

El Niño, Drought and a Whole Lot More!

MVTL

New Ulm, MN

Dennis Todey, Director

7 February 2024



Topics/Agenda

- A brief Background of USDA Climate Hubs
 - Partners, Executive Committee and Steering Committee
 - More on the Midwest Climate Hub
- Tools
- Climate Issues
- Current Conditions
- Drought/El Niño
- Outlook and more
- For More Information
 - Resources
 - Website
 - Contact Info



Intro to Climate Hubs



Assessments and Syntheses
Delivering relevant information

Outreach and Education
Enabling climate-informed decisions

Technical Support
Facilitating engagement, discovery and exchange

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.

Let us know if you have other needs...

TOOLS

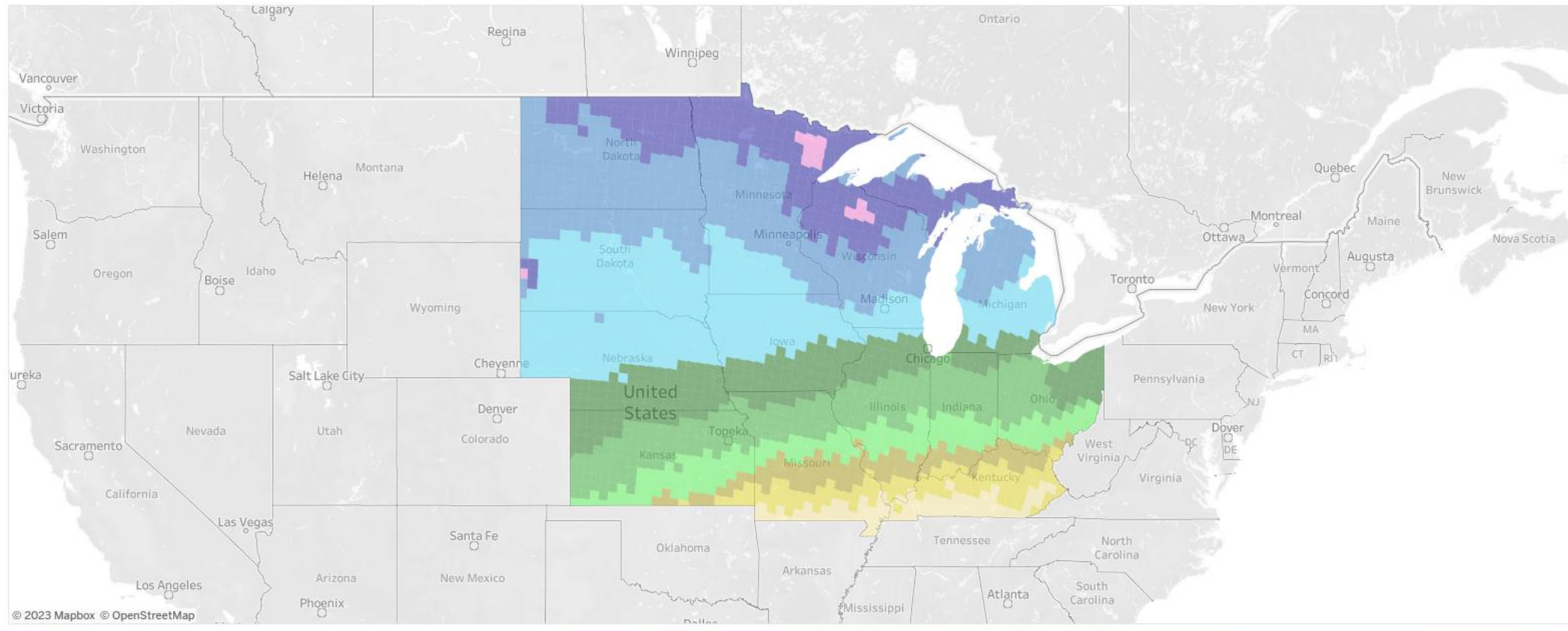
Soil Temperature Climatology (ver. 1)

Soil Temperature Climatology

Average Date

- 09-10 or Earlier
- 09-11 to 09-20
- 09-21 to 09-30
- 10-01 to 10-10
- 10-11 to 10-20
- 10-21 to 10-31
- 11-01 to 11-10
- 11-11 to 11-20
- 11-21 to 11-30
- 12-01 to 12-10
- 12-11 to 12-20
- 12-21 or Later

Date When Soil Temperature Cools Below 50 °F



Select Threshold (°F)

Go to "Warms Above" View

Climatology is based on 1991-2020 values at 4" depth. Map shows seven-day running average values. See About page for more information.

About

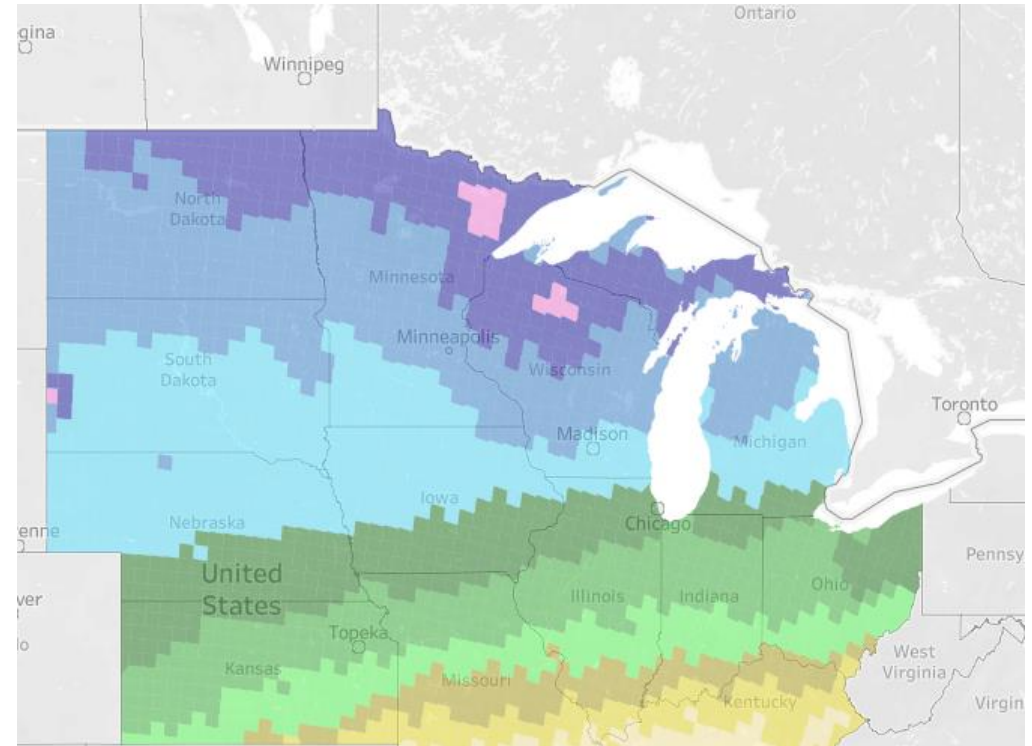


USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

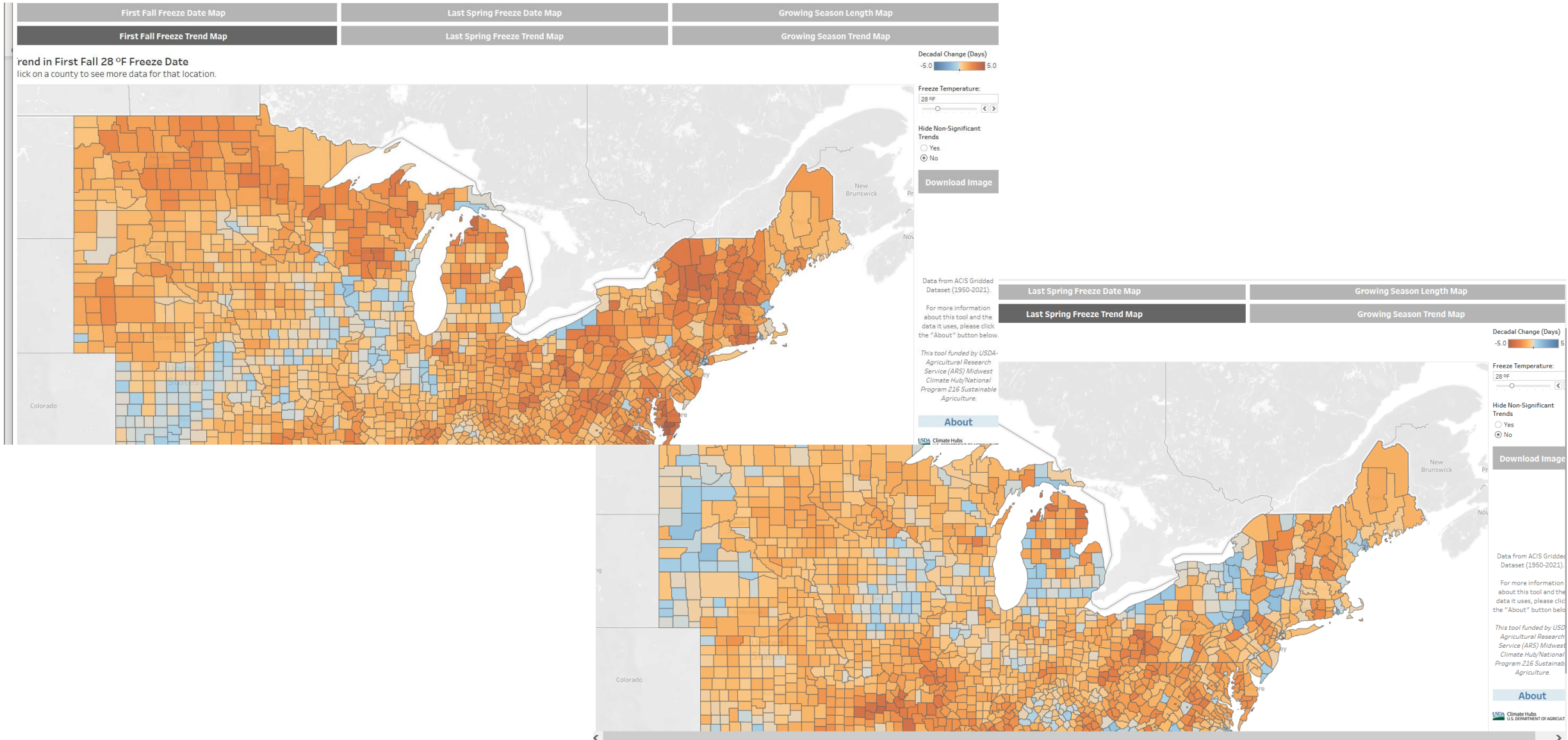
This tool funded by USDA Agricultural Research Service (ARS) Midwest Climate Hub/National Program 216 Sustainable Agriculture.

Soil Temperature Climatology (ver. 1)

- Focus on average dates (50 F – spring and fall)
- Freeze dates – much more variable
- Watch for spring webinar
- Additional updates to the product
 - Changes over time
 - Data availability

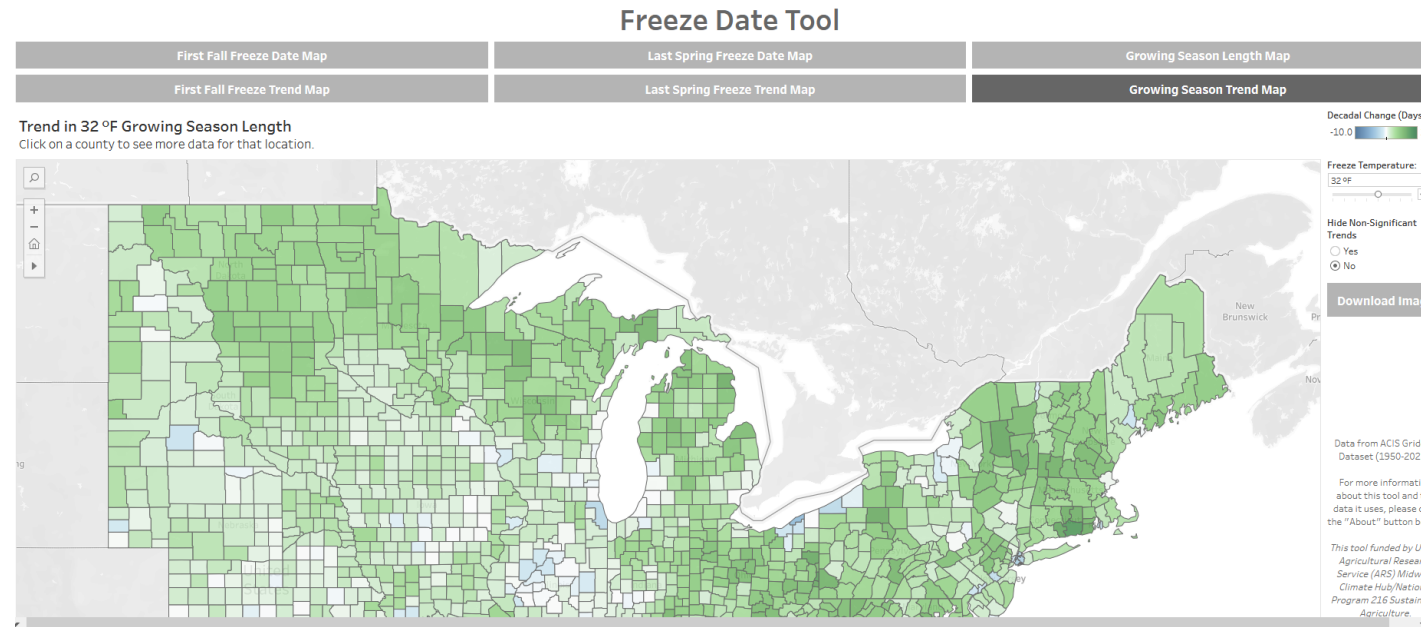


Regional Frost-Free Season Change



Regional Frost-Free Season Change

- Also growing season length
- Statistical significance
- Various temperature cut-offs.
- Understand season lengths

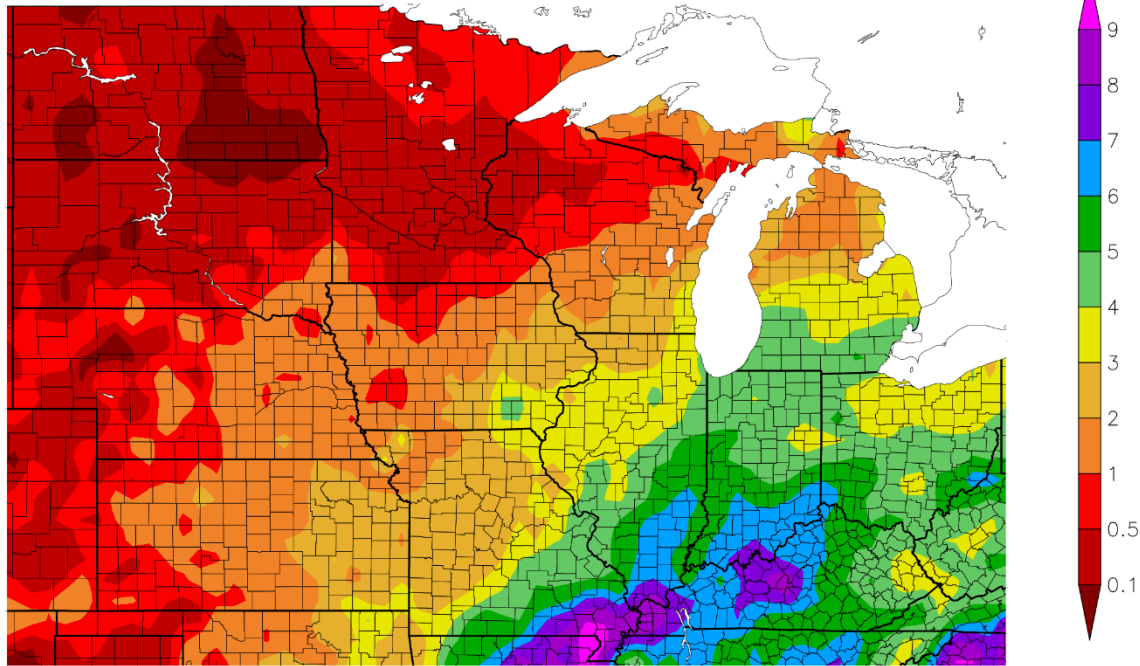


Where do we stand right now?

CURRENT CONDITIONS

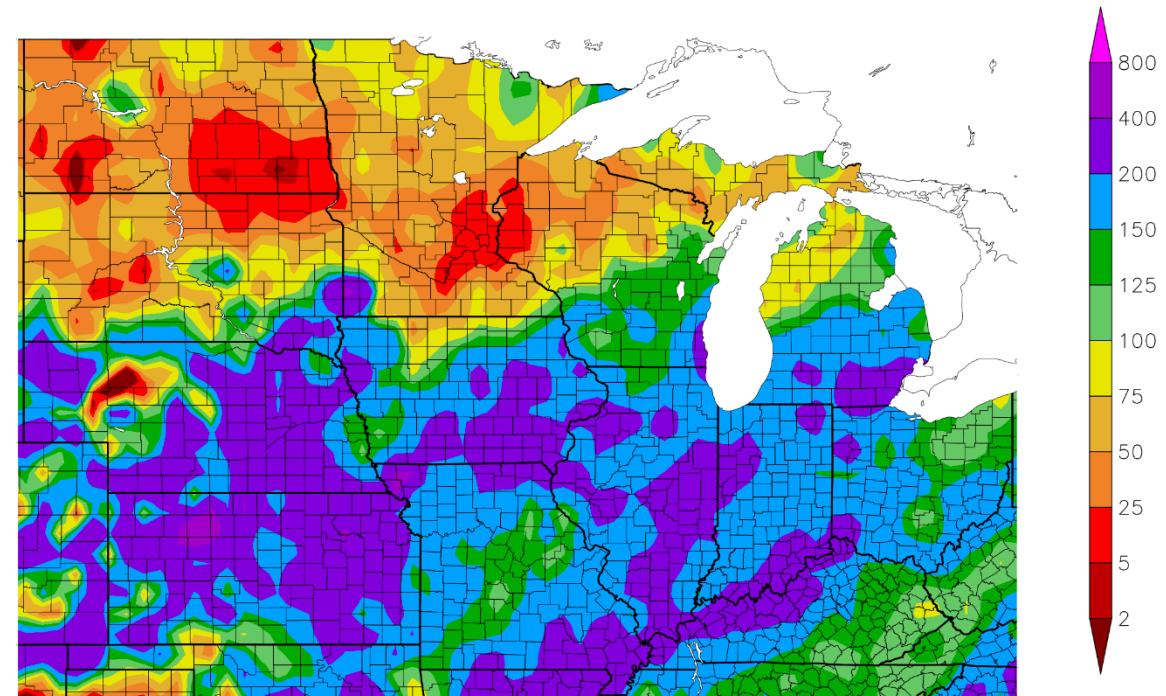
Precipitation (30 days)

Precipitation (in)
1/6/2024 – 2/4/2024



Dry conditions continue (north) – some improvement (south).

Percent of Normal Precipitation (%)
1/6/2024 – 2/4/2024



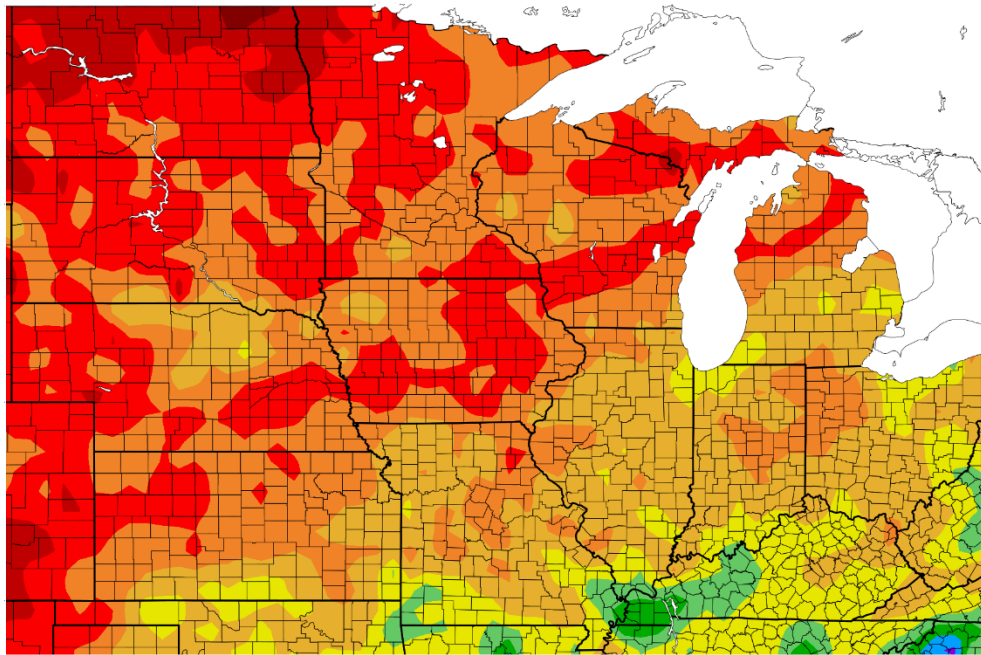
Generated 2/5/2024 at HPRCC using provisional data.

NOAA Regional Climate Centers

<https://hprcc.unl.edu/maps.php?maps=ACISClimateMaps>

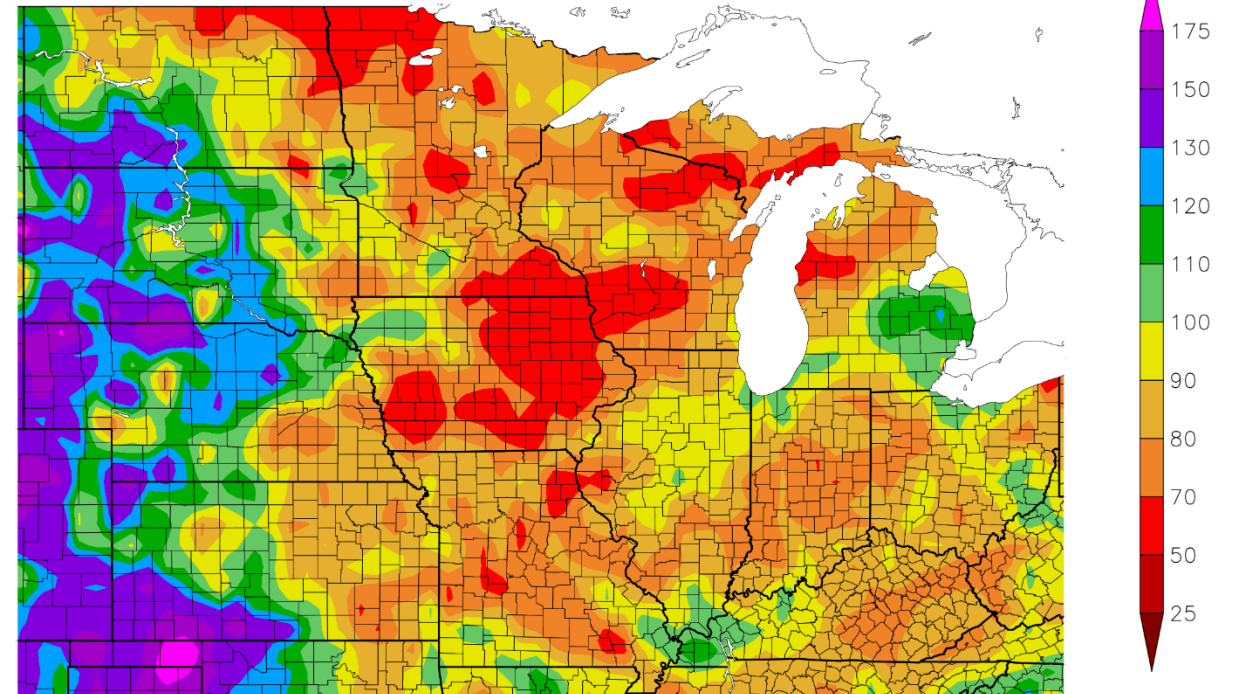
Precipitation (6 months)

Precipitation (in)
5/4/2023 – 2/3/2024



Very dry conditions continue.

