

North Central U.S. Climate & Drought Outlook

June 15, 2023

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OSU Extension & Byrd Polar and Climate
Research Center

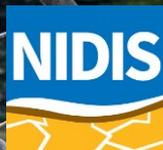


Photo Courtesy of Tyler Carr (OSU)

Photo Courtesy of Melissa Widhalm (MRCC)



General Information

Providing climate services to the North Central US

Collaboration Activity Among:

- NOAA NCEI/NWS/OAR/NIDIS
- USDA Climate Hubs
- American Association of State Climatologists
- Midwest and High Plains Regional Climate Centers
- National Drought Mitigation Center

Next Regular Climate/Drought Outlook Webinar

- *July 20, 2023 (1 PM CDT) – Trent Ford (Illinois State Climatologist)*

Access to Future Climate Webinars and Information

<http://www.drought.gov/drought/content/regional-programs/regional-drought-webinars>

- <https://mrcc.purdue.edu/multimedia/webinars.jsp>
- <http://www.hprcc.unl.edu/webinars.php>

Open for questions at the end (Enter them along the way)

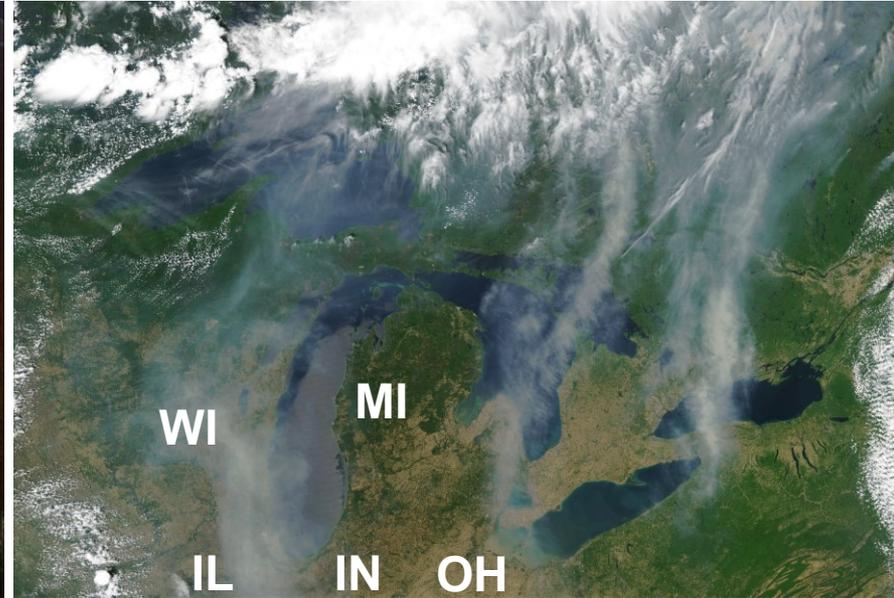


Agenda

- Recent Conditions
- Issues & Events
- Hydrologic Impacts
- Agricultural Impacts
- Fire Conditions
- Outlooks



Easy to find dryness impacts on a stroll through Wildcat Den State Park south of the Quad Cities – Ray Wolf



One cannot escape wildfire smoke across the region this summer. MODIS satellite image showing plumes of smoke flowing southward across eastern Wisconsin into NE Illinois and eastern Michigan/northern Ohio as well.

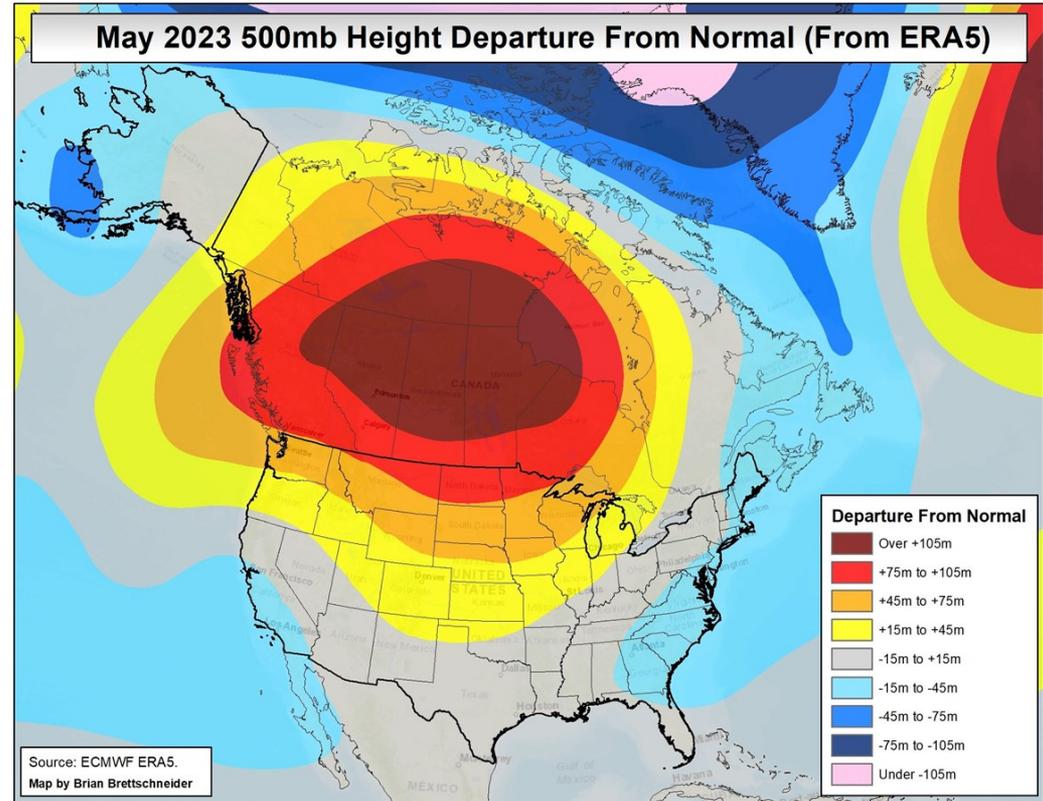
RECENT CONDITIONS

A cloudburst at Camp Ripley north of Little Falls, MN on June 3. – Photo courtesy of Pete Boulay, MNDNR Ecological and Water Resources



“Weird” Conditions

- Blocking Pattern – Upper air pattern that remains stationary and prevents weather systems from moving through (typical west to east)
- Sinking air underneath the high (warm/dry) – increased fire potential in parts of Canada
- Clockwise flow around the high – flow from the north on east side; pull Gulf of Mexico moisture into the High Plains



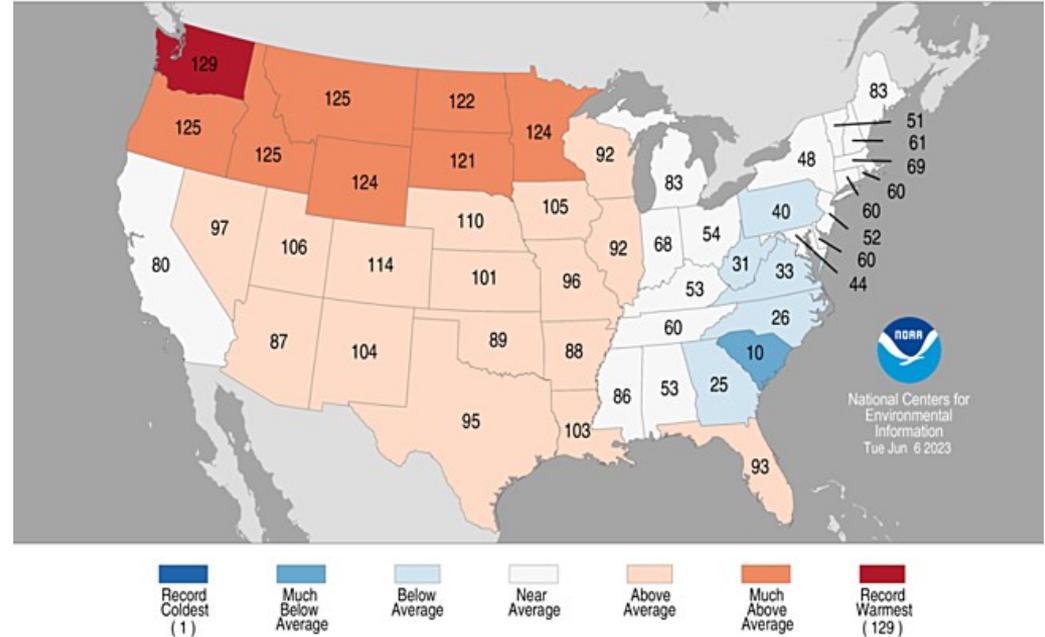
Source: Brian Brettschneider @Climatologist49 (Twitter)



May Temperature Recap

- Very warm across Upper Midwest/N. Great Plains
- Top 10 warmest for Minnesota, North and South Dakota, Wyoming, and Montana
- Above average from Colorado to Illinois and Wisconsin
- Cooler – about average in the east (OH, KY, IN, MI)

Statewide Average Temperature Ranks
May 2023
Period: 1895–2023

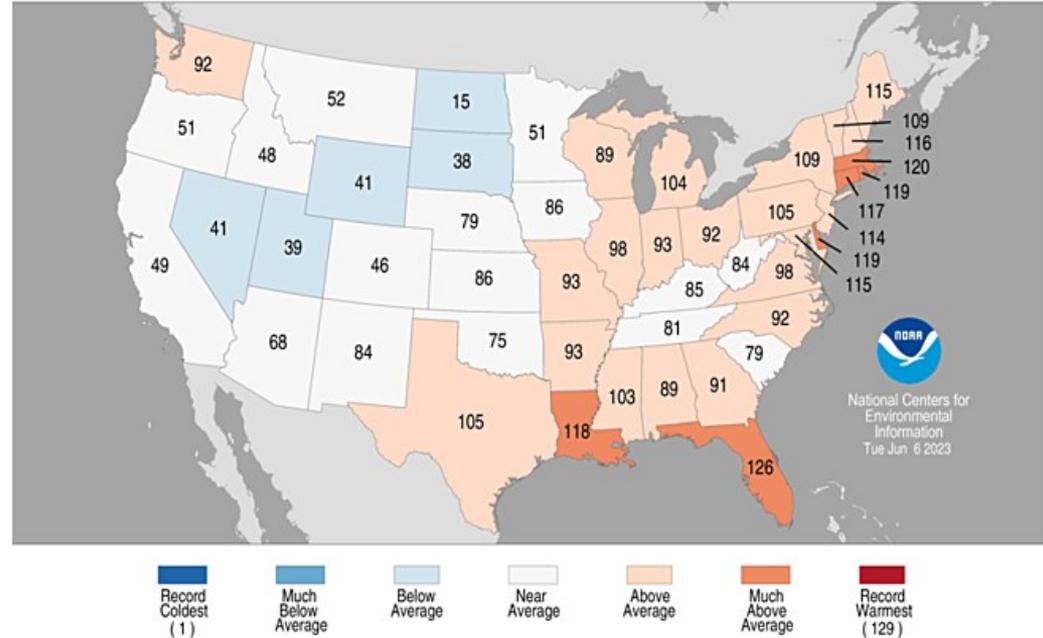




March - May Temperature Recap

- Sort of opposite of May alone (Cooler in the west, warmer in the east) – shows the change in pattern recently
- 15th coldest spring for North Dakota despite the 8th warmest May
- No top 10 warmest

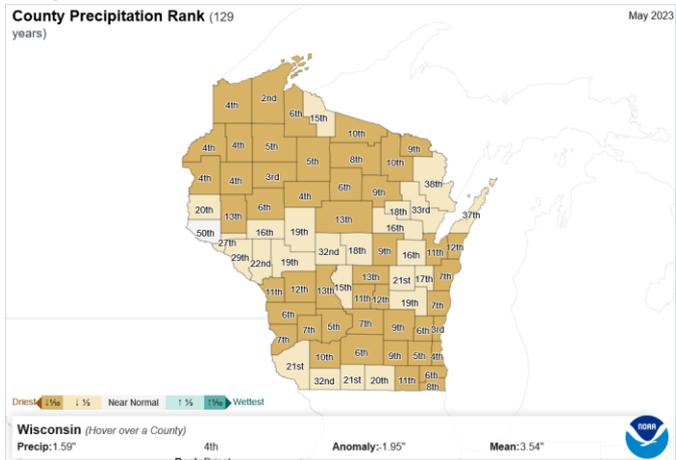
Statewide Average Temperature Ranks
March - May 2023
Period: 1895-2023



