

# Central Region Climate & Drought Outlook

March 16, 2023

Zachary Hoylman

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Research Asst. Professor (U of MT)



**Central Region Climate & Drought Outlook**  
Zachary Hoylman, Montana Climate Office  
University of Montana  
Missoula, MT - 3/16/2023

# GENERAL INFORMATION

- **Providing climate services to the Central Region**
- **Collaboration Activity Between:**
  - State Climatologists/American Association of State Climatologists
  - NOAA NCEI/NWS/OAR/NIDIS/
  - USDA Climate Hubs
  - Midwest and High Plains Regional Climate Centers
  - National Drought Mitigation Center
- **Next Regular Climate/Drought Outlook Webinar**
  - April 20, 2023 - 1pm CT/12pm MT, Dennis Today
- **Access to Future Climate Webinars and Information**
  - <https://www.drought.gov/events>
- **Recordings of Past Webinars**
  - <https://mrcc.purdue.edu/multimedia/webinars.jsp>
  - <https://hprcc.unl.edu/webinars.php>



# SUMMARY AND OUTLINE

## - Recent Conditions

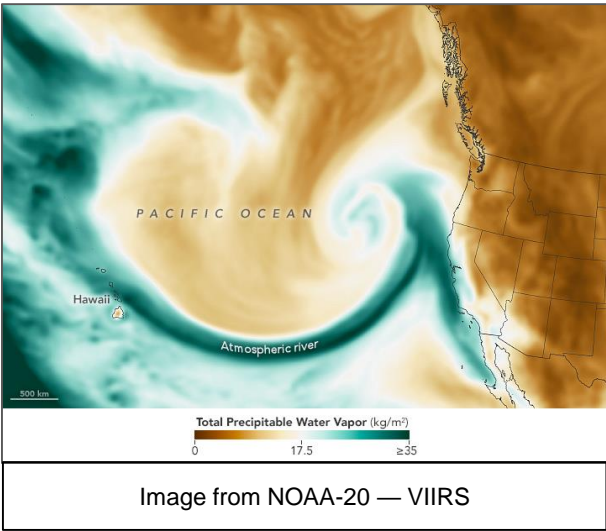
- 1-3 month & month-to-date precipitation / temperature
- Snow anomalies
- Soil Moisture
- Streamflow (current and forecast)
- Reservoirs
- Drought

## - Impacts

- Heavy, Wet Snow in WI / MI
- Extreme Weather in KY / IN

## - Outlooks

- 8 day - 3 month precipitation and temperature
- ENSO Forecast
- Drought and Fire



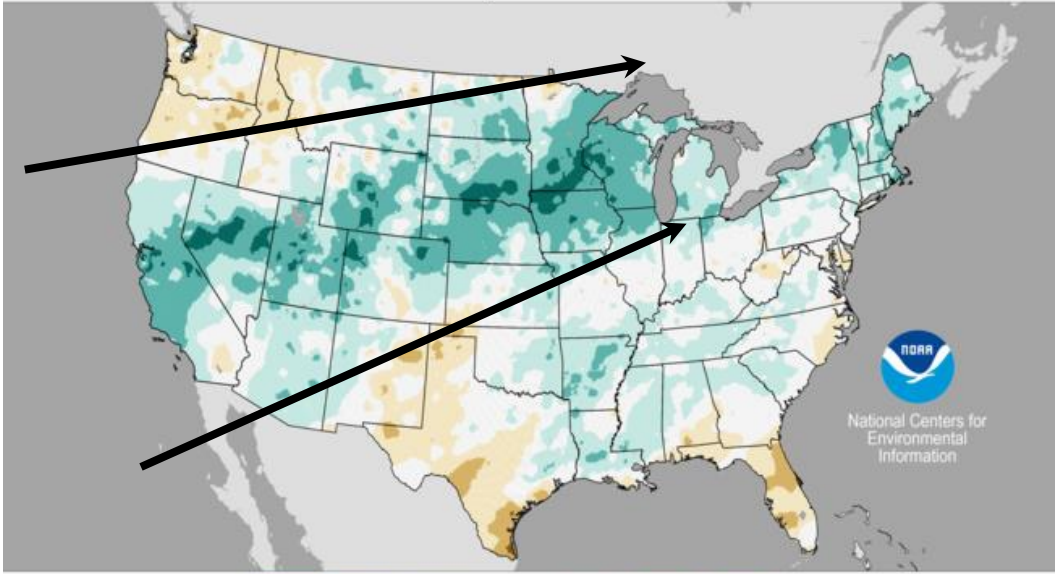
# Recent Conditions



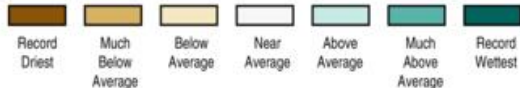


# 3 MONTH PRECIPITATION PERCENTILE

Total Precipitation Percentiles  
December 2022–February 2023  
Ranking Period: 1895–2023



A component of this seasons wet winter can be attributed to a series of “Atmospheric Rivers”



Created: Mon Mar 06 2023

Data Source: nClimGrid

<https://www.ncei.noaa.gov/access/monitoring/us-maps/>



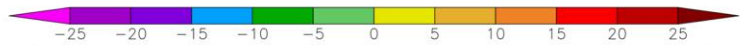
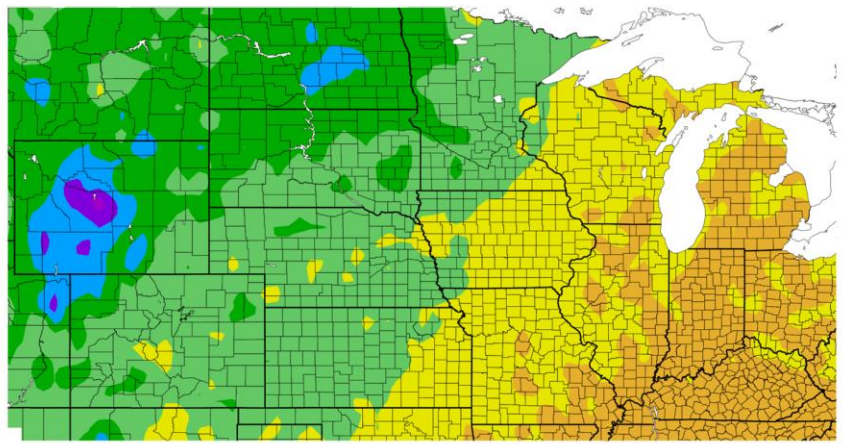
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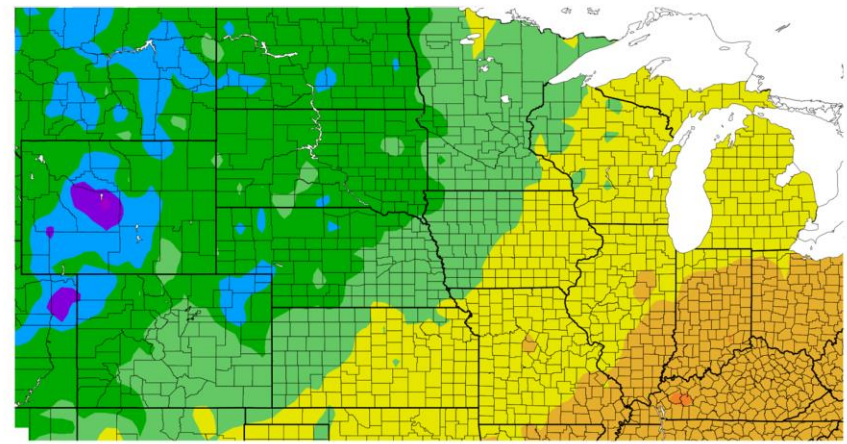
# Last 30 Days: Temperature departure from mean

Departure from Normal Average Minimum Temperature (F)  
2/14/2023 – 3/15/2023



Generated 3/16/2023 at HPRCC using provisional data. NOAA Regional Climate Centers

Departure from Normal Average Maximum Temperature (F)  
2/14/2023 – 3/15/2023



Generated 3/16/2023 at HPRCC using provisional data. NOAA Regional Climate Centers