Percent of Normal Precipitation (%)
5/4/2023 – 2/3/2024



Generated 2/4/2024 at HPRCC using provisional data.

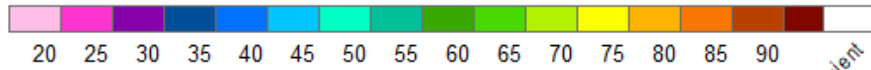
NOAA Regional Climate Centers

<https://hprcc.unl.edu/maps.php?maps=ACISClimateMaps>

Soil Temperature

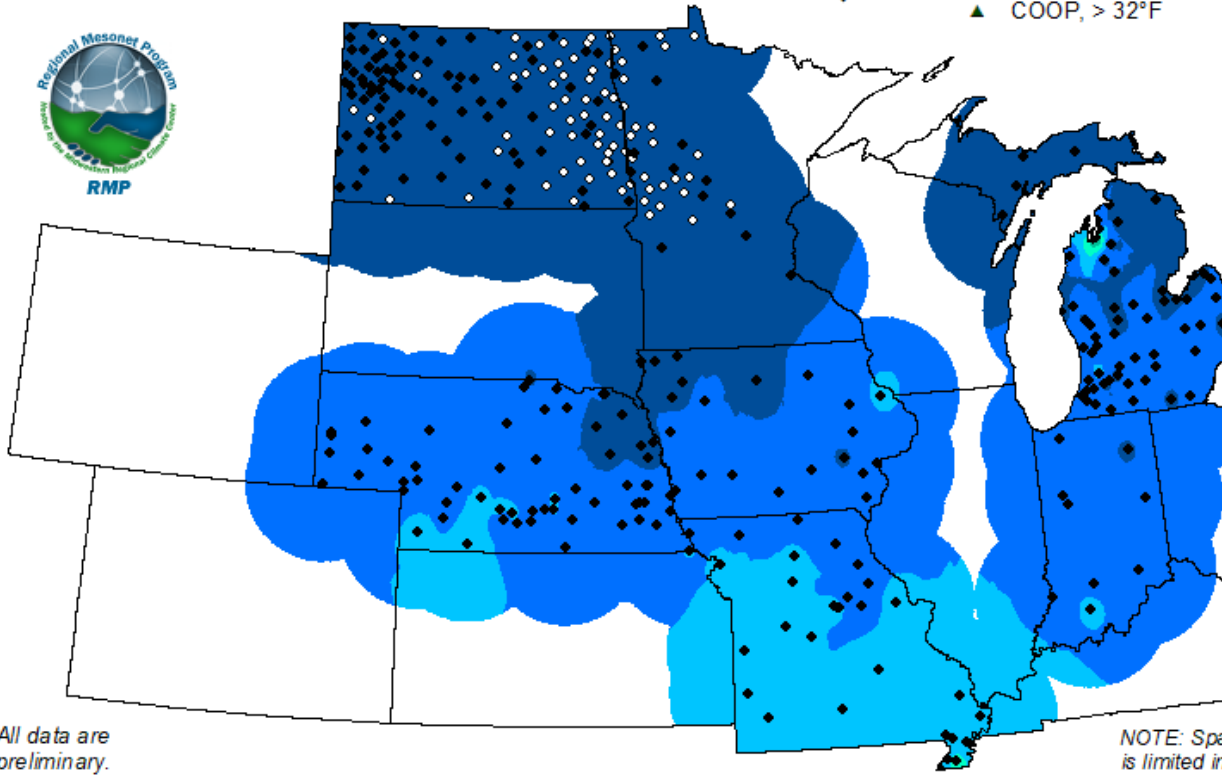
4" Soil Temperature (°F) (Bare)

24-Hour Period Through 2/6/2024



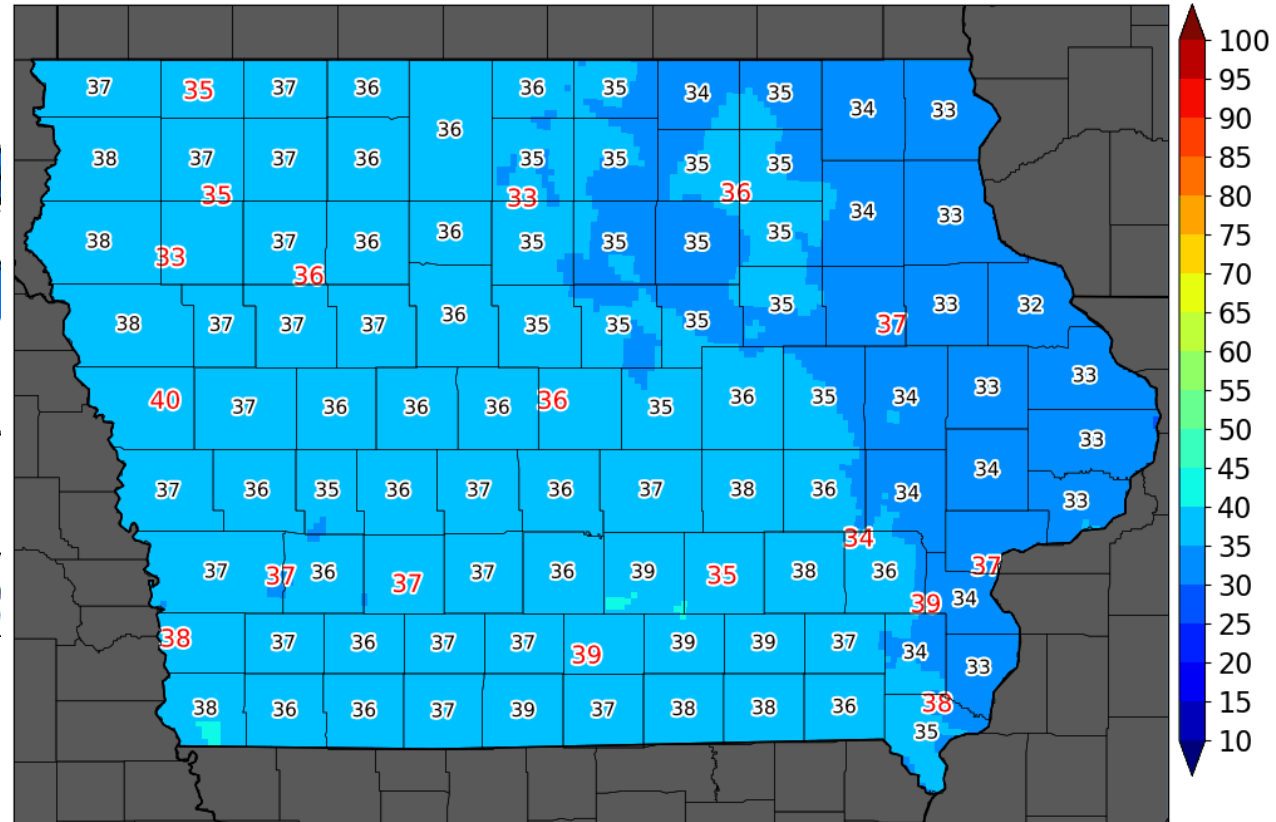
- ◇ Mesonets, <= 32°F
- ◆ Mesonets, > 32°F
- △ COOP, <= 32°F
- ▲ COOP, > 32°F

Insufficient Data



Feb 06, 2024 Avg [(Hi+Lo)/2] Daily 4 inch Depth Soil Temp

County est. based on bias adj. NWS NAM Model (black numbers), ISUSM network observations (red numbers)



<https://mrcc.purdue.edu/RMP/currentMaps>
<https://mesonet.agron.iastate.edu/agclimate/soilt.php>

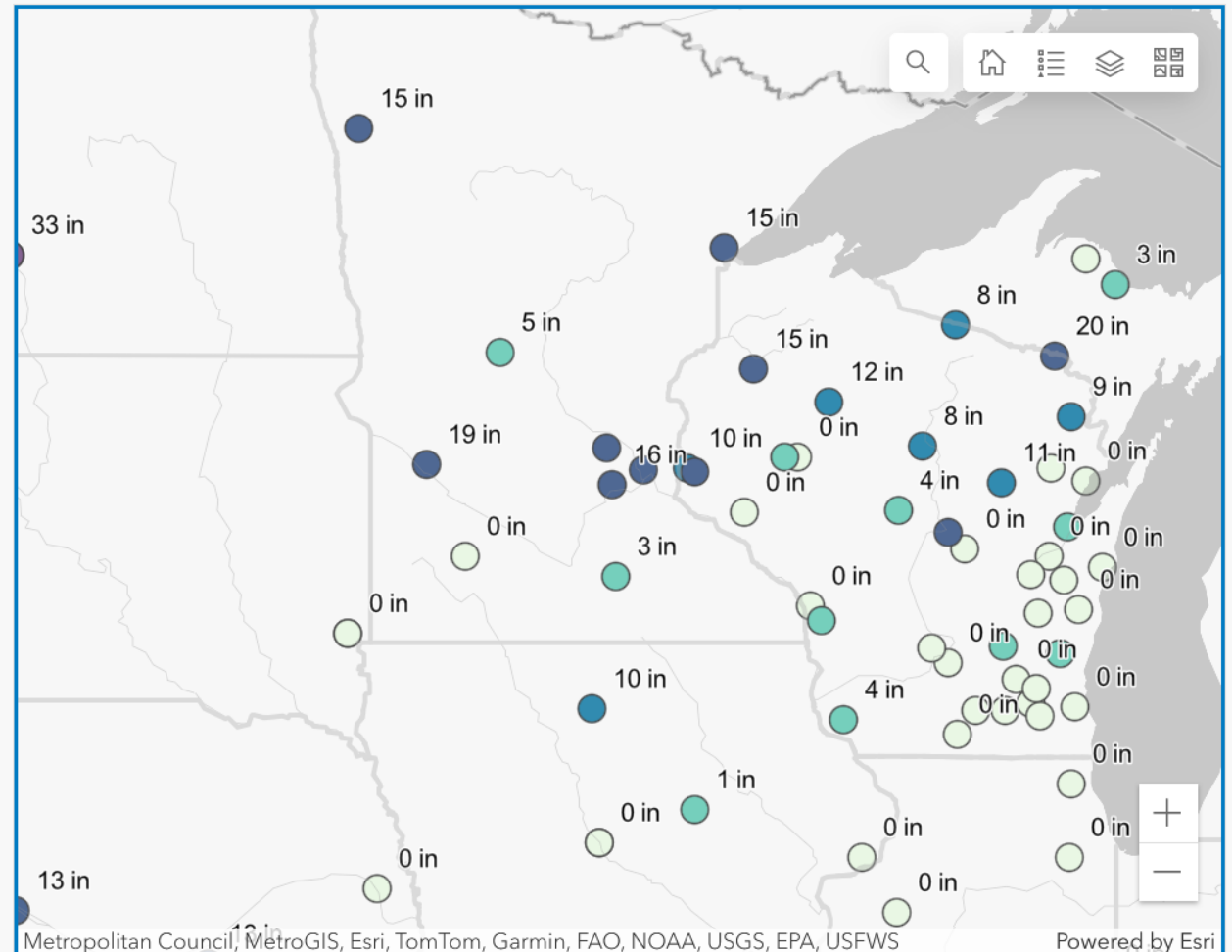
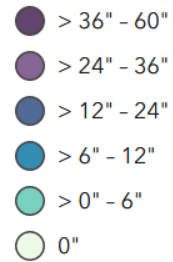
Frost Depth

Frost Depth (inches)

In regions of the central U.S.

Soil Frost Depth (Inches)

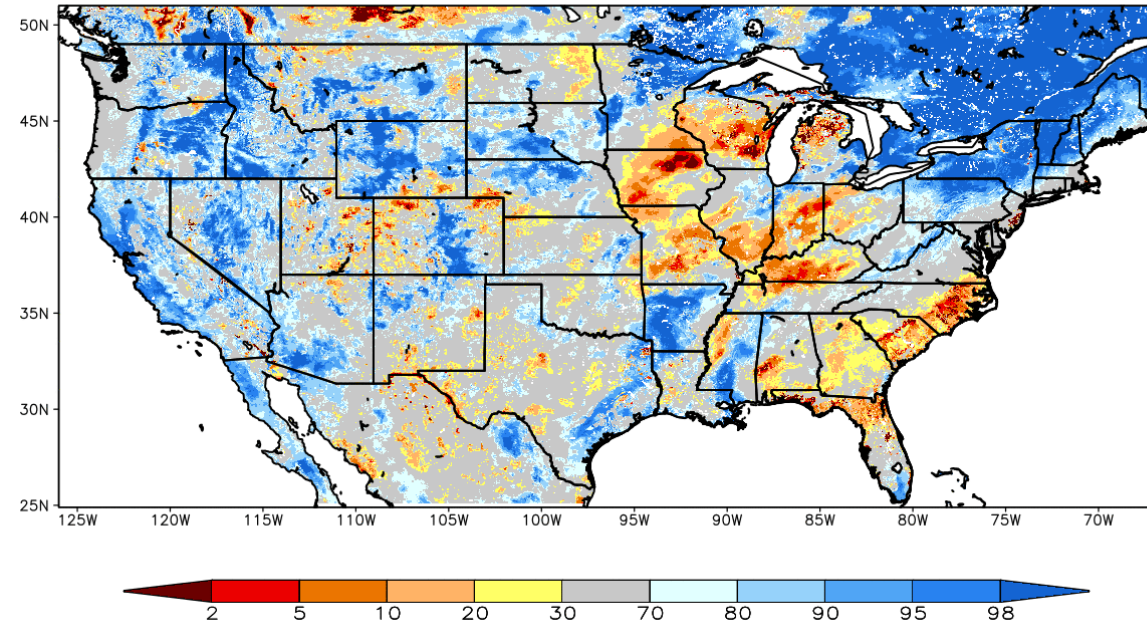
FrostDepth



- Shallow frost depth
- Snow will help protect during cold
- Unlikely to go too deep
-

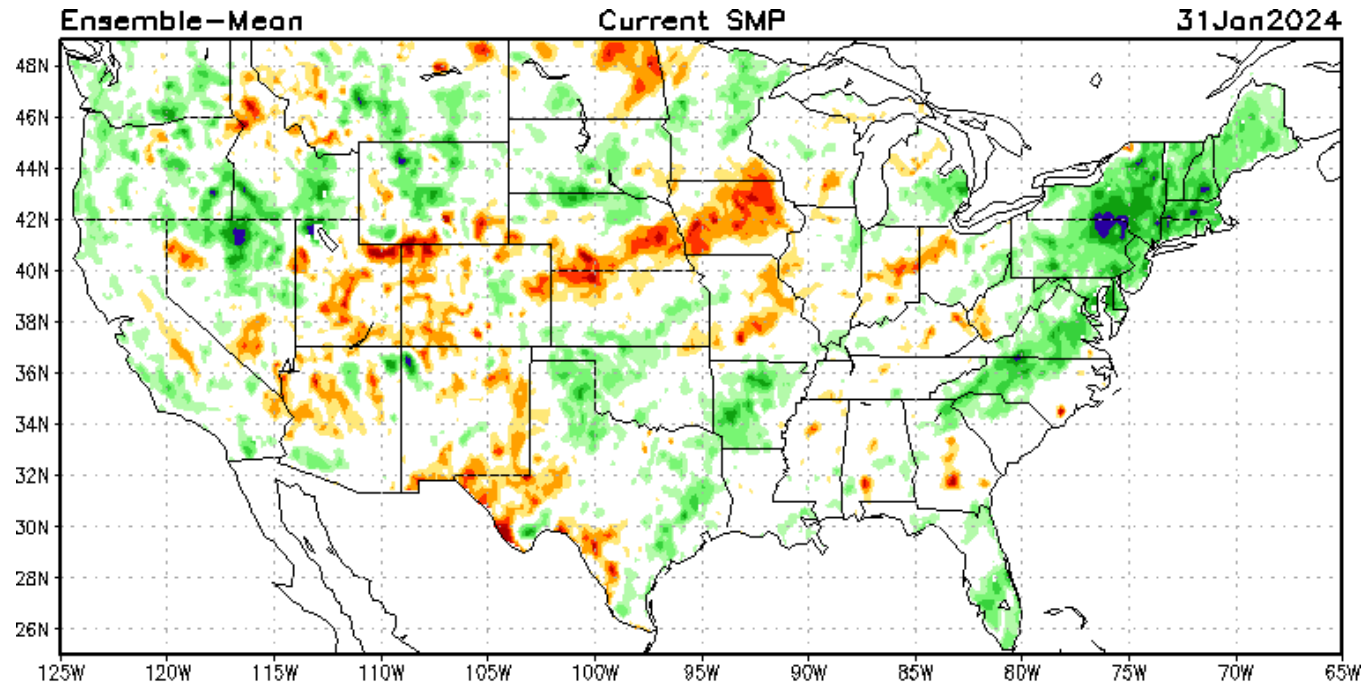
Modeled Soil Moisture

SPoRT-LIS 0-100 cm Soil Moisture percentile valid 05 Feb 2024



NOTE
Experimental

https://weather.msfc.nasa.gov/sport/case_studies/lis_CONUS.html
https://www.cpc.ncep.noaa.gov/products/Drought/Monitoring/smp_new.shtml#



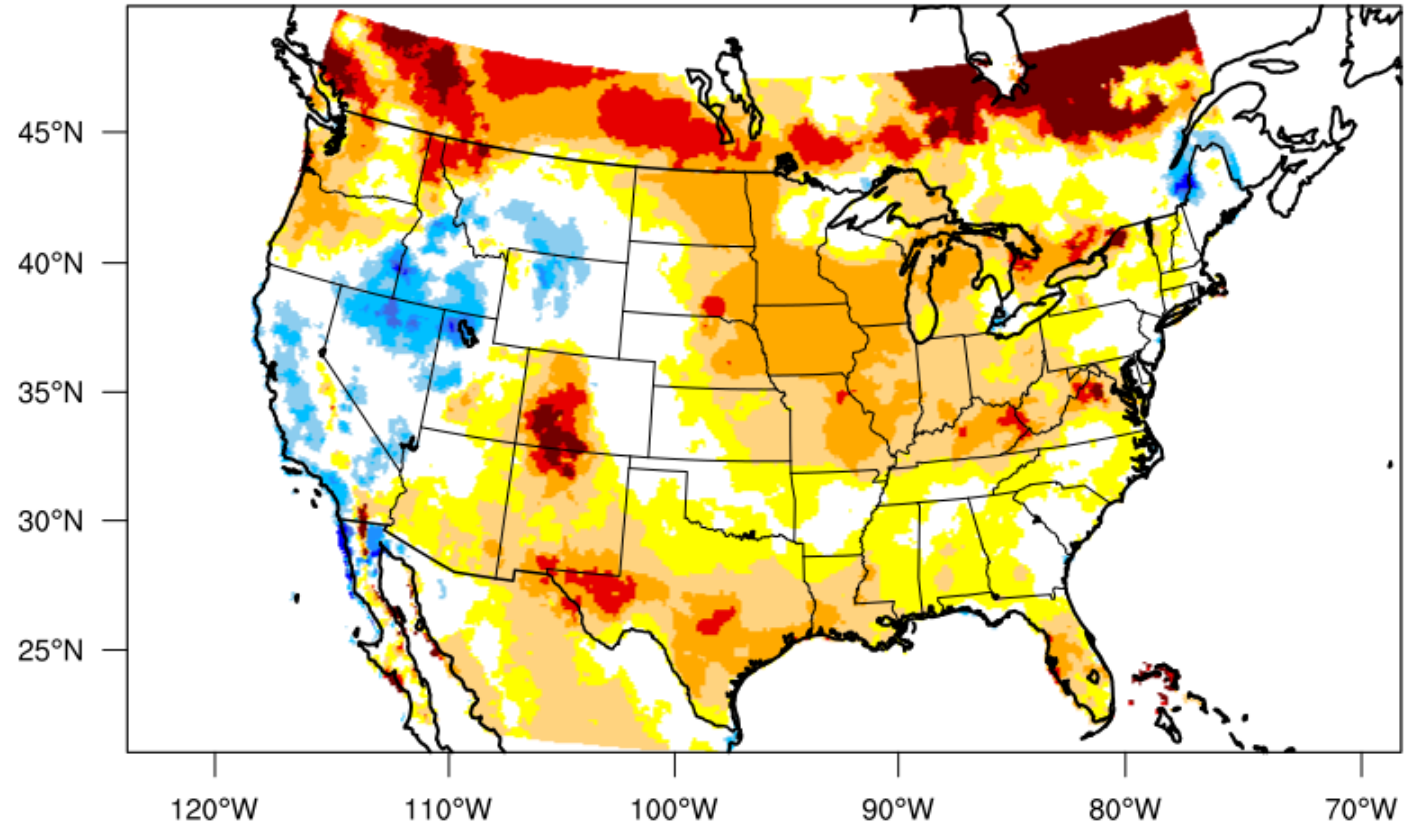
Evaporation Growing Season 2023

Very dry conditions continue.

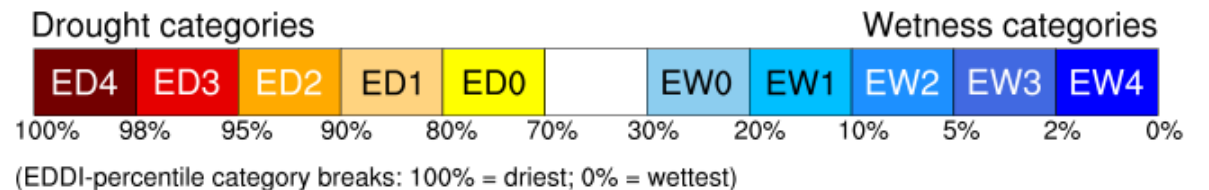
Evaporative demand adding to the issue

Winter warmth also helps dry soils some.

