAROLINA.




# For Example:

[Map](#) [Animations](#)

[Feedback?](#) [About GDD](#)

To get started, click on any location within the gray area of the map. Use the zoom function for a more accurate selection.



Story Co., IA  
Lat-Lon: 42.057, -93.089  
[Create GDD Graph](#)

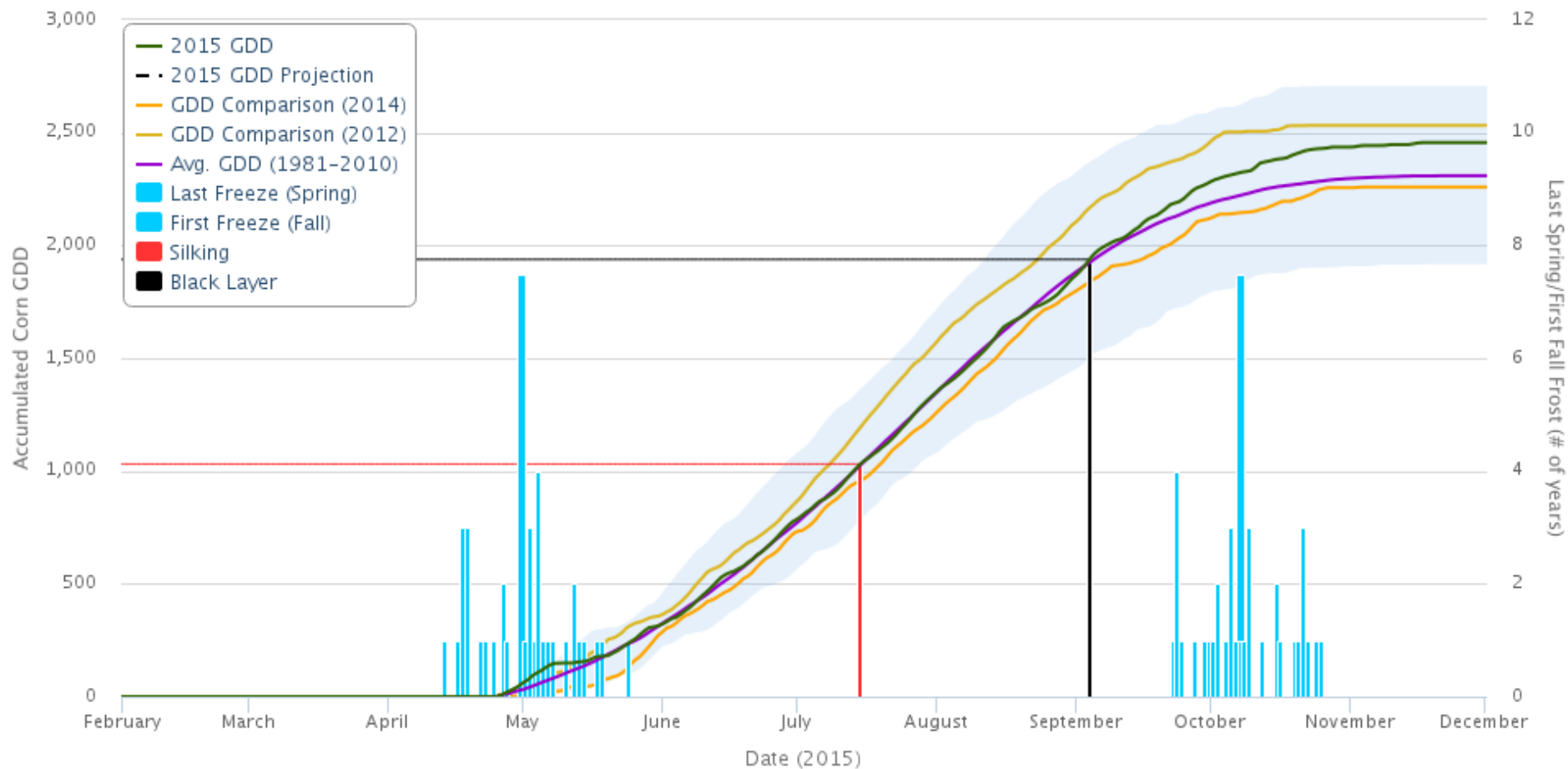
Map labels include: MONTANA, NORTH DAKOTA, SOUTH DAKOTA, WYOMING, NEBRASKA, IOWA, MINN, MICHIGAN, VER, NEW YORK, MA, CONNE, PENNSYLVANIA, NJ, MARYLAND, DELAWARE, VIRGINIA, NORTH CAROLINA, TENNESSEE, ARKANSAS, OKLAHOMA, COLORADO, KANSAS, MISSOURI, ILLINOIS, INDIANA, OHIO, WEST VIRGINIA, UNITED STATES.

# GDD Graph



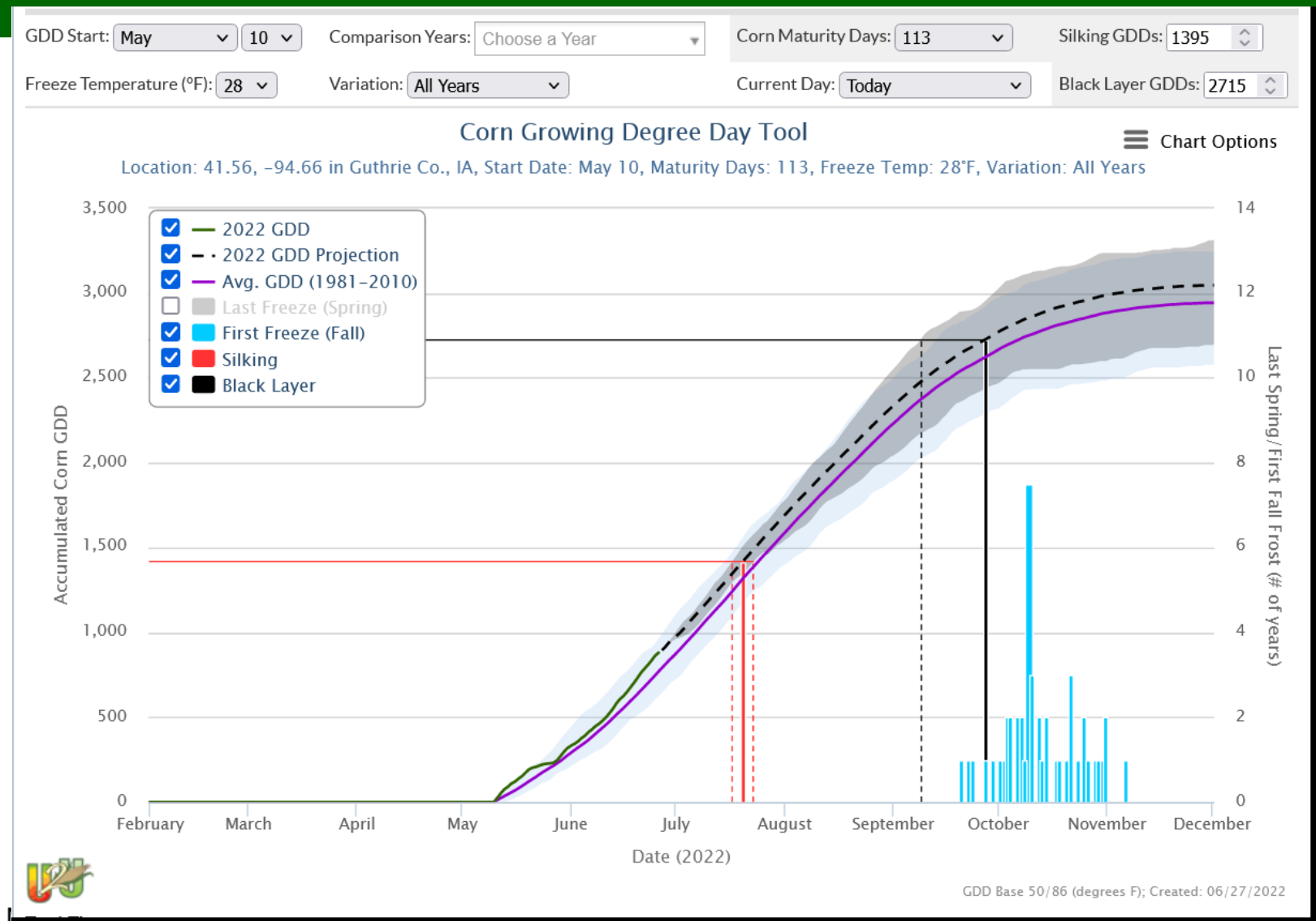
## Corn Growing Degree Day Tool

Location: 47.92, -97.04 in Grand Forks Co., ND, Start Date: April 25, Maturity Days: 80, Freeze Temp: 28°F, Variation: All Years



GDD Base 50/86 (degrees F); Created: 01/04/2016

# GDD Accumulations (Guthrie Co.)



# Data Details and Download



[Map](#) [Graph](#) [Data](#) [Animations](#)

[Feedback?](#) [About GDD](#)

This tab provides a text-only view of current and historical Corn (86/50) GDD accumulations, silking and black layer dates, and first/last freeze dates.

GDD Start: April 11

Corn Maturity Days: 108

Silking GDDs: 1338

Freeze Temperature (°F): 28

Variation: All Years

Current Day: Today

Black Layer GDDs: 2594

### User Input Summary

Location (lat, long):	42.057, -93.089
Location (county, state):	Story Co., IA
GDD Start Date:	April 11, 2015
Today's Date:	March 16, 2015
Latest Data Available:	March 15, 2015
Corn Maturity Days:	108 days
Growing Degree Days to Silking:	1338
Growing Degree Days to Black Layer:	2594

### Corn Growing Degree Day (GDD) Results

30-Year History (1981 - 2010)

	This Year (2015)	Average	Occurs within 100% of the time
GDD Accumulation (not available)	**	**	**
V2 Date	**	May 15	May 3 - May 27
V4 Date	**	May 28	May 15 - June 10
V6 Date	**	June 7	May 28 - June 18
V8 Date	**	June 16	June 6 - June 26
V10 Date	**	June 24	June 14 - July 4
Silking Date	**	July 12	June 30 - July 21
Blacklayer Date	**	September 12	August 25 - October 10

### Freeze Results (28°F)

Last Spring Freeze	March 15	April 14	March 25 - May 7
Freeze Probability after April 11	61%		
First Fall Freeze		October 16	September 23 - November 4
Freeze Probability before Black Layer	9%		

\*\* = Not available since, GDD start date is after today's date; use information under 30-year history

☐ **Accumulated GDD Details**

**Tool Tips:**

- Select the blue question mark icon in the top right corner of the tab section for instructions and other information.