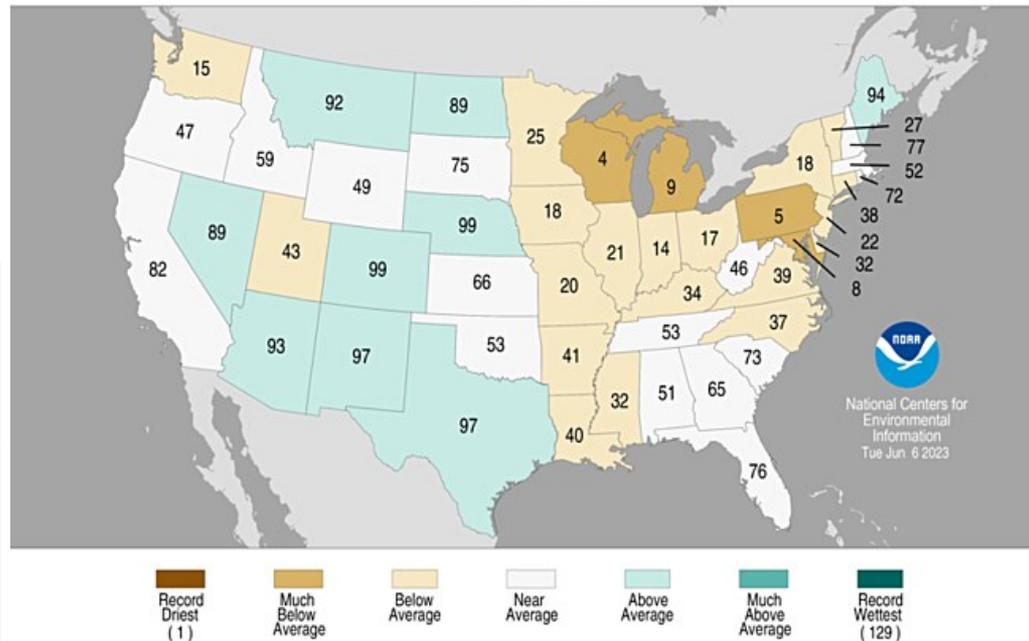


May Precipitation Recap

- Average to above average across Great Plains
- Drier than average for much of the region with top 10 driest May in Wisconsin and Michigan
- For Wisconsin - 4th driest (1988, 1934, 1925); only 40% of normal precipitation; after wettest start of year



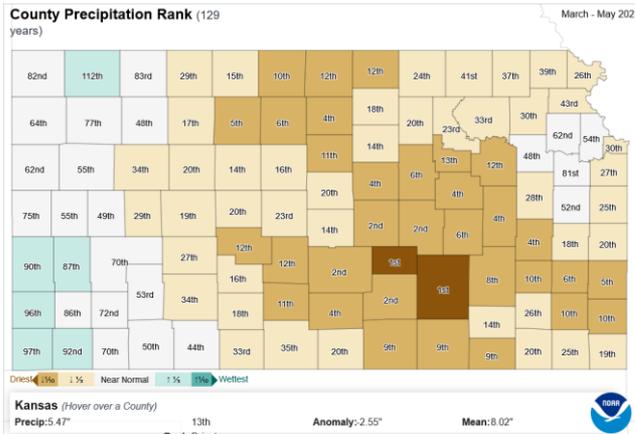
Statewide Precipitation Ranks
May 2023
Period: 1895–2023





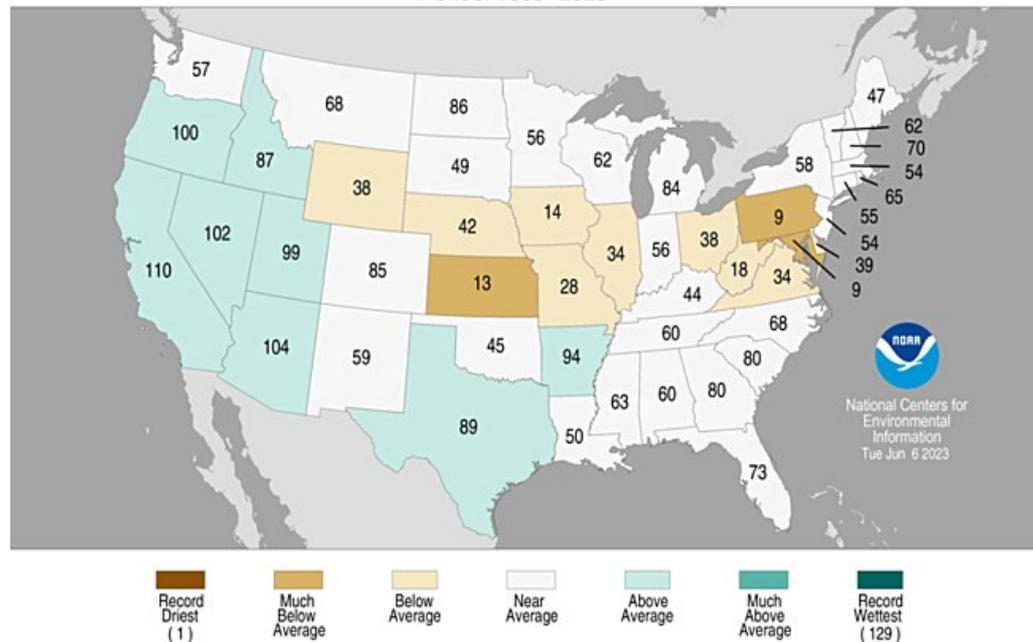
March - May Precipitation Recap

- About average across northern tier of states
- Drier than average for southern tier
- 13th Driest for Kansas (2 counties – record driest)



Statewide Precipitation Ranks

March - May 2023
Period: 1895-2023

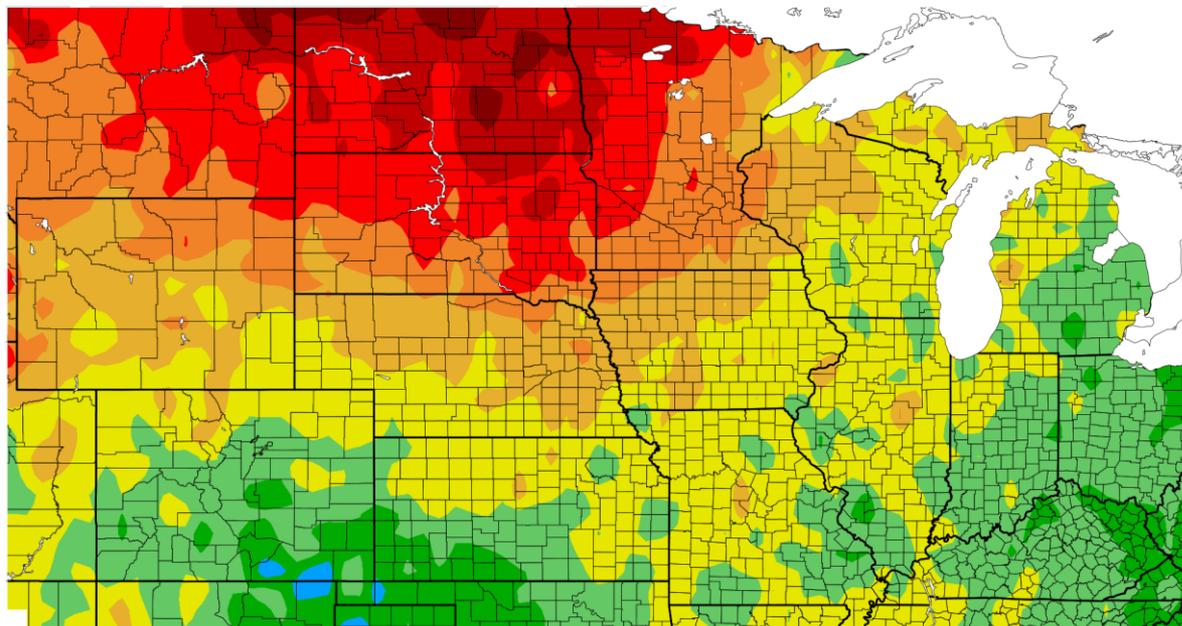


National Centers for Environmental Information
Tue Jun 6 2023

Departure from Normal Temperature (F) 5/14/2023 – 6/12/2023

Temperatures: Last 30 Days

- Again – complete opposite from earlier in the spring
- Very warm across Upper Midwest/N. Great Plains
- Close to average for bulk of the region
- Cooler than average in the east and across southern Colorado and Kansas

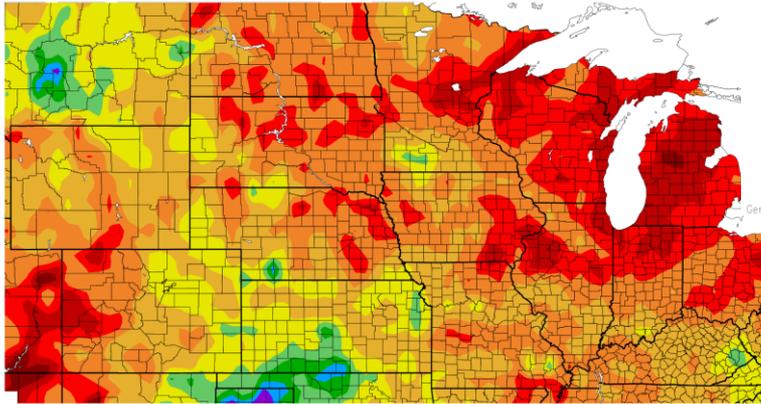


Generated 6/13/2023 at HPRCC using provisional data.

NOAA Regional Climate Centers

Precipitation: Last 30 Days

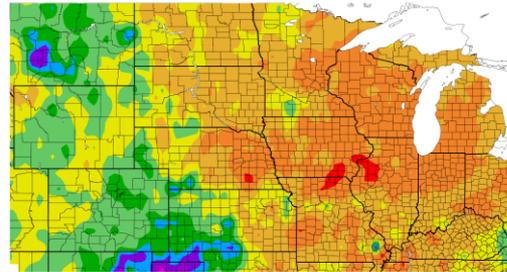
Precipitation (in)
5/14/2023 – 6/12/2023



Generated 6/13/2023 at HPRCC using provisional data. NOAA Regional Climate Centers

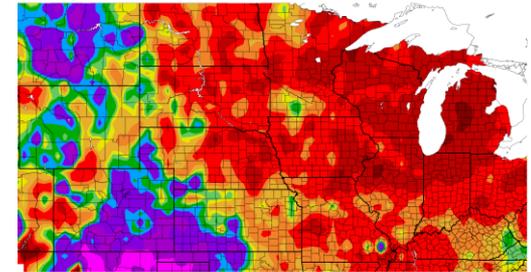
- Pockets of sub 5% of normal rainfall in MI, IL, IA, WI
- Very wet across Montana, Wyoming, eastern Colorado, and southwestern Kansas
- Note very recent rains - More widespread across Colorado, W. Kansas, Ohio, and Kentucky but scattered elsewhere

Departure from Normal Precipitation (in)
5/14/2023 – 6/12/2023

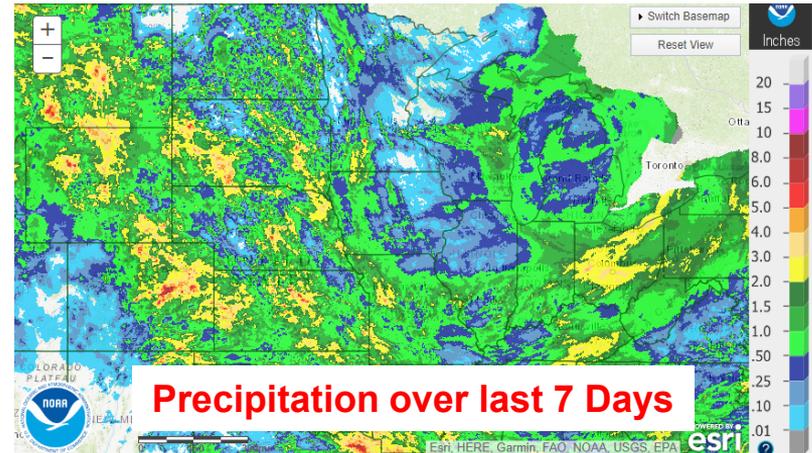


Generated 6/13/2023 at HPRCC using provisional data. NOAA Regional Climate Centers rated 6/13/2023 at HPRCC using provisional data. NOAA Regional Climate Centers

Percent of Normal Precipitation (%)
5/14/2023 – 6/12/2023



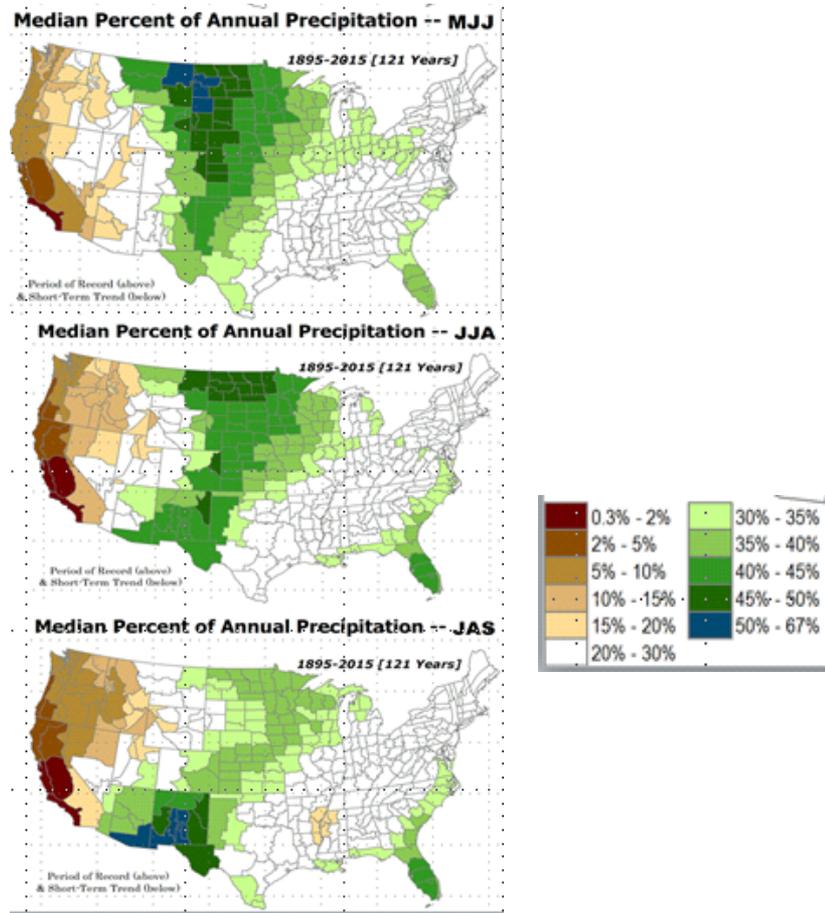
<https://hprcc.unl.edu/maps.php?map=ACISClimateMaps>



<https://water.weather.gov/precip/>

Why Are These Deficits Significant?