9-month EDDI categories for November 27, 2023

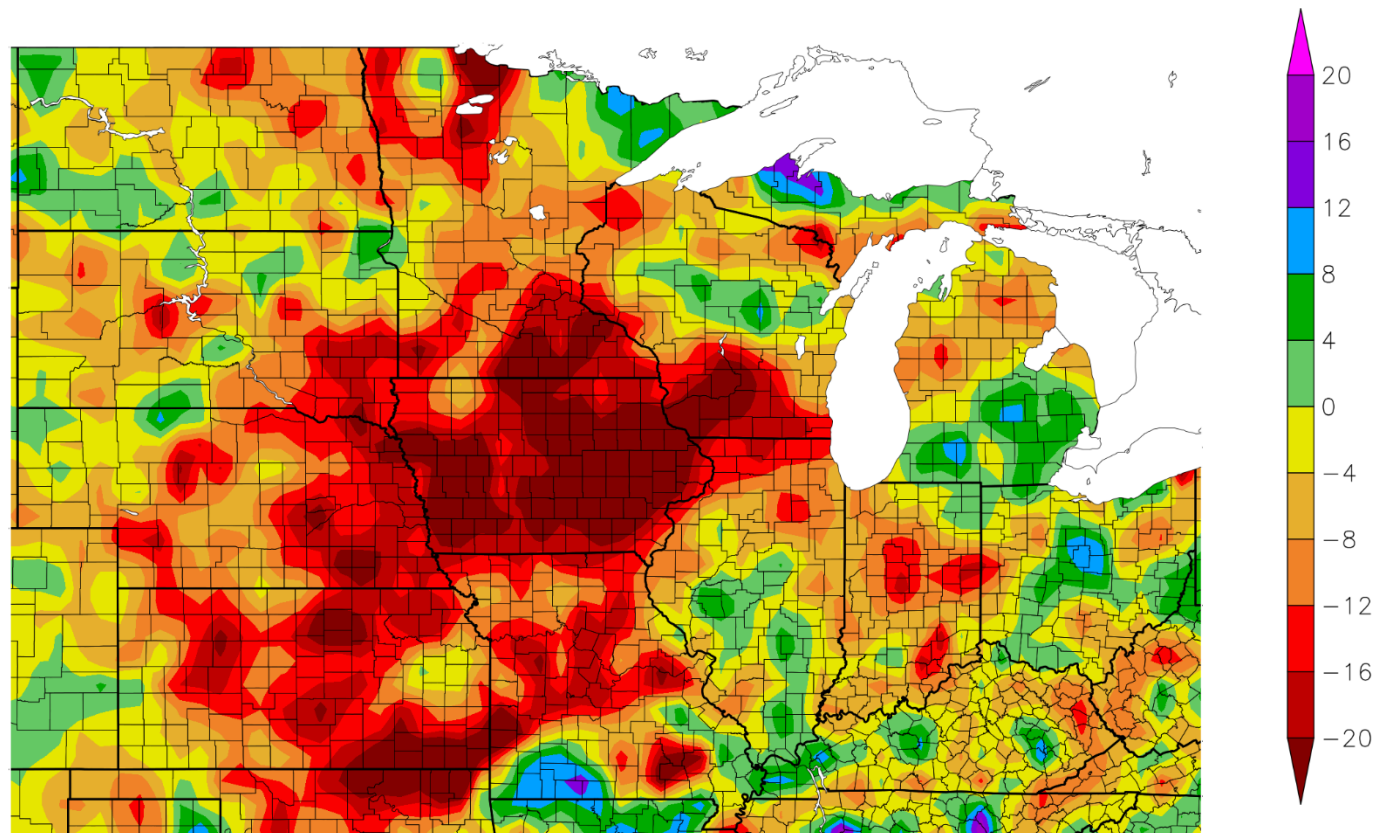


https://psl.noaa.gov/eddi/#current_conditions



Precipitation (departure last 3 years)

Departure from Normal Precipitation (in)
2/4/2021 – 2/3/2024



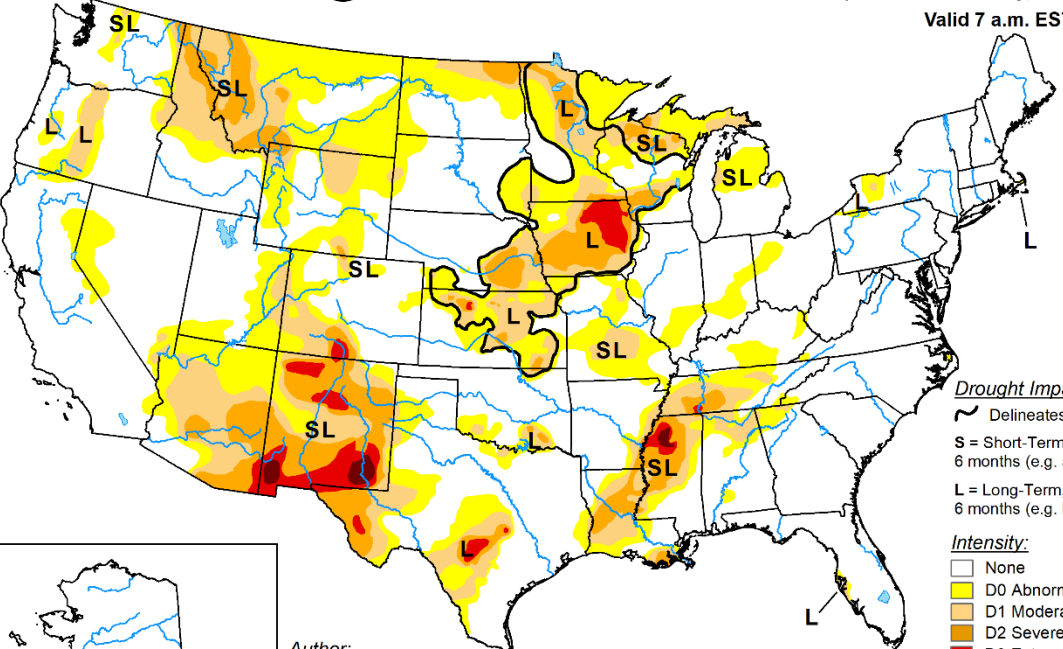
Climate context

DROUGHT

Drought Monitor

U.S. Drought Monitor

February 6, 2024
(Released Thursday, Feb. 8, 2024)
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)

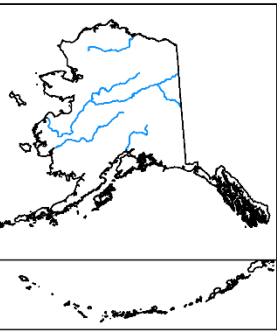
Intensity:
 None
 D0 Abnormally Dry
 D1 Moderate Drought
 D2 Severe Drought
 D3 Extreme Drought
 D4 Exceptional Drought

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>



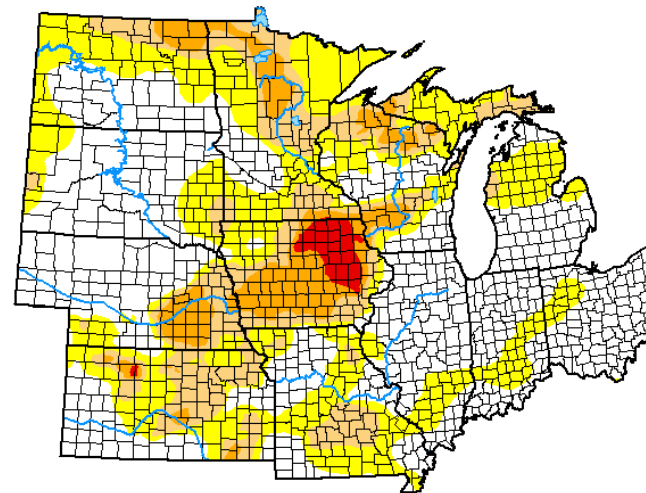
droughtmonitor.unl.edu

Author:
Deborah Bathke
National Drought Mitigation Center



U.S. Drought Monitor North Central States

February 6, 2024
(Released Thursday, Feb. 8, 2024)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	48.13	51.87	22.79	8.95	1.43	0.00
Last Week 01-30-2024	47.81	52.19	23.62	9.25	1.45	0.00
3 Months Ago 11-07-2023	43.93	56.07	31.77	15.76	3.79	0.47
Start of Calendar Year 01-02-2024	37.52	62.48	38.54	16.91	3.77	0.02
Start of Water Year 09-26-2023	25.87	74.13	49.98	25.16	7.67	0.73
One Year Ago 02-07-2023	36.16	63.84	44.00	21.55	11.45	5.07

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

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>

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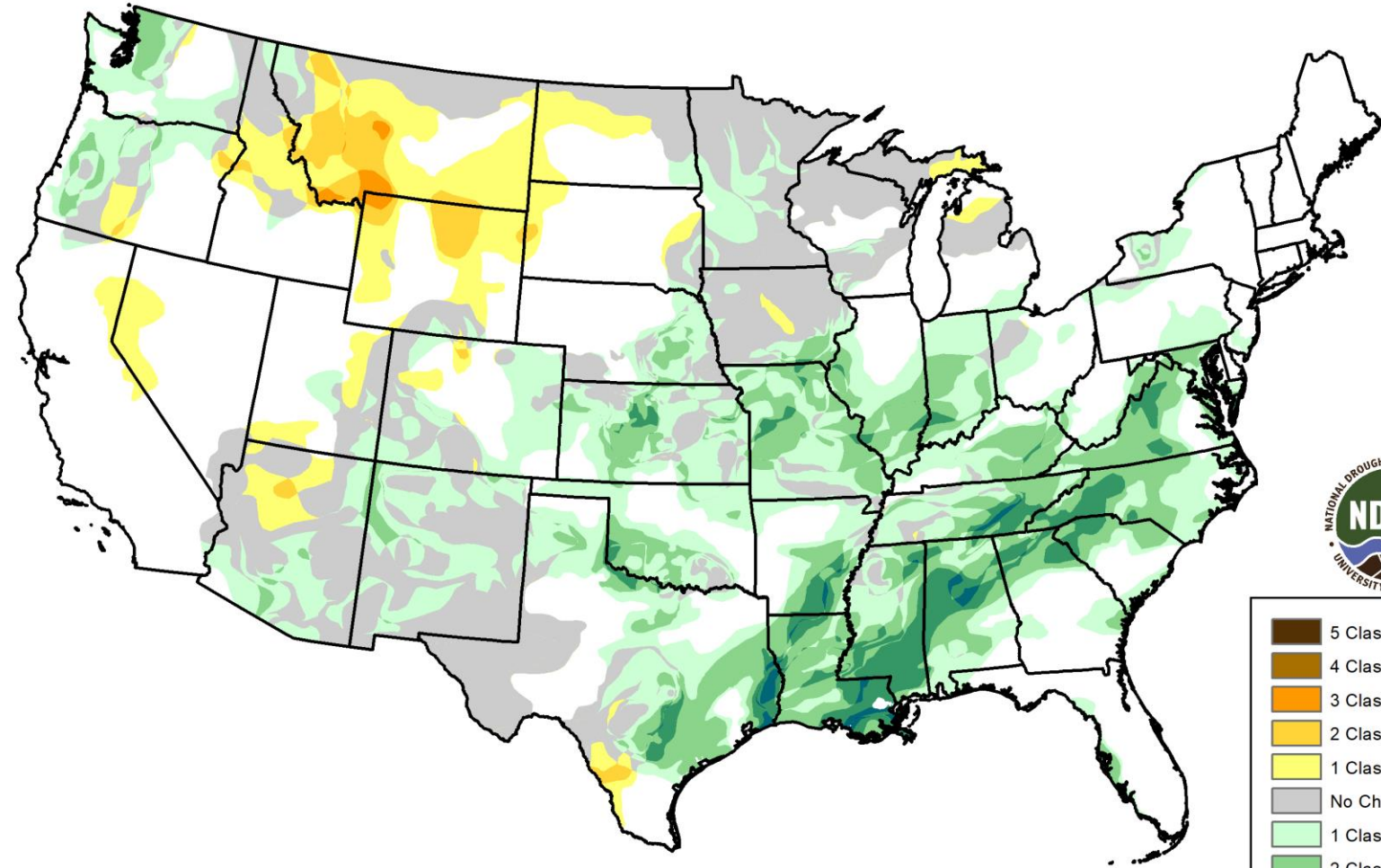
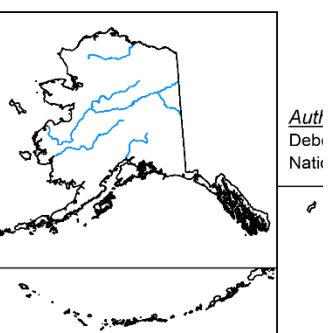
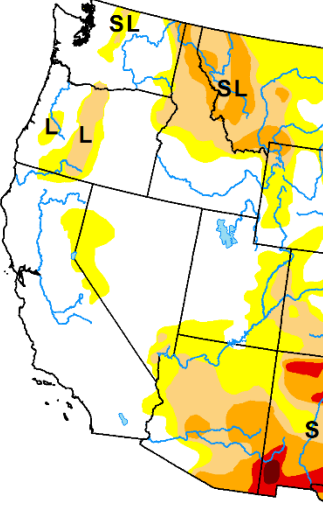


droughtmonitor.unl.edu

U.S. Drought Monitor Class Change - CONUS

8 Week

U.S. Drou



- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

February 6, 2024
 Thursday, Feb. 8, 2024
 Valid 7 a.m. EST

Drought Conditions (Percent Area)

State	D0-D4	D1-D4	D2-D4	D3-D4	D4
AK	51.87	22.79	8.95	1.43	0.00
AL	52.19	23.62	9.25	1.45	0.00
AR	56.07	31.77	15.76	3.79	0.47
CA	62.48	38.54	16.91	3.77	0.02
CO	74.13	49.98	25.16	7.67	0.73
CT	63.84	44.00	21.55	11.45	5.07

- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

focuses on broad-scale conditions. Data may vary. For more information on the report, visit <https://droughtmonitor.unl.edu/About.aspx>

February 6, 2024
 compared to
December 12, 2023

droughtmonitor.unl.edu

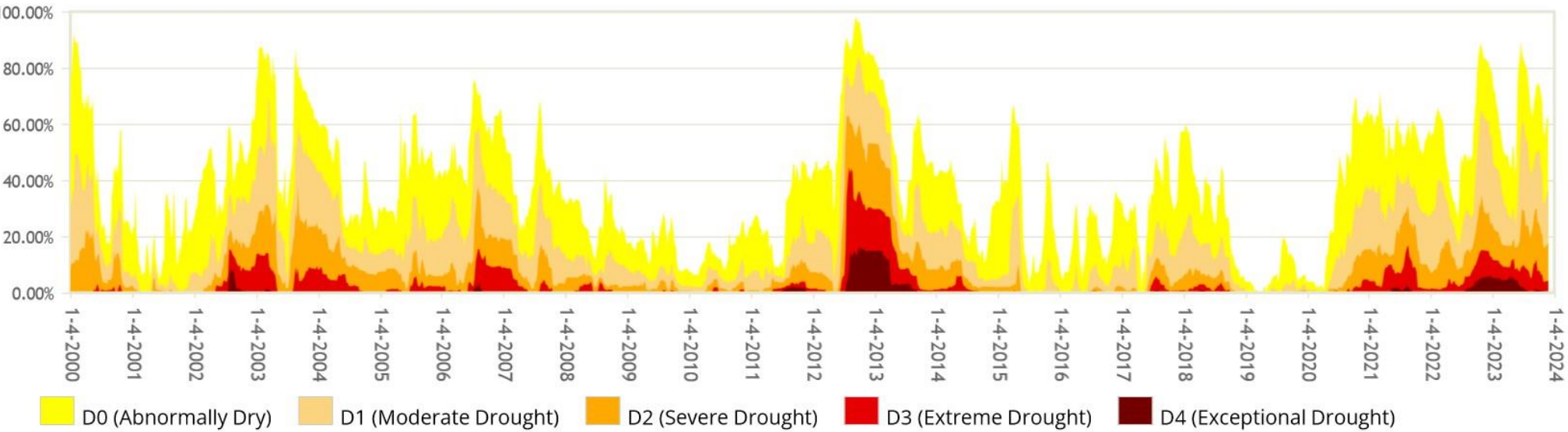
Mitigation Center



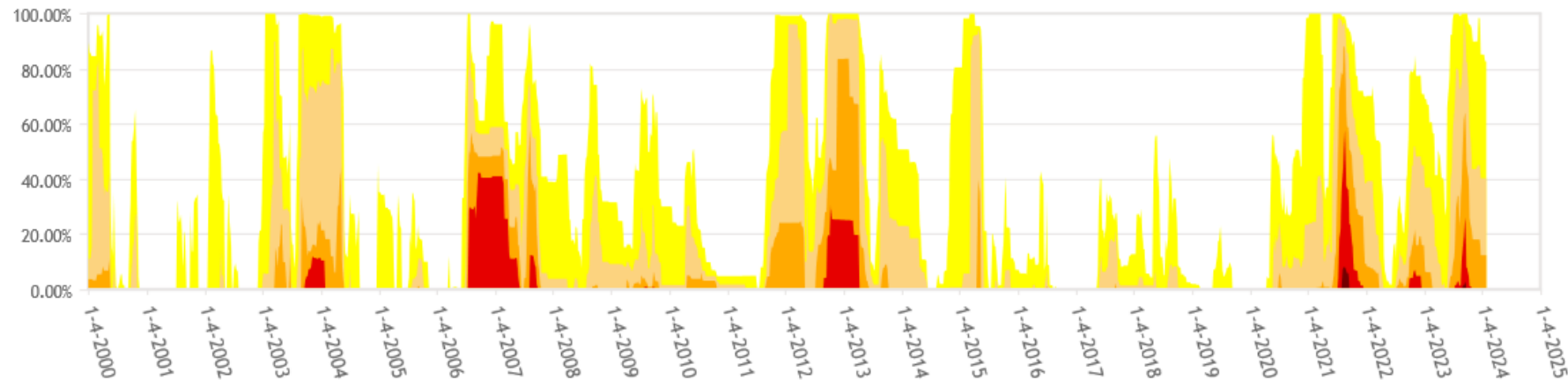
droughtmonitor.unl.edu

Drought-context

North Central Percent Area in U.S. Drought Monitor Categories



Minnesota Percent Area in U.S. Drought Monitor Categories

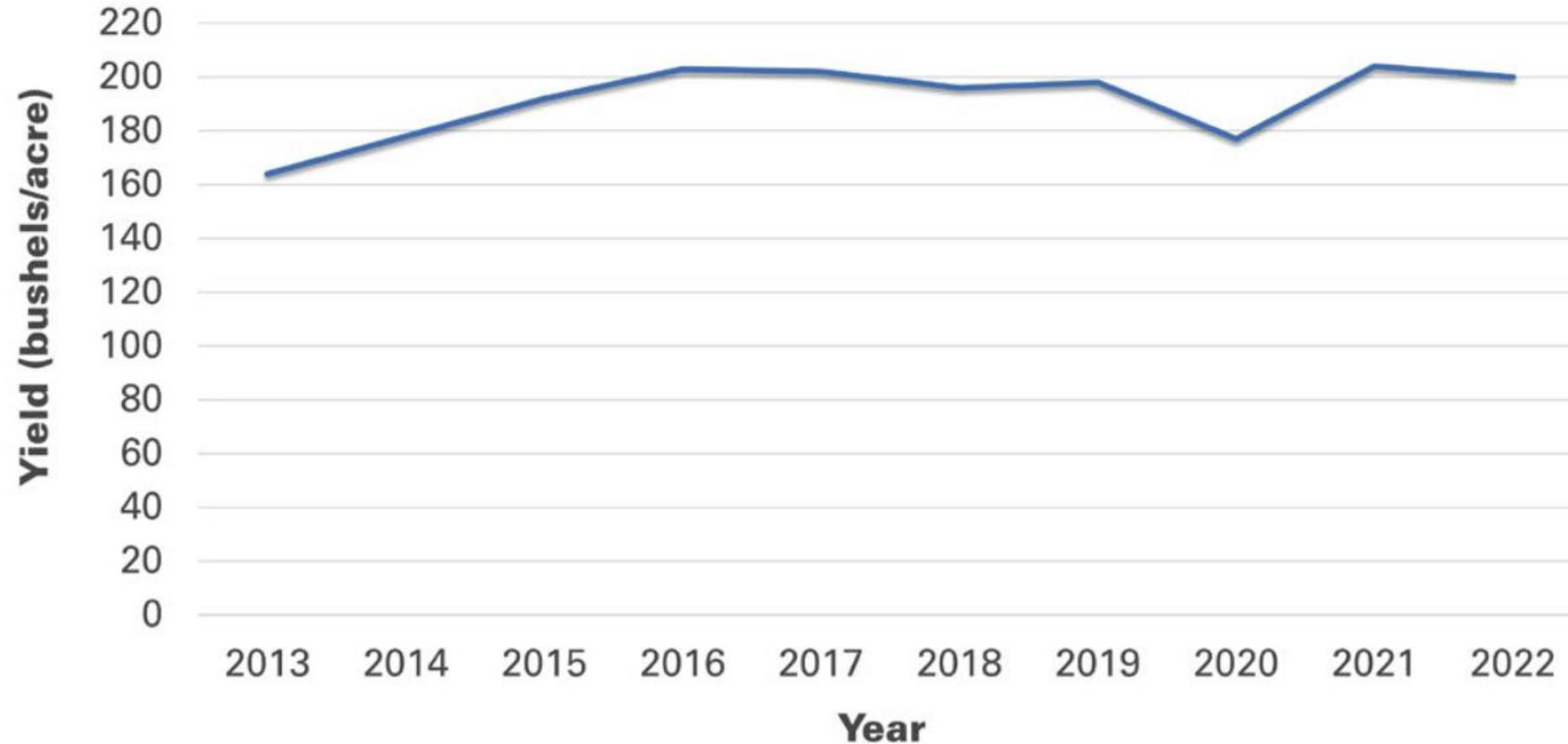


- Corn Belt persisting drought conditions
- Minnesota mostly in drought since May 2020.

<https://droughtmonitor.unl.edu>

Climate/Drought – Yield Impacts?