Download Data



# DATA MATTERS

*We have the tools to help you make decisions.*

- Climate Tools
- Interactive Maps
- Customized Services



**MRCC**  
Midwestern Regional Climate Center

[mrcc.purdue.edu](https://mrcc.purdue.edu)

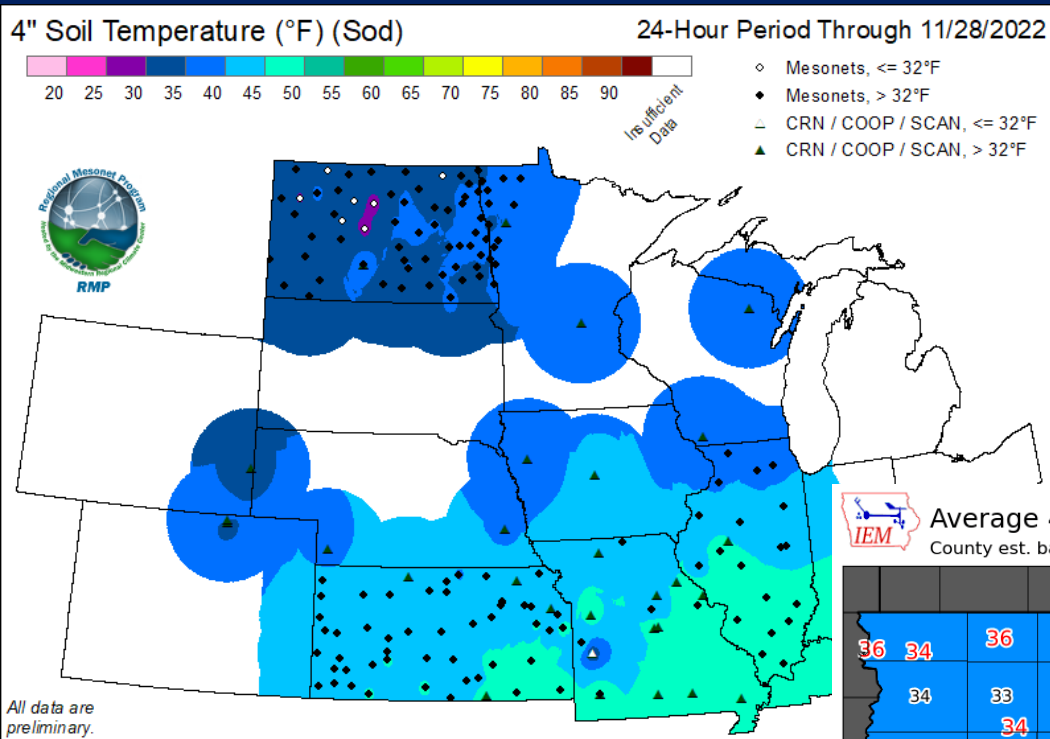


**P PURDUE**  
UNIVERSITY.

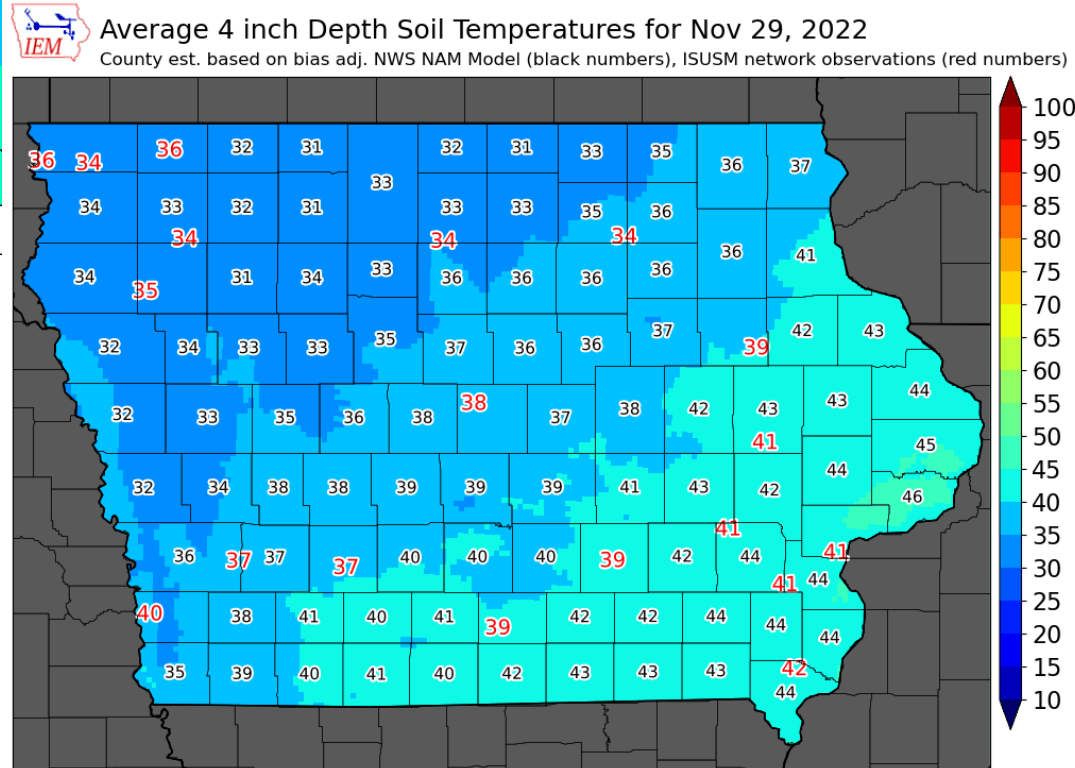
*Partnering with the National Centers for  
Environmental Information and Purdue University.*

A screenshot of a web browser displaying the MRCC website. The browser's address bar shows "https://mrcc.purdue.edu". The website has a blue header with the MRCC logo and navigation links: "About Us", "Data &amp; Services", "Midwest Climate", "Resources", "Research", "Multimedia", and "Home". The main content area is divided into two sections. The "Featured Products" section contains two boxes: "cli-MATE MRCC APPLICATION TOOLS ENVIRONMENT" with a bar chart icon, and "Midwest CLIMATE WATCH" with a map icon. Below these are links to the "cli-MATE Online Data Portal" and "Midwest Climate Watch". The "Seasonal Tools" section contains four boxes: "Corn Growing Degree Day" (line graph), "Regional Mesonet Project" (map), "Freeze Date Tool" (map), and "VIP Freeze Maps" (map). The Windows taskbar at the bottom shows the time as 5:29 AM on 11/30/2022.

# Soil Temperatures



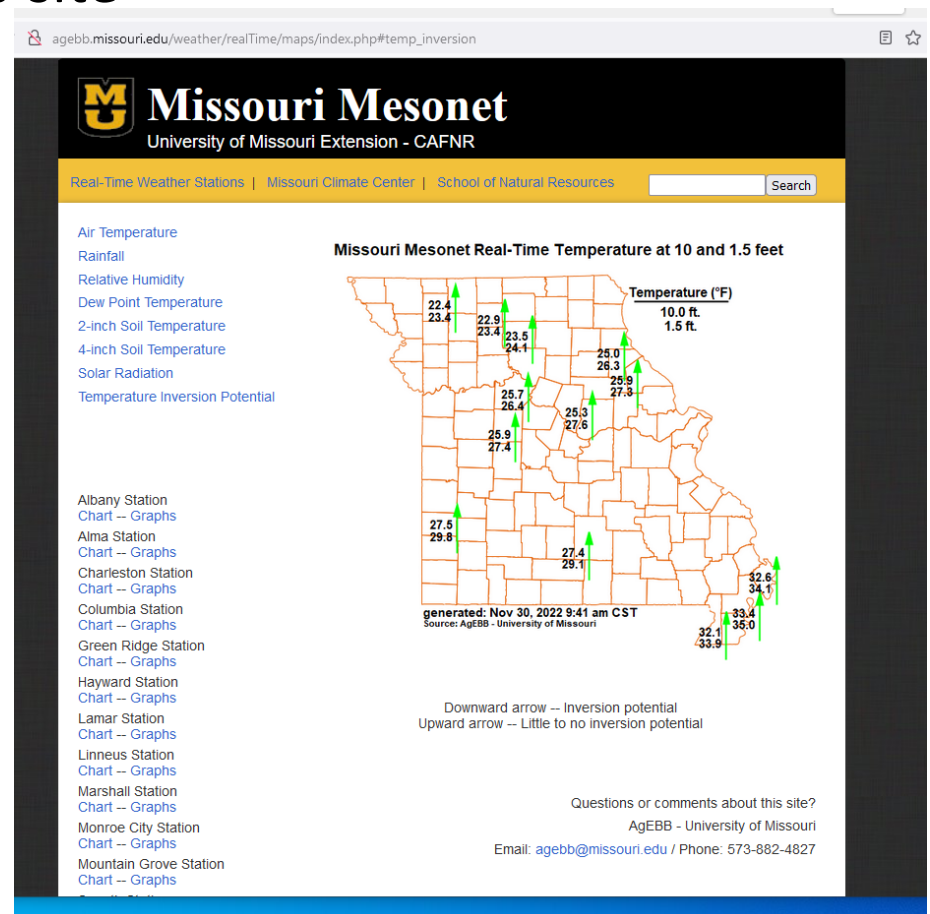
<https://mrcc.purdue.edu/RMP/currentMaps.html#banner>