- Think: “When does the bulk my annual precipitation occur?”
- May – September represents a significant portion of the climatological precipitation totals for the year across most of the North Central Region
- Missing May and June rainfall is difficult to overcome later in the summer season



Issues & Events



Smoky view of Lake Geneva in NE Ohio as wildfires burned across Ontario: Photo courtesy of Elizabeth Hawkins, OSU Extension.



SMOKE

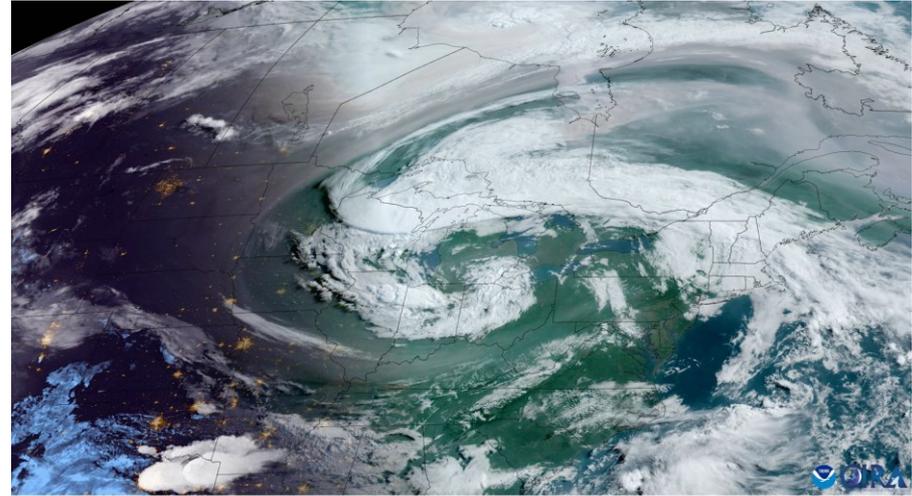
Dozens of Quebec wildfires turn eastern Canada, U.S. hazy

The effects of hundreds of wildfires burning in Quebec could be felt as far away as New York City and New England, blotting out skylines and irritating throats.

BY: ASSOCIATED PRESS 06/07/2023 12:53 PM EDT



06-03-2023 | 11:00:21 UTC | GOES-16 | GeoColor

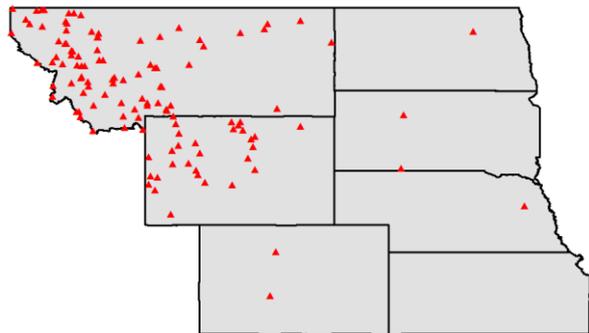


06-13-2023 | 11:50:20 UTC | GOES-16 | GeoColor

<https://rammb2.cira.colostate.edu/>



May Average Temperature Records



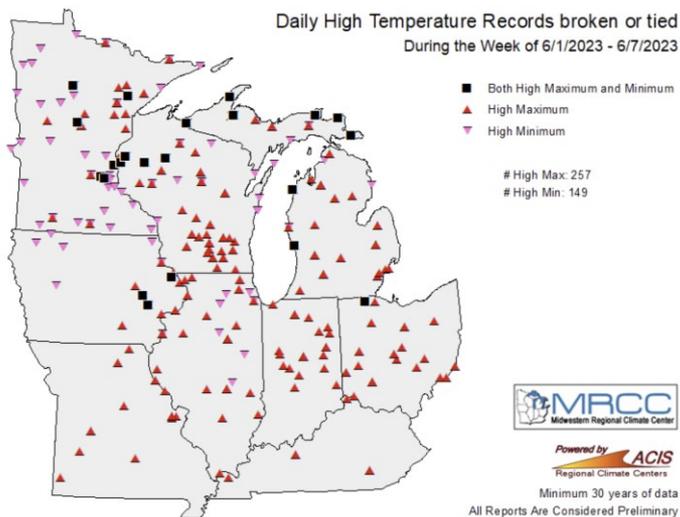
Records Broken: 121



Minimum 30 years of data
All Reports Are Considered Preliminary

Some May and Early June Heat

- Limited heat across much of the Midwest
- Heat occurred with very low humidity (sub 20% across the region)



- Near record low precipitable water values throughout the month at many locations (think – how much rain could occur if all the moisture in the air condensed and fell as rain)
- Note relative lack of severe weather across the whole region

HYDROLOGIC IMPACTS

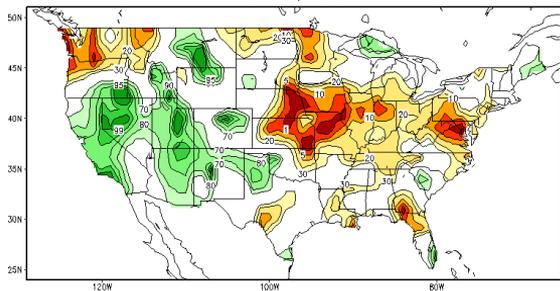


The Mighty Wabash in W. Lafayette, IN on May 24

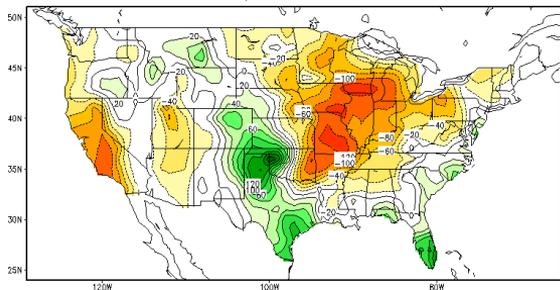


Soil Moisture

Calculated Soil Moisture Ranking Percentile
JUN 14, 2023



Calculated Soil Moisture Anomaly Change
JUN 14, 2023 from MAR.31



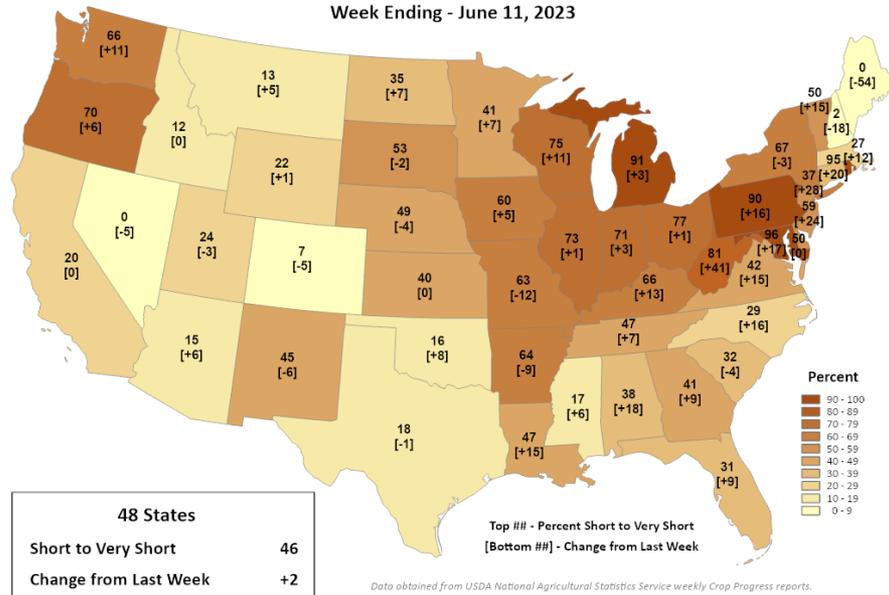
United States
Department of
Agriculture

This product was prepared by the
USDA Office of the Chief Economist (OCE)
World Agricultural Outlook Board (WAOB)

Topsoil Moisture

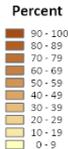
Percent Short to Very Short

Week Ending - June 11, 2023



48 States	
Short to Very Short	46
Change from Last Week	+2

Top ## - Percent Short to Very Short
Bottom ## - Change from Last Week



Data obtained from USDA National Agricultural Statistics Service weekly Crop Progress reports.

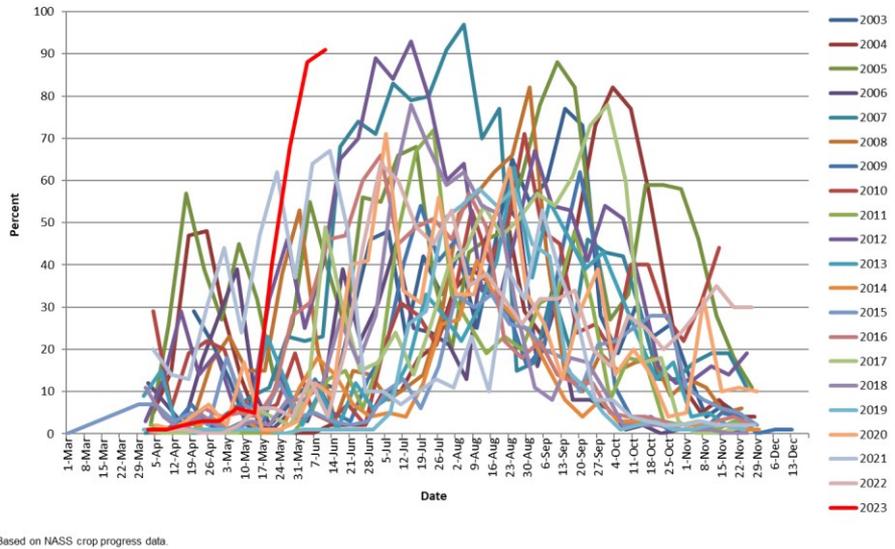
<https://agindrought.unl.edu/Other.aspx>

http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml#



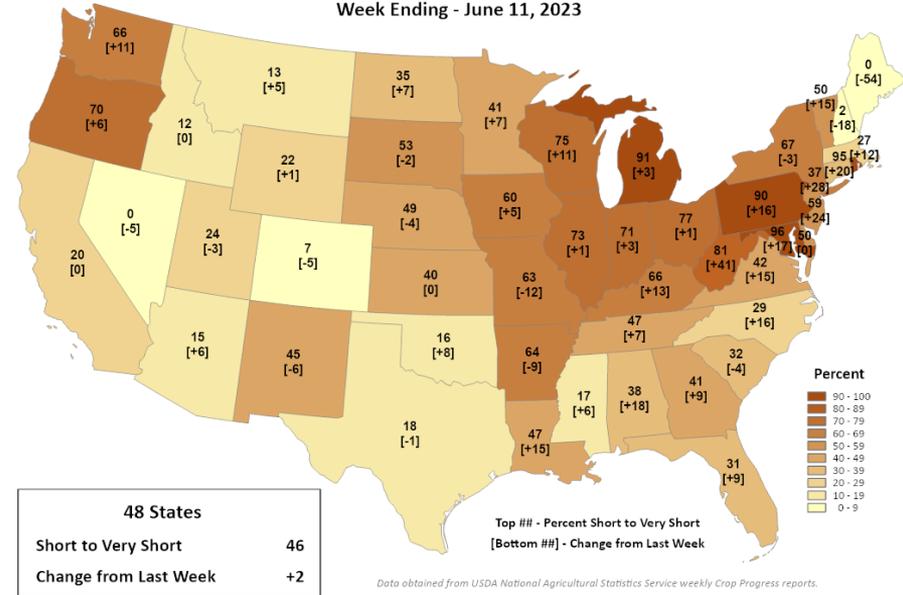
Woe is Michigan!