Figure 2. Iowa average corn yields, 2013-2022

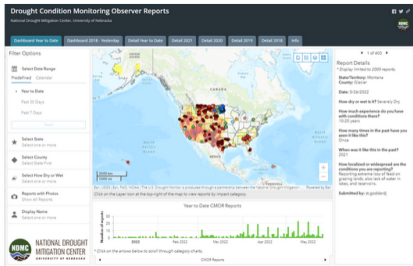


Things you can do - reporting

Drought Impacts Toolkit

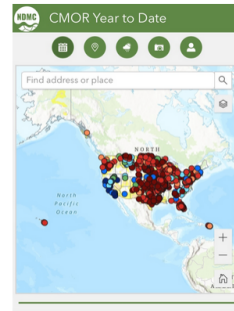
Home Tools Emerging Impacts Impact Assessments

CMOR Desktop and Mobile Options



CMOR Reports Dashboard for desktop
(Includes reports 2018-present and more filter options)

Map of Reports Submit a Report



CMOR Reports Map for mobile
(Includes year-to-date reports and fewer filter options)

Map of Reports Submit on Mobile

Other Resources



- [Frequently asked questions](#)
- Factsheet on how to submit and view reports:
[In English](#) | [En Español](#)
- [Video on how to submit and view reports](#)
- [Help Recruit CMOR Participants \(sample press rele](#)
- [Social Media Resources for people to submit obser](#)
- [Related publications](#)

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TENFORCOCORAHHS "YEAR-END" FUNDRAISER
DONATE ten dollars NOW THRU JAN 7, 2024

Reports received today 12/04/2023 as of 9:13 AM EST

Daily	Multi-day	SigWx	Hail	Condition	ET
6,193	251	0	0	19	3

TENFORCOCORAHHS
DONATE ten dollars

CoCoRaHS Testimonials
Tell us your story!
Celebrating 25 years

JOIN COCORAHHS

TRAINING SLIDE-SHOW

Training Animations

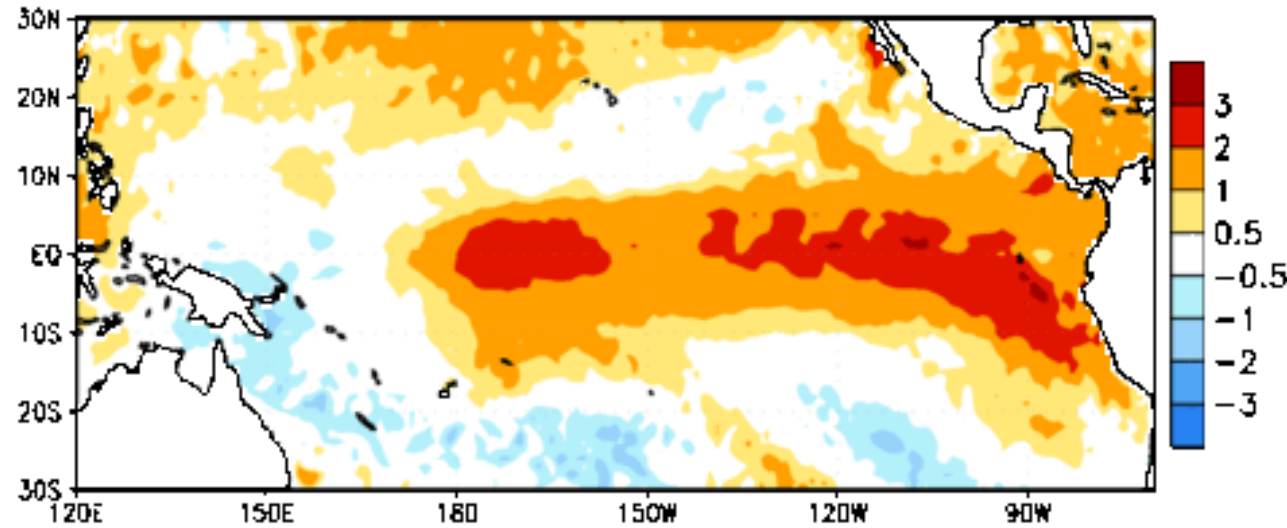
Things to know about...
 Rain
 Hail

Climate context

EL NIÑO

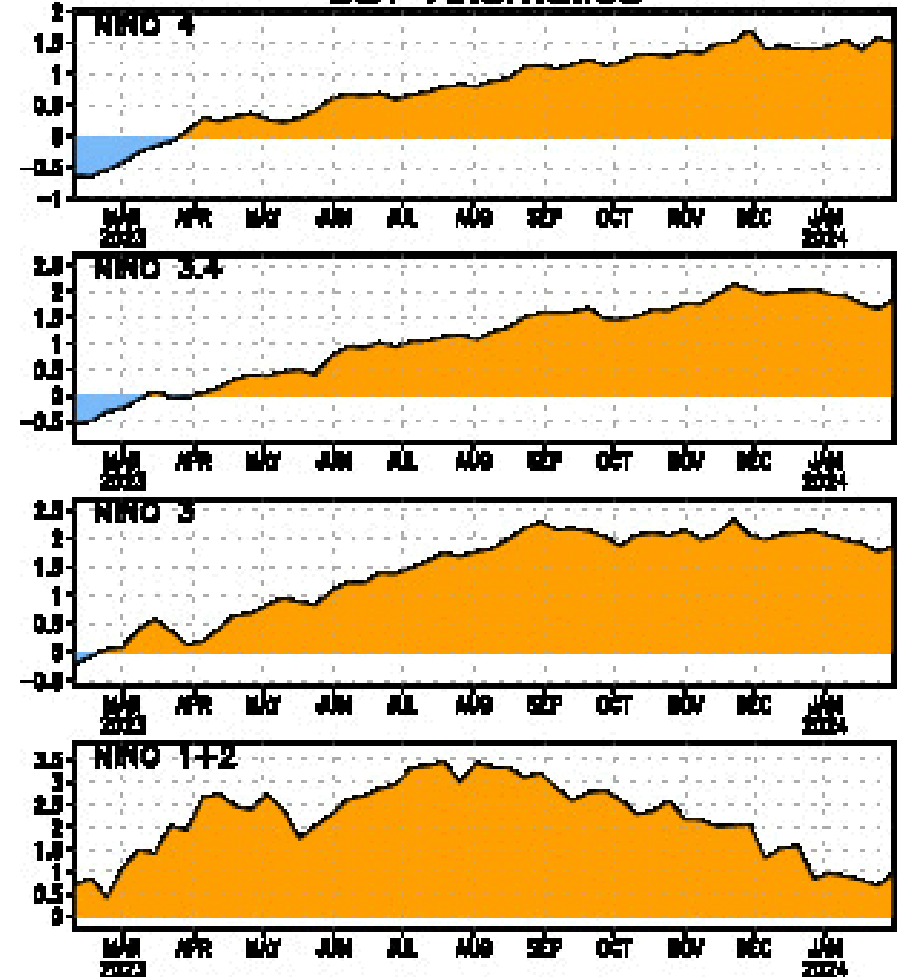
Strong El Niño

Week centered on 15 NOV 2023
SST Anomalies (°C)



- Current status – El Niño
- Weakening in the spring
- Unlikely to affect summer

SST Anomalies



ENSO Probabilistic Forecast

- Current status – El Niño
- Weakening into spring
- ~~Unlikely~~ slightly increased chance - to affect summer
- Neutral conditions probably more likely spring 2024.

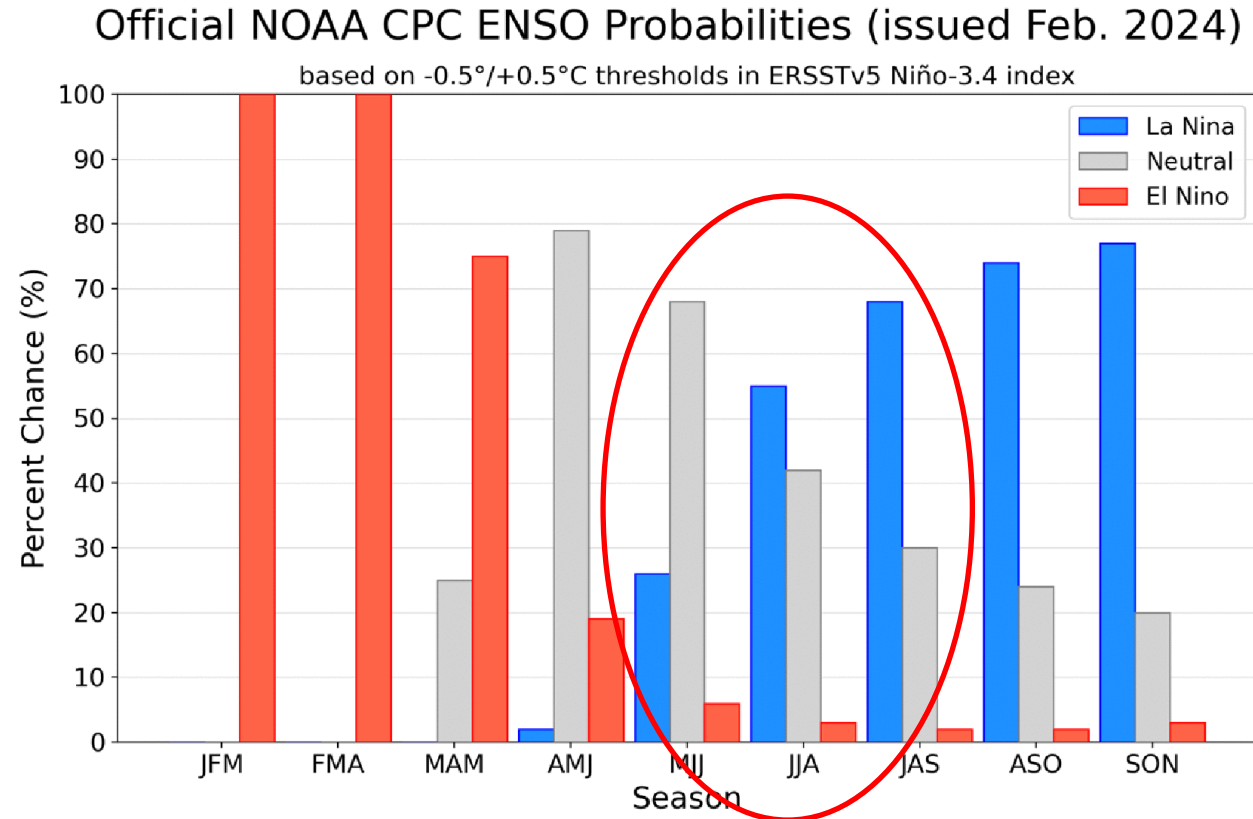
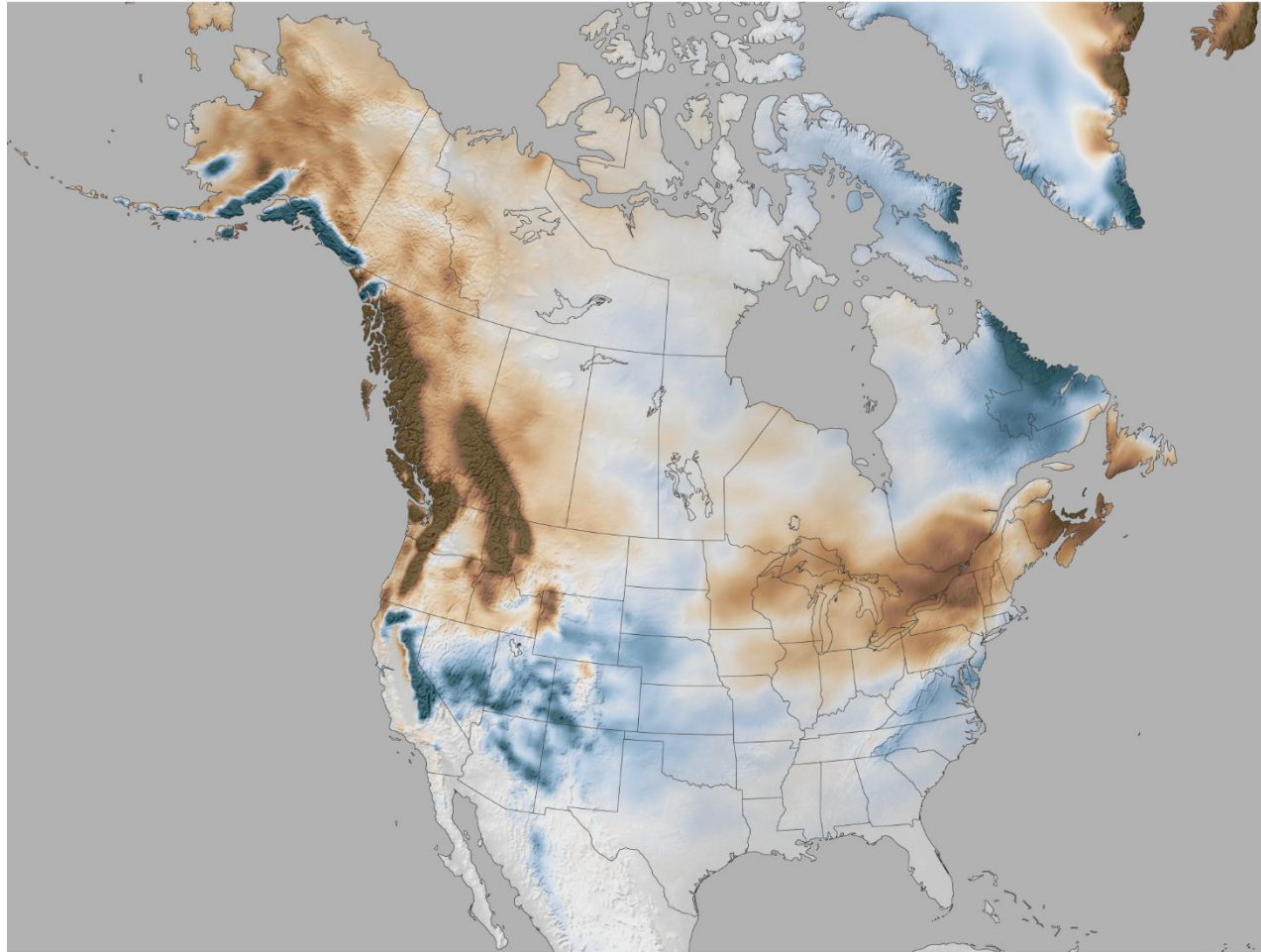


Figure 7. Official ENSO probabilities for the Niño 3.4 sea surface temperature index (5°N - 5°S , 120°W - 170°W). Figure updated 8 February 2024.

El Niño and Winter

Snowfall during all El Niño winters (Jan-Mar)



El Niño winters (1959–2023)
vs. 1991–2020 average
(detrended)

difference from average snowfall (inches)

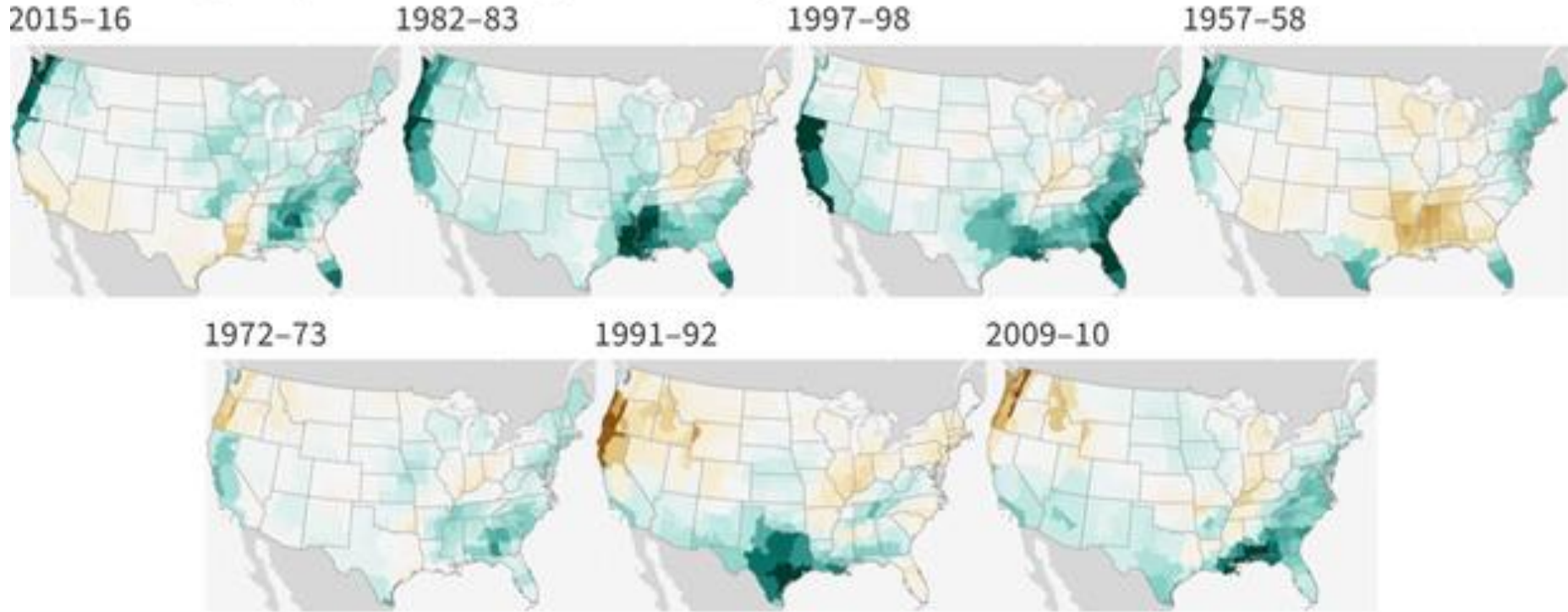


NOAA Climate.gov
Data: ERA5

- Less snow more likely with El Niño this winter (Jan. Mar.).

El Niño and Winter

U.S. winter precipitation during the 7 strongest El Niños since 1950



- Some wetness this winter possible – central Corn Belt
- Mixed but more likely drier eastern Corn Belt.

December–February
compared to 1981–2010

difference from average precipitation (in)



NOAA Climate.gov
Data: ESRL/NCEI

Precipitation Change

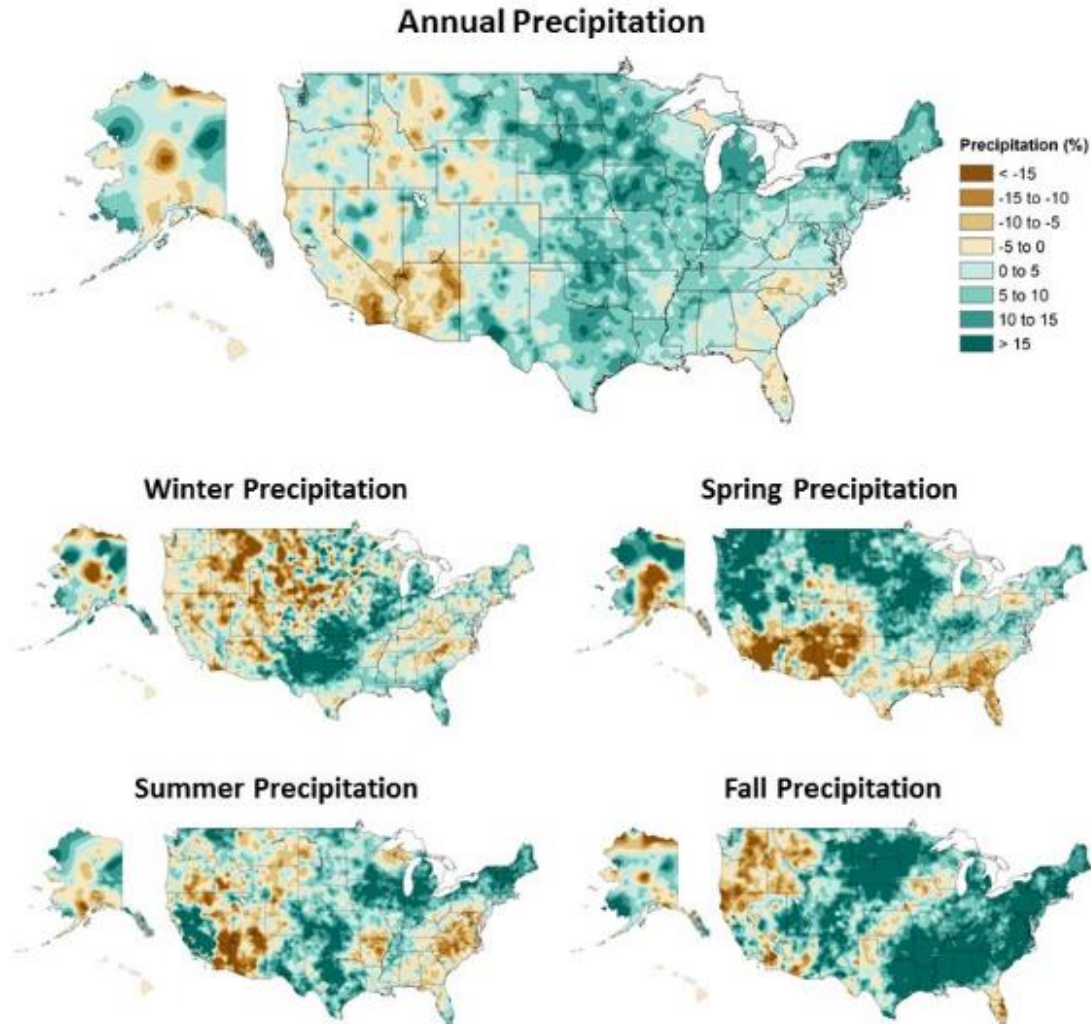
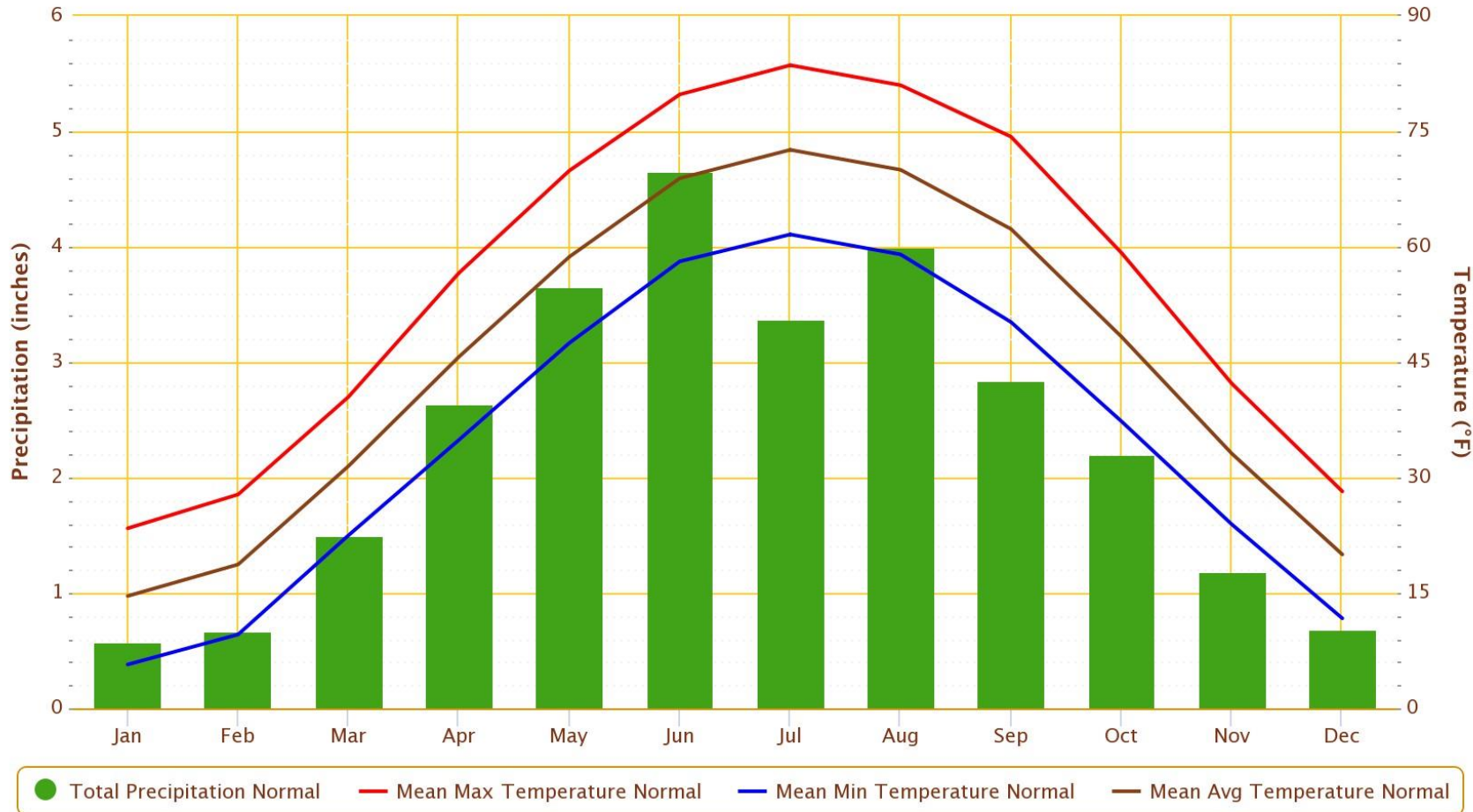


Figure 7.1: Annual and seasonal changes in precipitation over the United States. Changes are the average for present-day (1986–2015) minus the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawai'i) divided by the average for the first 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/CIAT, data source: nCLIMDiv).