<https://mesonet.agron.iastate.edu/agclimate/soilt.php>

# Coming Attractions-MRCC

- Soil temperature climatology
- Temperature Inversion web site





National to County level data for over 125 years

# LONG-TERM DATA



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

# Long Term Data/Trends

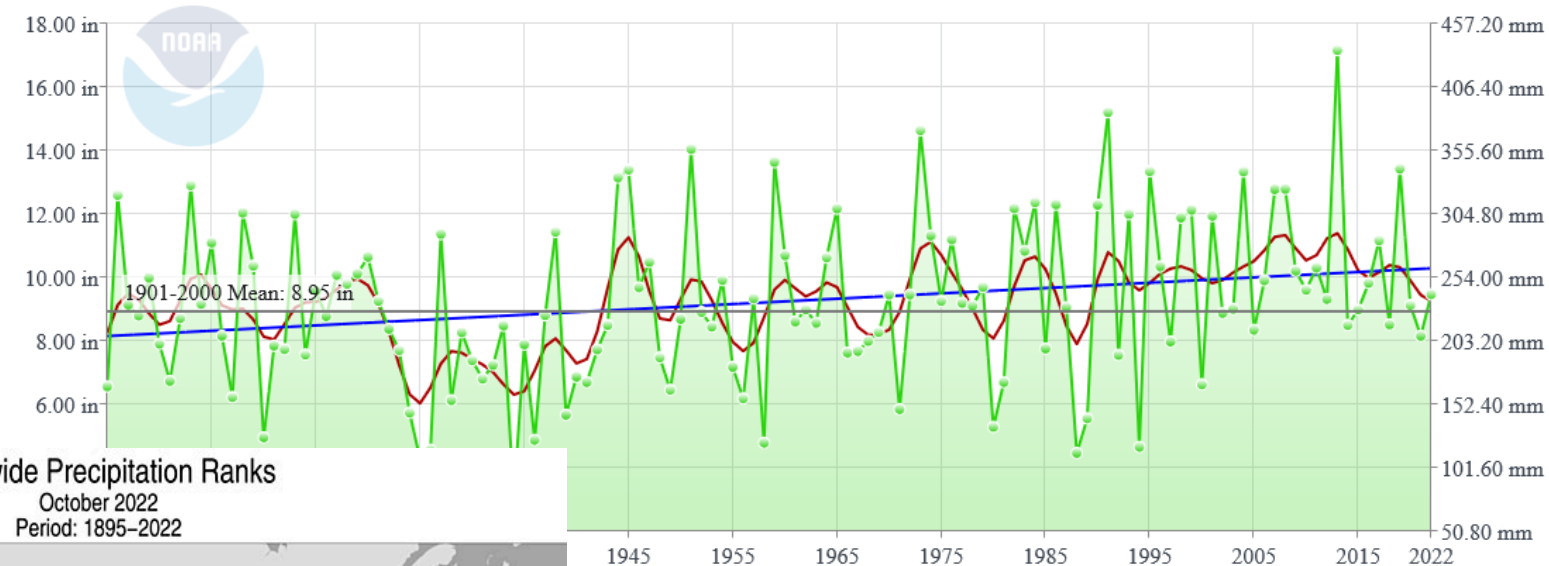
- National Drought Mitigation Center
  - <https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/>
  - <https://www.ncei.noaa.gov/access/monitoring/us-maps/>



# NOAA Climate Trends

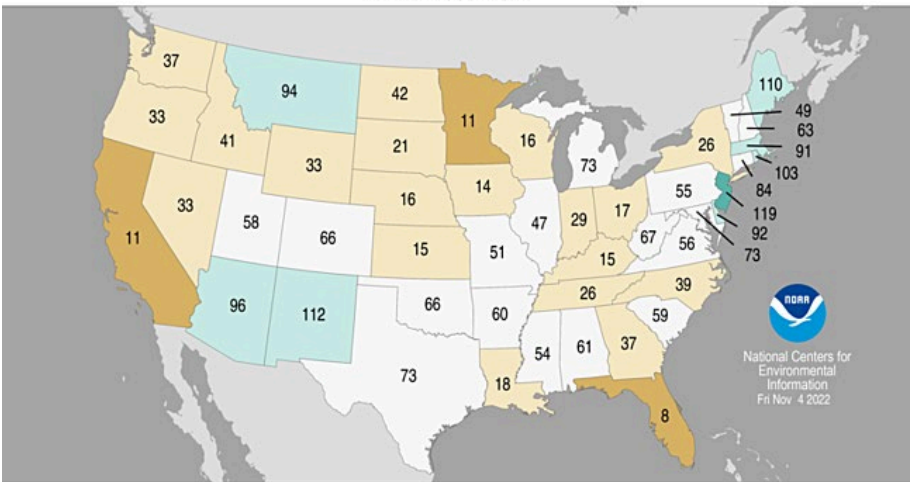
## Iowa Precipitation

March-May



## Statewide Precipitation Ranks

October 2022  
Period: 1895-2022



Record Driest (1)    Much Below Average    Below Average    Near Average    Above Average    Much Above Average    Record Wettest (128)

- <https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/>
- <https://www.ncei.noaa.gov/access/monitoring/us-maps/>

Information about and assessing drought

# DROUGHT



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

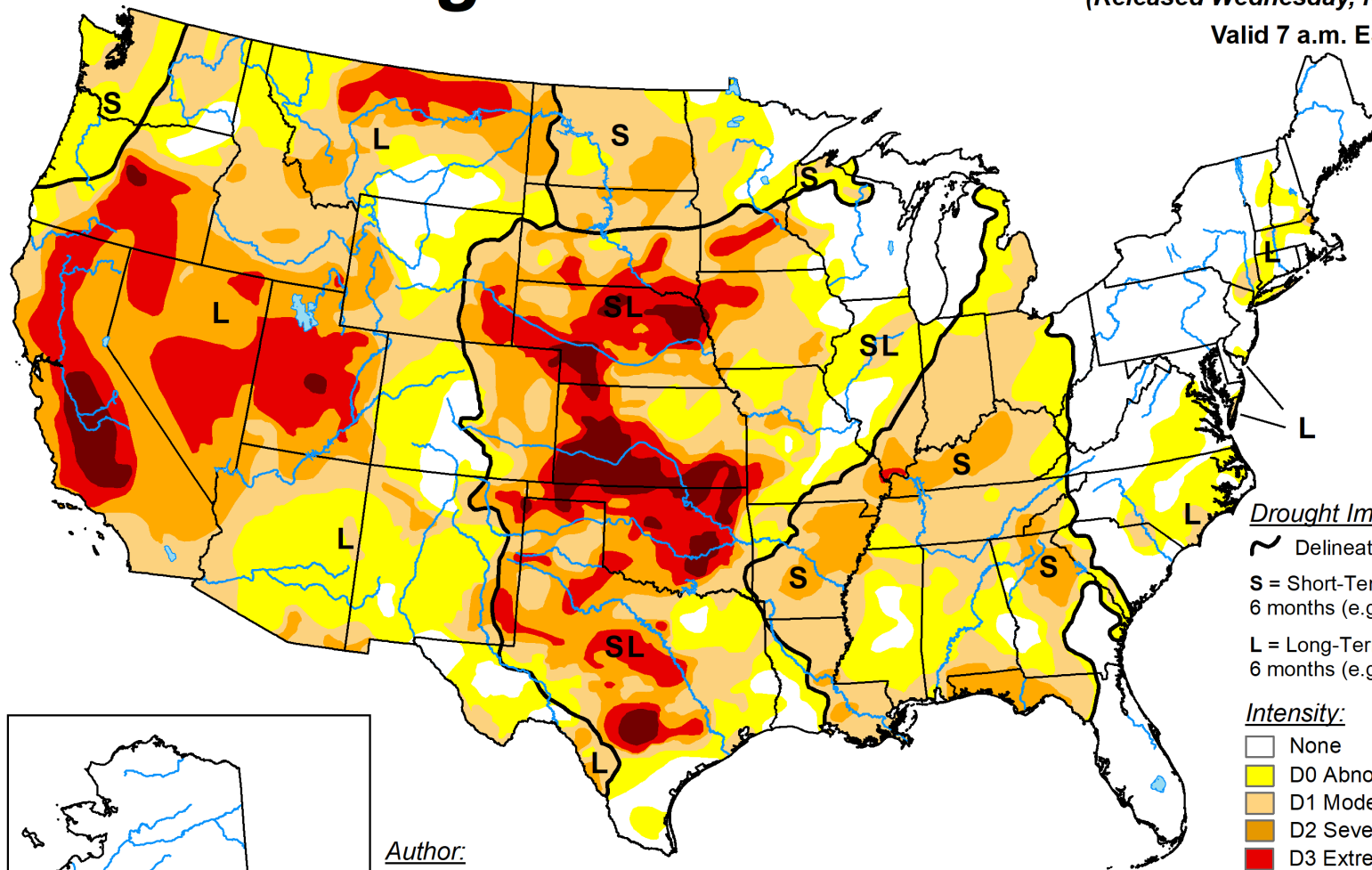
# Assessing Drought - Ag

- National Drought Mitigation Center
  - <https://droughtmonitor.unl.edu/>
  - <https://drought.unl.edu/Monitoring/DroughtMonitoringTools.aspx>
  - <https://agindrought.unl.edu/>
- National Integrated Drought Information System (NIDIS)
  - <https://www.drought.gov/>
  - <https://www.drought.gov/topics/agriculture>

# U.S. Drought Monitor

November 22, 2022  
(Released Wednesday, Nov. 23, 2022)

Valid 7 a.m. EST



## Drought Impact Types:

~ Delineates dominant impacts

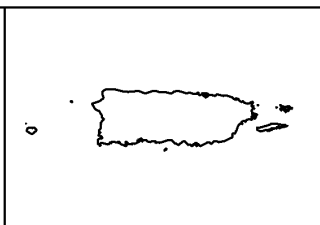
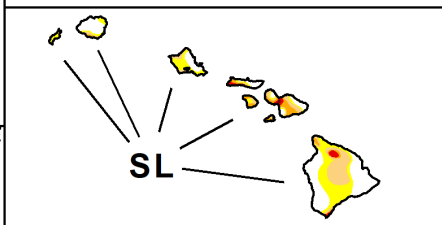
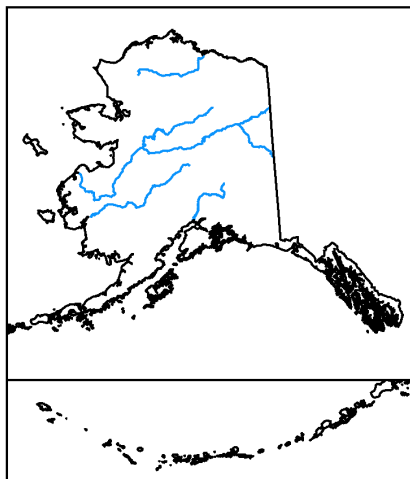
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

## Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

Author:  
Brad Rippey  
U.S. Department of Agriculture



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

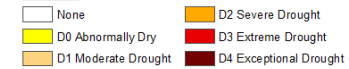


[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	7.36	92.64	73.30	29.84	12.01	0.57
Last Week 11-15-2022	7.36	92.64	73.30	29.84	12.01	0.57
3 Months Ago 08-29-2022	34.28	65.72	38.87	15.92	2.08	0.00
Start of Calendar Year 01-04-2022	50.98	49.02	11.87	0.00	0.00	0.00
Start of Water Year 09-27-2021	20.90	79.10	45.05	22.25	5.07	0.02
One Year Ago 11-23-2021	57.58	42.42	13.17	0.00	0.00	0.00