MI Topsoil Moisture: Percent Short-Very Short



This product was prepared by the USDA Office of the Chief Economist (OCE) World Agricultural Outlook Board (WAOB)

Topsoil Moisture Percent Short to Very Short Week Ending - June 11, 2023

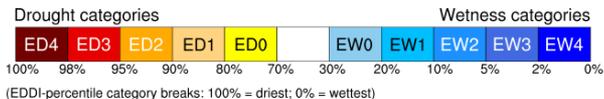
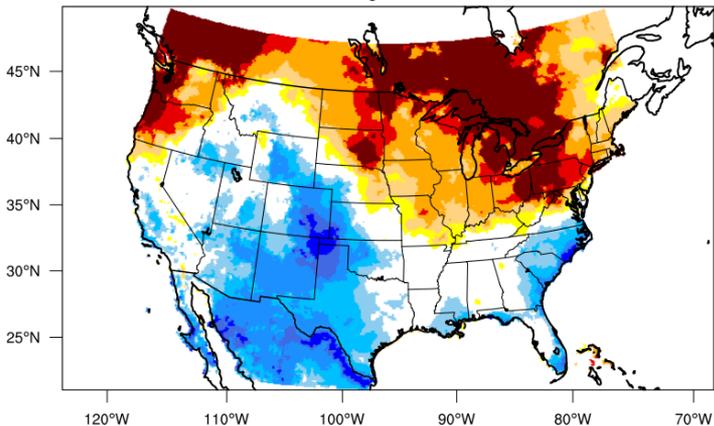




Evaporative Demand Drought Index

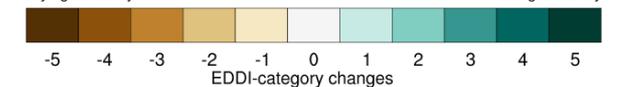
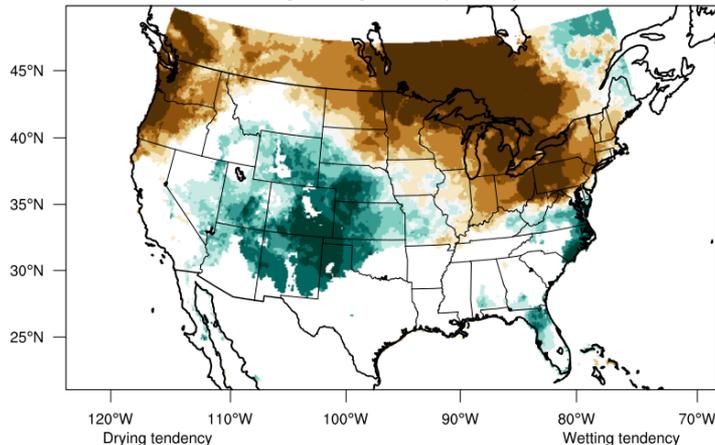
Think: “Thirst of the atmosphere” or precursor for water stress

1-month EDDI categories for June 10, 2023



Generated by NOAA/ESRL/Physical Sciences Laboratory

1-month EDDI: Changes during the 30 days ending on June 10, 2023



Only regions that start or end above the 70th percentile (i.e., ED0-ED4) are shown.

Generated by NOAA/ESRL/Physical Sciences Laboratory

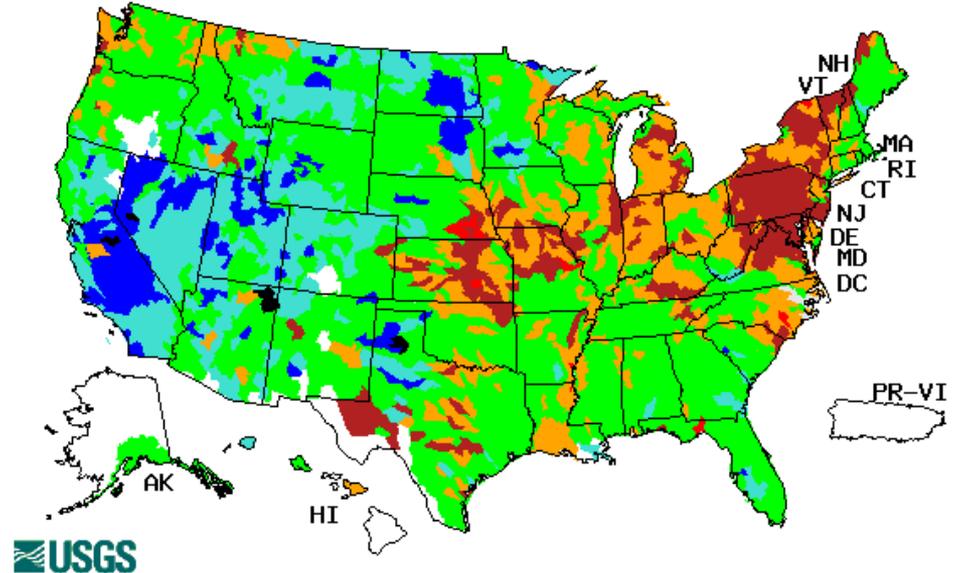
- Increasing demand across Northern Plains/Upper Midwest
- Decrease in demand across the High Plains – indicative of recent wet weather



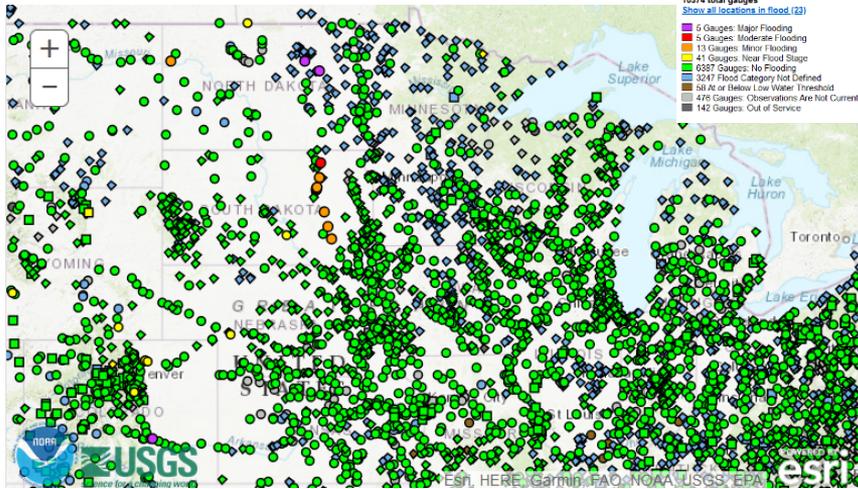
28-Day Stream Flows

- Above to much above normal levels across Dakotas, southern Minnesota, back into portions of Montana, Wyoming, Nebraska, and Colorado
- Below to much below normal levels from Kansas and eastern Nebraska eastward through Ohio and Michigan
- Showing effects of multiple years of drought as well
- Note the limited impact on streamflows in WI despite very dry conditions – while impacts to major streams in IL and IN (e.g., Kankakee and Fox impacting some major population areas)

Wednesday, June 14, 2023

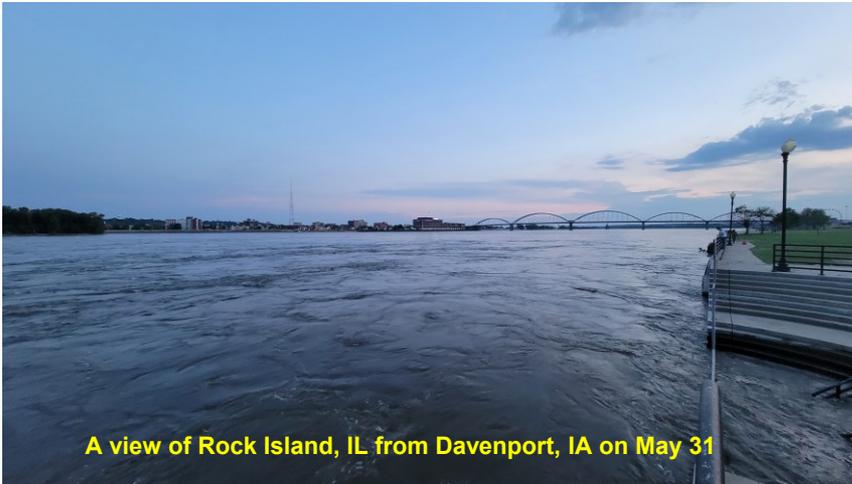


Explanation - Percentile classes						
Low	<10	10-24	25-75	76-90	>90	High
	Much below normal	Below normal	Normal	Above normal	Much above normal	



Major River Basins

- Missouri:
 - Warm temperatures in the mountainous region of the upper Missouri River Basin
 - May runoff for the Basin above Sioux City, Iowa was 4.9 million acre-feet, 144% of average
 - Inflows to the mainstem Missouri remain robust
 - James in flood (heavy snow during winter) but typical
- Mississippi:
 - Recall – low flow last fall followed by near record flow
 - After record/near record snowpack in MN/WI – storage areas were full and were not experiencing major water impacts across the basin
 - Now low flow is becoming a concern again (energy and water supplies) with ongoing/multi-year drought conditions – being monitored closely
 - Lower Mississippi: Cairo projected to reach 10ft by the first week of July
- Ohio River:
 - Dryness has been more the issue after a normal spring flood season
 - Some relief in Ohio the last several days, less so in Indiana and Illinois.
 - Below normal flows will likely persist into July on the Ohio River.



A view of Rock Island, IL from Davenport, IA on May 31



Snow

Blizzard on Pikes Peak on June 12: Video taken by Stephen “Pete” Peterson – peak ranger



- Mountain snows pretty much melted out
- Some flash and river flooding (e.g., Arkansas River hit major flood stage at Avondale despite moderate snowpack)
- Some minor flooding along the South Platte River at Fort Morgan and Balzac in Colorado



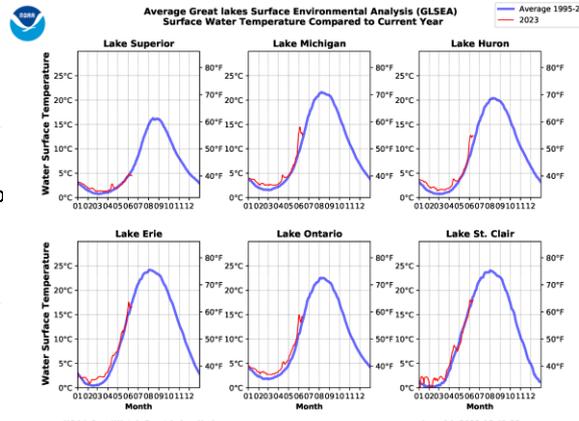
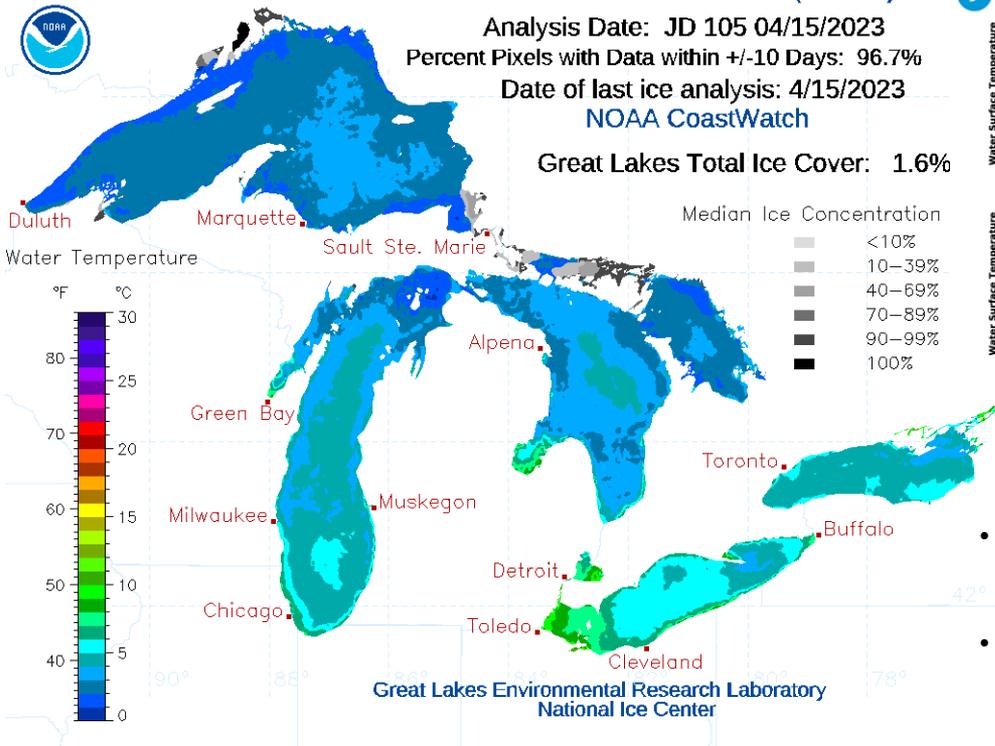
Snowy mountain peaks along I-70 just west of the Continental Divide – Photo Courtesy of Becky Bollinger - Asst. Colorado State Climatologist



GREAT LAKES SURFACE ENVIRONMENTAL ANALYSIS (GLSEA)

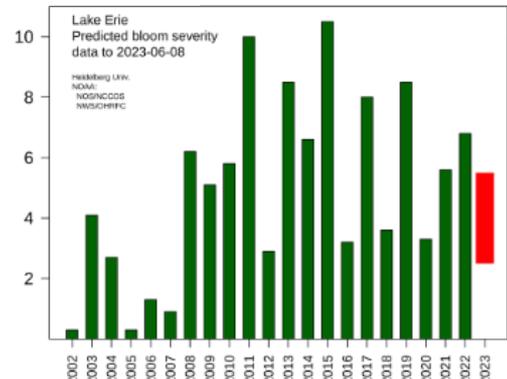
Analysis Date: JD 105 04/15/2023
Percent Pixels with Data within +/-10 Days: 96.7%
Date of last ice analysis: 4/15/2023
NOAA CoastWatch

Great Lakes Total Ice Cover: 1.6%



Great Lakes

- Small to Moderate Harmful Algal Bloom
- Precipitation dependent for the remainder of spring/early summer