30 Year Climatology (Redwood Falls, MN)

Monthly Climate Normals (1991-2020) – REDWOOD FALLS MUNICIPAL AIRPORT, MN

Click and drag to zoom to a shorter time interval



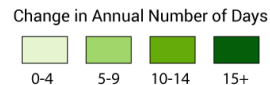
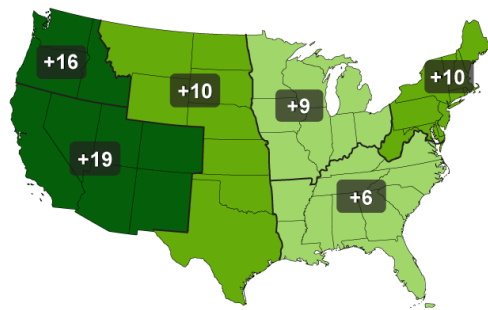
Using the new 1991-2020 normal
Shifting drier in the mid-summer

Powered by ACIS

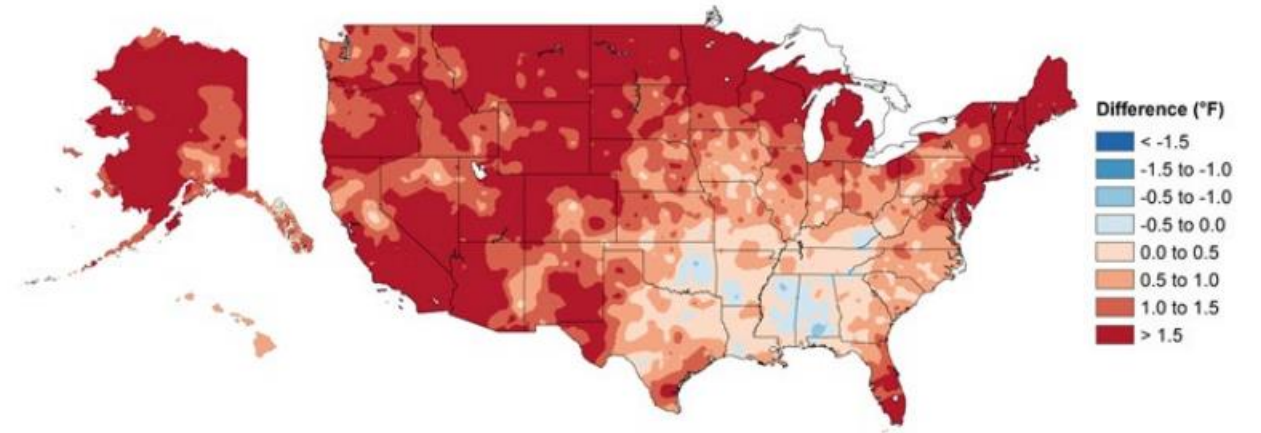
Temperature Change

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

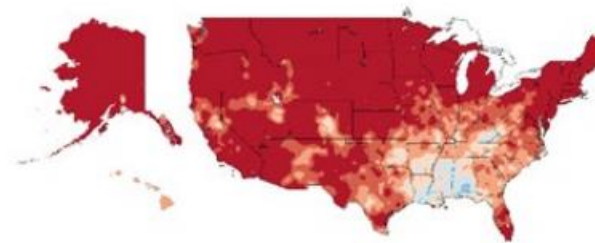
Observed Increase in Frost-Free Season Length



Annual Temperature



Winter Temperature



Summer Temperature

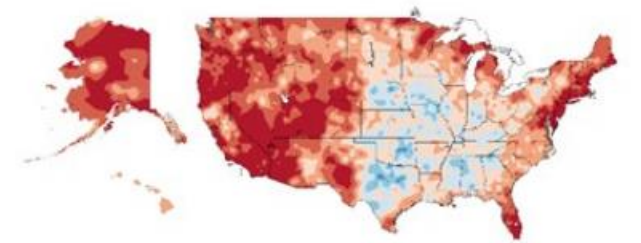
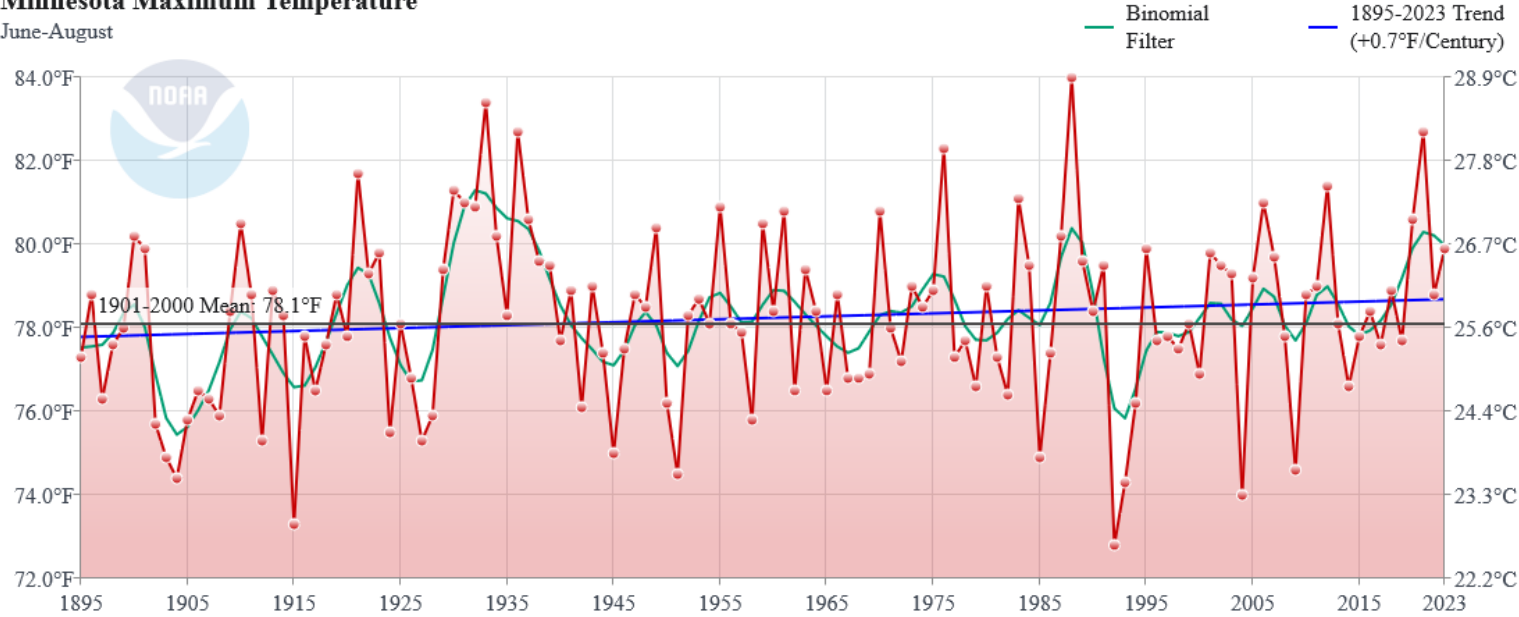


Figure 6.1. Observed changes in annual, winter, and summer temperature (°F). Changes are the difference between the average for present-day (1986–2016) and the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawaii). Estimates are derived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

Minnesota Maximum Temperature

June-August



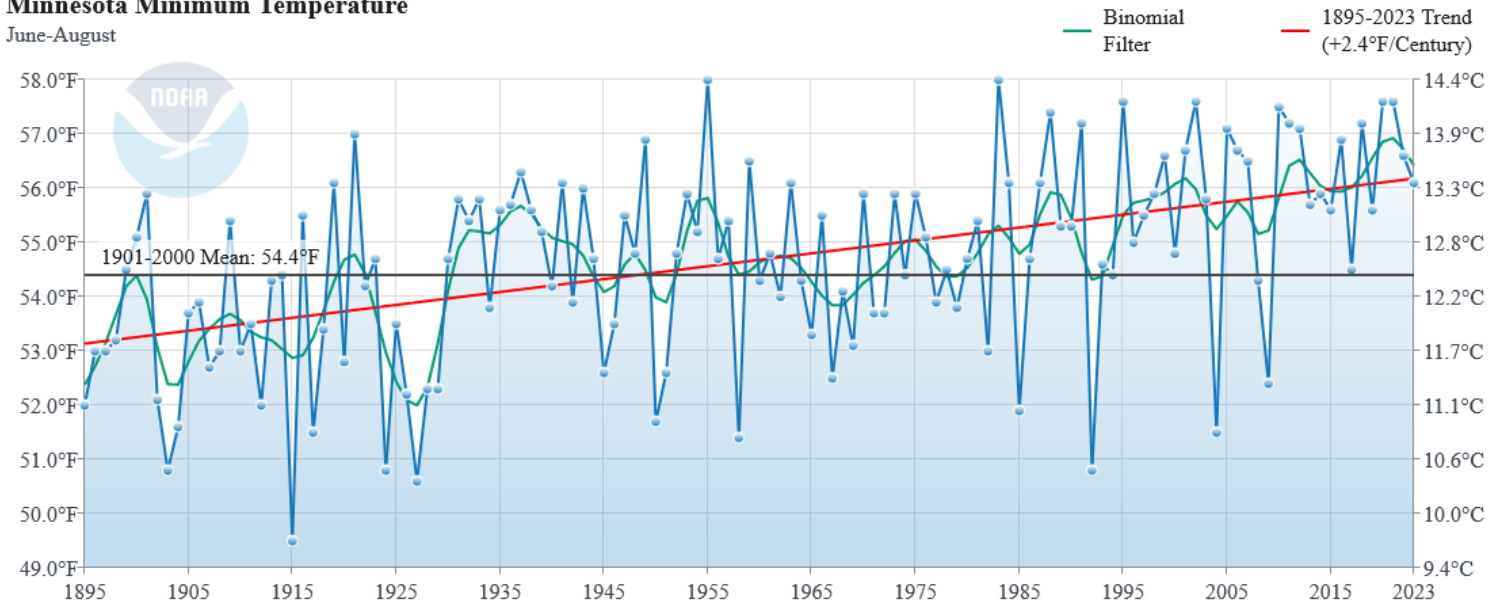
Minnesota Summer Temperatures

- Minimums warming (warmer nights)
- Maximums cooling (fewer hot days)

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

Minnesota Minimum Temperature

June-August



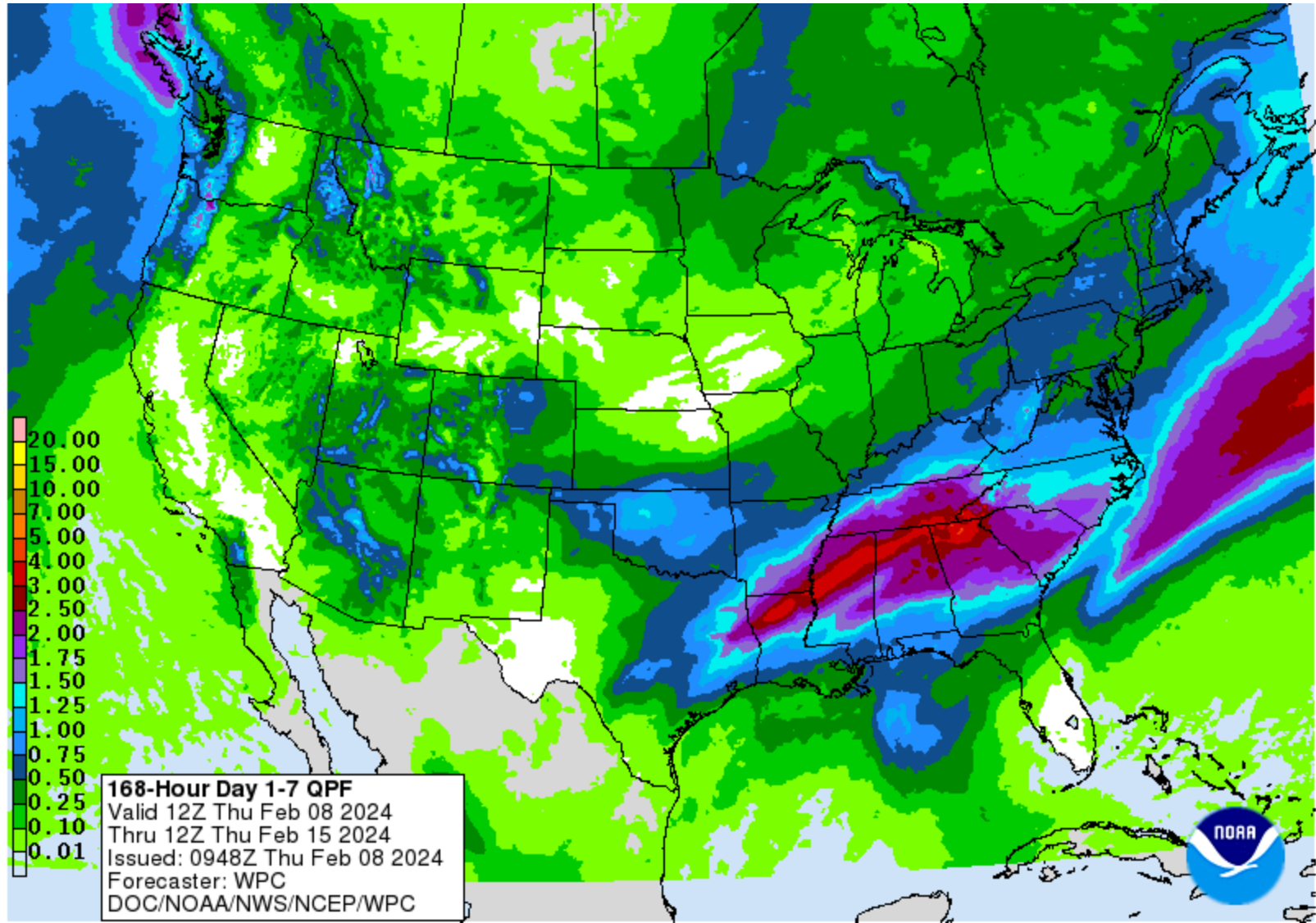
A look ahead

OUTLOOKS

Climate Outlooks

- 6-10 and 8-14 day updated daily
- Monthly updated 2x/month
- Longer range updated monthly
- Based on probabilities
- Good to have ag interpretation
- **Check Midwest Climate Hub website for ag interpretation**

7-day Quantitative Precipitation Forecast



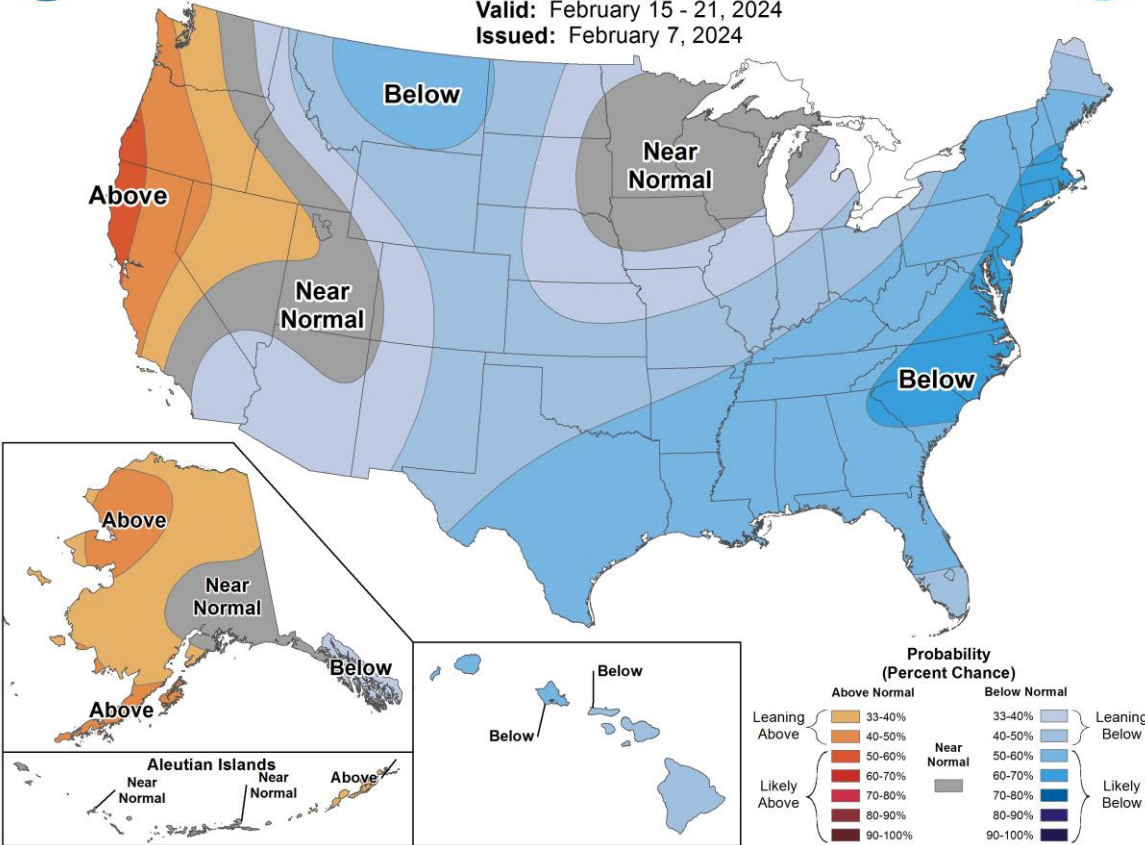
8-14 Day Temp. and Precip. Outlook



8-14 Day Temperature Outlook



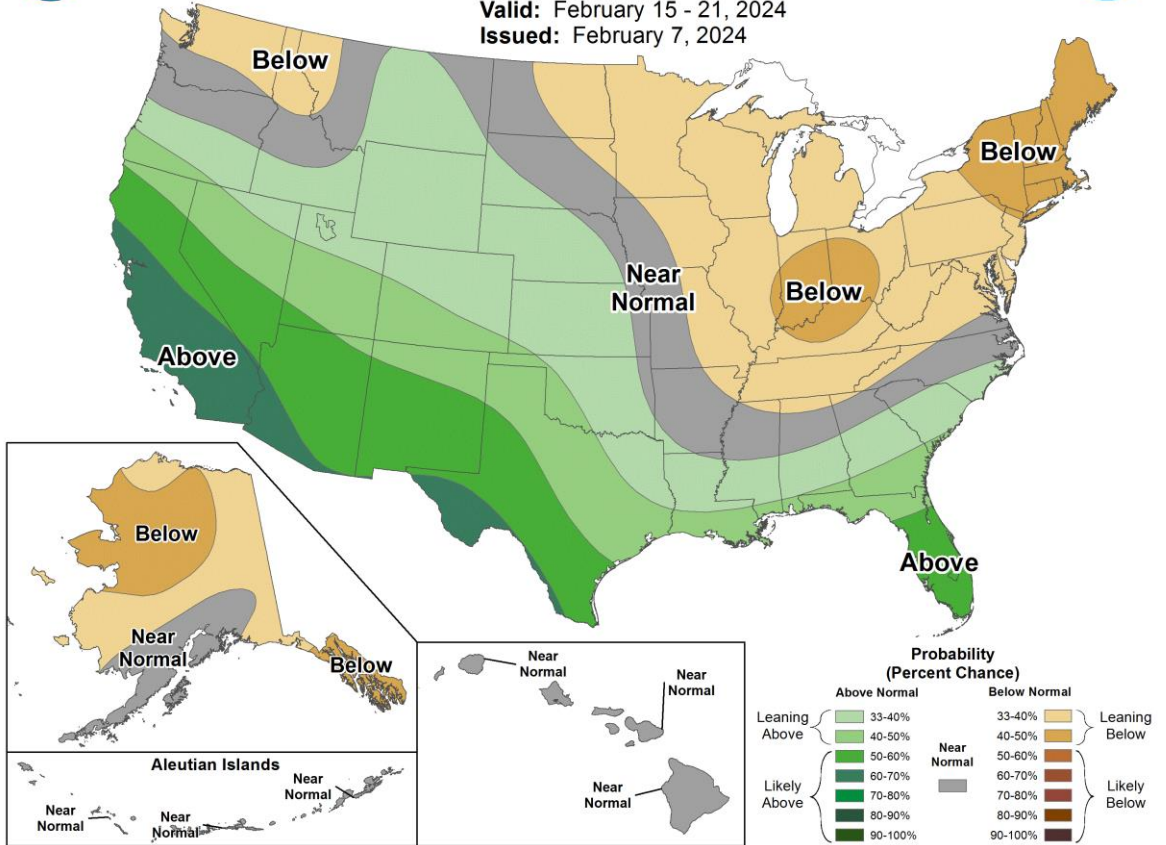
Valid: February 15 - 21, 2024
 Issued: February 7, 2024