Intensity:



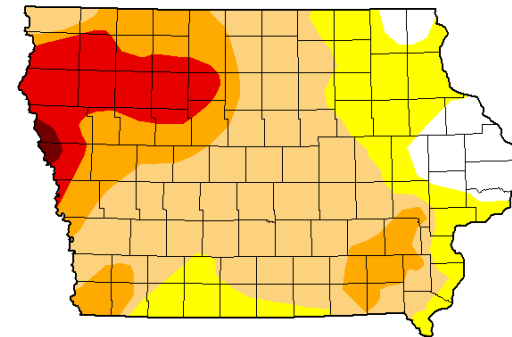
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Author:

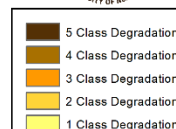
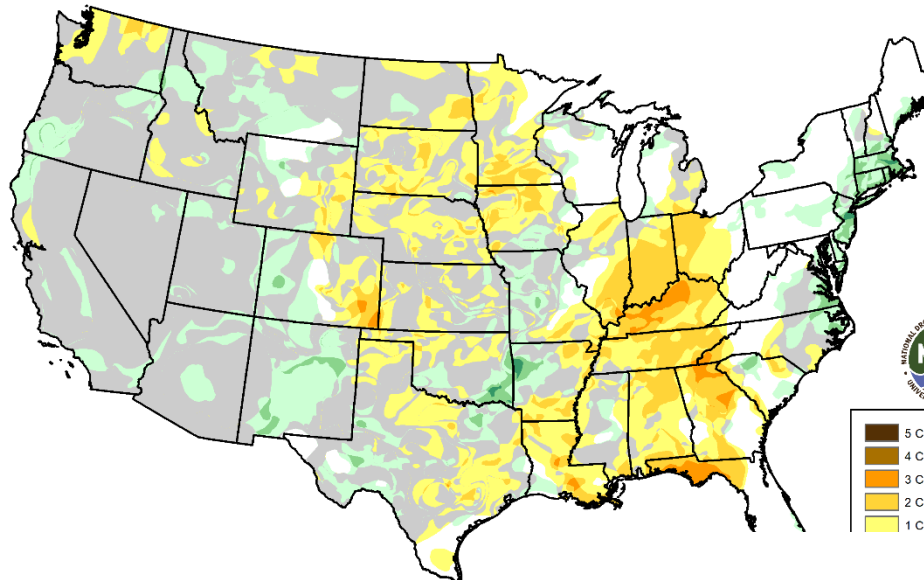
Brad Rippey  
U.S. Department of Agriculture



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

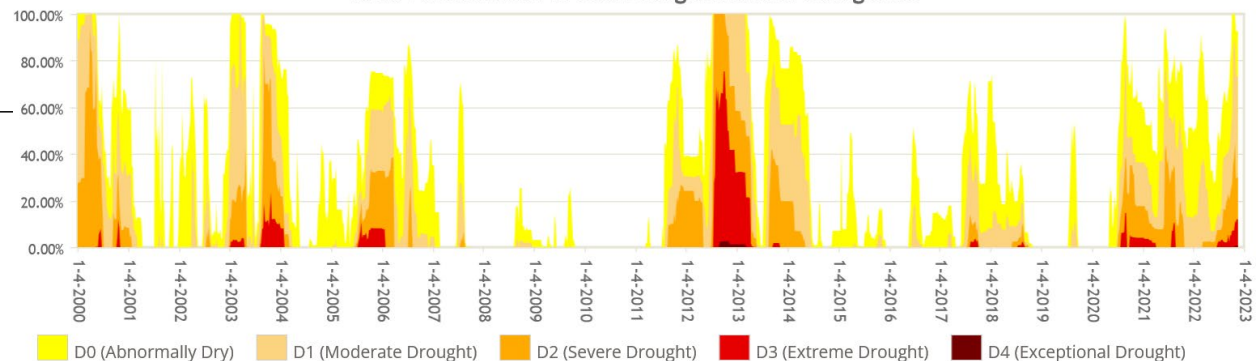


U.S. Drought Monitor Class Change - CONUS  
8 Week



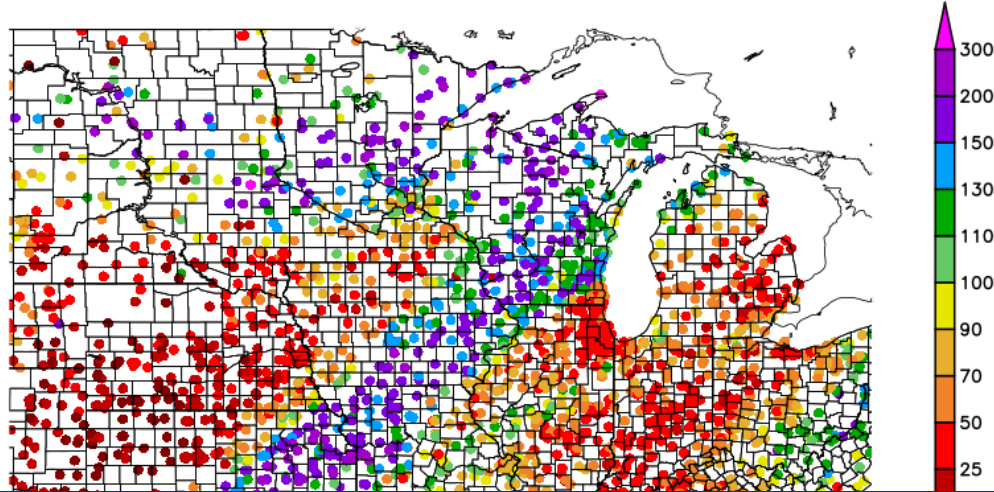
November 22, 2022  
compared to  
September 27, 2022

Iowa Percent Area in U.S. Drought Monitor Categories

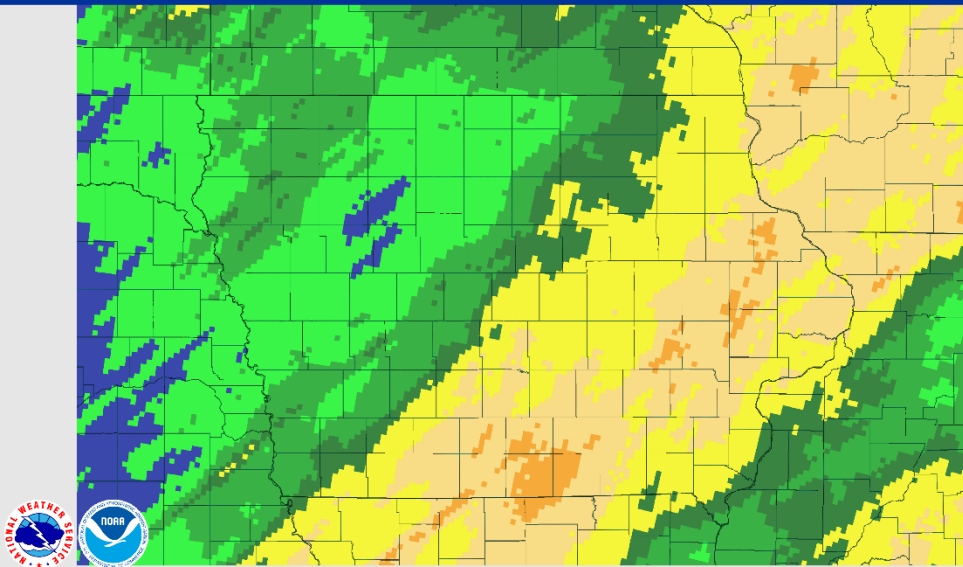




## Percent of Normal Precipitation (%) 10/31/2022 – 11/29/2022

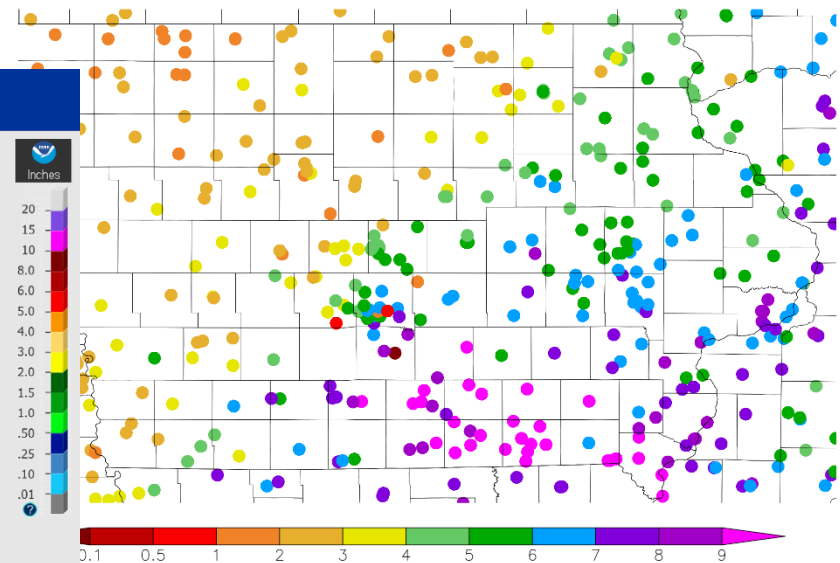


November 30, 2022 30-Day Observed Precipitation  
Created on: November 30, 2022 - 13:50 UTC  
Valid on: November 30, 2022 12:00 UTC