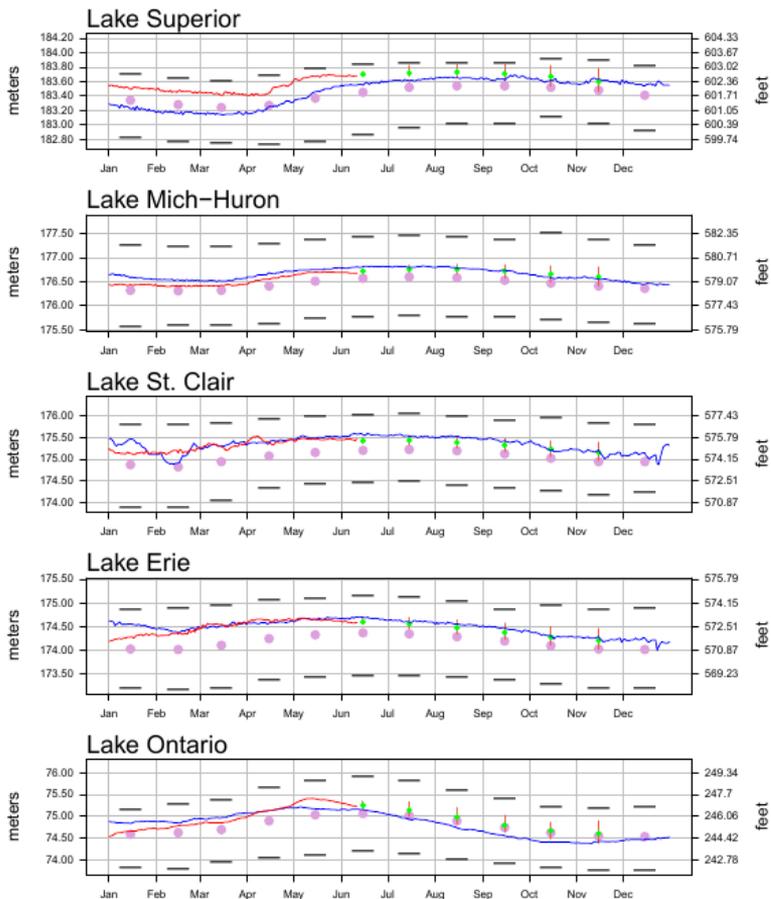
https://coastwatch.glerl.noaa.gov/glsea/cur/glsea_cur.png

A. Hounshell, R. Stumpf, J. Noel (NOAA), & L. Johnson (Heidelberg University)
<https://coastalscience.noaa.gov/science-areas/habs/hab-forecasts/lake-erie/>



Daily Great Lakes Water Levels

— 2023
— 2022
♦ Coordinated Forecast
● LTA Monthly Mean
— Record High/Low Monthly Mean



Great Lakes Water Levels

- Water levels on the lakes have peaked and plateaued
- Some levels are falling
- All the lakes are above their long-term average May levels.

<https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Information-2/Water-Level-Data/>

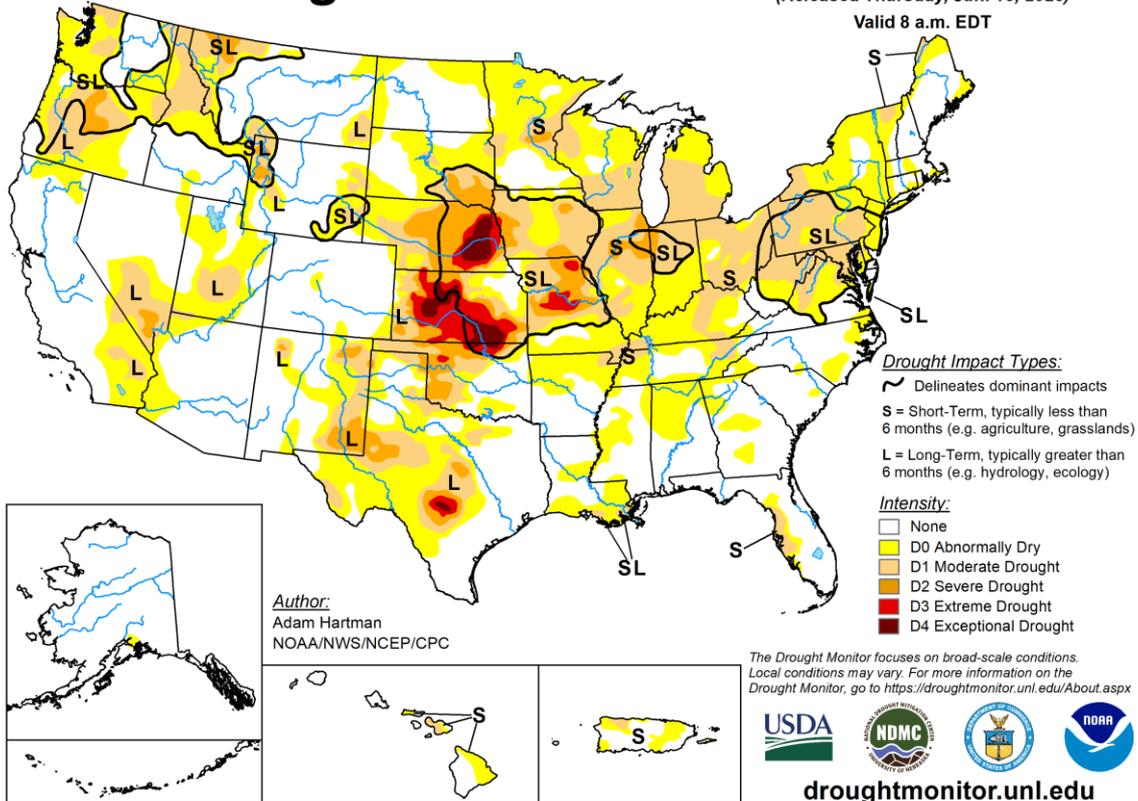


U.S. Drought Monitor

June 13, 2023

(Released Thursday, Jun. 15, 2023)

Valid 8 a.m. EDT



droughtmonitor.unl.edu



U.S. Drought Monitor NWS Central

June 13, 2023

(Released Thursday, Jun. 15, 2023)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	33.91	66.09	37.09	13.08	4.99	1.71
Last Week <i>06-06-2023</i>	31.90	68.10	30.66	11.86	5.16	1.91
3 Months Ago <i>03-14-2023</i>	47.01	52.99	34.76	15.28	6.76	2.97
Start of Calendar Year <i>01-03-2023</i>	25.76	74.24	48.98	24.27	9.90	3.48
Start of Water Year <i>09-27-2022</i>	27.00	73.00	47.70	23.08	8.80	2.73
One Year Ago <i>06-14-2022</i>	54.54	45.46	30.16	13.93	5.02	0.61

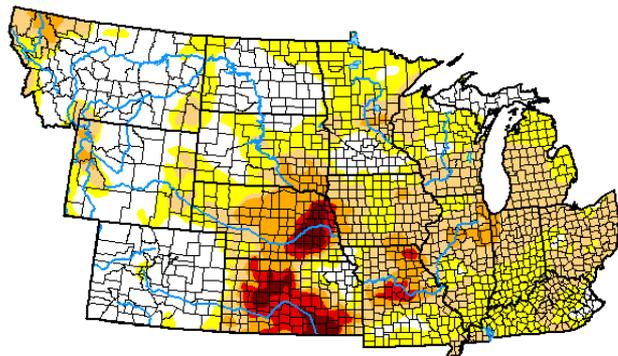
Intensity:

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

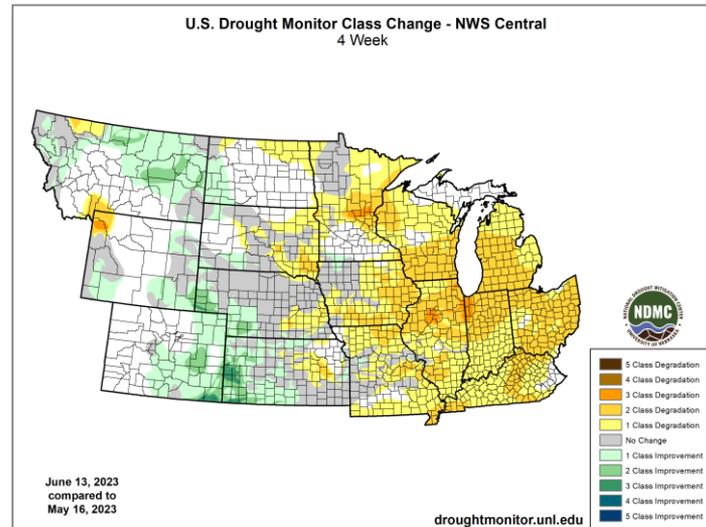
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Adam Hartman
NOAA/NWS/NCEP/CPC



U.S. Drought Monitor Class Change - NWS Central
4 Week



AGRICULTURAL IMPACTS

Photo Courtesy of Josh Michel – Iowa State University Extension: Effects of Drought on Crop Fields in Eastern Iowa

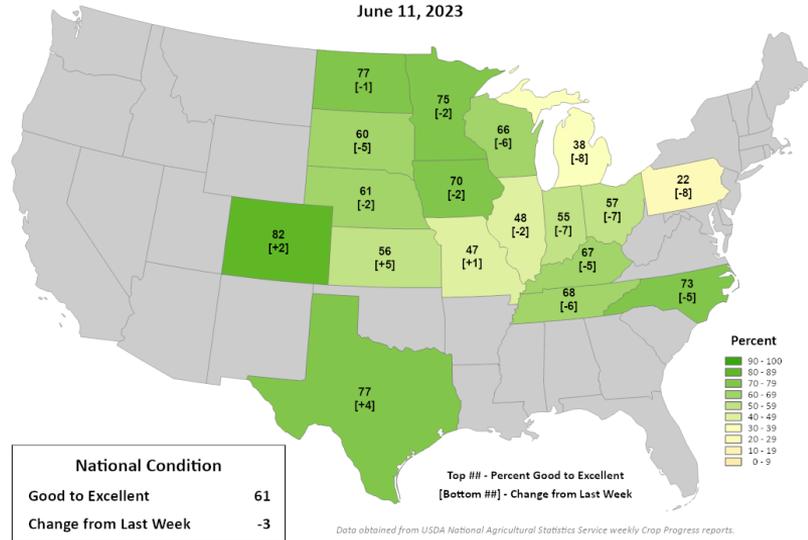


USDA NASS Crop Progress: Corn and Soy

USDA United States Department of Agriculture
This product was prepared by the USDA Office of the Chief Economist (OCE) World Agricultural Outlook Board (WAOB)

Corn Conditions

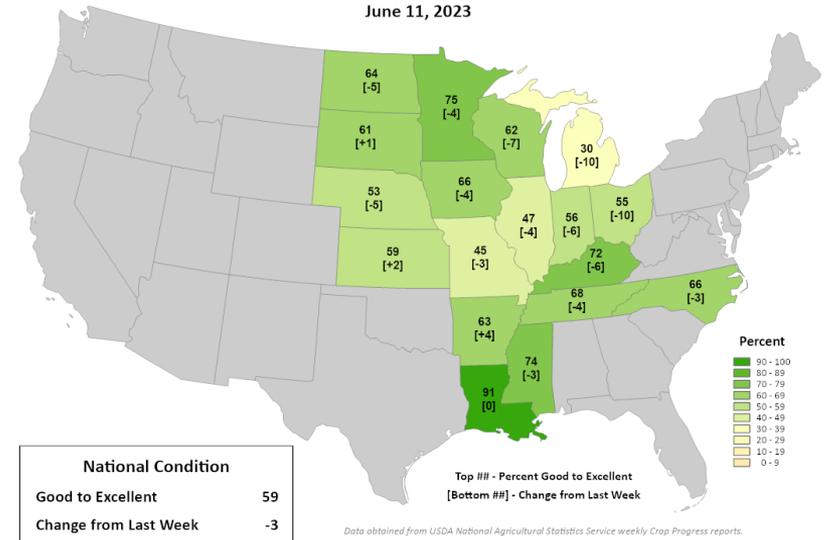
Percent Good to Excellent
June 11, 2023



USDA United States Department of Agriculture
This product was prepared by the USDA Office of the Chief Economist (OCE) World Agricultural Outlook Board (WAOB)

Soybean Conditions

Percent Good to Excellent
June 11, 2023



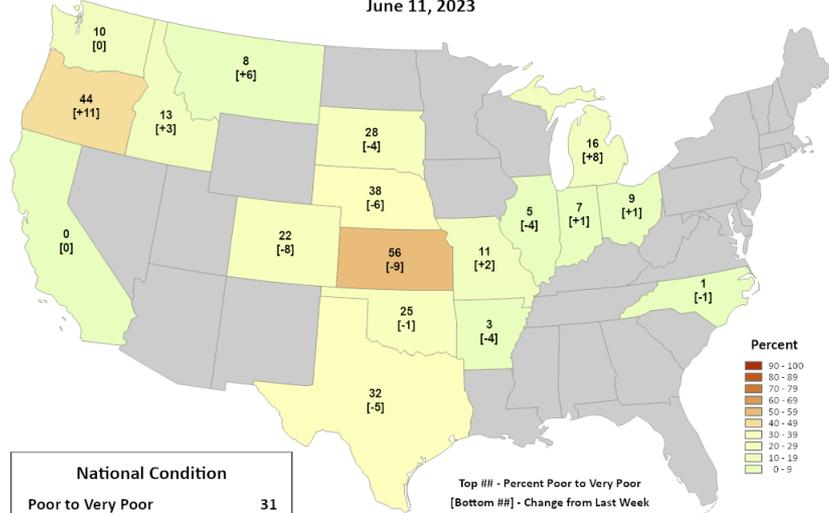


USDA NASS Crop Progress: Winter Wheat



United States Department of Agriculture
This product was prepared by the USDA Office of the Chief Economist (OCE) Winter Agricultural Outlook Board (WAOB)

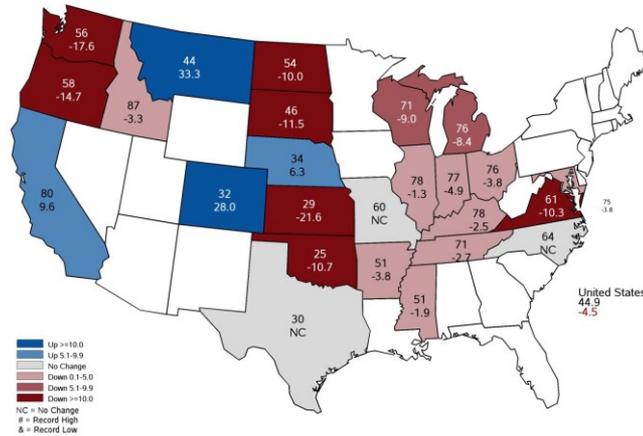
Winter Wheat Conditions Percent Poor to Very Poor June 11, 2023



National Condition	
Poor to Very Poor	31
Change from Last Week	-3

Data obtained from USDA National Agricultural Statistics Service weekly Crop Progress reports.