8-14 Day Precipitation Outlook



Valid: February 15 - 21, 2024
 Issued: February 7, 2024



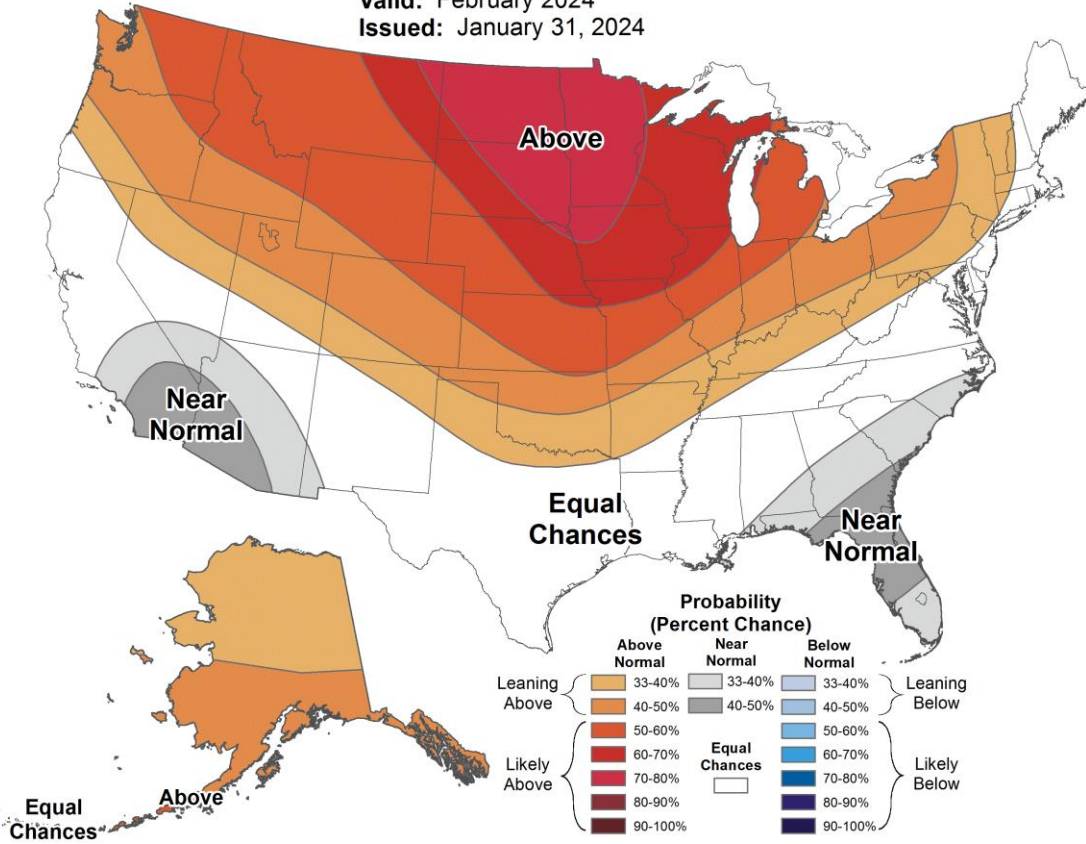
30 Day Temp and Precip. Outlook



Monthly Temperature Outlook



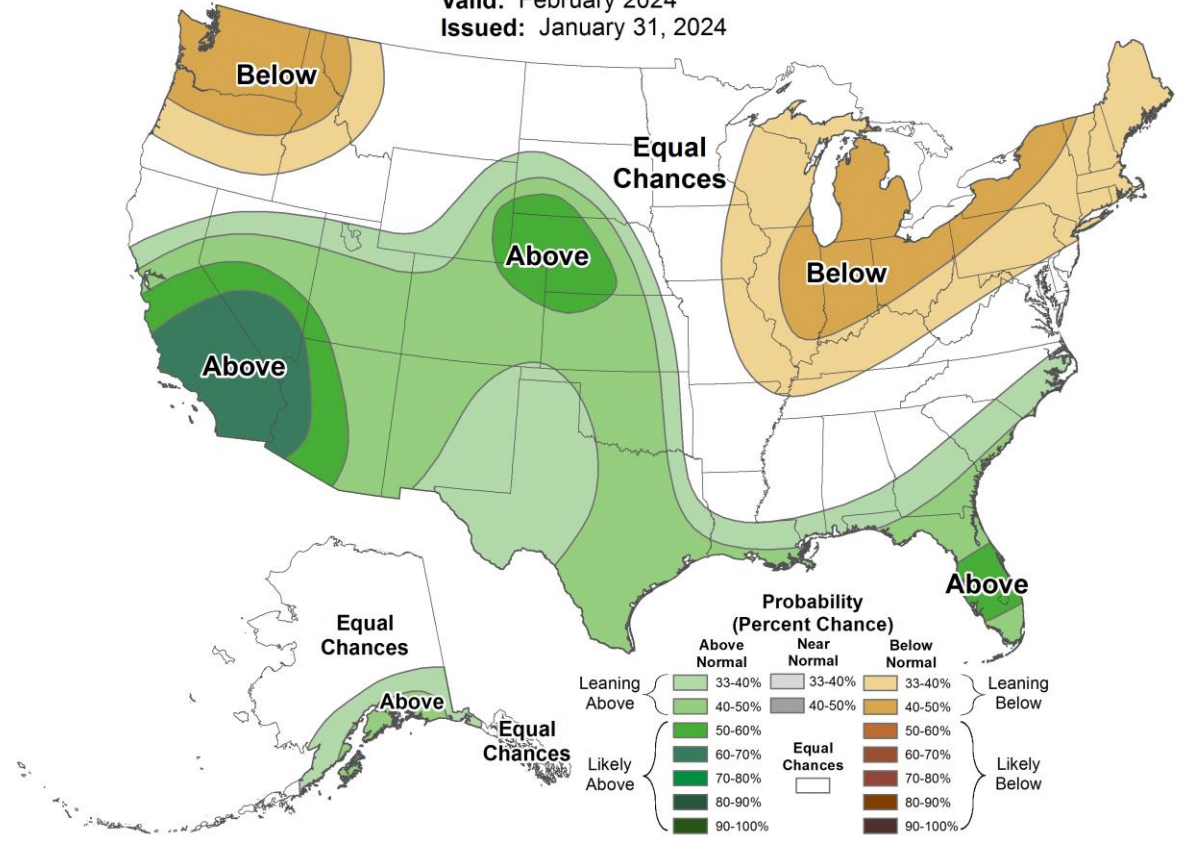
Valid: February 2024
Issued: January 31, 2024



Monthly Precipitation Outlook



Valid: February 2024
Issued: January 31, 2024



<http://www.cpc.ncep.noaa.gov/>

30 day outlook for February – likely warmer again.
No strong indications on precipitation.

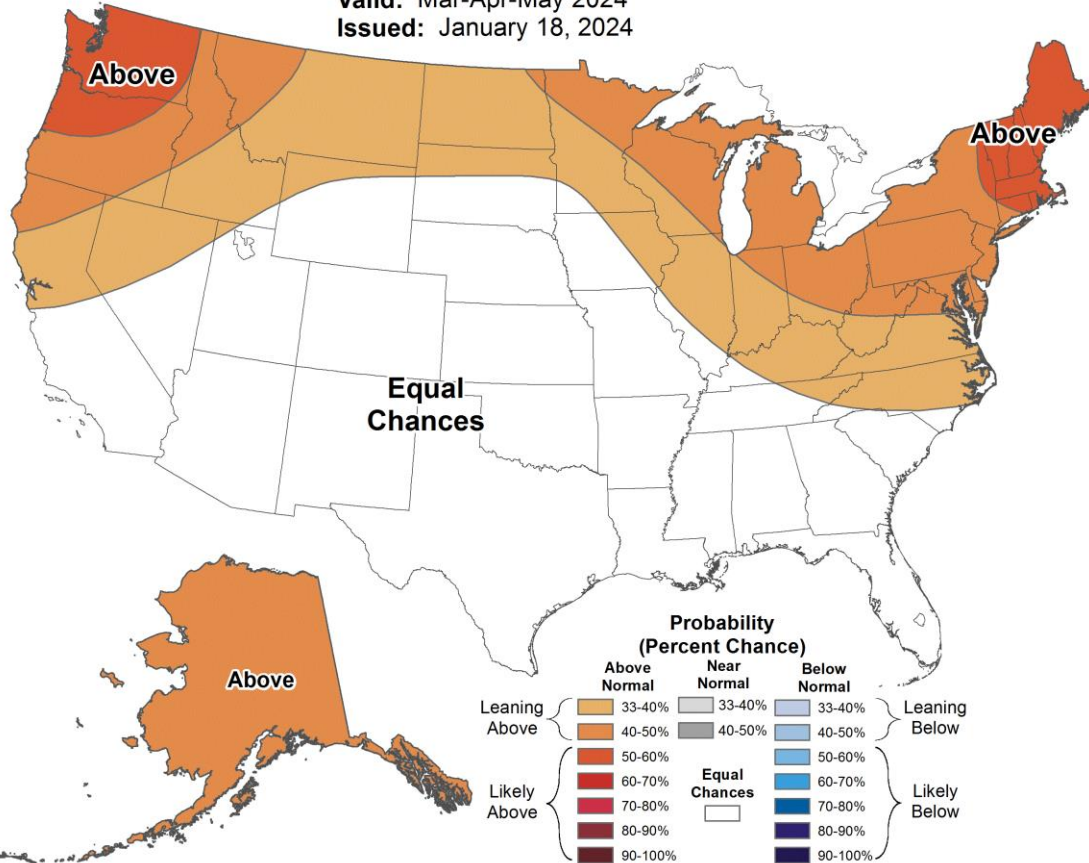
90 Day Temp and Precip. Outlook



Seasonal Temperature Outlook



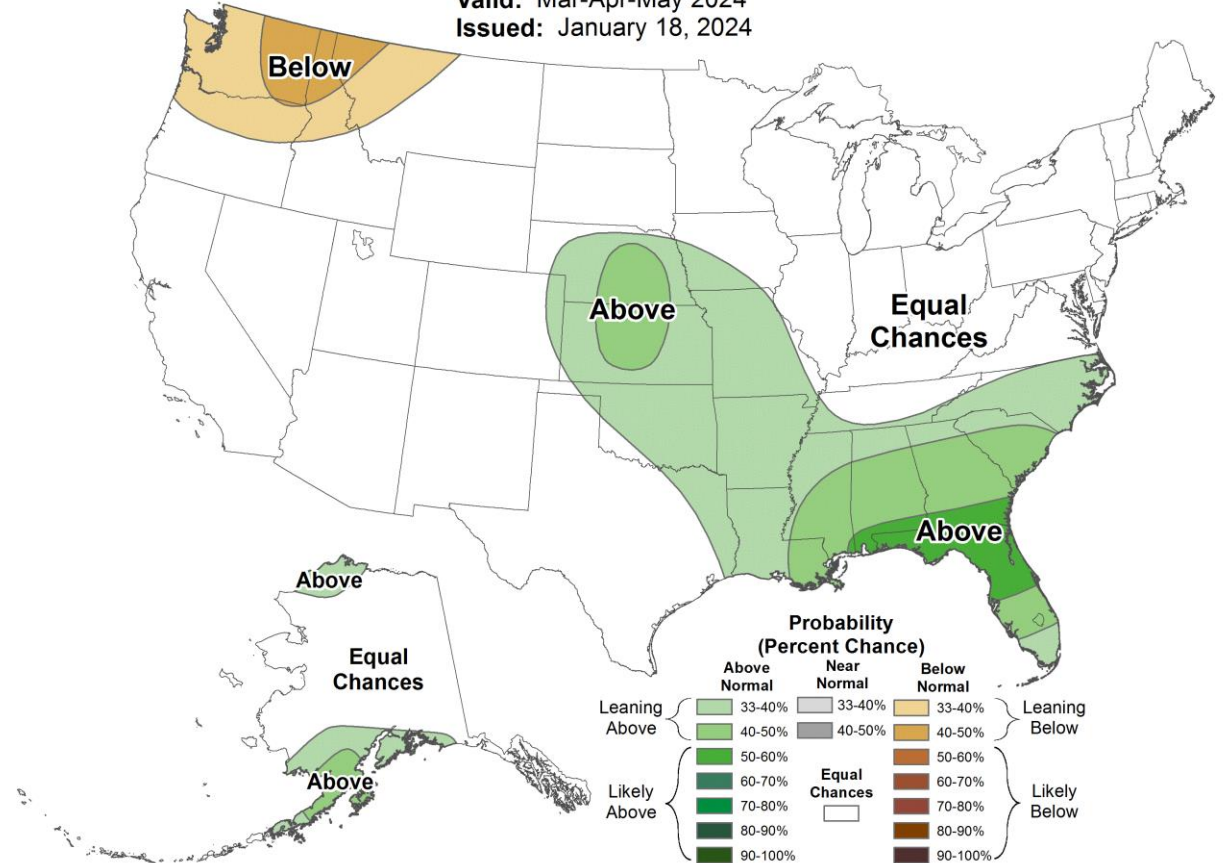
Valid: Mar-Apr-May 2024
Issued: January 18, 2024



Seasonal Precipitation Outlook



Valid: Mar-Apr-May 2024
Issued: January 18, 2024



<http://www.cpc.ncep.noaa.gov/>

El Niño-weakening. Slightly more likely warm. No indications on precipitation.

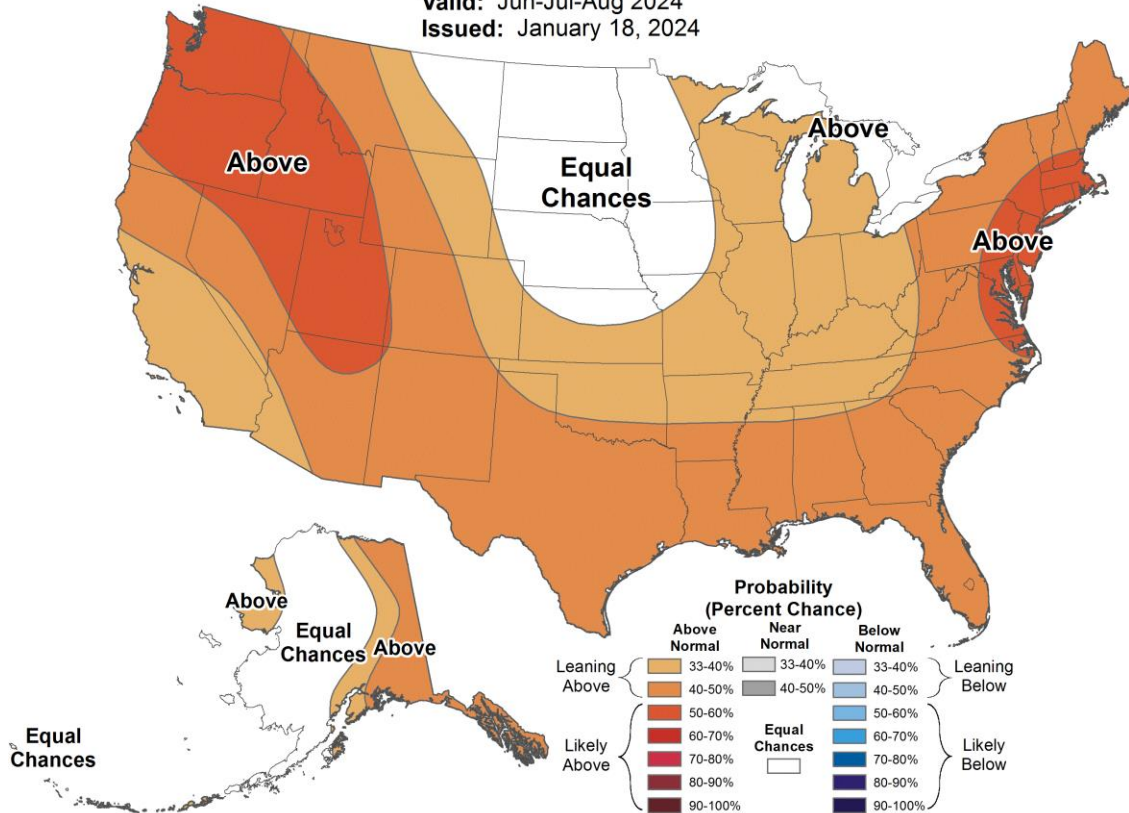
Seasonal Outlook for June-August



Seasonal Temperature Outlook



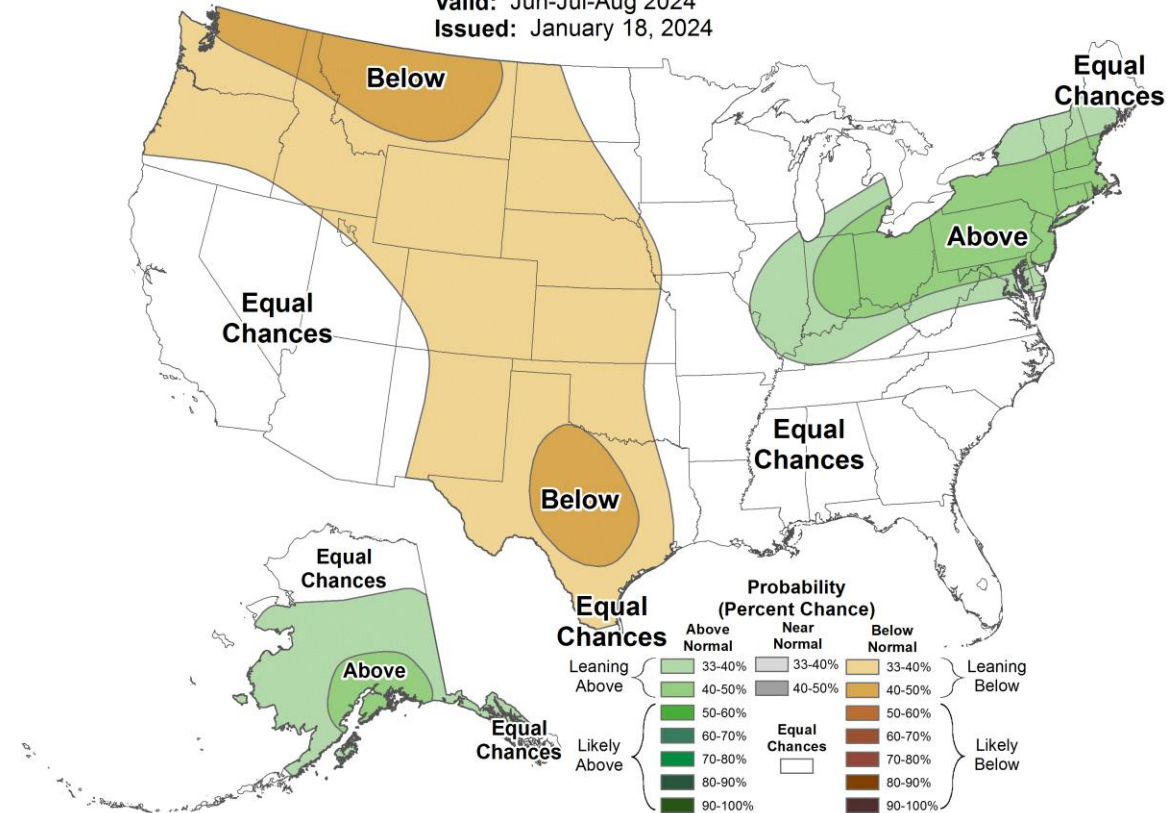
Valid: Jun-Jul-Aug 2024
Issued: January 18, 2024



Seasonal Precipitation Outlook



Valid: Jun-Jul-Aug 2024
Issued: January 18, 2024



- Summer - El Niño influence likely gone. Mostly based on “trend”.
- How much drought continues? What other develops?

Summary

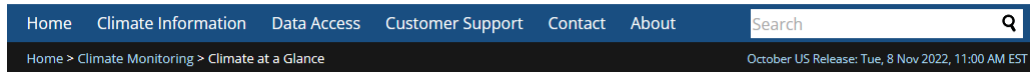
- *Conditions*
- Drought continues into year 4
- Ongoing dryness
- Some recent recovery
- El Niño helping drive current conditions – along with climate change
- *Outlooks*
- El Niño will continue to play into winter and spring
- Drought recovery (some but marginal)
- Spring planting less likely major wetness slowdowns.
- Increasing chance transition to La Niña (by late summer/fall)
- Increased chance of warmer summer

Recommendations

- Strongly consider yield goals – fertilizer recommendations (soil moisture recovery could limit)
- Increased chance of heat – increases water use. Increasing risk of crop stress in dry areas.
- Mixed message by location.
- Soil management – tillage loses soil moisture.
- If depending on a water source (irrigation/livestock etc.) – check its level and develop alternate plans

Useful Resources

Historical Climate Data



Climate at a Glance

Global National Regional Statewide Divisional **County** City

Mapping Time Series Rankings Haywood Plots Data Information Background

County Time Series

Choose from the options below and click "Plot" to create a time series graph.
Please note, Degree Days and Palmer Indices are not available for Counties.