# Assessing Drought

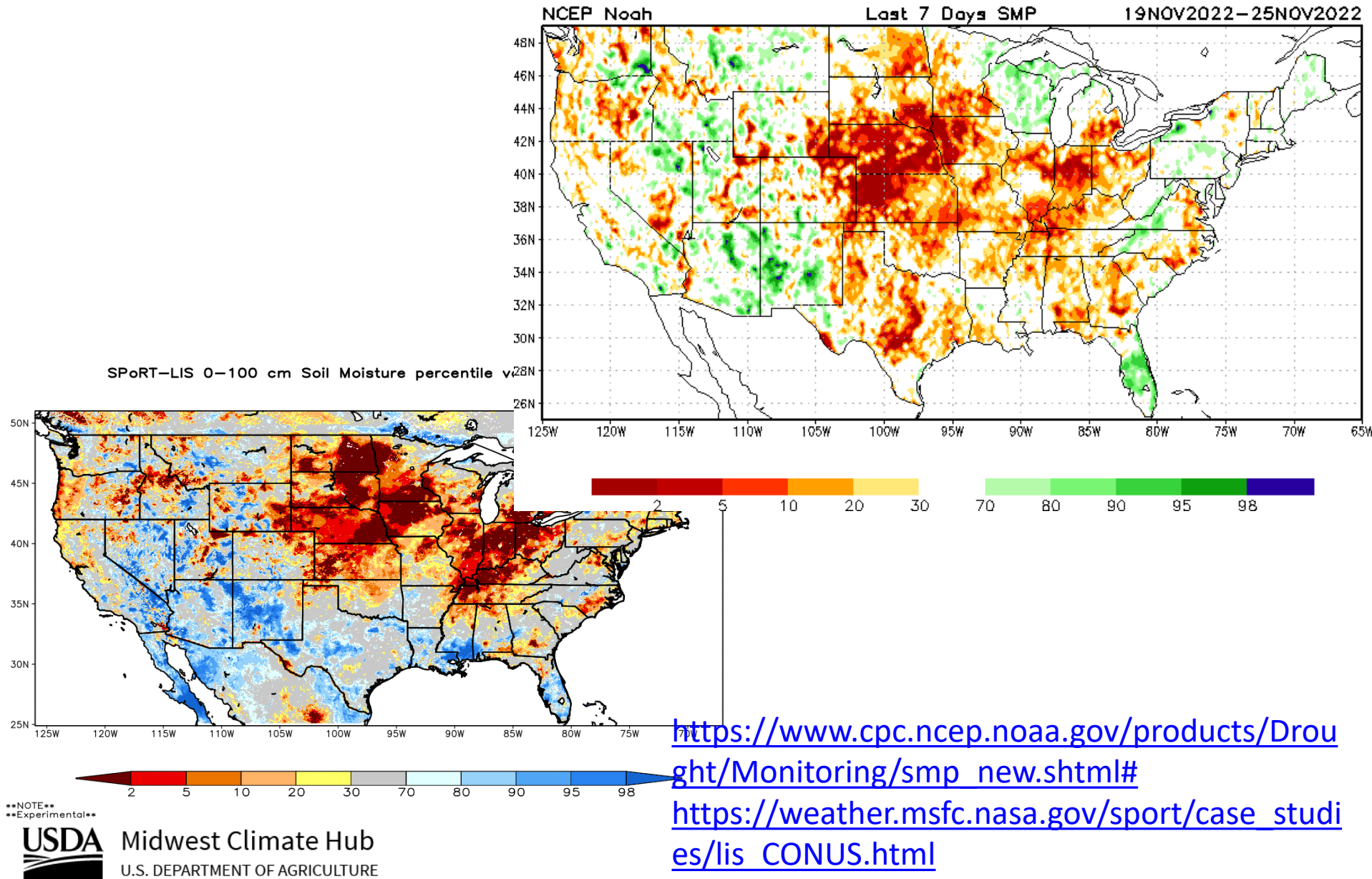
Precipitation (in)  
8/31/2022 – 11/28/2022



11/29/2022 at HPRCC using provisional data.

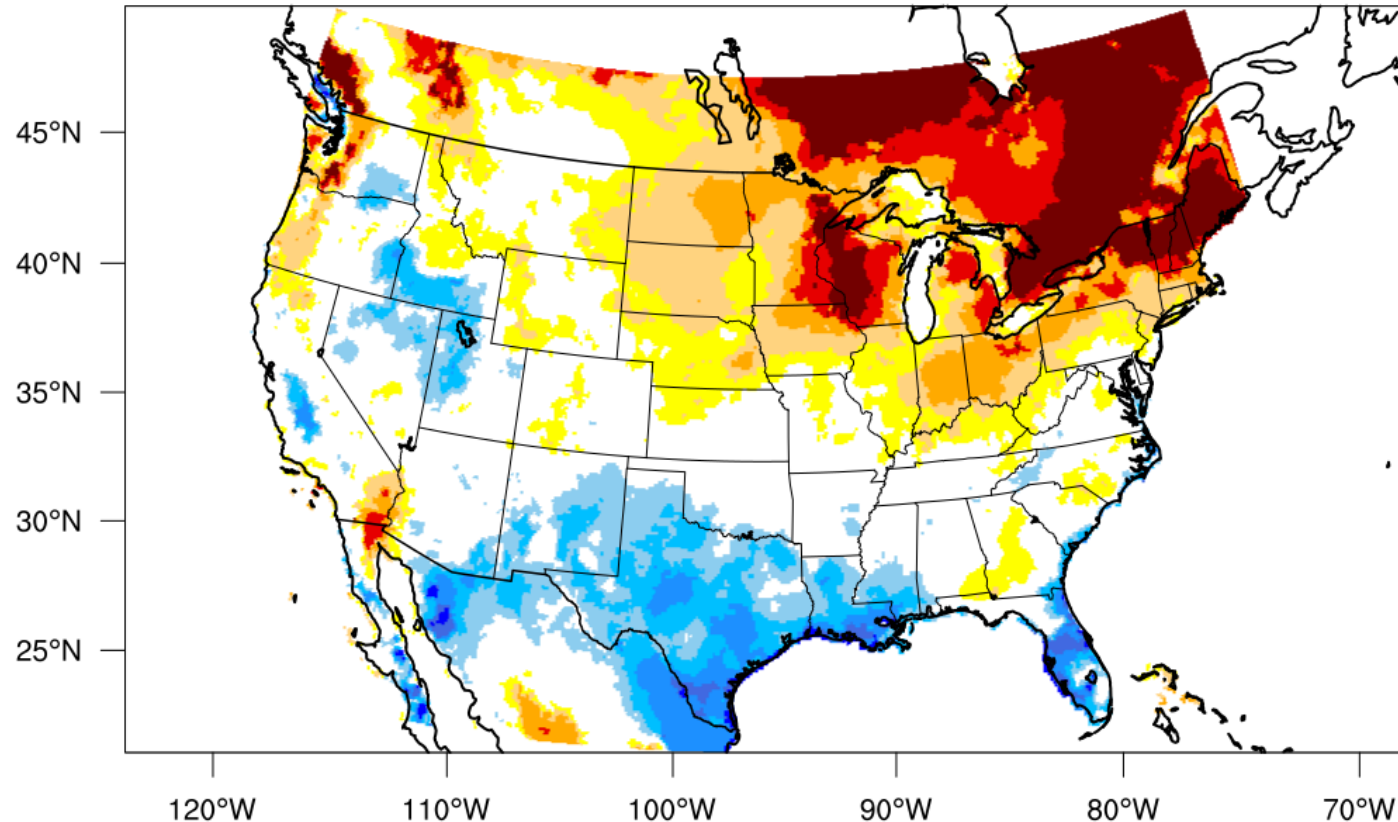
NOAA Regional Climate Centers

# Soil Moisture



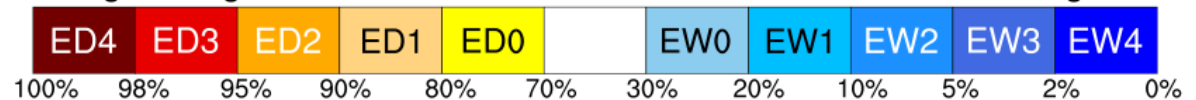
# Assessing Drought Evapo-Transpiration

1-month EDDI categories for November 25, 2022



Drought categories

Wetness categories

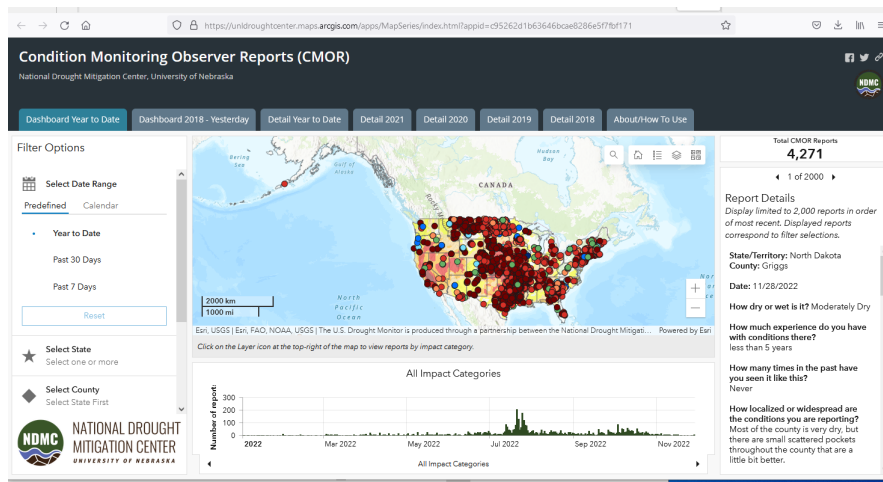


(EDDI-percentile category breaks: 100% = driest; 0% = wettest)

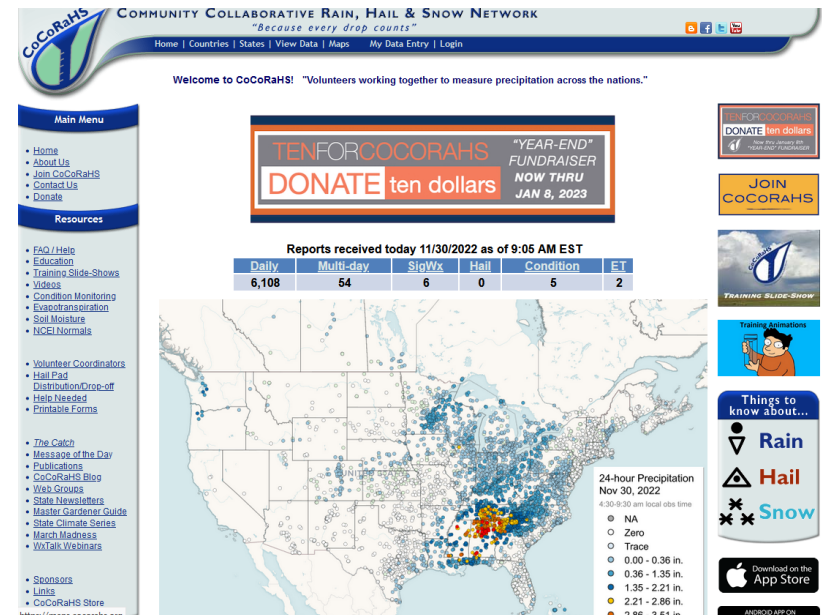
Generated by NOAA/ESRL/Physical Sciences Laboratory