Bushels and Percent Change from Previous Year



The high plains drought is so bad that Kansas is importing wheat from Europe



Kansas wheat farmers will reap the smallest harvest in more than 60 years. Persistent drought withered much of the crop.
Sylvan Grove, Kansas -- Kansas is "the wheat state," the officially adopted moniker that embraces its place as the country's

- Projected to be 4th consecutive down year in yield
- U.S. winter wheat abandonment is still pegged at 32.6% (12.2 of 37.5 million acres), highest since 1917 and second highest on record.



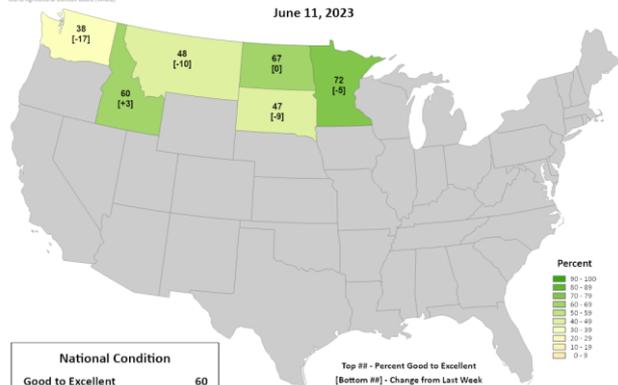
USDA NASS Crop Progress: Others



Spring Wheat Conditions

Percent Good to Excellent

June 11, 2023



National Condition	
Good to Excellent	60
Change from Last Week	-4

- “Spring wheat starting to struggle in SD – heading out though only a 12” tall...not enough grain to harvest” – Laura Edwards SD State Climatologist

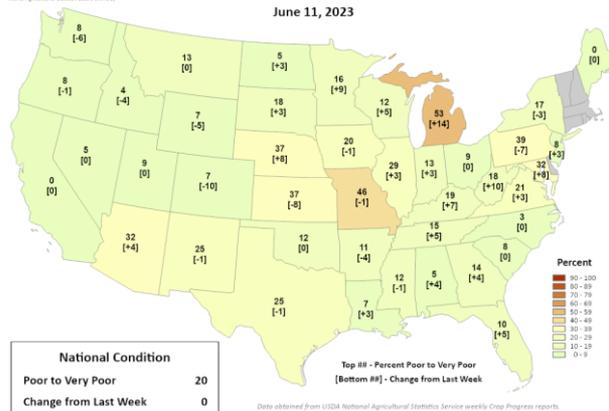
- Oats and Barley being abandoned



Pasture and Range Conditions

Percent Poor to Very Poor

June 11, 2023



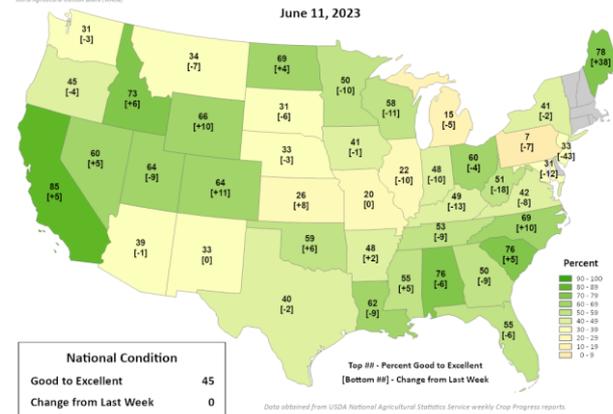
National Condition	
Poor to Very Poor	20
Change from Last Week	0



Pasture and Range Conditions

Percent Good to Excellent

June 11, 2023



National Condition	
Good to Excellent	45
Change from Last Week	0

“Amazing changes here in SE Wyoming, western Nebraska, and NE Colorado from substantial drought and really dry soils to full soil profiles and really green.” – Justin Derner USDA-ARS

Other Impacts

- High grasshopper, blister beetle, tick populations (North and South Dakota)
- Ponds, streams and watershed tributaries appeared to be low, or water flow was significantly reduced (Iowa and others)
- US tart cherry total production for 2023 is forecast down 17% over last year (Michigan)
- Limited alfalfa regrowth/hay production from lack of precipitation (Many States)
- Early agricultural irrigation (e.g., SD, IN) impacting water supplies



- Pastures struggling and low creeks and streams in Missouri (From Condition Monitoring Observer Reports (CMOR))
- Drought and some heat combining to stress other crops such as peas and strawberries in Indiana – Hans Schmitz Purdue Extension

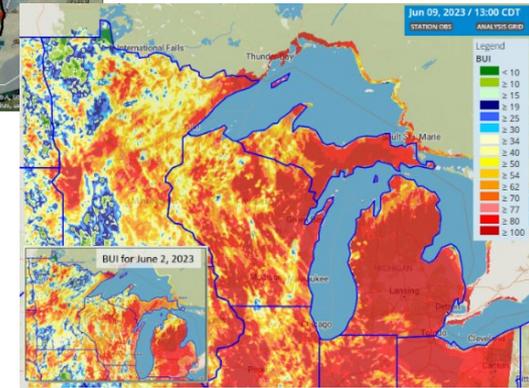
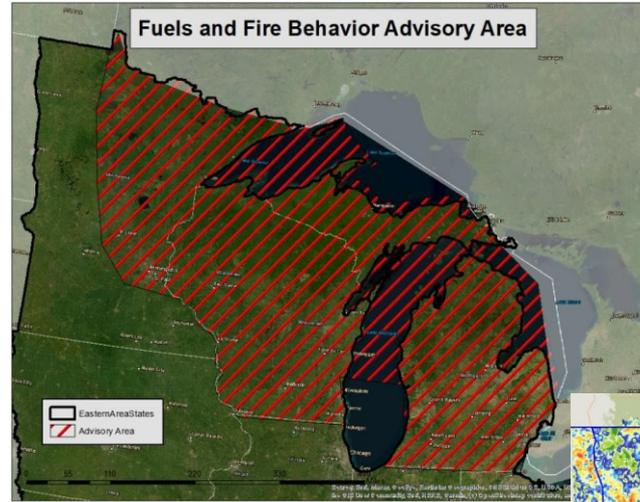


Nymph grasshoppers on corn. Courtesy: Adam Varenhorst - Assistant Professor & SDSU Extension Field Crop Entomologist

FIRE CONDITIONS



Photo Courtesy of National Park Service: Voyageurs National Park is banning all campfires within the park. Burning restrictions in place for northern St. Louis County.

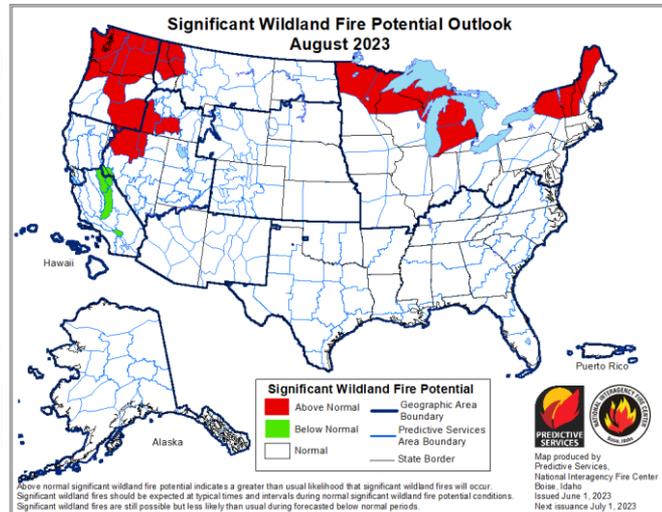
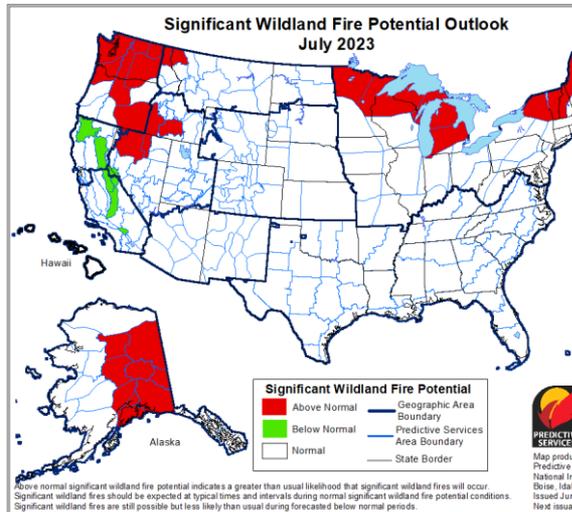
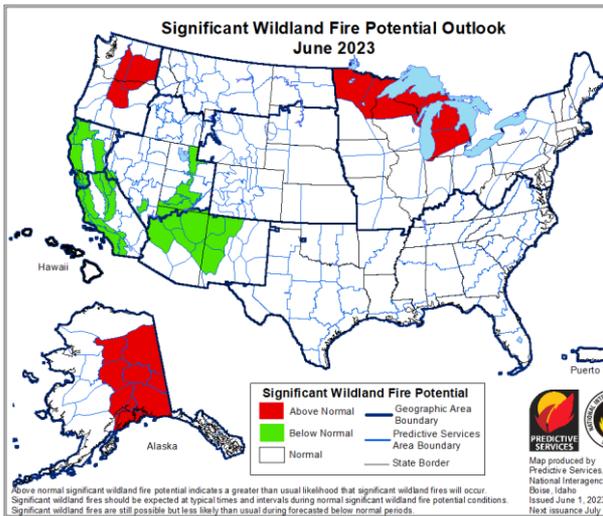


- Dickinson County wildfire (between Norway and Foster City, MI) June 7, 2023
- Build Up Index (potential heat release – long-term indicator of fire danger and fuel availability)
- Fuels and Fire Behavior Advisory Issued
- Not typically thought of as a dry area historically – getting wetter

Information from EACC for MN, WI, and MI- courtesy of Allan Hepworth (US Forest Service) and Jeff Boyne (NOAA)



Fire

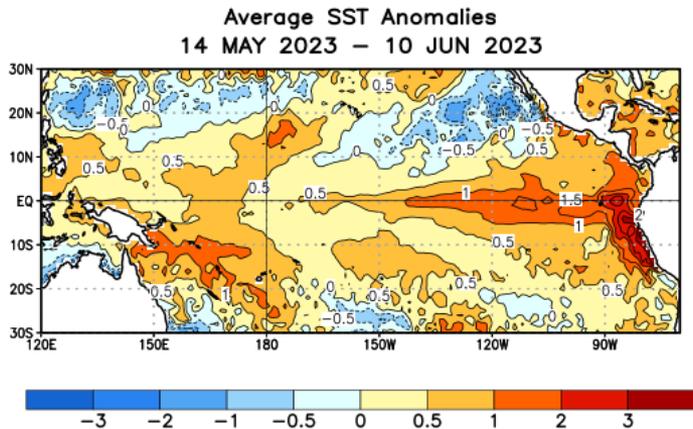


Outlooks

Overlooking a pond in NE Ohio

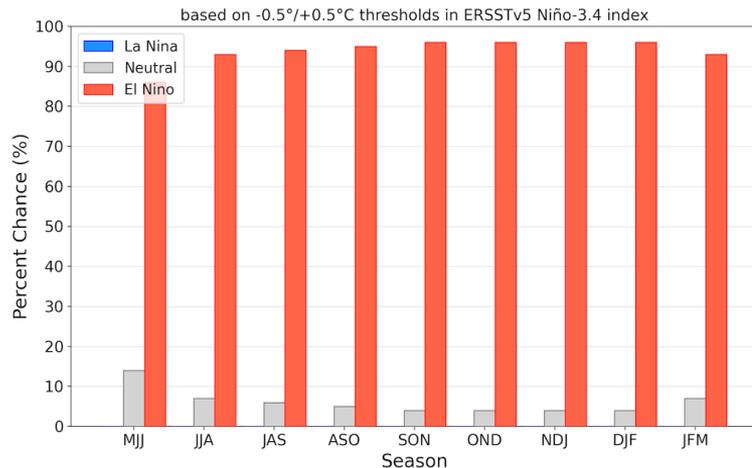


ENSO (El Niño – Southern Oscillation) Status and Projection



- El Niño conditions are observed
- Equatorial sea surface temperatures are above average across the east-central and eastern Pacific Ocean