Parameter: Average Temperature
Time Scale: 1-Month
Month: September
Start Year: 1895
End Year: 2022
State: Alabama
County: Autauga County

Options
 Display Base Period
Start: 1901 End: 2000
 Display Trend
 per Decade per Century
Start: 1895 End: 2022
 Smoothed Time Series
 Binomial Filter LOESS

Plot

Autauga County, Alabama Average Temperature
September

Find all links at
tiny.cc/acj1vz



Plus, NRCS Climate Quick Reference Guides (Counties)

<https://webapps.jorn.ada.nmsu.edu/climate-quick-guides/>

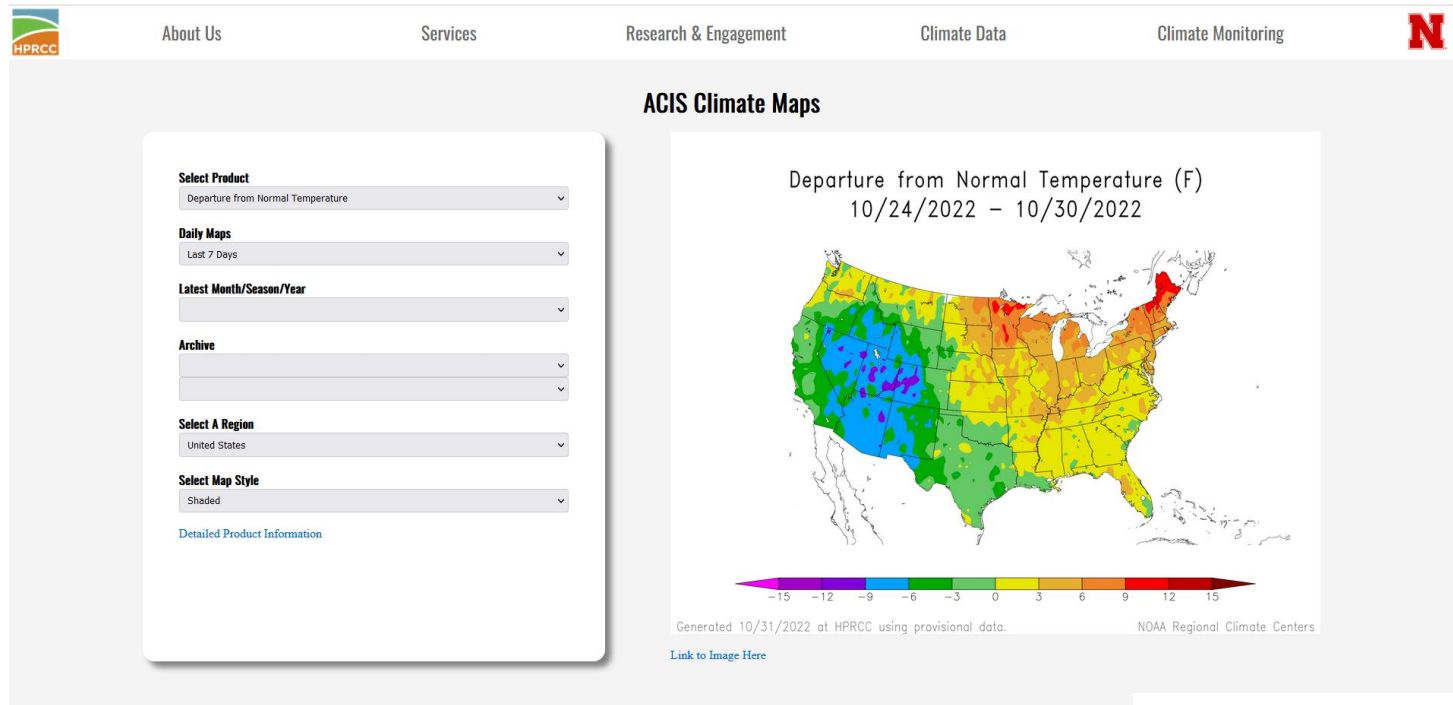
NCEI Climate at a Glance

Midwestern Regional Climate Center



Midwestern Regional Climate Center

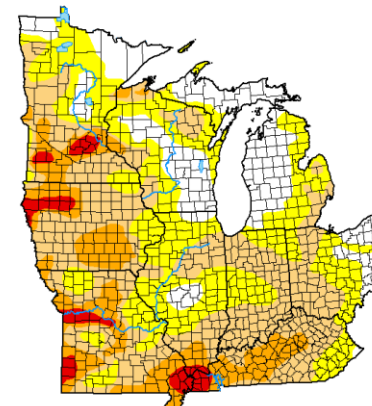
The screenshot shows the MRCC website interface. At the top, there are navigation links for 'About Us', 'Data & Services', and 'Midwest'. The main content is organized into three sections: 'Featured Products', 'Seasonal Tools', and 'Highlighted Products'. 'Featured Products' includes 'cli-MATE MRCC APPLICATION TOOLS ENVIRONMENT' and 'Midwest CLIMATE WATCH'. 'Seasonal Tools' includes 'Corn Growing Degree Day', 'Regional Mesonet Project', 'Freeze Date Tool', and 'VIP Freeze Maps'. 'Highlighted Products' includes 'VIP Freeze Probabilities', 'AWSI Winter Index', 'Weather on Your Birthday', and 'Climate Perspectives Tool'.



Find all links at
tiny.cc/acj1vz

U.S. Drought Monitor Midwest

October 25, 2022
(Released Thursday, Oct. 27, 2022)
Valid 8 a.m. EDT



Intensity:

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

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>

Author:
Adam Hartman
NOAA/NWS/NCEP/CPC

National Weather Service
Climate Prediction Center

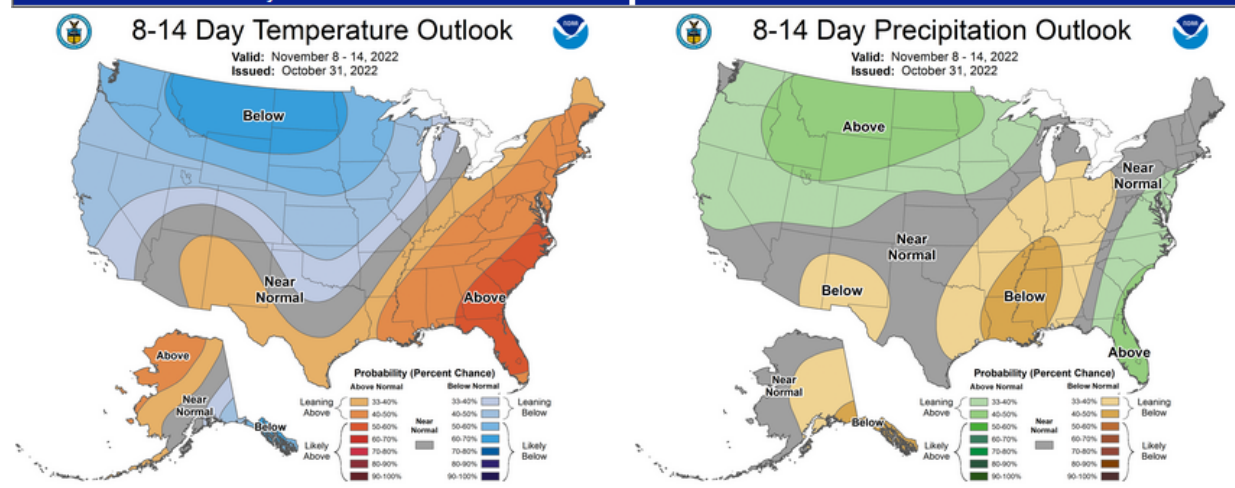
Home			Site Map			News			Organization					
DOC	NOAA	NWS	NCEP Centers:			AWC	CPC	EMC	NCO	NHC	OPC	SPC	SWPC	WPC

Climate News

- [NOAA Issues Winter Outlook \(20 Oct 2022\)](#)
- [75% chance of La Niña during Northern Hemisphere winter \(December-February\) 2022-23, with 54% chance for ENSO-neutral in February-April 2023 \(13 Oct 2022\)](#)
- [47th Climate Diagnostics and Prediction Workshop Announcement \(15 Apr 2022\)](#)

Click on product title to go to product page. Move cursor over product parameter name to display the graphic -- click to enlarge. Links to these same products are also available below.

6-10 Day Outlook (Interactive) Temperature Precipitation	One Month Outlook (Interactive) Temperature Precipitation
8-14 Day Outlook (Interactive) Temperature Precipitation	Three Month Outlook (Interactive) Temperature Precipitation
Week 3-4 Outlooks Temperature Exp. Precipitation	8-14 Day U.S. Hazards Outlook Composite Probabilistic: Temp Precip Snow Wind
U.S. Drought Information Monitor Monthly Outlook Seasonal Outlook	Global Tropics Hazards Outlook Weeks 2 and 3



Find all links at
tiny.cc/acj1vz

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

Midwest and Great Plains Climate-Drought Outlook 15 September 2016




United States Department of Agriculture
Midwest Climate Hub

Climate Hub – Ongoing Projects

USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

GLISA
A NOAA RISA TEAM



Climate Change Impacts on Illinois Agriculture

Kristen Giesting
Todd Ontl
William Baule
Danielle Shannon
Jeff Andresen
Aaron Wilson
Laurie Nowatzke
Dennis Today

October 2022



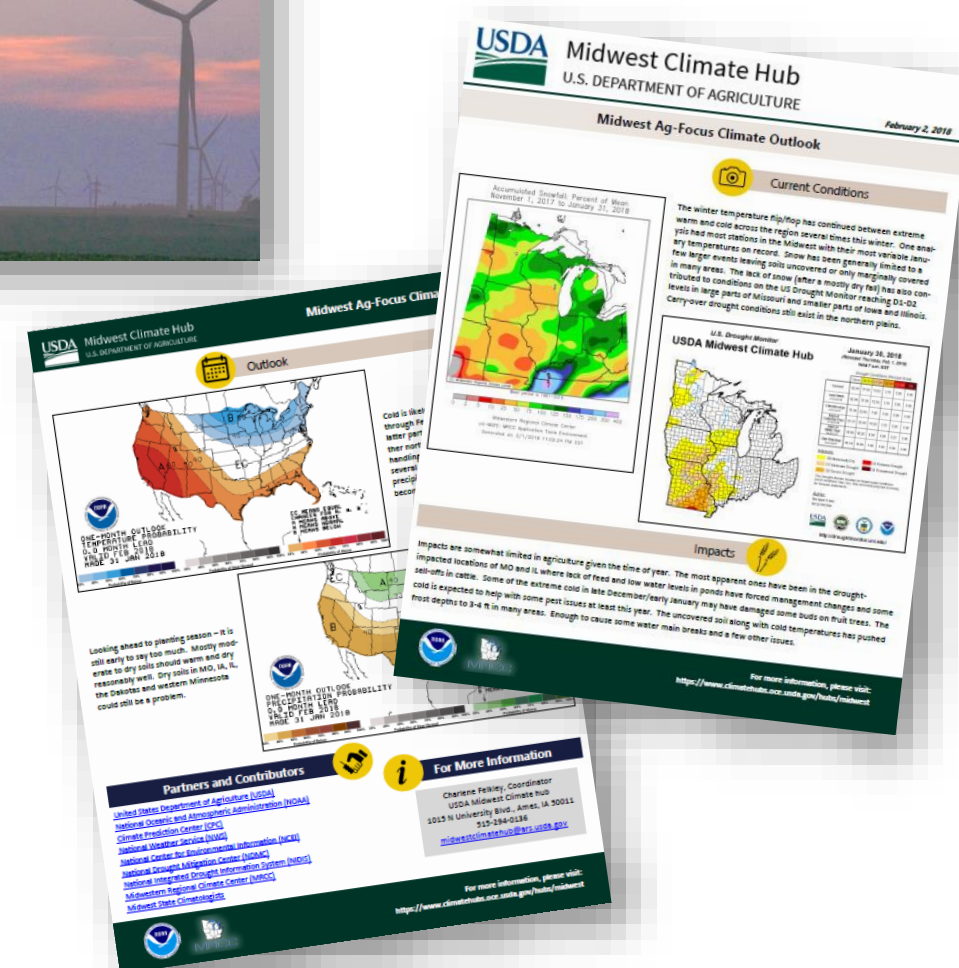
- Hear more about these tomorrow at 10 and 11.

Climate Hub –Operational Products

Midwest Ag-Focus Climate Outlook



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



Climate Smart Agriculture



Climate Ready Midwest

Climate Ready Midwest is a multistate partnership working to increase the impact of climate-smart agriculture across the region. Our mission is twofold:

1 To define what climate-smart agriculture means to the midwestern Extension agricultural community

2 To empower Extension professionals to lead climate-informed agricultural programming across the Midwest

Extension professionals and the USDA Midwest Climate Hub are working together to assess and build climate-informed programming by:



Climate Smart Agriculture

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PURDUE UNIVERSITY Agriculture News

HOME NEWS TOPICS ▾ PURDUE TODAY MEDIA INFO ▾ PODCAST STORIES PURDUE IN THE NEWS

May 18, 2023

Purdue-led USDA project aims to double impact of climate-smart Corn Belt agriculture

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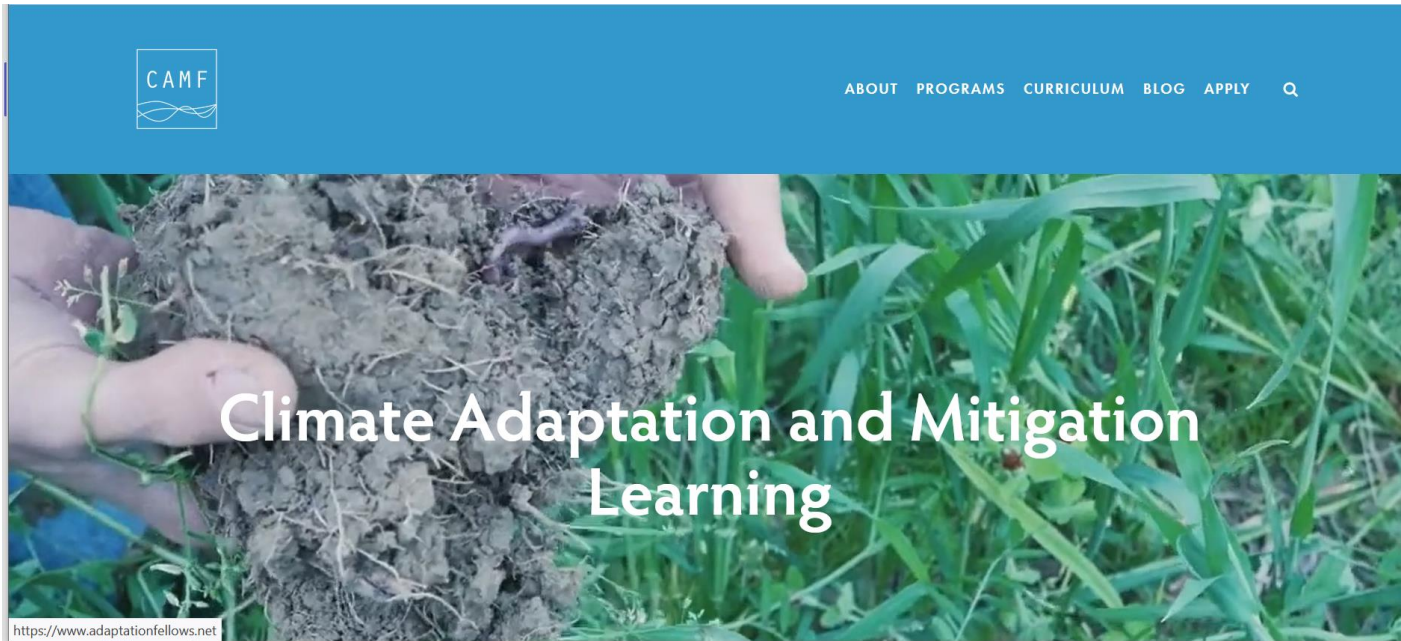
Ag News

- **Purdue receives \$1.4 million for cattle and swine research projects**
- **Drone imagery analysis to help**

Type here to search

6:00 AM 6/22/2023 43

Climate Smart Agriculture



- *Partners needed!*
- Training fellowship for producers and advisers
- 4 week training in February (virtual) – CEUs available
- Understand more about climate issues in the Midwest
- Develop new adaptation strategies working with other producers
- Sign up soon!

For More Information



@USDAClimateHubs
@dennistoday



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

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

MidwestClimateHub@usda.gov



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

Contact Laurie to sign up for newsletter and monthly ag outlooks! →



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Laurie.Nowatzke@usda.gov

Melissa Kadolph – Admin

Melissa.Kadolph@usda.gov

Adam Reed – NRCS Co-Lead

Adam.Reed@usda.gov

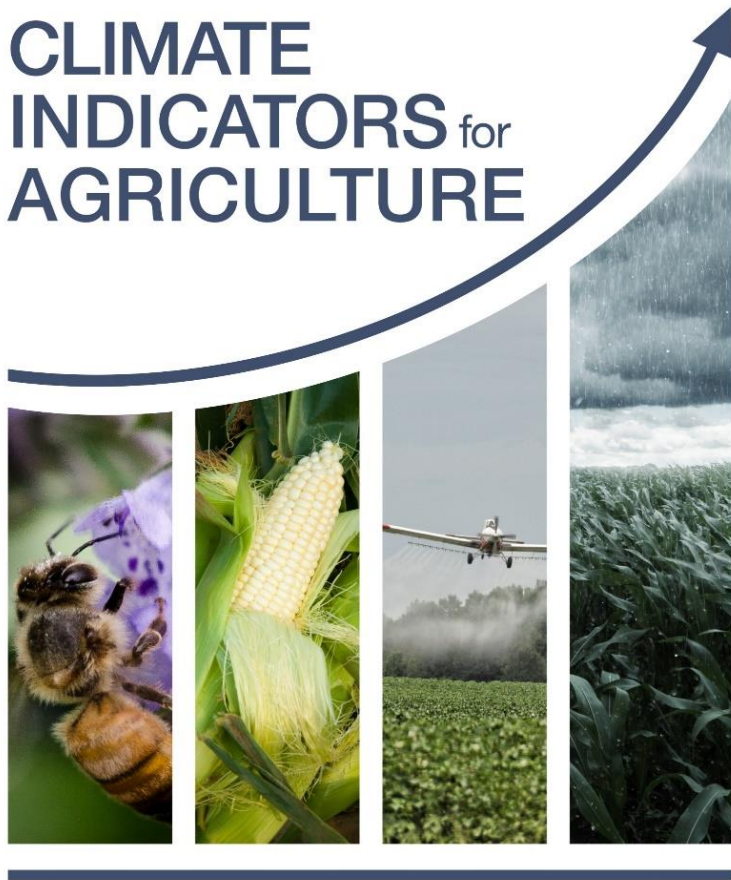
What is happening?

CLIMATE ISSUES AND AGRICULTURE

United States
Department
of Agriculture
Climate Change
Program Office
Technical Bulletin 1953



CLIMATE INDICATORS for AGRICULTURE



Climate Change Indicators for Agriculture

ISU Extension Agronomy Fall Meeting

22 September 2020

Dennis Todey

USDA Midwest Climate Hub


https://www.usda.gov/sites/default/files/documents/climate_indicators_for_agriculture.pdf

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

Climate Hub – Ongoing Projects

USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

GLISA
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October 2022

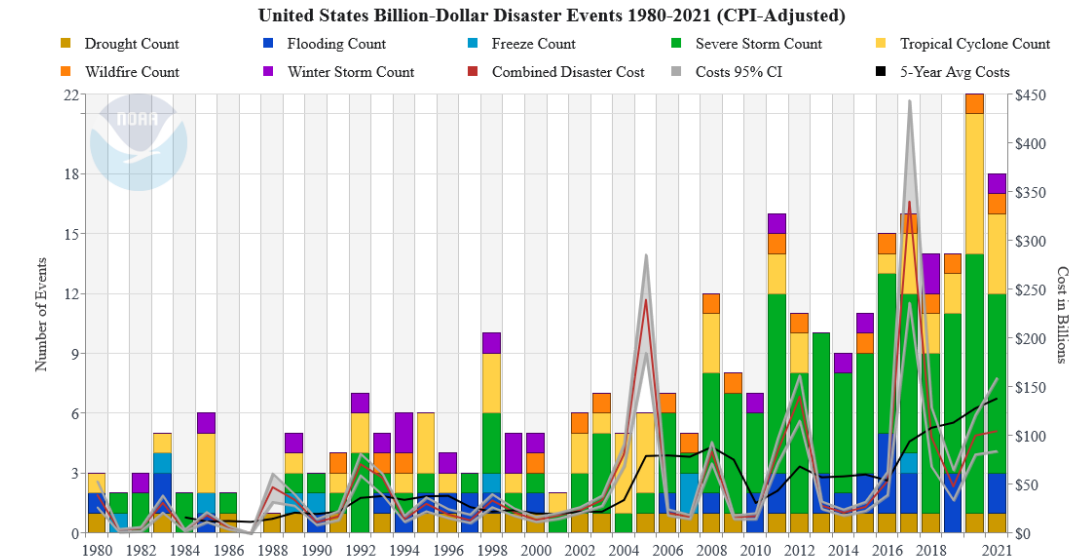
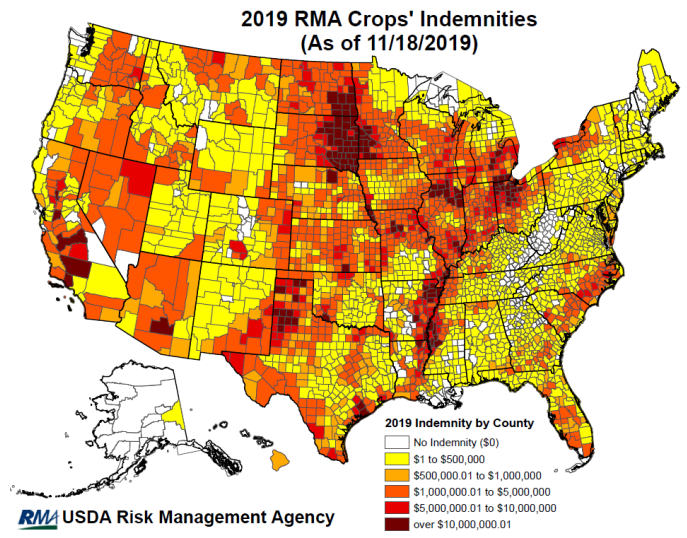


Minnesota released last week

<https://www.climatehubs.usda.gov/hubs/midwest/topic/assessing-impacts-climate-change-midwest-agriculture>

Climate-Impacted Issues for Agriculture

- Bigger events
- More extremes
- Larger disaster issues
- Increased variability

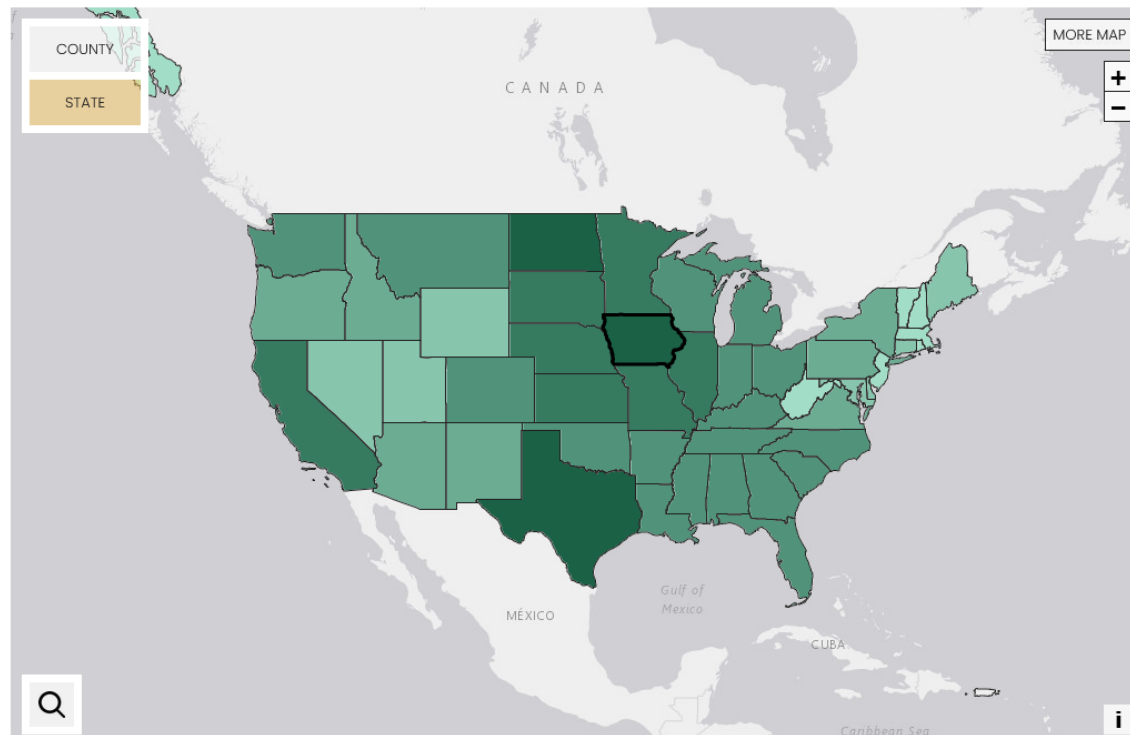


Climate-Impacted Issues for Agriculture

- Since 1989 Iowa has 3rd highest RMA indemnity payments
 - Texas \$20.6B
 - North Dakota \$12.7B
 - Iowa \$10.6B
- Drought-largest
- Wetness – most consistent