# Drought (and other) Share Information

- Condition Monitoring Reports (CMOR)
  - <https://droughtimpacts.unl.edu/Tools/ConditionMonitoringObservations.aspx>
  - Submit condition reports/pictures



- CoCoRaHS
  - <https://cocoahs.org/>
  - Record rainfall (daily) – can also do condition reporting



Looking ahead from tomorrow to a year from now

# **FORECASTS/OUTLOOKS**



# Forecasts/Outlooks

- Forecasts (1-7 Day)
  - <https://www.weather.gov/>
- Outlooks (Week 2 – 1 Year)
  - <https://www.cpc.ncep.noaa.gov/>

# Forecasts 1-7 Days

https://www.weather.gov

**NATIONAL WEATHER SERVICE**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME FORECAST PAST WEATHER SAFETY INFORMATION EDUCATION NEWS SEARCH ABOUT

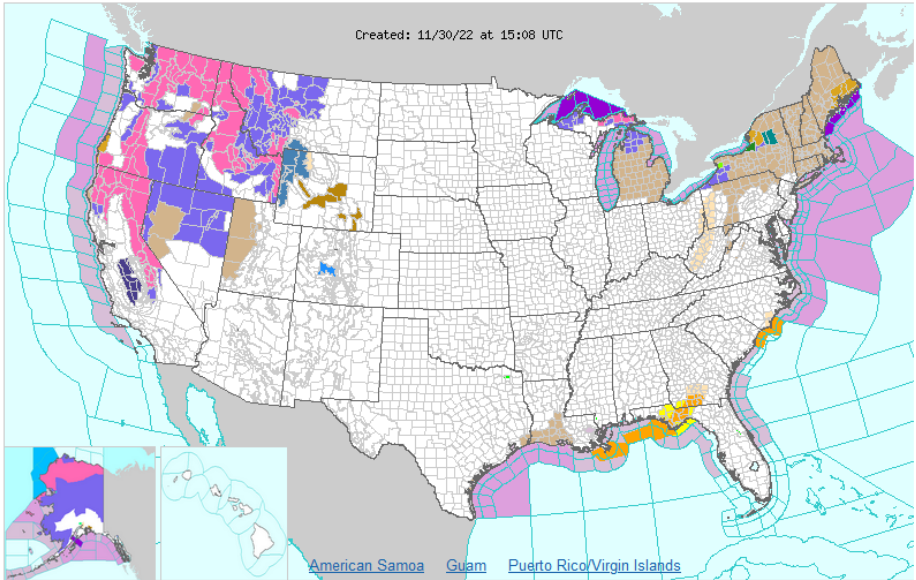
Local forecast by "City, ST" or ZIP code  
Enter location ...   
[Location Help](#)

**Cold Front Sweeping Through East; Winter Storm To Affect West**  
A strong cold front will sweep through the East today with a variety of weather hazards, including severe storms and heavy rain near the northeastern Gulf Coast region and rain and gusty winds in the Northeast. Meanwhile, a powerhouse winter storm will affect the Western U.S. the next few days with widespread heavy mountain snow, locally heavy rain along the West Coast and gusty winds.  
[Read More >](#)

**WRN** ACTIVE ALERTS FORECAST MAPS RADAR RIVERS, LAKES, RAINFALL AIR QUALITY SATELLITE PAST WEATHER

Customize Your Weather.gov  
City, ST  
Enter Your City, ST or ZIP Code  
☐ Remember Me  
  
[Privacy Policy](#)

Created: 11/30/22 at 15:08 UTC



American Samoa [Guam](#) [Puerto Rico/Virgin Islands](#)

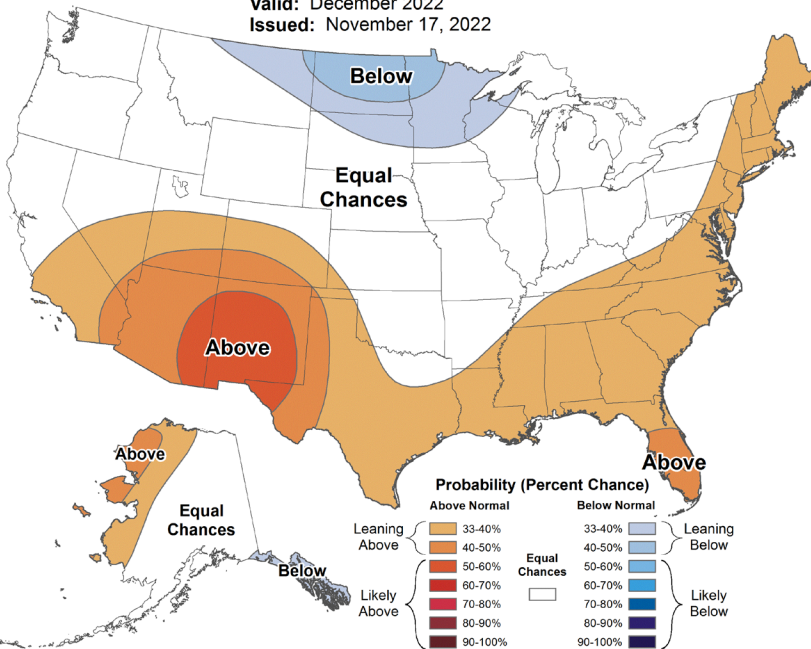
Click on the map above for detailed alerts or   [Public Alerts in XML/CAP v1.2 and ATOM Formats](#)