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

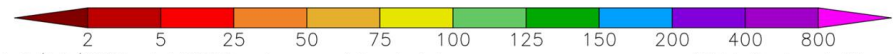
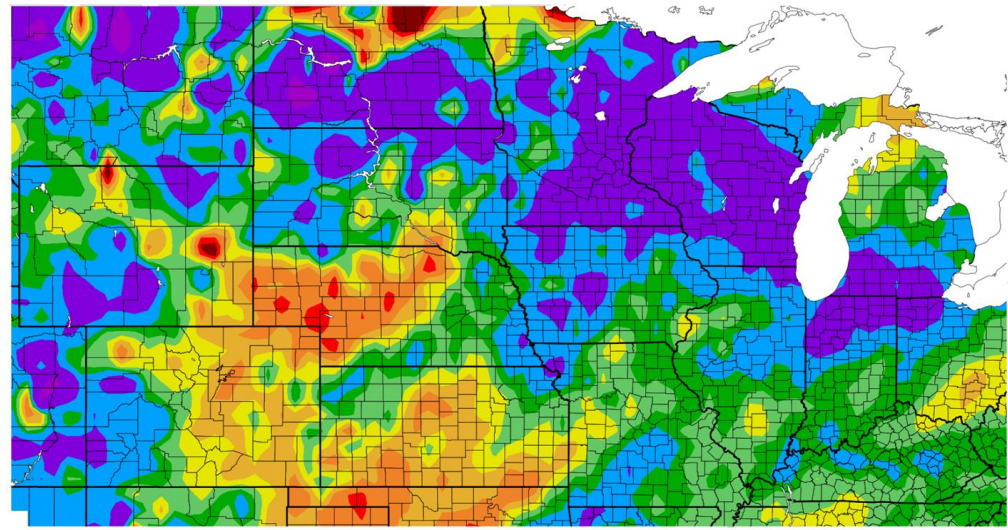


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# Last 30 Days: Precipitation Percent of Mean

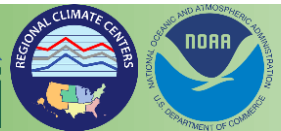
Percent of Normal Precipitation (%)  
2/14/2023 - 3/15/2023



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

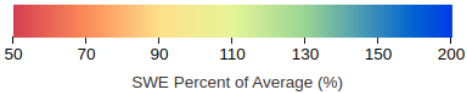
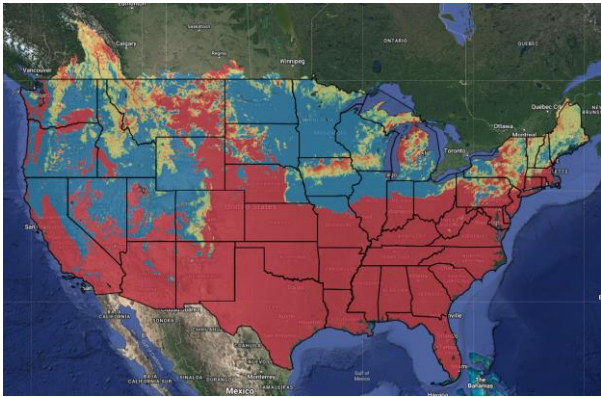
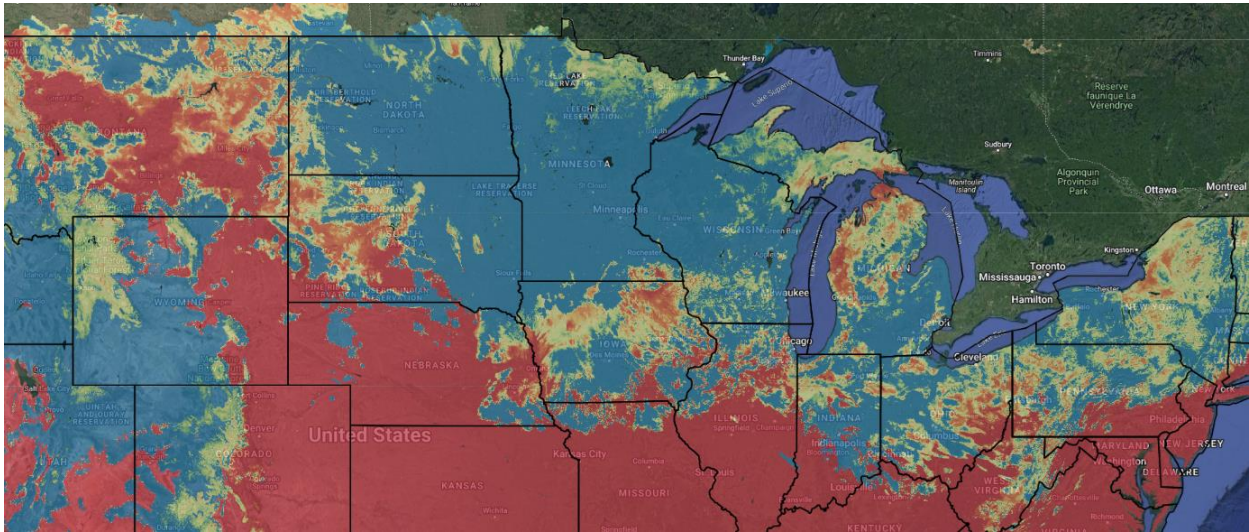
Generated 3/16/2023 at HPRCC using provisional data.

NOAA Regional Climate Centers



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# SEASONAL SNOW WATER EQUIVALENT (Percent of Normal SWE)



SWE Percent Of Average (SNODAS) : Generally Well Above Average!  
\*note period of record is 2004 - present\*

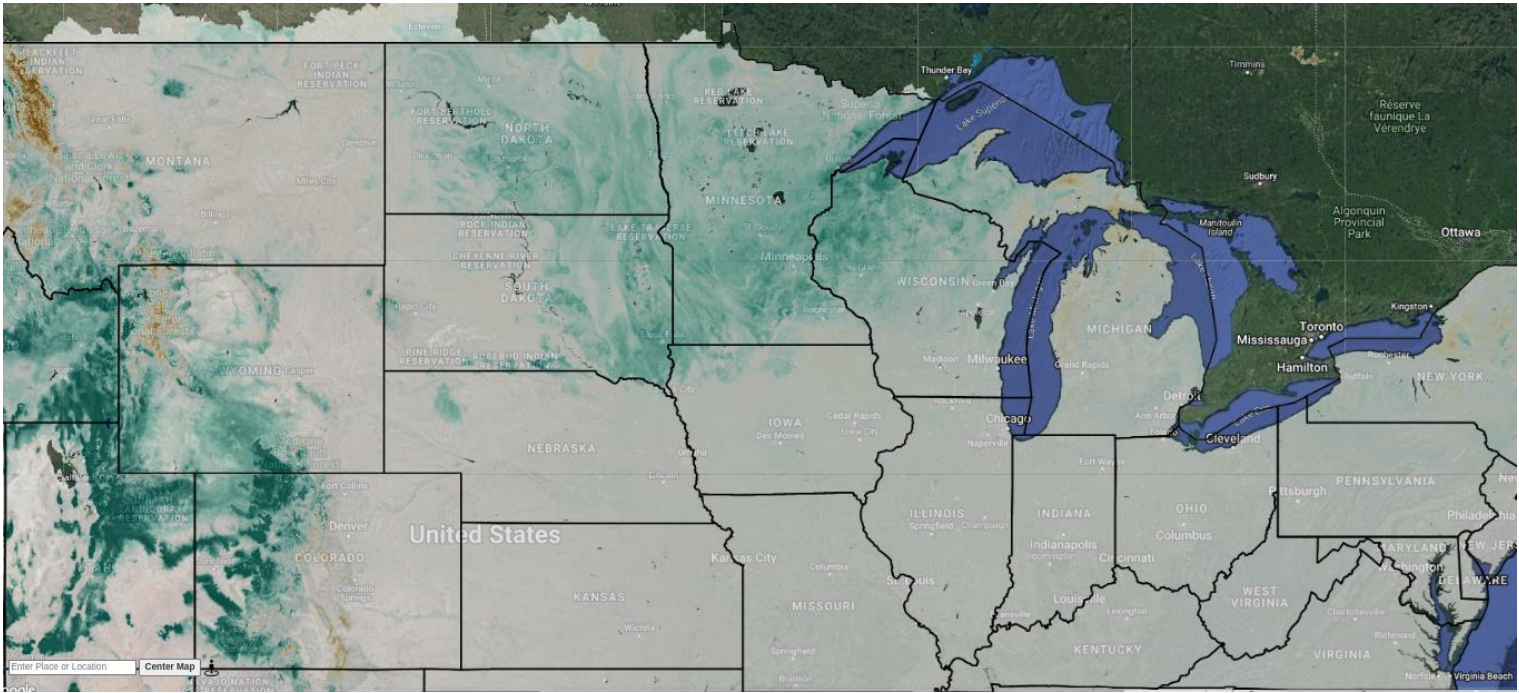
<https://app.climateengine.com/climateEngine>



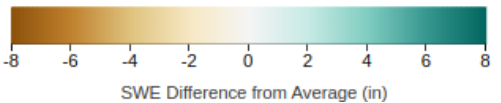
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# SEASONAL SNOW WATER EQUIVALENT (Difference from Average)



SWE Difference from Average (SNODAS) : Generally Well Above Average!  
 \*note period of record is 2004 - present\*