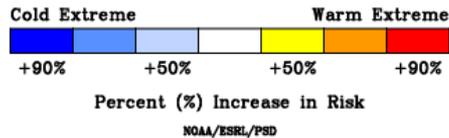
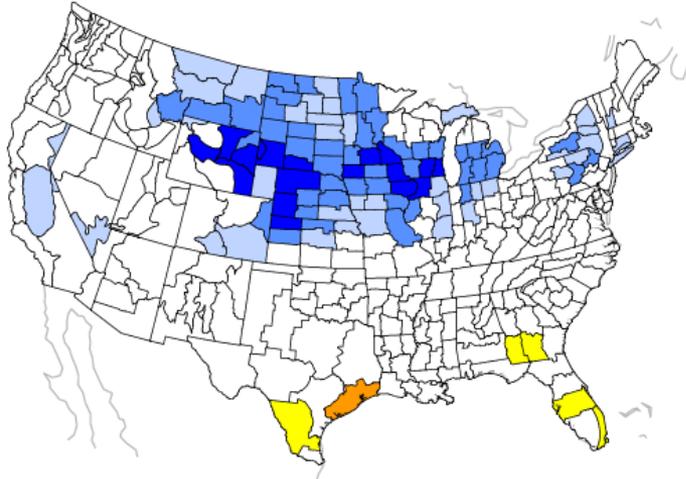
Official NOAA CPC ENSO Probabilities (issued June 2023)



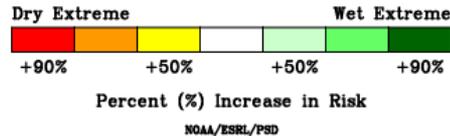
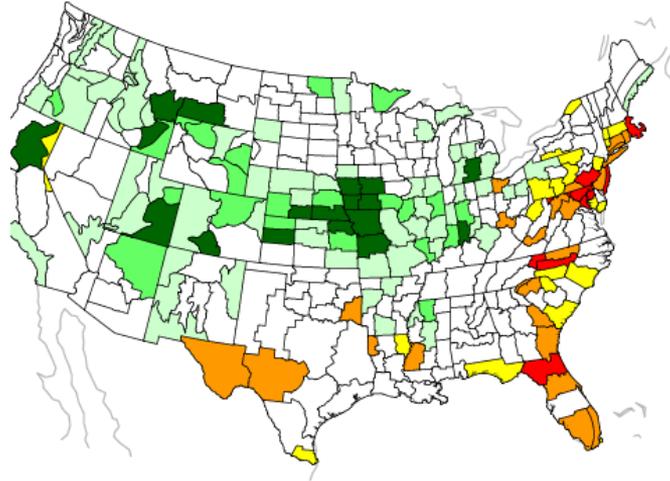
- Consistent with weak El Niño conditions.
- El Niño conditions are expected to gradually strengthen through Northern Hemisphere summer and persist into winter 2023-24
- Greater than 50% chance of reaching major/strong event status

Risk of ENSO-Related Seasonal Climate Extremes

JAS Temperature During El Nino
Increased Risk of Warm or Cold Extremes



JAS Precipitation During El Nino
Increased Risk of Wet or Dry Extremes



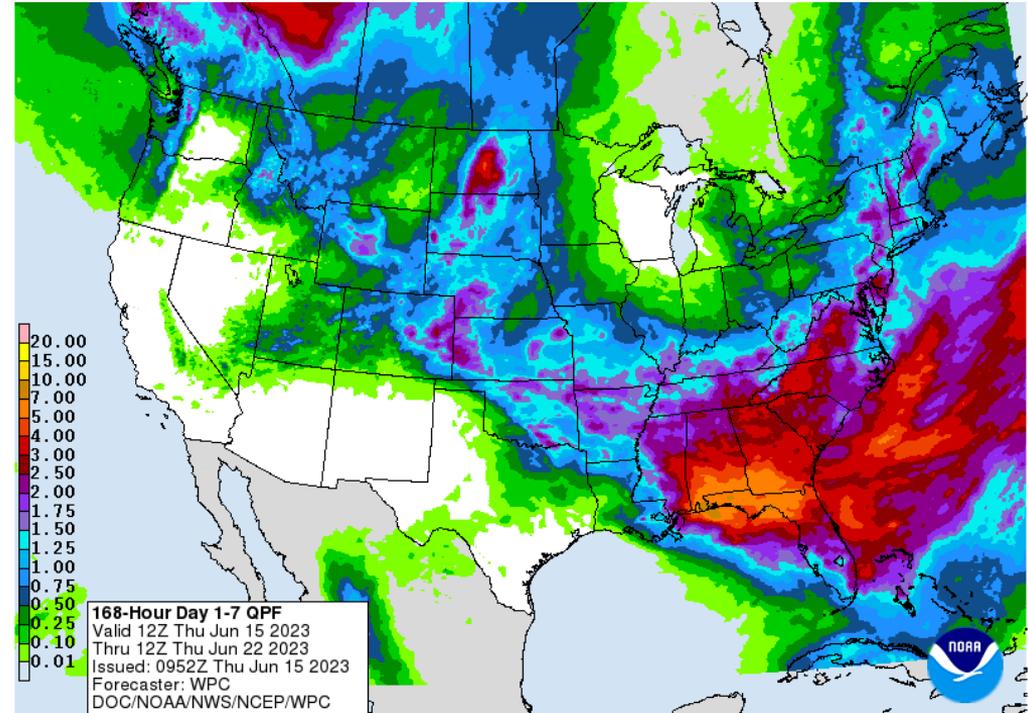
- Important to note plots these are composites of years in which EN has been present in JAS.
- These are not forecasts but rather an average of past behavior and the percent increase in risk.
- Overall, the general behavior across much of the region is cooler and not as dry as the La Niña phase.



7-Day Quantitative Precipitation Forecast

Valid Thu June 15 – Thu Jun 22

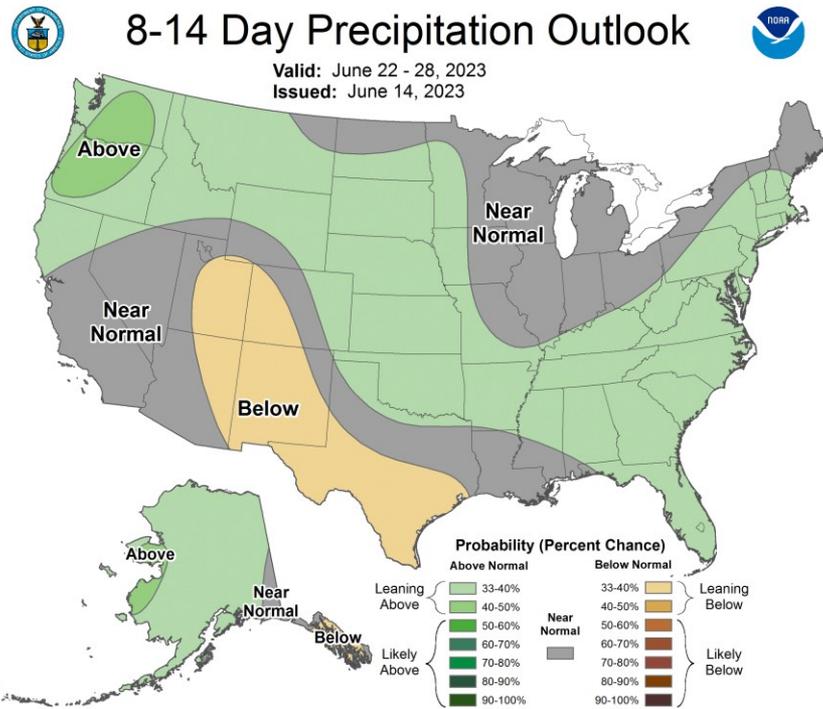
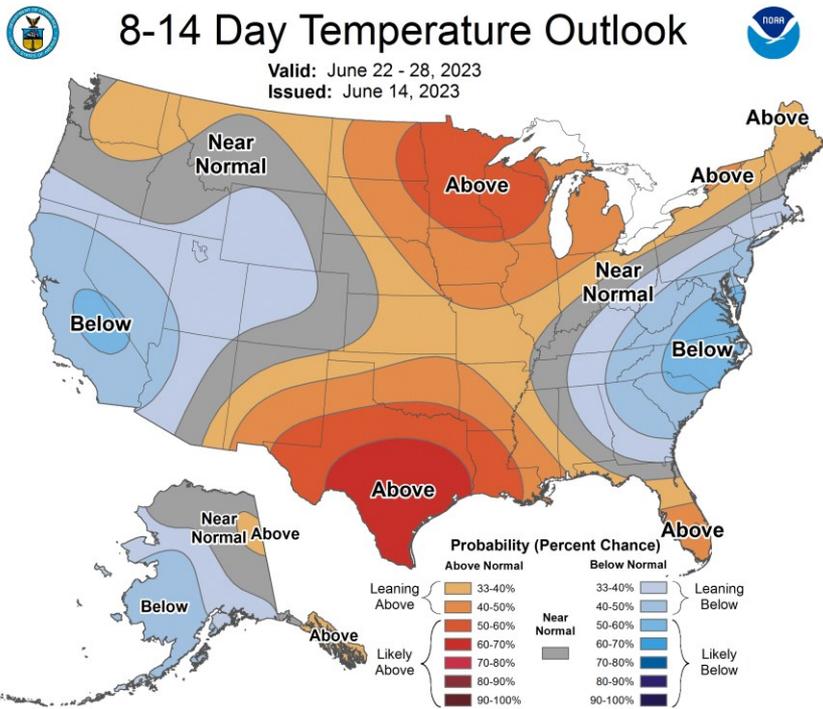
- Busy June Pattern
- Series of disturbances affecting the Plains and southern tier of North Central Region
- More rain potential and perhaps drought improvement in the High Plains and parts of the Dakotas as well
- Not much for eastern Great Lakes
- Influx of wildfire smoke throughout northern Plains and Midwest





8-14 Day Temperature/Precipitation Probabilities

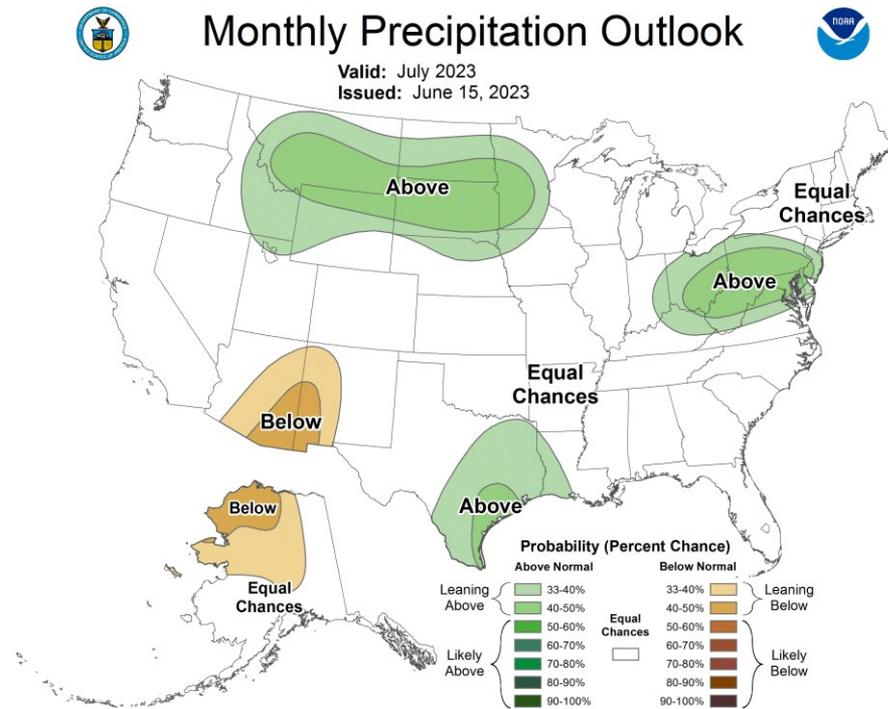
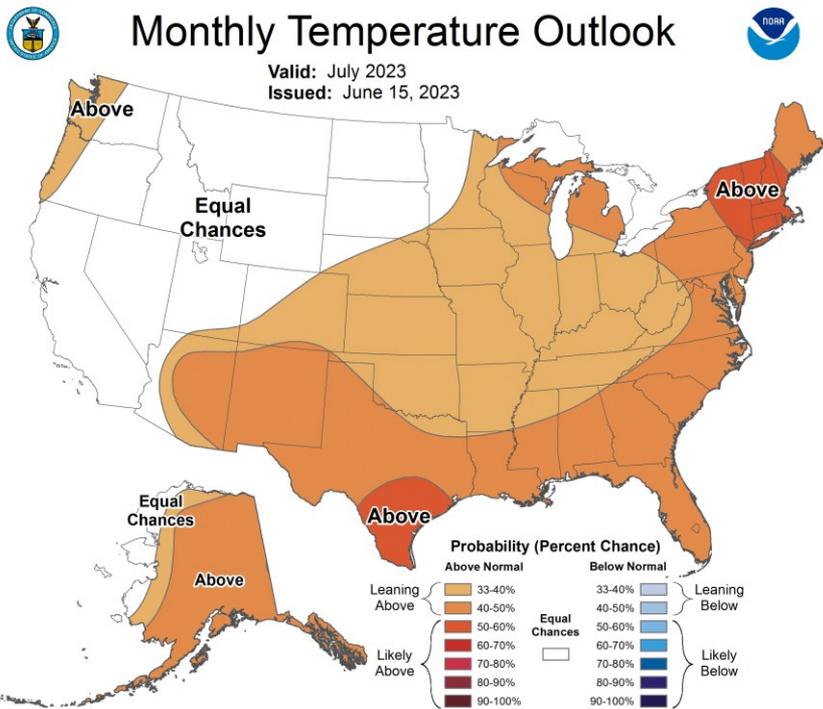
June 22 - 28