# December Temperature and Precipitation Probabilities



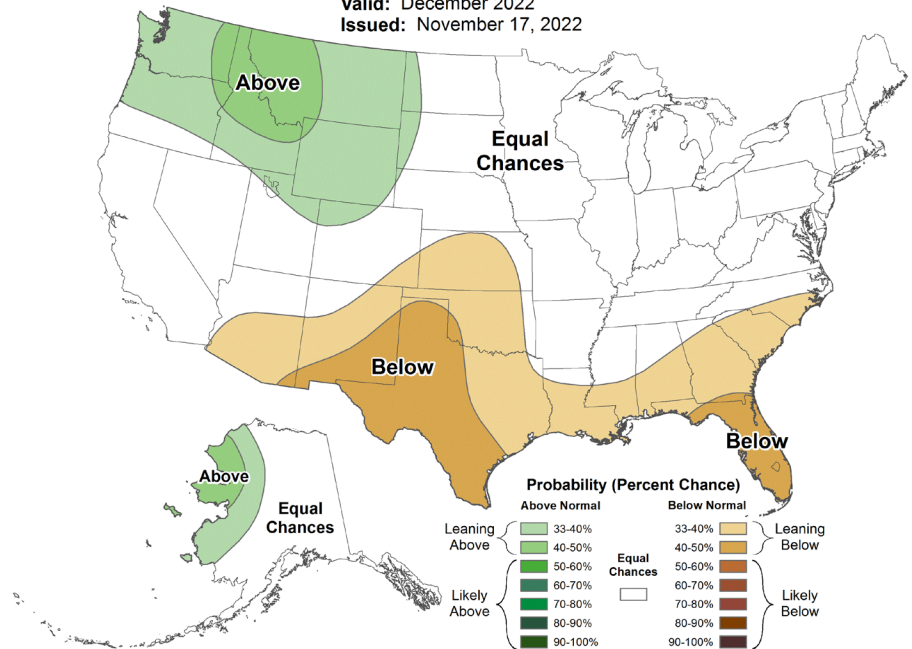
## Monthly Temperature Outlook

Valid: December 2022  
Issued: November 17, 2022



## Monthly Precipitation Outlook

Valid: December 2022  
Issued: November 17, 2022



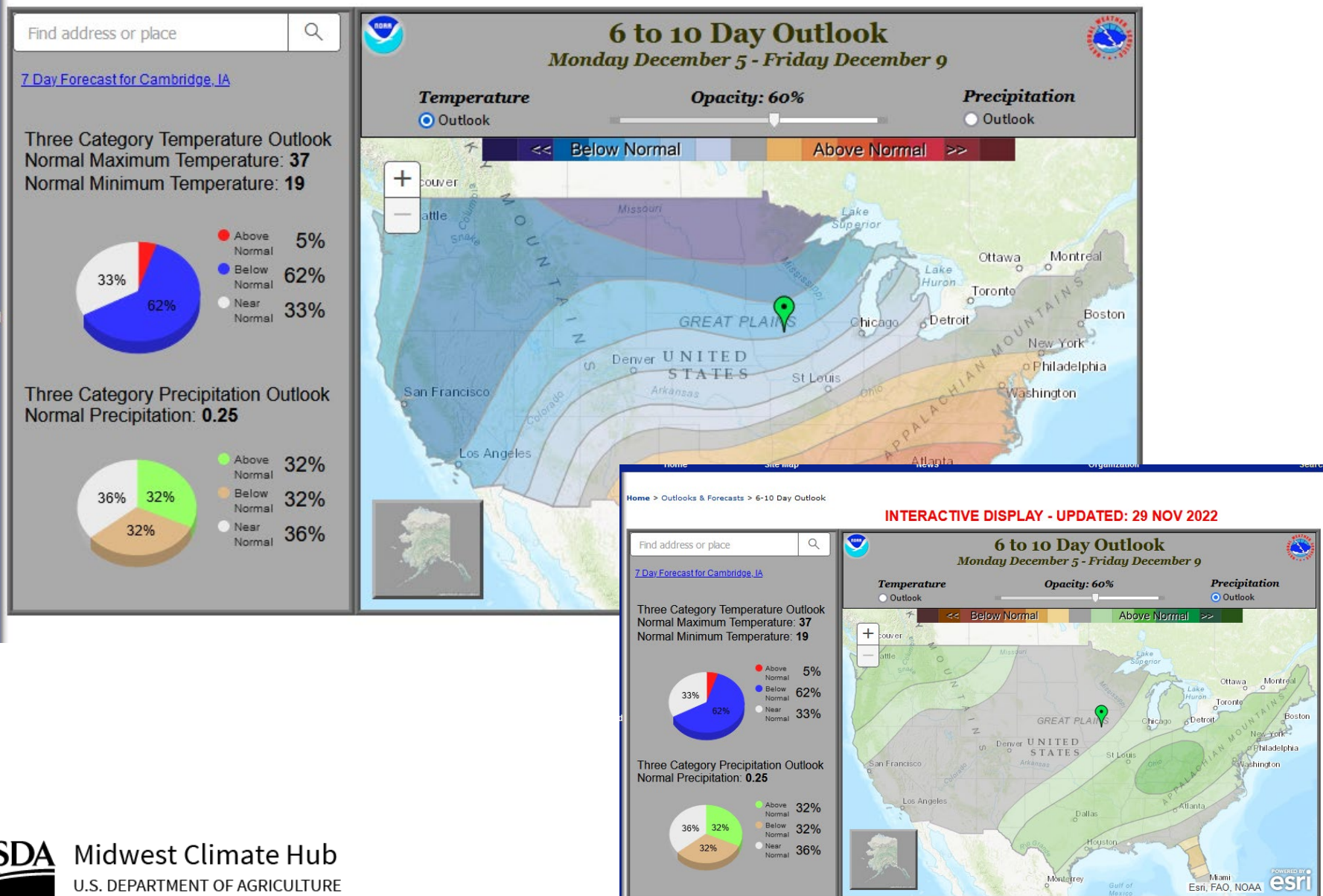
**Temperature**

**Precipitation**

<http://www.cpc.ncep.noaa.gov/products/predictions/30day/>

# Understanding CPC Outlooks

INTERACTIVE DISPLAY - UPDATED: 29 NOV 2022





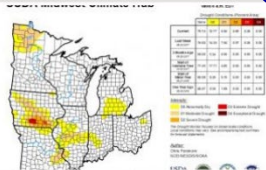
# Resources: Operational Products

## 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.



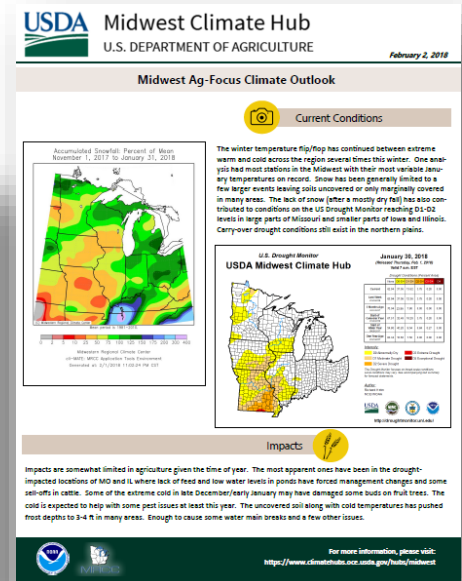
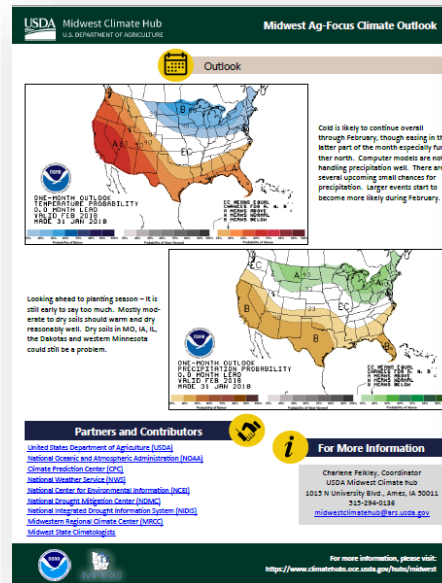
### Climate and Agriculture

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.





# What else do you need?

# For More Information



@USDAClimateHubs  
@dennistoday



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

<https://www.climatehubs.usda.gov/newsletter-signup>



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE

**National Laboratory for Agriculture and the Environment**

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# OPTIONAL SLIDES

# Freeze Date Tool

First Fall Freeze Date Map

Last Spring Freeze Date Map

Growing Season Length Map

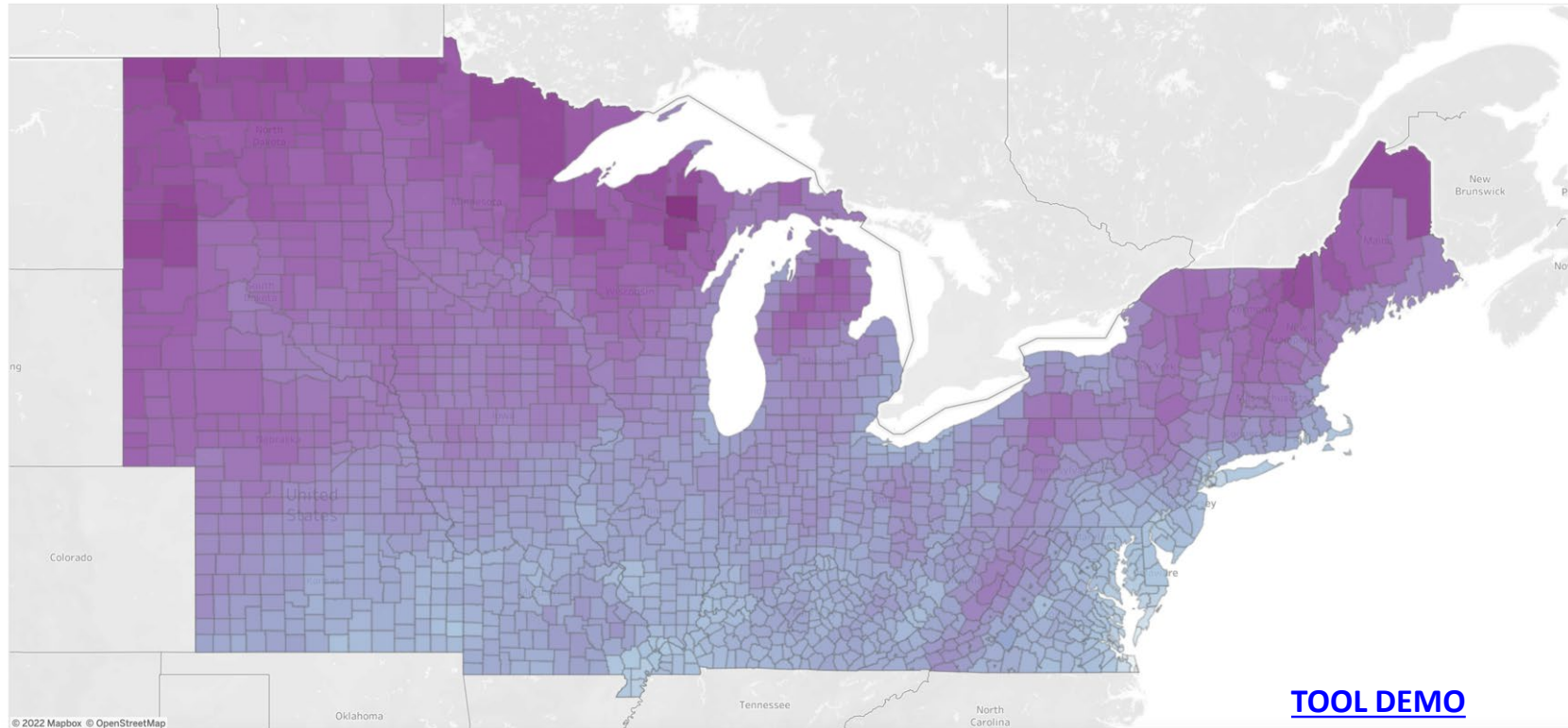
First Fall Freeze Trend Map

Last Spring Freeze Trend Map

Growing Season Trend Map

## Average First Fall 32 °F Freeze Date

Click on a county to see more data for that location.



First Fall Freeze Date

Sep 13 Nov 23

Freeze Temperature:

32 °F

Select Statistic:

Average

Download Image

Data from ACIS Gridded Dataset (1950-2021).

For more information about this tool and the data it uses, please click the "About" button below.

This tool funded by USDA-Agricultural Research Service (ARS) Midwest Climate Hub/National Program 216 Sustainable Agriculture.

About

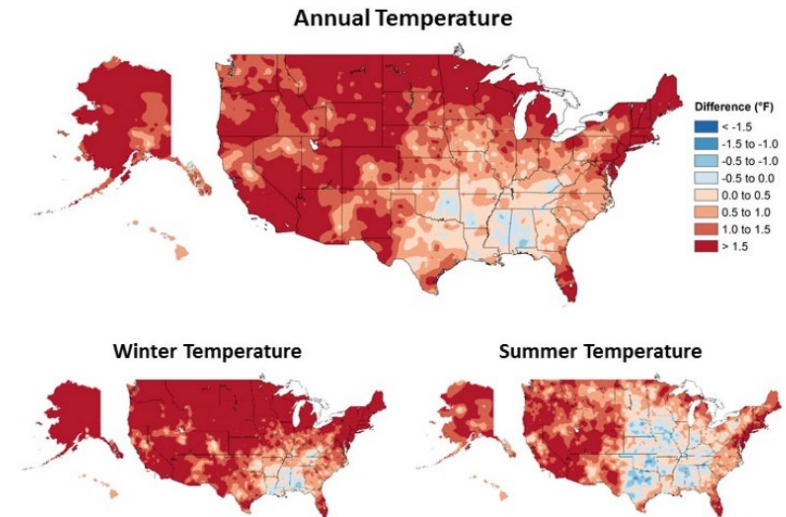
USDA Climate Hub U.S. DEPARTMENT OF AGRICULTURE



[TOOL DEMO](#)

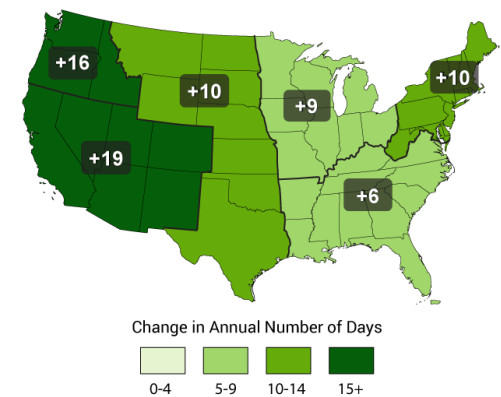
# Temperature Change

- Central/Northeast US Warming
  - Winter
  - Nights
- Push GDD accumulation/phenological state
- Increase insect issues
- 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).