<https://app.climateengine.com/climateEngine>



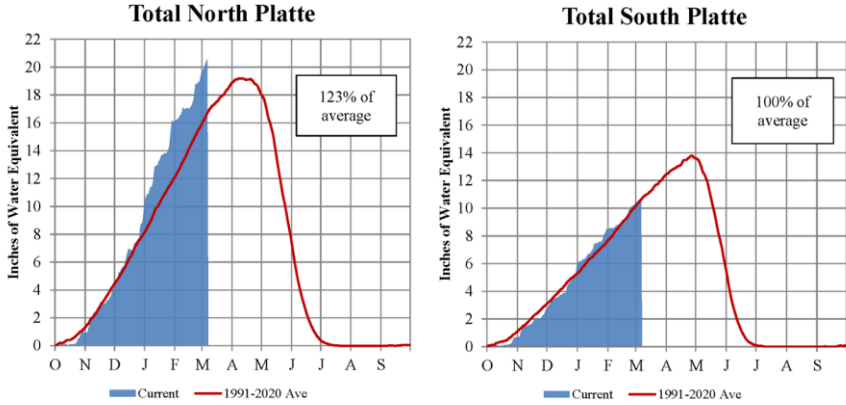
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# SEASONAL SNOW WATER EQUIVALENT (SWE Accumulation)

## PLATTE RIVER BASIN

### Platte River Basin - Mountain Snowpack Water Content Water Year 2022-2023

March 07, 2023



The North and South Platte River Basin mountain snowpacks normally peak near April 10 and the end of April, respectively. As of March 7, 2023, the mountain snowpack SWE in the "Total North Platte" reach is 20.6", 123% of the (1991-2020) average. The mountain snowpack SWE in the "Total South Platte" reach is 10.7", 100% of the (1991-2020) average.

Source: USDA, Natural Resource Conservation Service

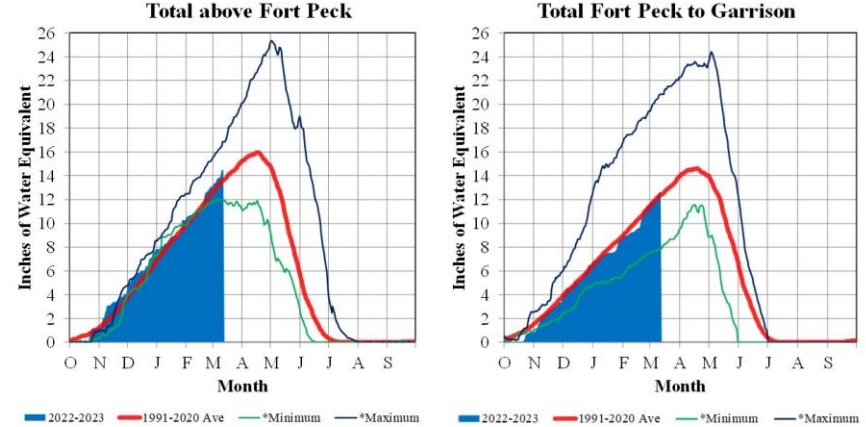
Provisional Data. Subject to Revision

<https://www.nwd-mr.usace.army.mil/rcc/>

## MISSOURI RIVER BASIN

### Missouri River Basin – Mountain Snowpack Water Content 2022-2023 with comparison plots from recent high and low years

12-Mar-2023



On March 12, 2023 the mountain Snow Water Equivalent (SWE) in the "Total above Fort Peck" reach is 14.5" and 107% of the (1991-2020) average. The mountain SWE in the "Fort Peck to Garrison" reach is 12.6" and 102% of the (1991-2020) average. The normal peak for both reaches occurs near April 17.

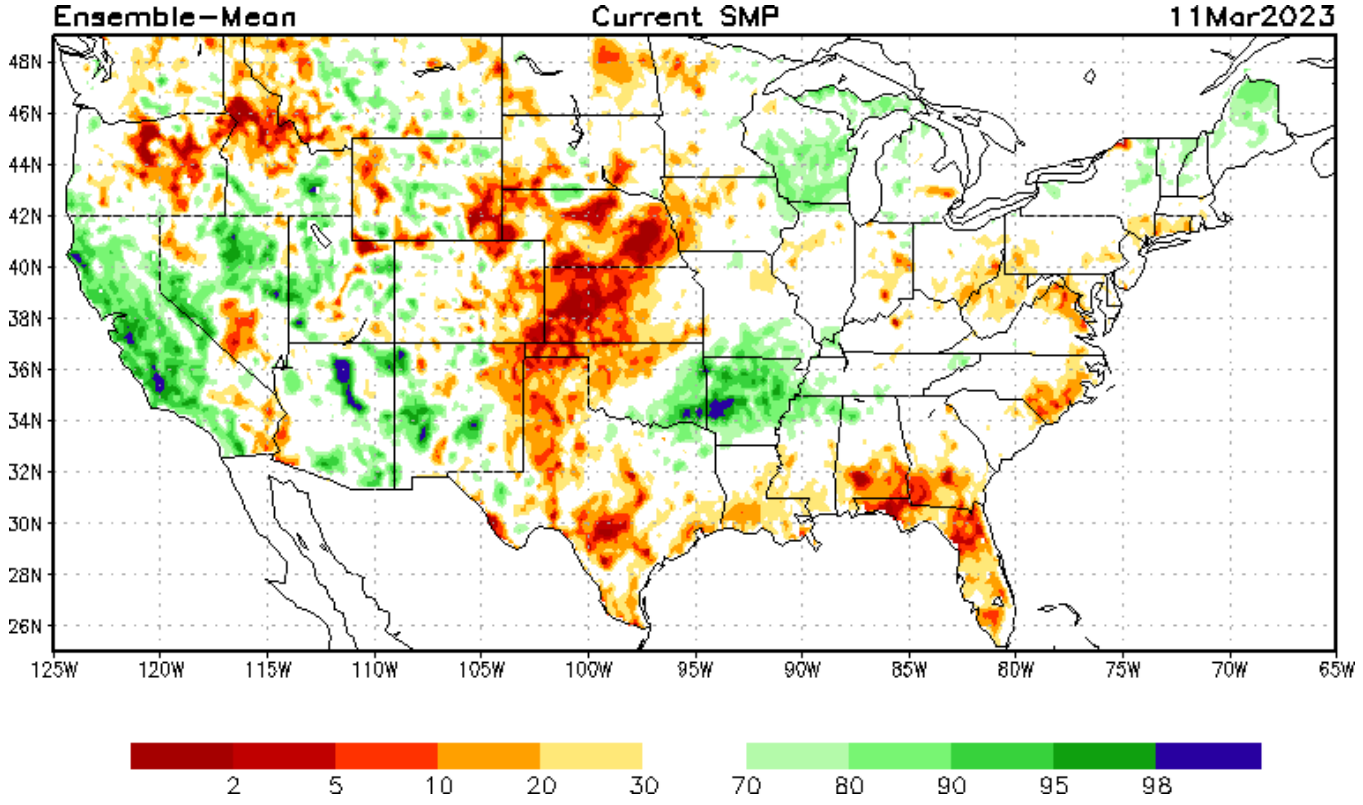
\*Minimum peak SWE between 1991-2020 occurred in 2015 above Fort Peck, and in 2001 between Fort Peck and Garrison. Maximum peak SWE between 1991-2020 occurred in 2011 above Fort Peck, and in 1997 between Fort Peck and Garrison.

Provisional data. Subject to revision.