AgRisk Viewer

USDA SOUTHWEST CLIMATE HUB



Now Viewing
Risk Management Agency Payments

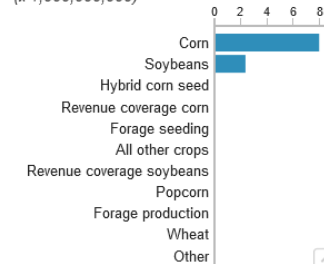
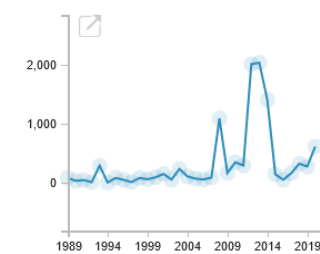
Iowa: 10,615,492,877.69

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

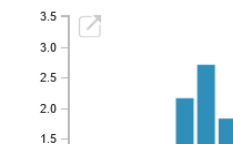
Payment indemnity by commodity

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

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



1989–2020 monthly totals, all commodities
(x 1,000,000,000)



Midwest Climate Hub

U.S. DEPARTMENT OF AGRICULTURE

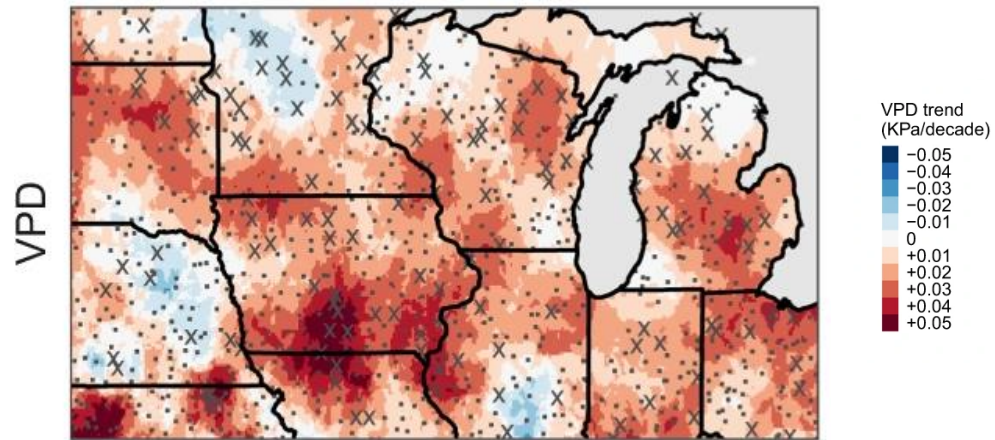
<https://swclimatehub.info/rma/rma-data-viewer.html>

Possible Management Changes

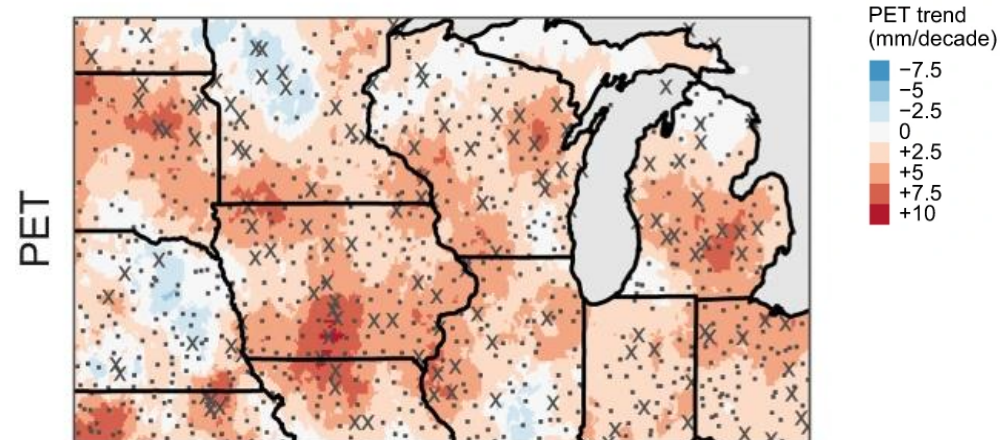
- Flooding/inundation (extended periods)
- Increasing precip intensity/amounts (especially off-season)
- More soil/nutrient loss potential
- Soil loss
 - Reducing tillage
 - Cover crops
- Splash potential
- Drought?
 - Still occurs
 - Even in wet years...
 - Quicker transitions
- Location specific



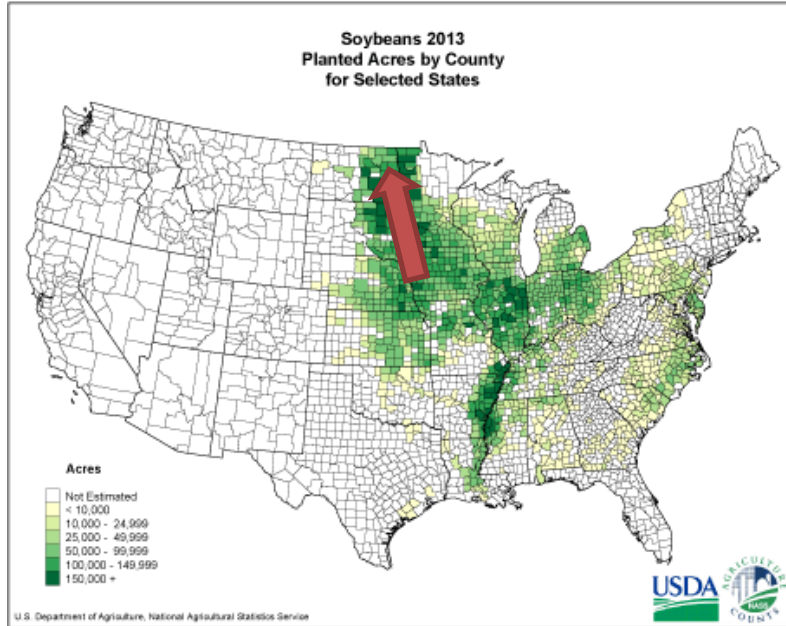
30 Year Trend (Summer VPD and PET)



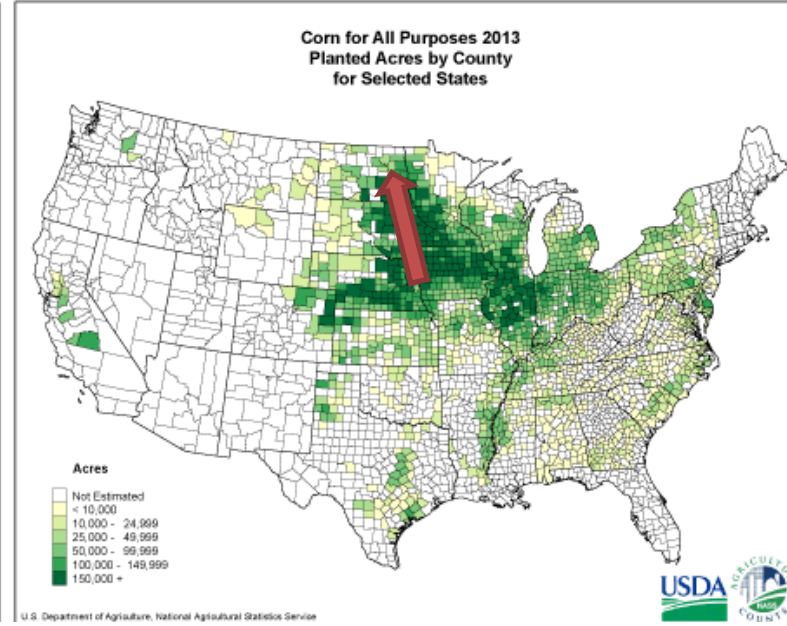
Trend to drier air – higher PET.



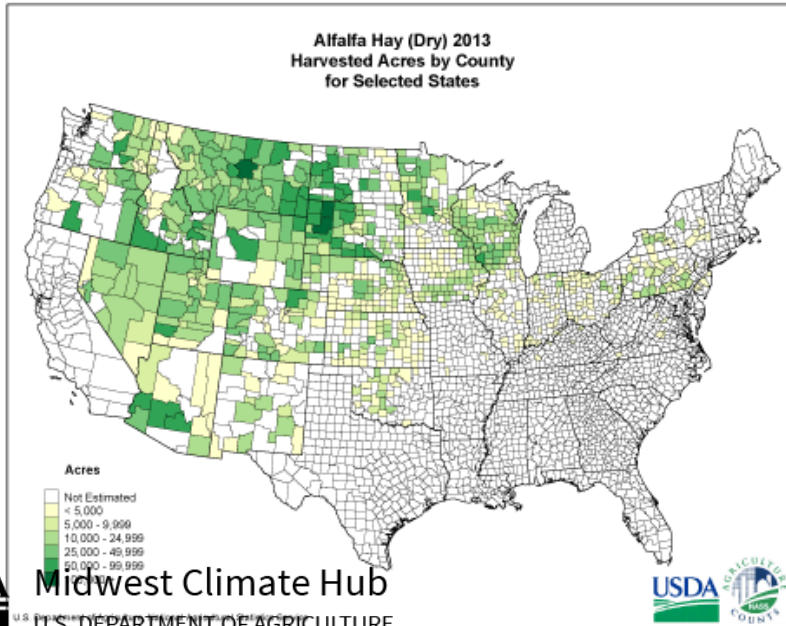
Crop Production



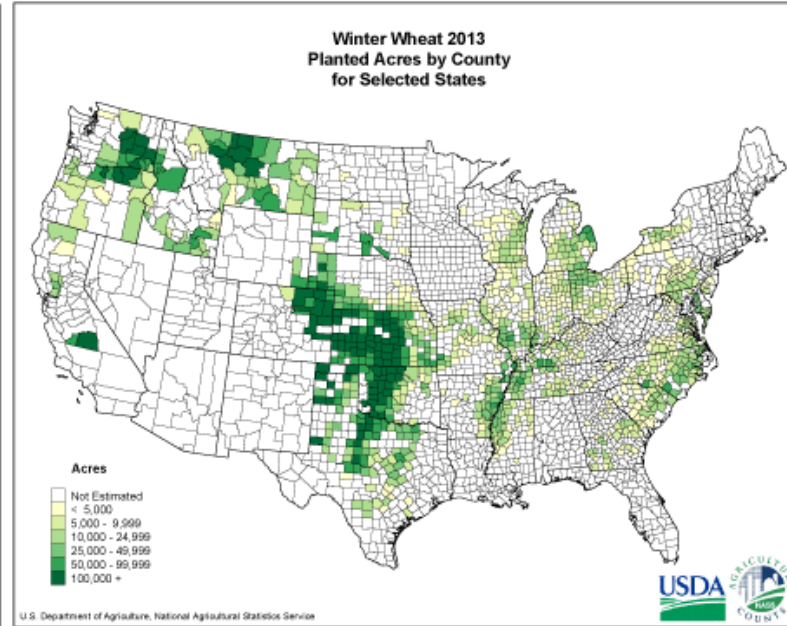
U.S. Department of Agriculture, National Agricultural Statistics Service



U.S. Department of Agriculture, National Agricultural Statistics Service

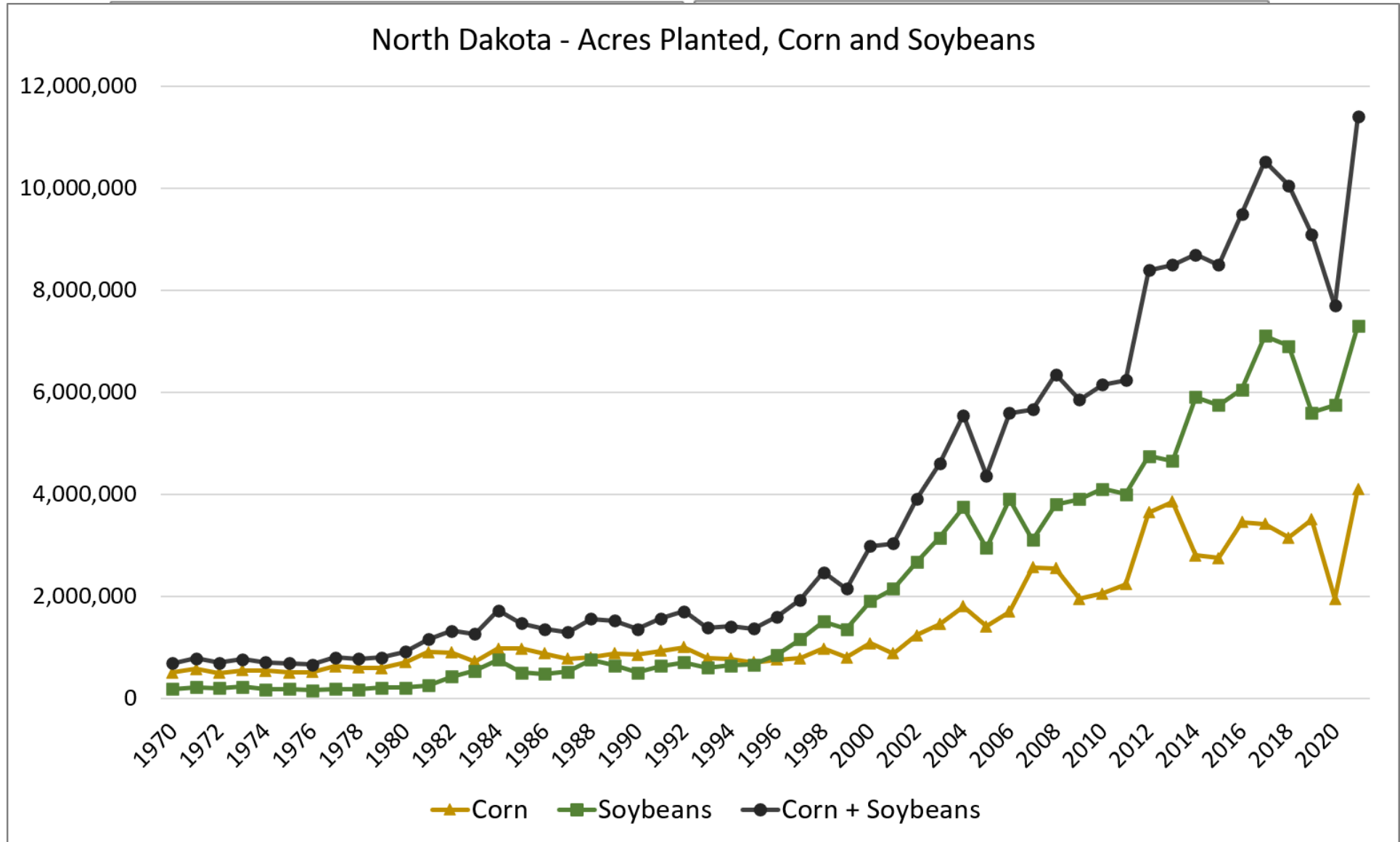


USDA Midwestern Climate Hub
U.S. DEPARTMENT OF AGRICULTURE



U.S. Department of Agriculture, National Agricultural Statistics Service

Crop Production

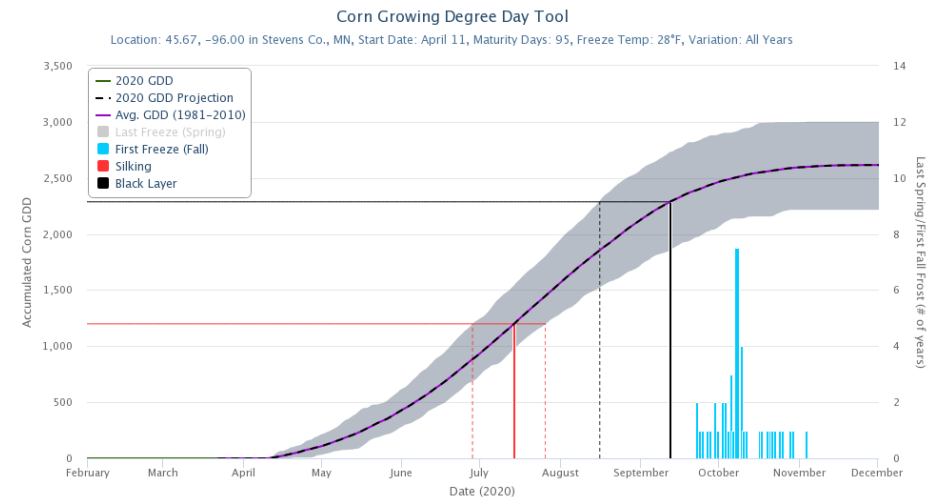


Issues with Temperature Changes

- Extending growing season
- Phenology
 - Growing season
 - Too quickly progressing – lead to yield loss
- Insects (will discuss more)

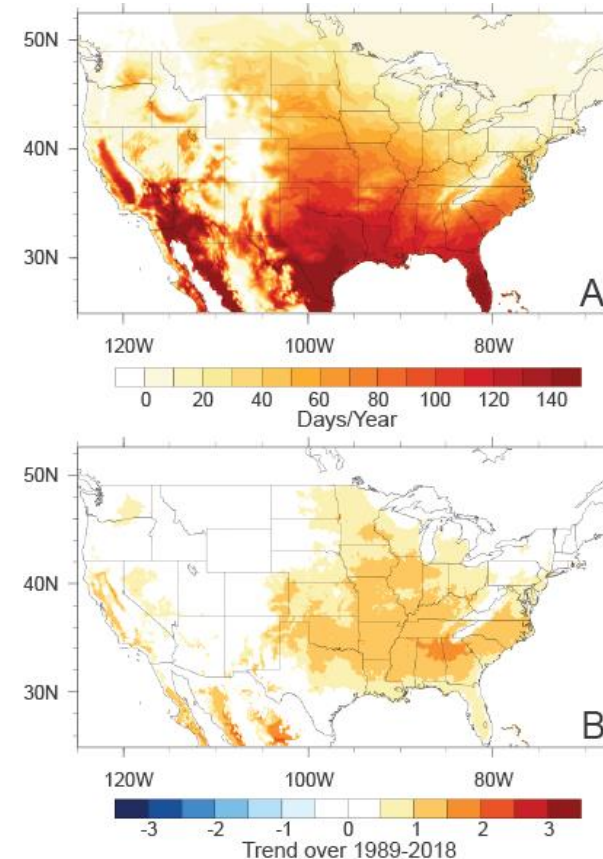


<https://hprcc.unl.edu/agroclimate/gdd.php>
<https://mrcc.illinois.edu/U2U/gdd/>



Heat Waves

- Interfere with normal biophysical functioning of agricultural plants and animals
- More frequent, more intense, and longer duration heat waves are anticipated with detrimental effects on productivity
- Adaptation may reduce biophysical impacts, but raises production inputs, reducing efficiencies (see TFP)



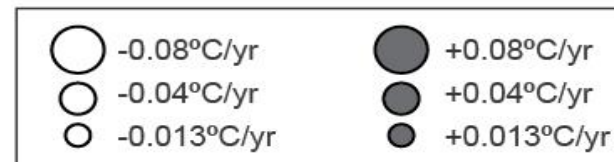
a) Annual average number of heat wave days for 1989–2018. b) Trends in the number of annual heat wave days (1989–2019).

Humidity Changes

- Increased at most regional scales in the U.S. over the last 50 years
- Key factor in plant and animal stress indices, and provides a measure of atmospheric water available for agriculture
- Trends can be influenced by land use and agricultural management practices



Magnitude and sign of trend



U.S. summer dew point temperature trends

Livestock issues and temperature/humidity

- Warm/humid conditions –less cooling at night
- Creates additional stress on livestock
 - Reduced production
 - Reduced gain
 - Possible breeding issues
 - Mortality – extreme cases

Tougher on humans working in these conditions, too.



Terms

Adaptation – How do we shift agricultural activities to adapt to changing conditions?

Mitigation – How can we do activities that help reduce the risk of future problems?

We cannot adapt our way out of our current situation.

Climate Smart Agriculture

Climate-Smart Agriculture is guided by three main goals:

1. Increased productivity (sustainably intensifying agriculture)
2. Enhanced resilience (adapting to climate change)
3. Reduced emissions (mitigating greenhouse gas emissions)

Borrowed from USDA Northeast Climate Hub

<https://www.climatehubs.usda.gov/hubs/northeast/topic/role-climate-smart-agriculture-climate-adaptation-and-mitigation-northeast>

Climate Smart Agriculture

What does a practice really do?

Can we quantify its capability?

Where do practices work (or not)?

How should practices be implemented?

How do we get practices adopted?

Can a practice be implemented incorrectly?

Can actions after a practice undo its effects?

What about for different crops?



Climate Smart Agriculture

Partnerships for Climate-Smart Commodities

Equity at USDA

Climate Solutions

Partnerships for Climate-Smart Commodities

Partnerships for Climate-Smart Commodities Project Summaries

USDA is committed to supporting a diverse range of farmers, ranchers, and private forest landowners through Partnerships for Climate-Smart Commodities. This effort will expand markets for America's climate-smart commodities, leverage the greenhouse gas benefits of climate-smart commodity production, and provide direct, meaningful benefits to production agriculture, including for small and underserved producers.

USDA is investing more than \$3.1 billion for 141 projects through this effort and all the projects require meaningful involvement of small and underserved producers.

Climate Smart Agriculture



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May 18, 2023

Purdue-led USDA project aims to double impact of climate-smart Corn Belt agriculture

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Ag News

- **Purdue receives \$1.4 million for cattle and swine research projects**
- **Drone imagery analysis to help**

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USDA Agricultural Research Service **ltar**

NETWORK ▾ SITES ▾ RESEARCH ▾ DATA ▾ RESOURCES ▾ GET INVOLVED ▾ 🔍

The Long-Term Agroecosystem Research (LTAR) Network

We are a growing research network focused on developing national strategies that respond to the agricultural challenges of the 21st Century: food security and climate change.

< >

Learn about LTAR research

(Click dots to open LTAR site page)

Who We Are

The LTAR Network is a growing group of research increase agricultural productivity, environmental such as climate change. [Read more](#)

Climate Smart Agriculture

Much more to come on management changes and their implications.

We welcome your questions and ideas.