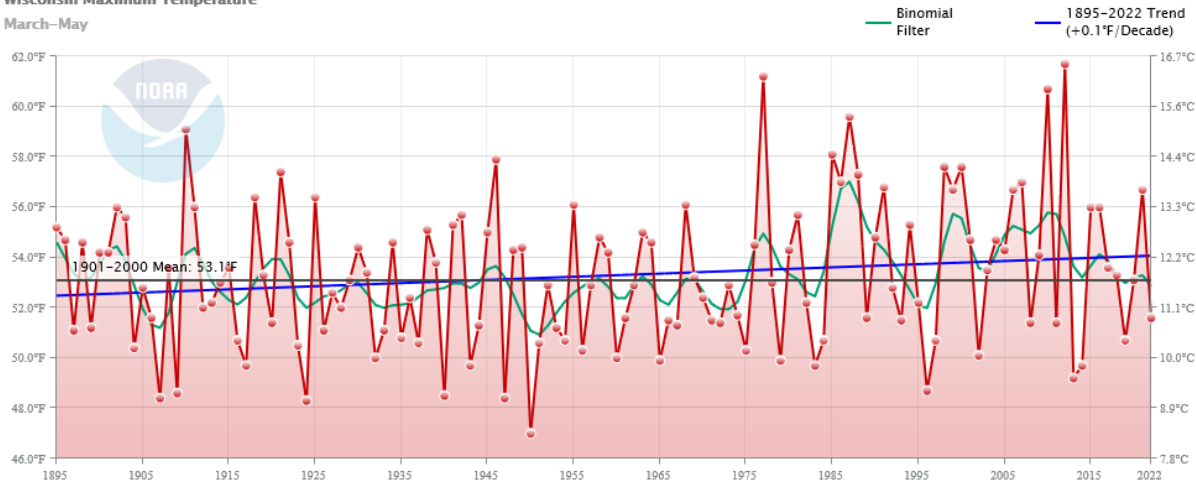
Observed Increase in Frost-Free Season Length





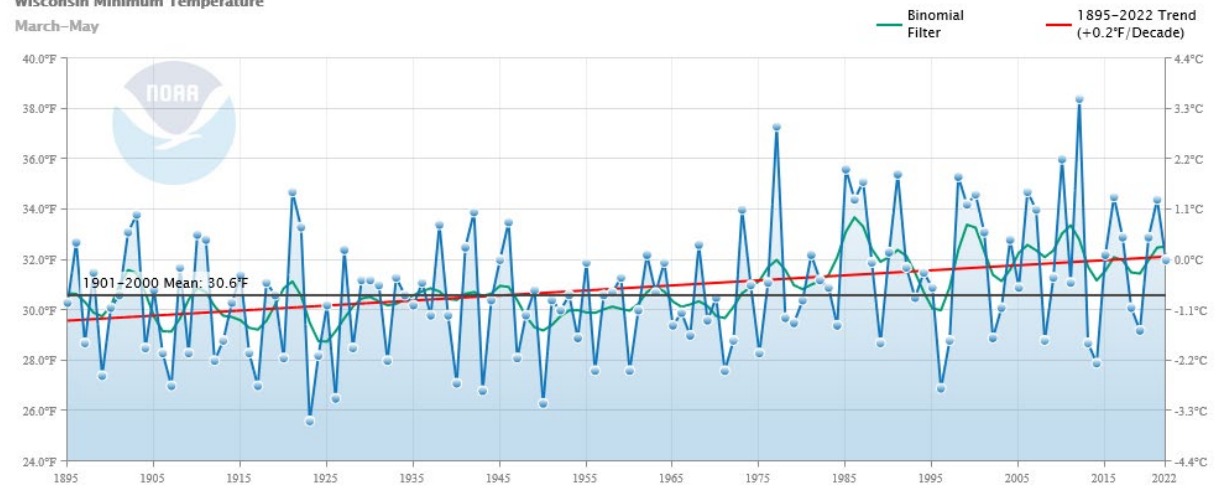
# Wisconsin Spring Temperatures Max/Min

Wisconsin Maximum Temperature  
March-May



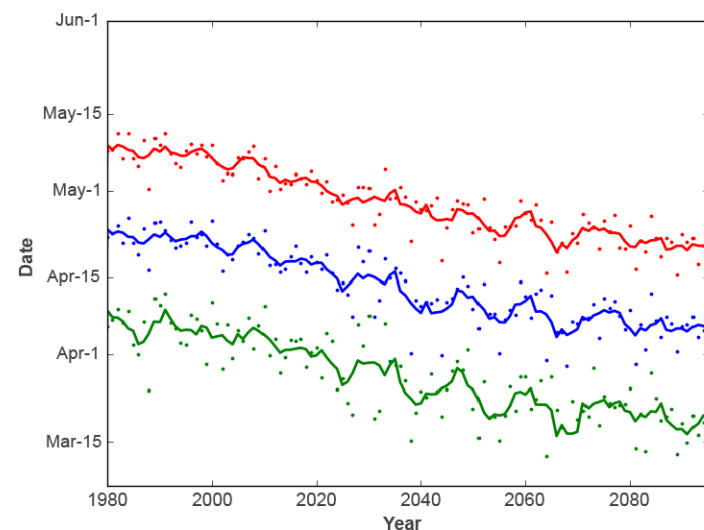
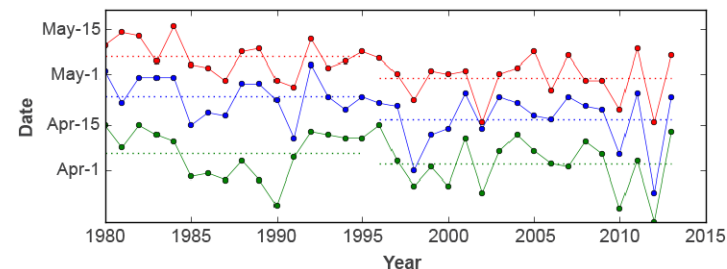
- Both Maximums and Minimums warming in spring
- Variable

Wisconsin Minimum Temperature  
March-May

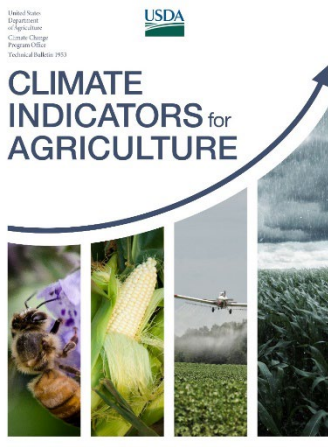


# Timing of Budbreak in Fruit Trees

- Primarily influenced by temperature; also affected by soil moisture, solar radiation, and humidity
- Earlier bloom dates have been widely reported for domestic fruit crops since the 1970s
- Warm winter temperatures paradoxically increase the risk of freeze damage due to early emergence

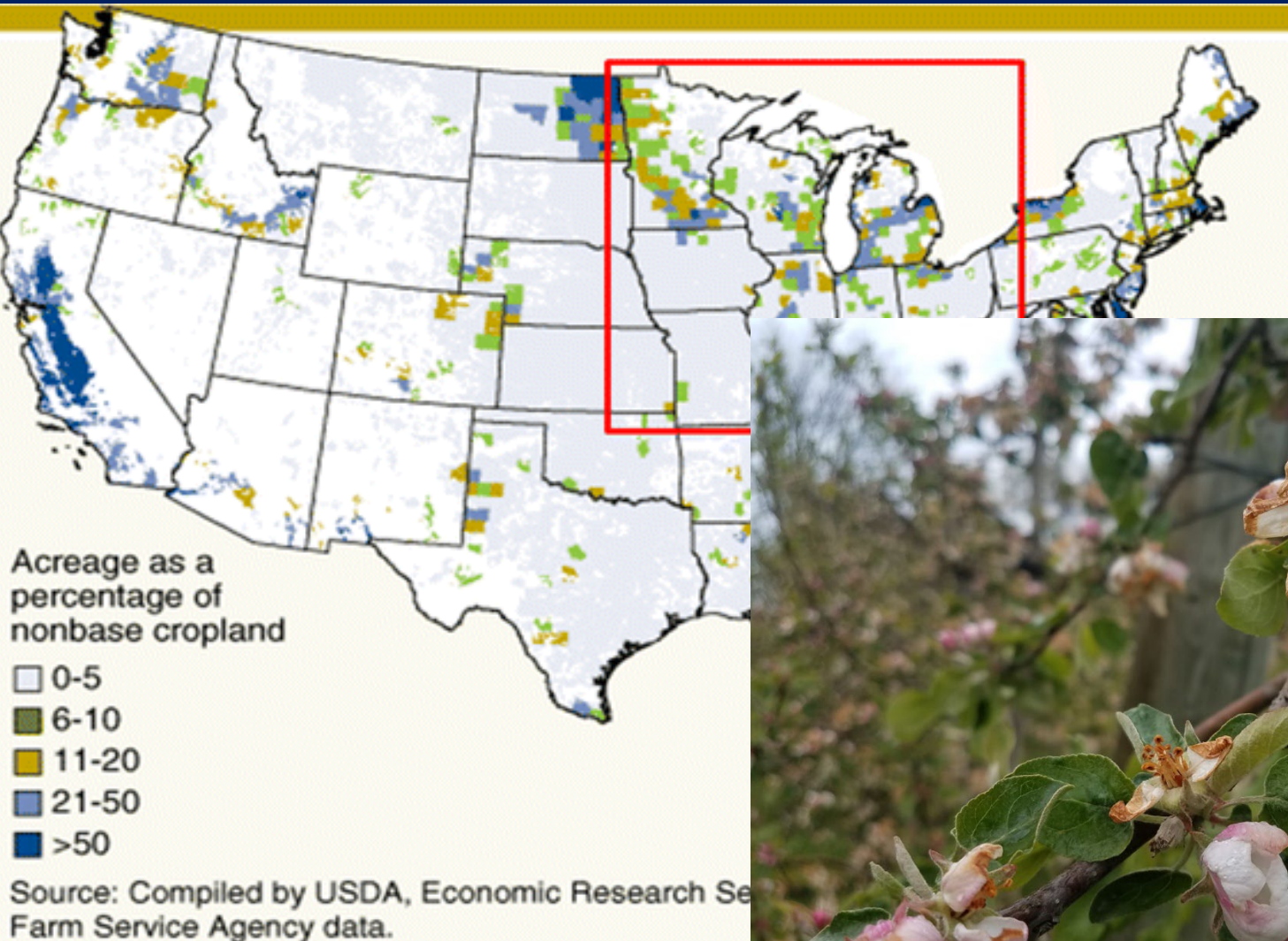


*Historical and projected changes in apple bud development.*



<https://naldc.nal.usda.gov/catalog/7201760>

# Here in the Midwest...



## Goal

Information to help



Apple blossoms are damaged by a freeze event on May 9, 2020, in Berrien County, Michigan. Photo credit: by Mike Reinke, Michigan State University Extension.



Midwest Climate Hub  
U.S. DEPARTMENT OF AGRICULTURE