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# SOIL MOISTURE PERCENTILES



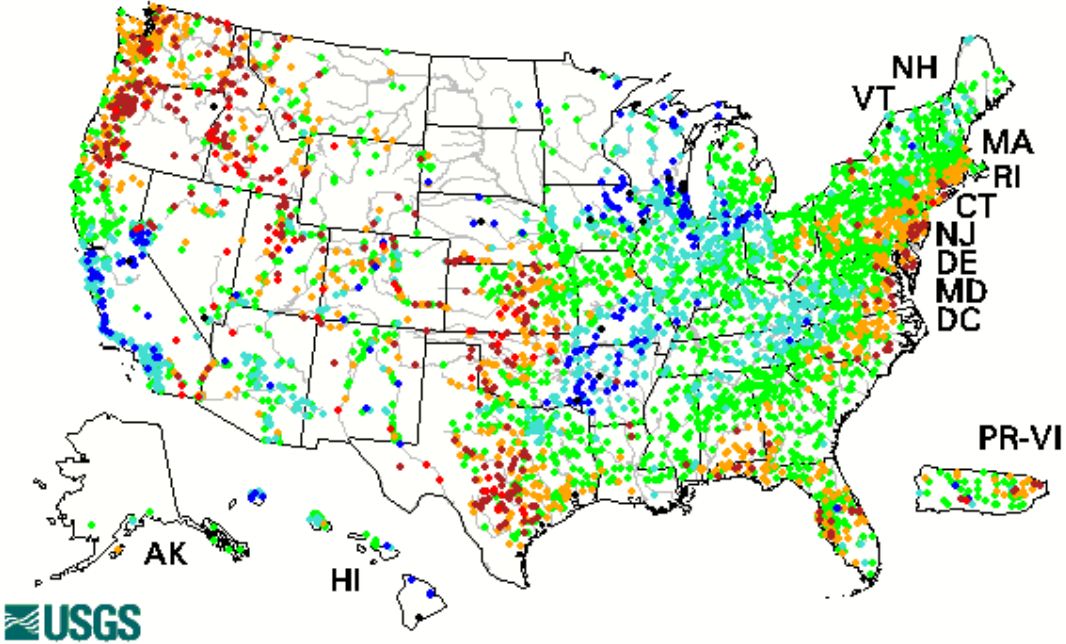
[https://www.cpc.ncep.noaa.gov/products/Drought/Monitoring/smp\\_new.shtml](https://www.cpc.ncep.noaa.gov/products/Drought/Monitoring/smp_new.shtml)



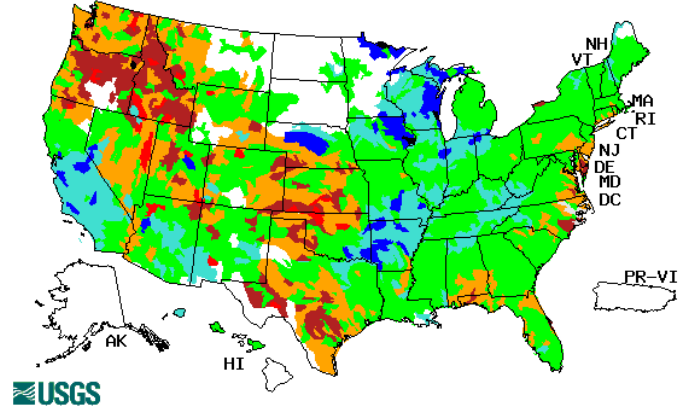
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# STREAMFLOW PERCENTILES (28 Day Average)

Monday, March 13, 2023



Monday, March 13, 2023

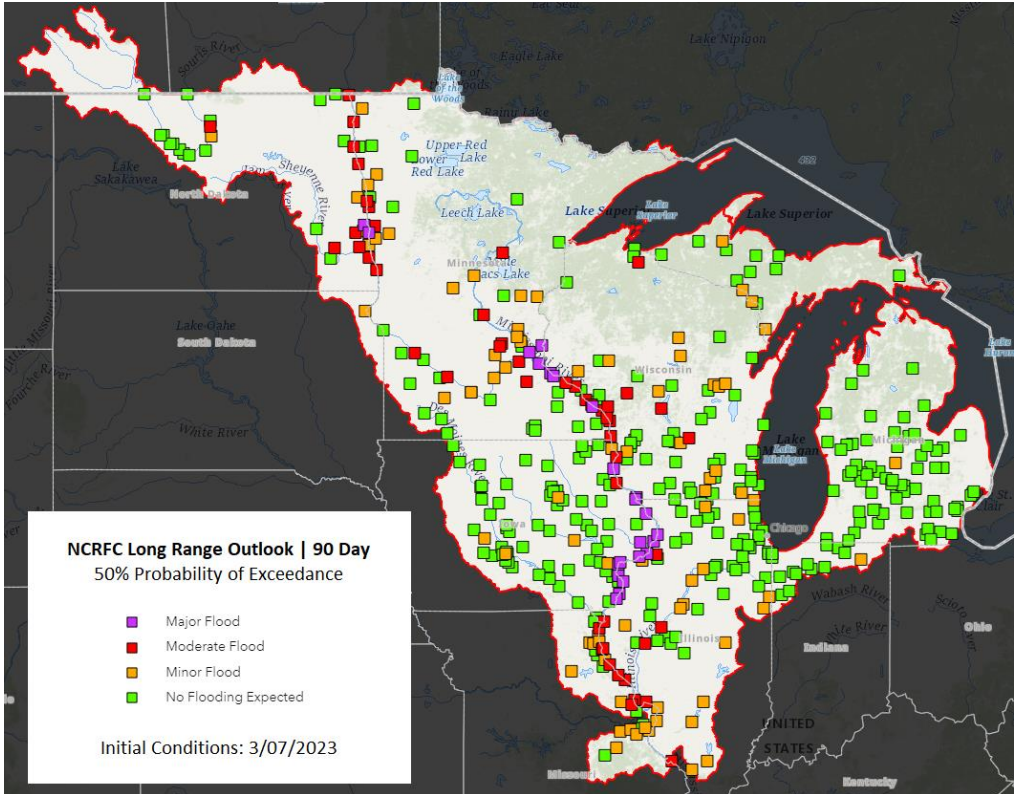


Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		

<https://waterwatch.usgs.gov/>



# STREAMFLOW FORECAST (UPPER MISSISSIPPI)



- Flood Risk along the mainstem Mississippi River from the **Twin Cities area, downstream through about Keokuk, IA is well above normal**
- **“If the melt is delayed and significant rainfall is added, we could see the worst flooding in over 20 years”**
- **2023 could rival what was seen in the spring of 2019, and could be the worst since 2001**

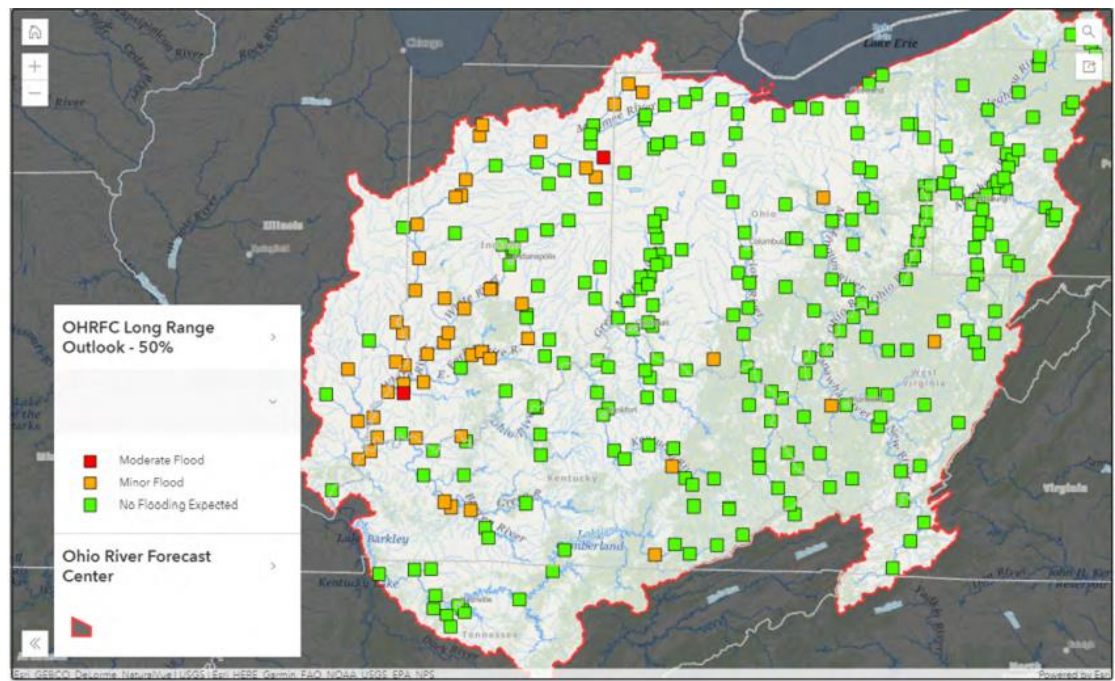
Information courtesy of the National Weather Service

National Weather Service North Central River Forecast Center



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# STREAMFLOW FORECAST (OHIO RIVER BASIN)



- Flood Risk is **near normal** this spring for the Ohio and Cumberland Valley regions
- **Minor flooding is expected** in the Ohio Valley (which is relatively normal)
- Snow and Ice are not expected to be factors in this springs flood risk