July Temperature/Precipitation Probabilities

***Perhaps lacking a little consistency or strong confidence**





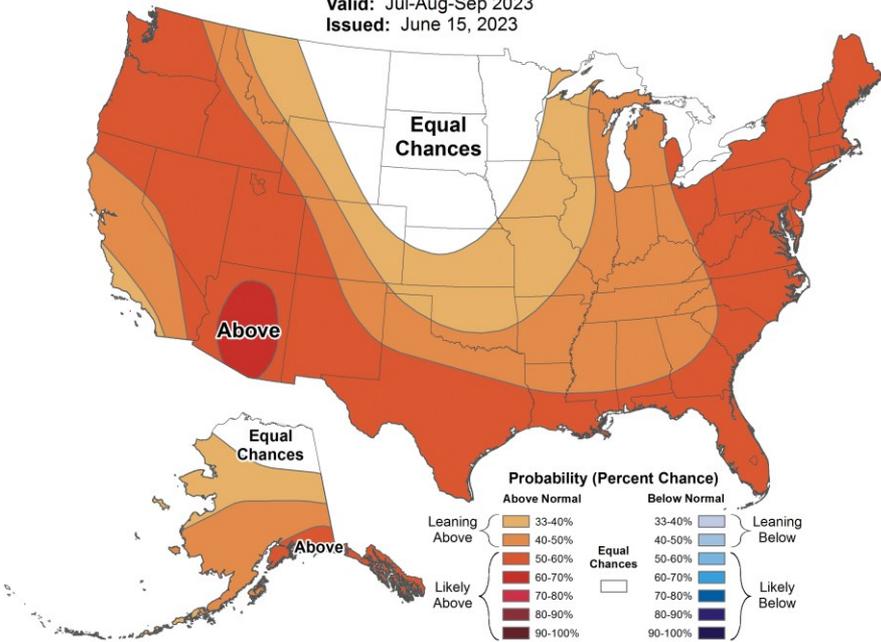
July - September Temperature/Precipitation Probabilities



Seasonal Temperature Outlook



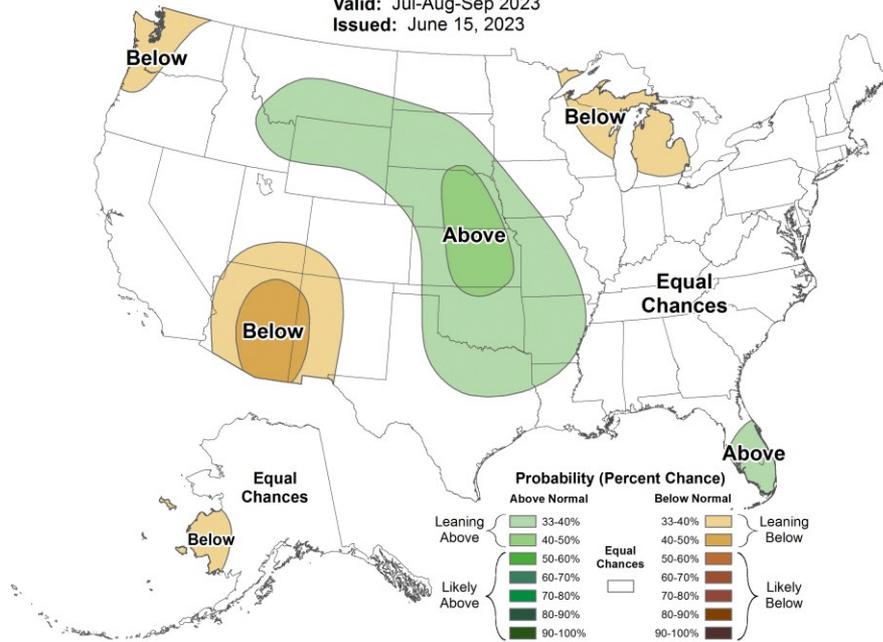
Valid: Jul-Aug-Sep 2023
Issued: June 15, 2023



Seasonal Precipitation Outlook



Valid: Jul-Aug-Sep 2023
Issued: June 15, 2023





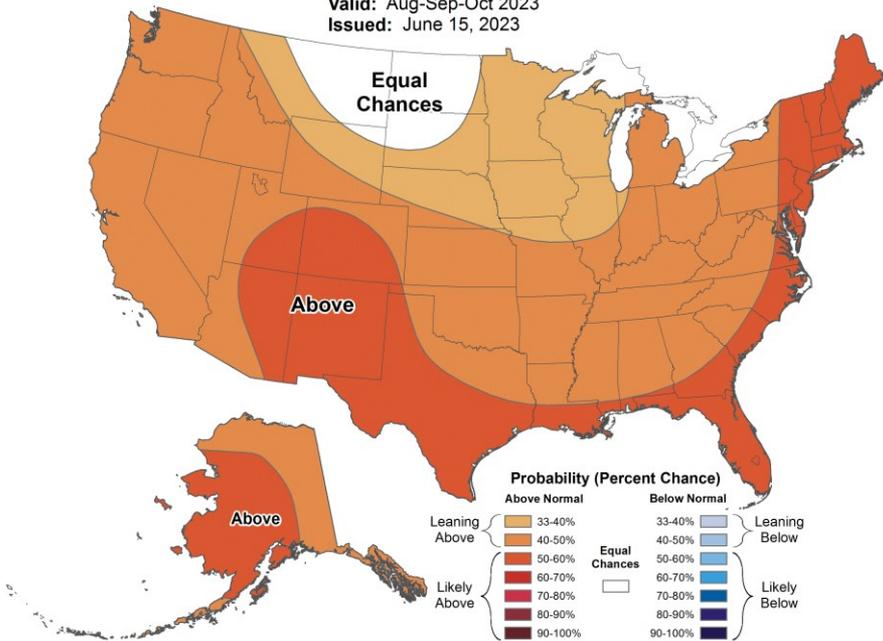
August – October Temperature/Precipitation Probabilities



Seasonal Temperature Outlook



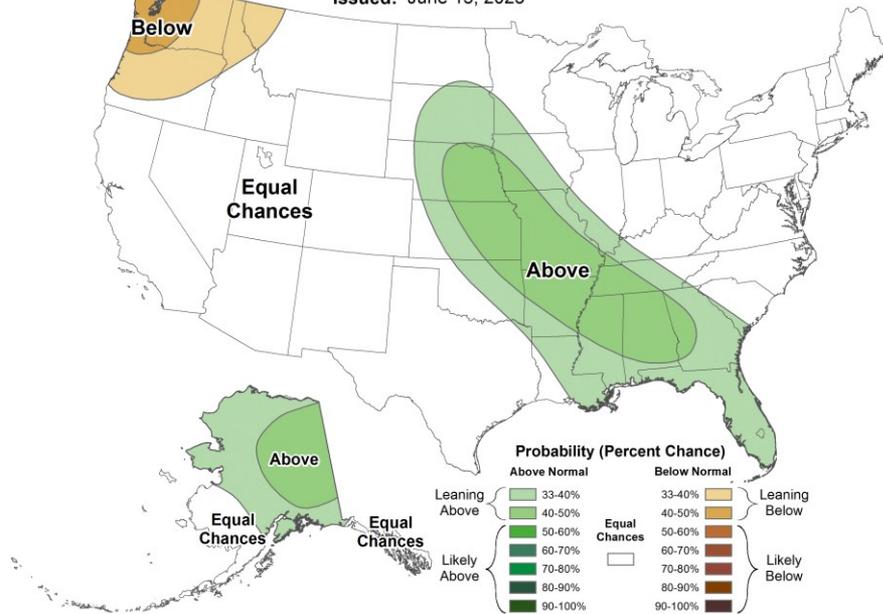
Valid: Aug-Sep-Oct 2023
Issued: June 15, 2023



Seasonal Precipitation Outlook



Valid: Aug-Sep-Oct 2023
Issued: June 15, 2023



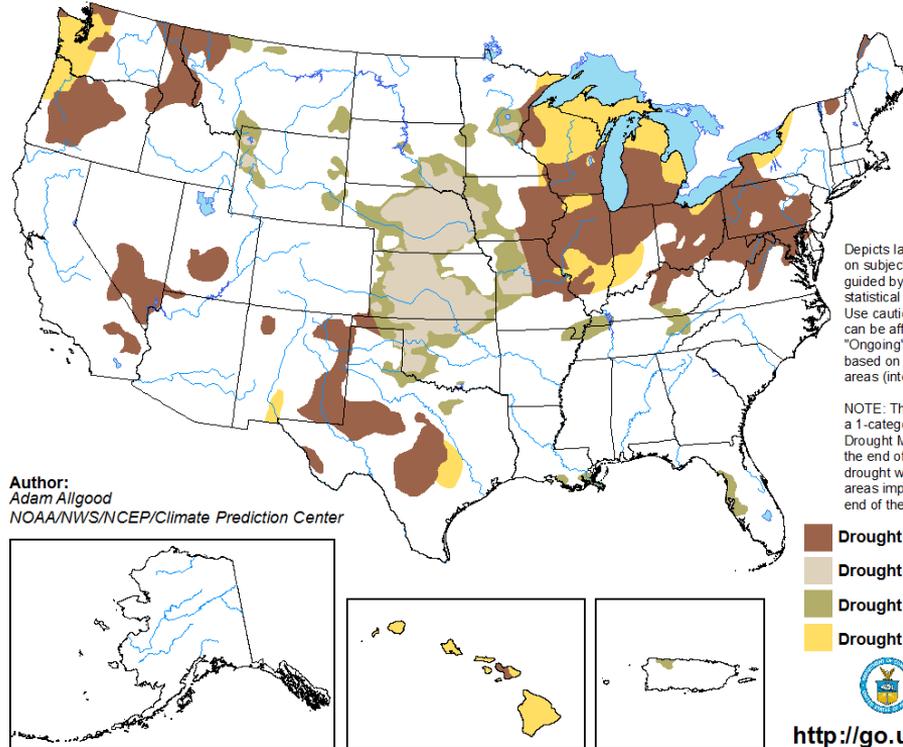


Drought Outlook

- Drought improvement
Central Plains into IA, MN,
MO
- Drought development or
persists across Great Lakes
and Eastern Corn Belt

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for June 15 - September 30, 2023
Released June 15



Author:
Adam Allgood
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely



<http://go.usa.gov/3eZ73>



Summary of Current Conditions

- May temperatures were very warm across the northern tier of states, above average for most of the region, and a bit cool in the east
- Very dry conditions for most of the NC region (WI, MI especially); Wetter than normal conditions across the western states (ND, NE, CO, MT)
- Soil Moisture and Rivers/Streams Impacted by on-going dryness across Central Plains toward Ohio Valley – Lower Mississippi and Ohio River Basin being watched closely
- Crops are stressed but yield impacts this time of year are generally smaller – close to causing problems; Winter wheat hit particularly hard in Kansas with too little rainfall too late
- Expanding drought and fire danger for parts of the NC region (e.g., WI, MI, and SD)



Outlook Summary

- **Weak El Niño conditions present and likely to strengthen into NH Winter**
- **July Outlook: Temperature probabilities leaning toward warmer than average across all but the far NW portion of the North Central Region; Precipitation leaning above average for Ohio and from Montana/Wyoming east through the Dakotas into Minnesota**
- **Rest of Summer reflects temperatures leaning toward warmer than average across most of the region (EC across the north); Precipitation leaning above average for central Plains with some drought improvement**



Additional Information - Partners

Today and Past Recorded Presentations

<https://mrcc.purdue.edu/multimedia/webinars.jsp>

<https://hprcc.unl.edu/webinars.php>

NOAA's National Climatic Data Center: www.ncdc.noaa.gov

Monthly climate reports (U.S. & Global): www.ncdc.noaa.gov/sotc/

NOAA's Climate Prediction Center: www.cpc.ncep.noaa.gov

Climate Portal: www.climate.gov

U.S. Drought Portal: www.drought.gov

National Drought Mitigation Center: <http://drought.unl.edu/>

USDA Climate Hubs <https://www.climatehubs.usda.gov/>

State climatologists: <http://www.stateclimate.org>

Regional climate centers: <http://mrcc.purdue.edu> and <http://www.hprcc.unl.edu>



Thank you and Questions?

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