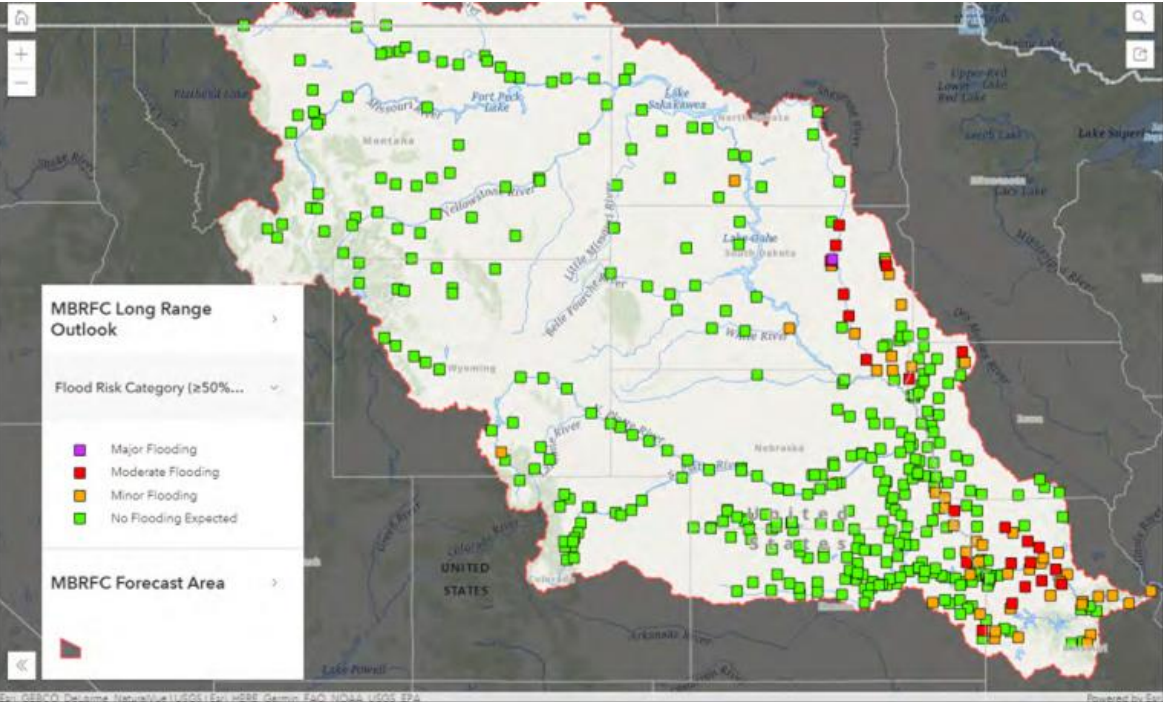
Information courtesy of the National Weather Service

National Weather Service North Central River Forecast Center



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# STREAMFLOW FORECAST (Missouri)



- Flood risk **varies significantly** across the Missouri River basin
- Significant snowpack in the plains with average to above average conditions in the mountains - melt will be an important factor
- The **Mainstem of the Missouri** is likely to experience **episodic floods** from **Nebraska City** downstream to the mouth

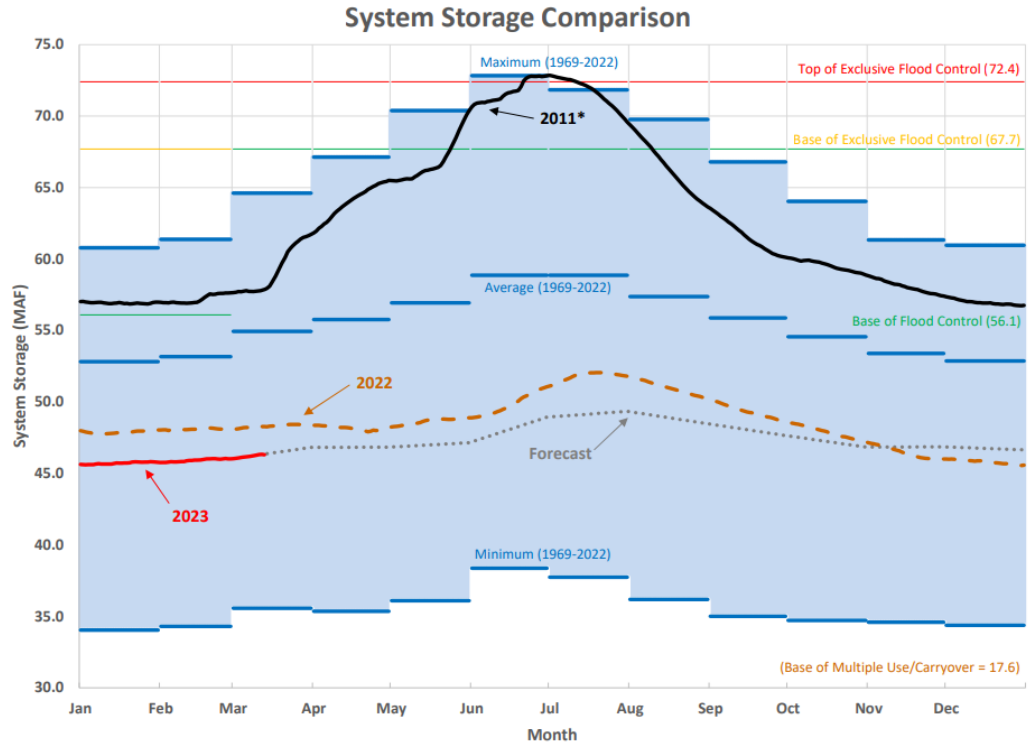
Information courtesy of the National Weather Service

National Weather Service North Central River Forecast Center



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# MISSOURI RIVER RESERVOIR STORAGE



The 2023 calendar year runoff forecast above Sioux City is 21.5 million acre feet, 84% of average

“Despite some improvement in basin conditions, we expect 2023 runoff to remain below average” - John Remus, chief of the U.S. Army Corps of Engineers’

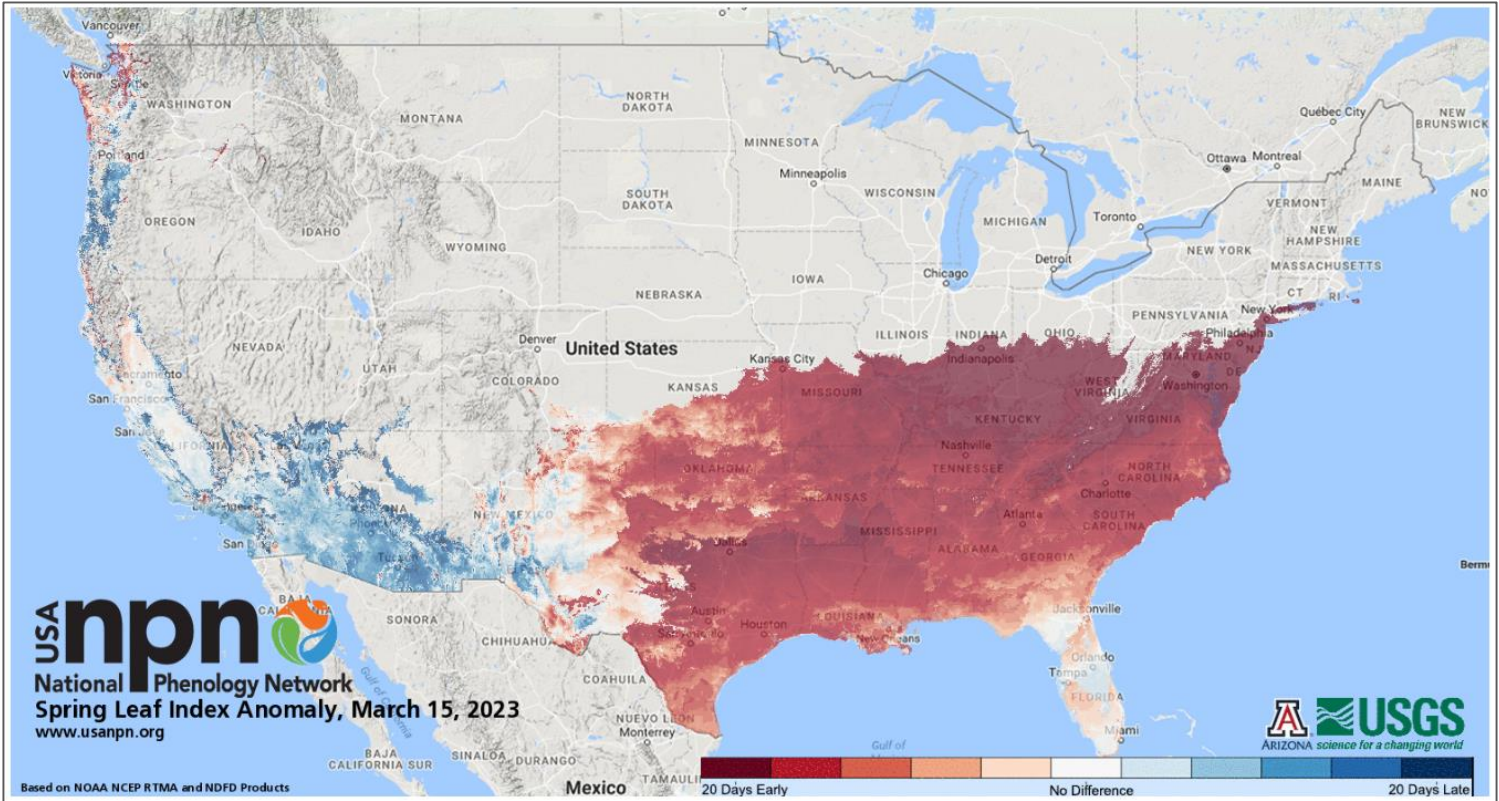
<https://www.nwd-mr.usace.army.mil/rcc/reports/pdfs/weeklyupdate.pdf>



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# SPRING PHENOLOGY



<https://www.usanpn.org/news/spring>

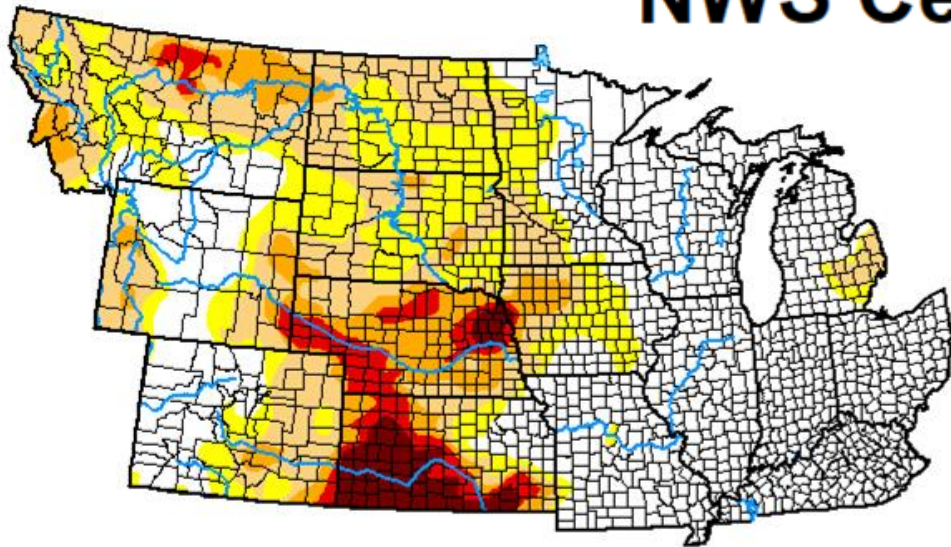


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# U.S. DROUGHT MONITOR

# U.S. Drought Monitor NWS Central

March 14, 2023  
(Released Thursday, Mar. 16, 2023)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	47.01	52.99	34.76	15.28	6.76	2.97
<b>Last Week</b> 03-07-2023	45.47	54.53	37.68	15.51	6.76	2.87
<b>3 Months Ago</b> 12-13-2022	17.91	82.09	57.82	29.23	12.22	3.87
<b>Start of Calendar Year</b> 01-03-2023	25.76	74.24	48.98	24.27	9.90	3.48
<b>Start of Water Year</b> 09-27-2022	27.00	73.00	47.70	23.08	8.80	2.73
<b>One Year Ago</b> 03-15-2022	30.31	69.69	53.60	32.19	10.12	0.13

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>

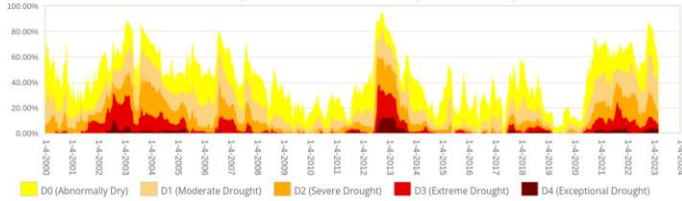
Author:

Brad Rippey  
U.S. Department of Agriculture



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

NWS Central Region Percent Area in U.S. Drought Monitor Categories



<https://droughtmonitor.unl.edu/>

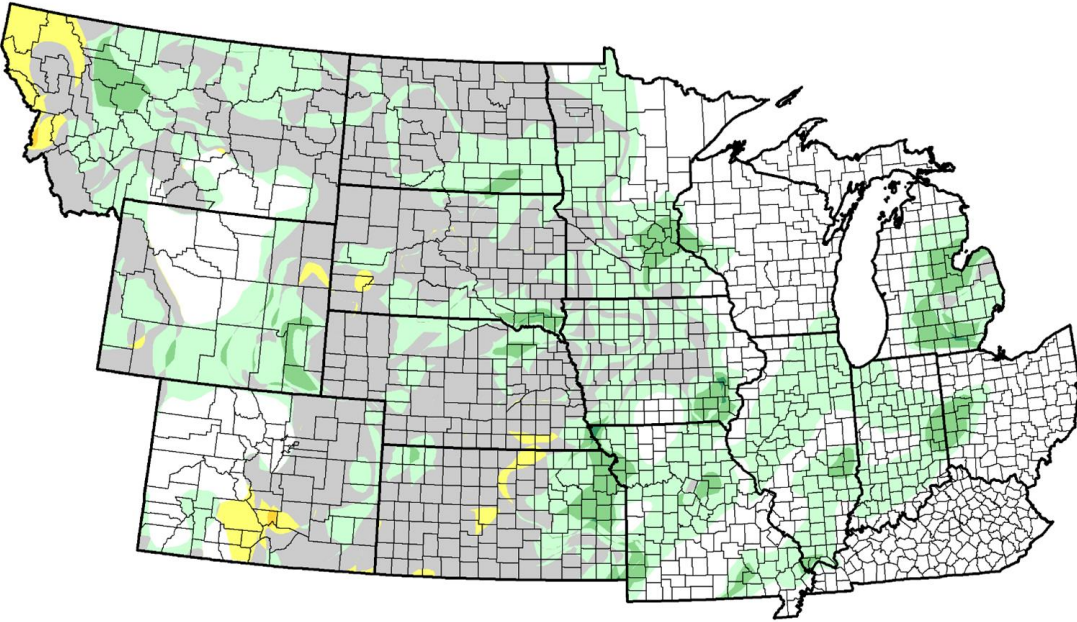


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# U.S. DROUGHT MONITOR (8 week change)

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



	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

<https://droughtmonitor.unl.edu/>



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# Impacts



# WET/HEAVY SNOW AND RAIN IN WI / MN / MI

A winter season with extreme *ice and heavy snow* events

- **Wettest (WI) & 2nd wettest (MN) winter in 128 years**
- **Ice storm in southern WI on Feb 23** that caused lots of **power outages** from **downed trees**
- **800,000 homes and businesses** lost power due to the **Feb 23 ice storm** in MI, **780 flights canceled**
  - **0.5in of ICE accumulation!**
- Heavy rains on **Feb 27th** caused **flooding** in SE WI
  - **Milwaukee's wettest February day on record**, since 1871
  - Equivalent to expected **precipitation for the entire month of Feb**
- **Roof collapse** in Duluth's Miller Hill Mall Barnes & Noble (March 14th)



Fallen tree limbs due to heavy snow  
-Steve Vavrus (Wisconsin-Madison)

# EXTREME WEATHER IN KY / IN

## Kentucky's Windy, Warm Winter

- **2023 is the windiest year on record**
  - Recorded **70+ mph** winds
- Feb. average temp. was **48.6F**, which was **+8.2deg above normal**
  - **Second warmest Feb on record** according to NCEI
- Winter (DJF) average temp. was **41.7F**, which was **+5.8 F above normal**
- Warm conditions are causing a **very early spring green-up**

## Indiana's Heavy Rain

- **Almost 4in of rain in 2 days caused "debris flows"**
  - Instead of mud and rock, flows consisted of **corn stalks for ¼ mile**



Road closed because road and ditch are now corn stalks for around ¼ mile. Nearest station showed a 3.8" rain event over two days.  
-Hans Schmitz (Purdue)



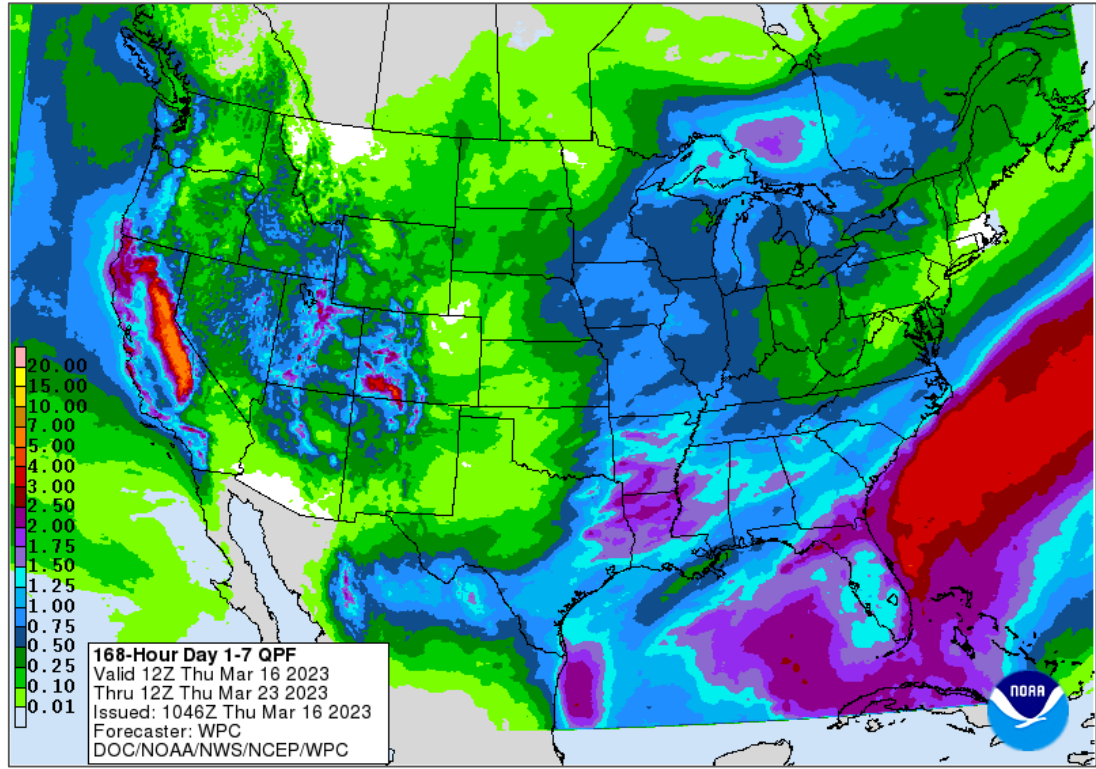
# Outlook



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# 7 DAY PRECIPITATION FORECAST (MARCH 16 - 23)



<https://www.wpc.ncep.noaa.gov/qpf/day1-7.shtml>



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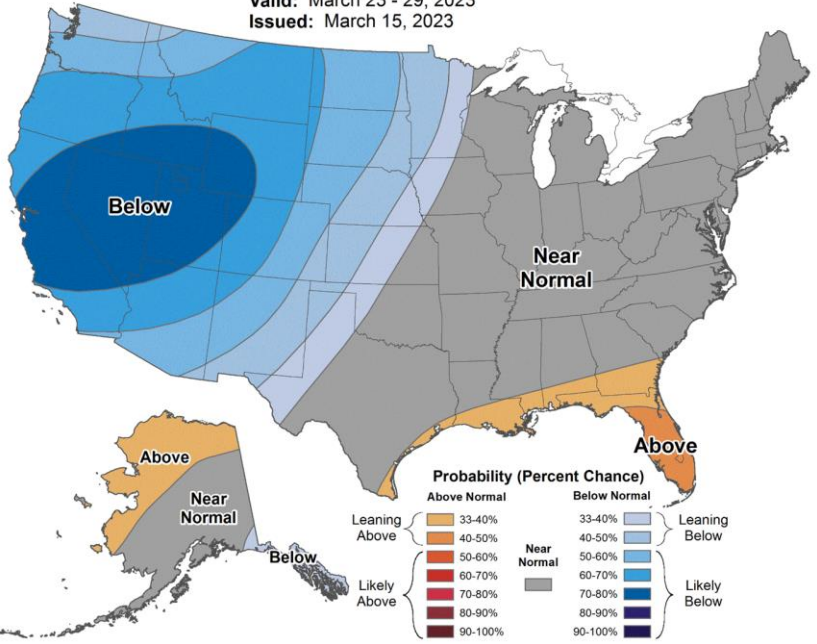
# 8-14 DAY OUTLOOK



## 8-14 Day Temperature Outlook



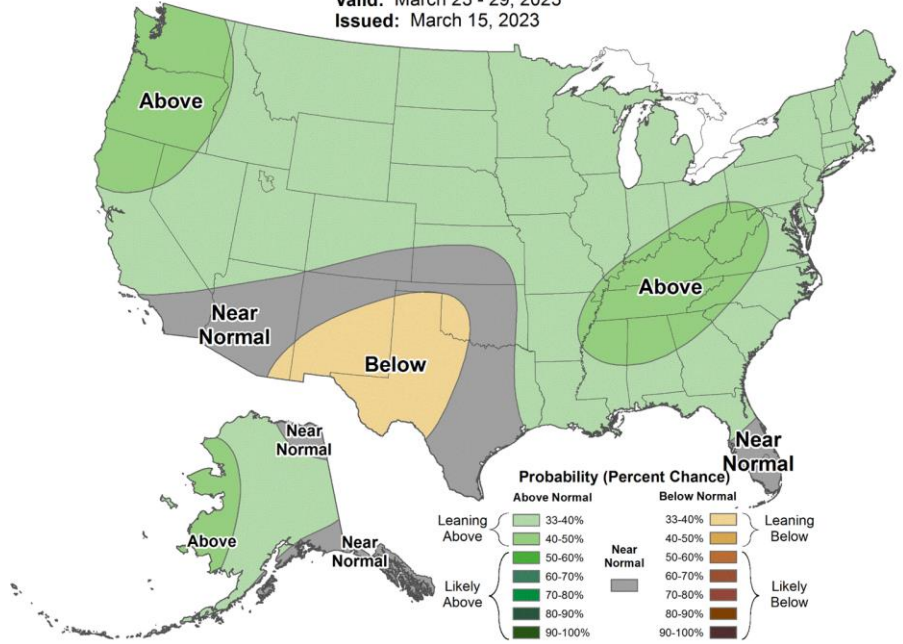
Valid: March 23 - 29, 2023  
 Issued: March 15, 2023



## 8-14 Day Precipitation Outlook



Valid: March 23 - 29, 2023  
 Issued: March 15, 2023



<https://www.cpc.ncep.noaa.gov/products/predictions/814day/>



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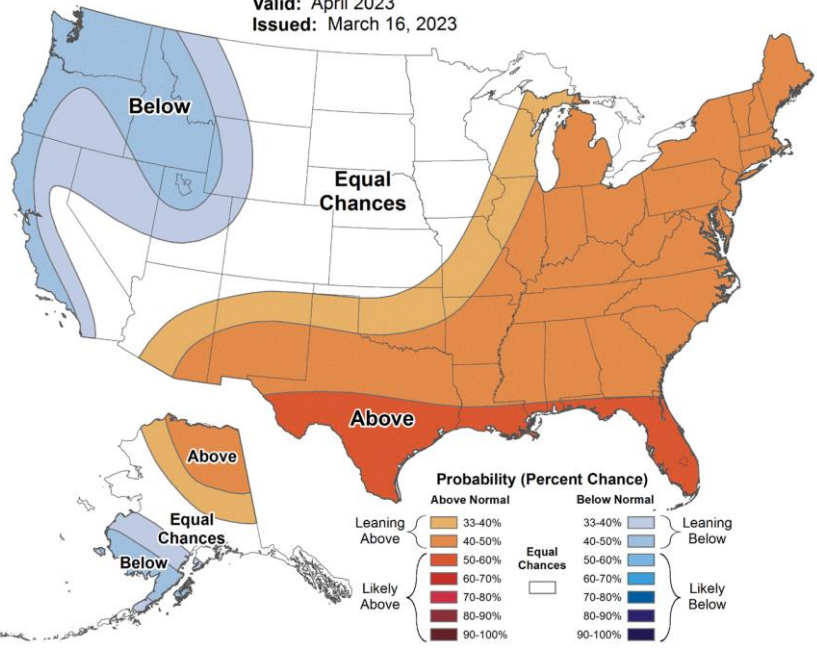
# 1 MONTH OUTLOOK



## Monthly Temperature Outlook



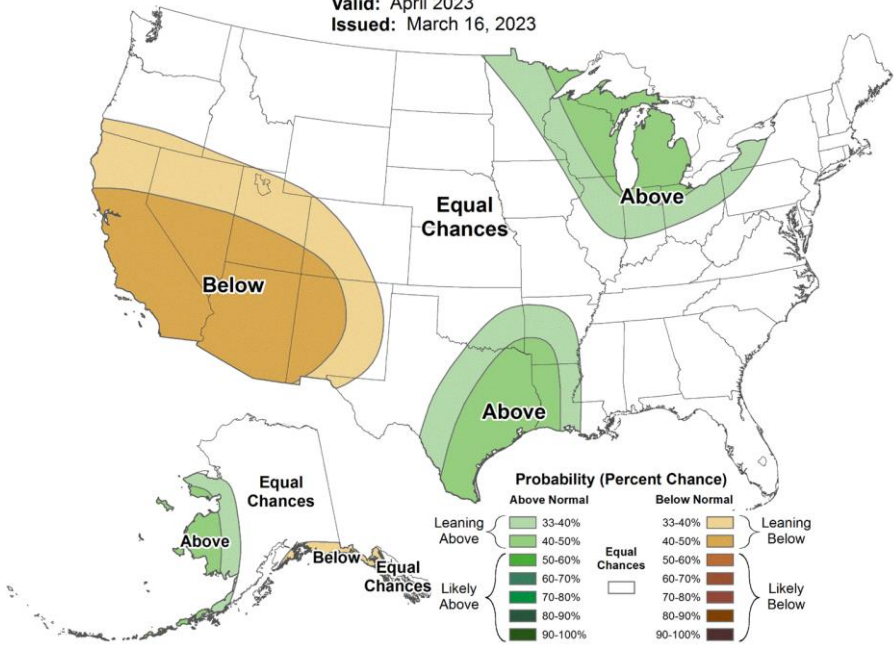
Valid: April 2023  
 Issued: March 16, 2023



## Monthly Precipitation Outlook



Valid: April 2023  
 Issued: March 16, 2023



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



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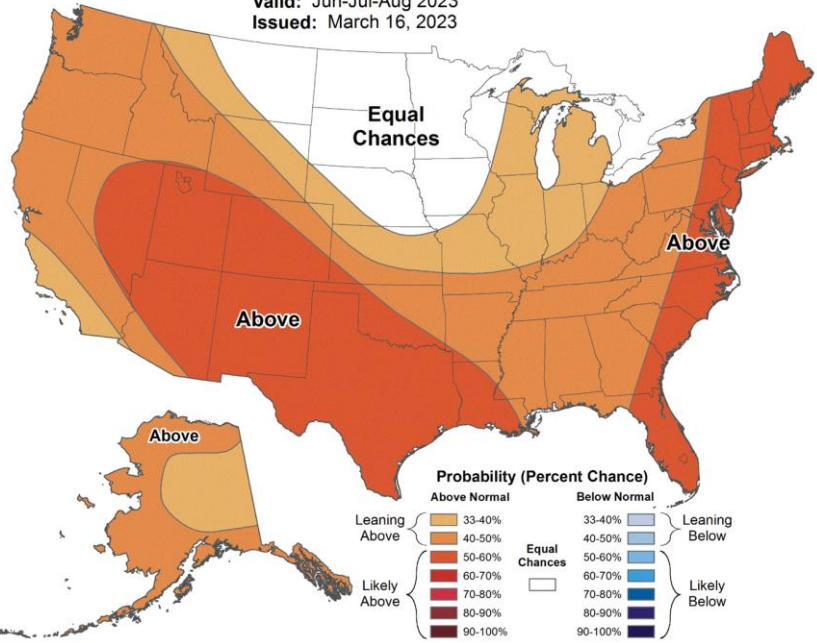
# 3 MONTH OUTLOOK



## Seasonal Temperature Outlook



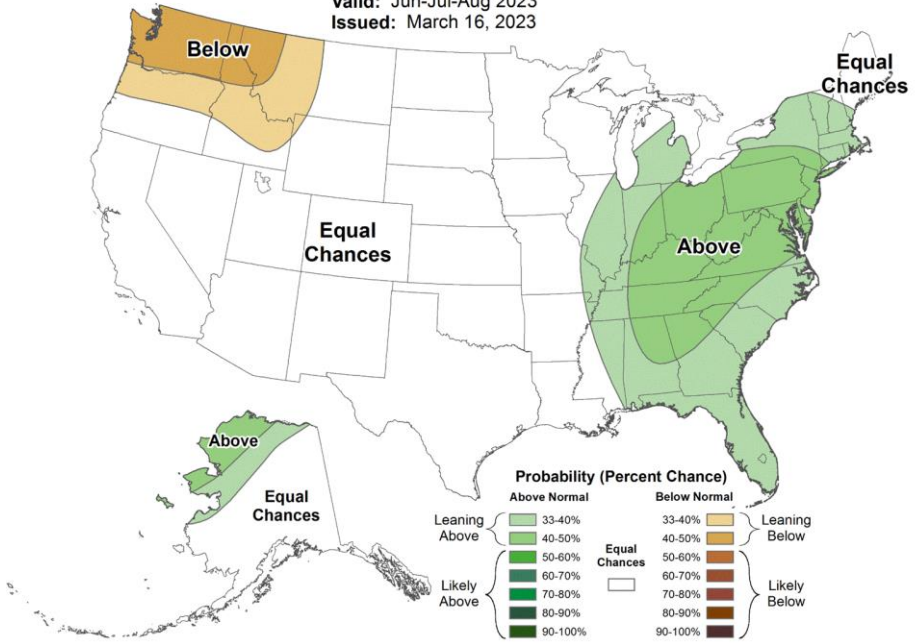
Valid: Jun-Jul-Aug 2023  
 Issued: March 16, 2023



## Seasonal Precipitation Outlook



Valid: Jun-Jul-Aug 2023  
 Issued: March 16, 2023



[https://www.cpc.ncep.noaa.gov/products/predictions/long\\_range/seasonal.php?lead=3](https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=3)



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# El Niño/La Niña (ENSO) PROBABILITY

## Official NOAA CPC ENSO Probabilities (issued Mar. 2023)

based on  $-0.5^{\circ}/+0.5^{\circ}\text{C}$  thresholds in ERSSTv5 Niño-3.4 index

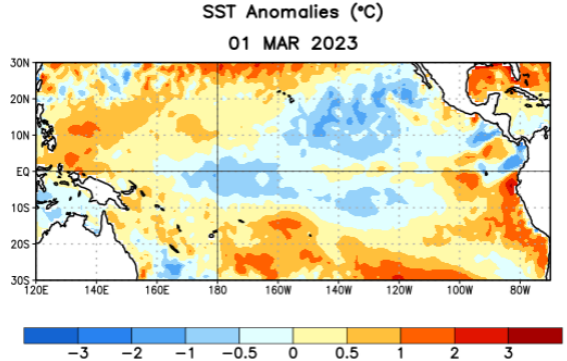
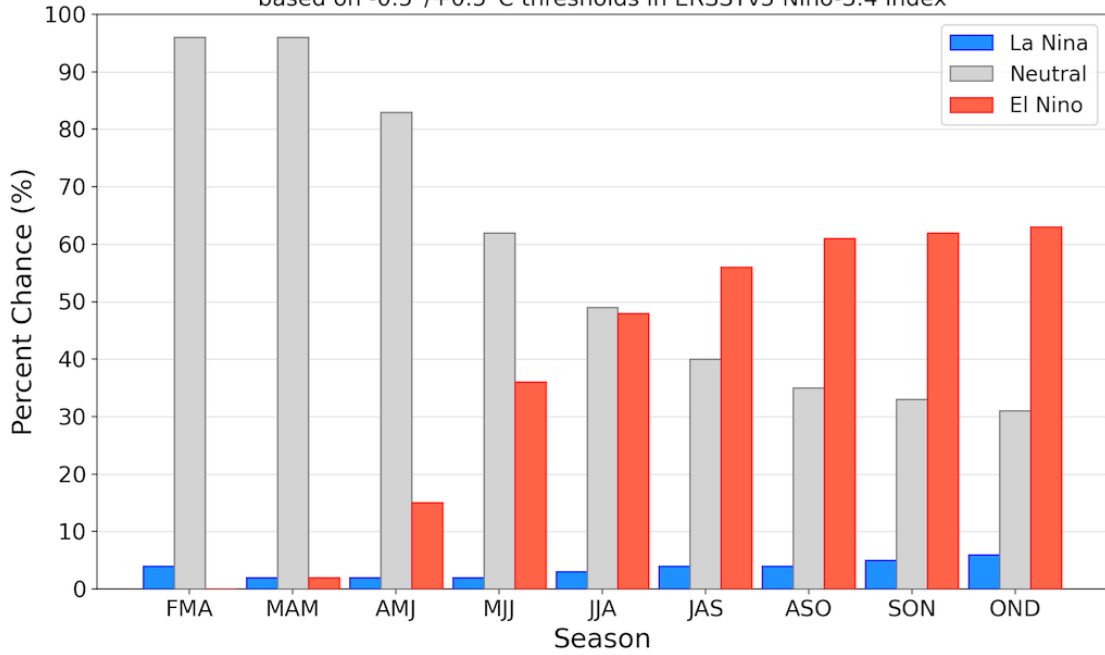


Figure 1. Average sea surface temperature (SST) anomalies (°C) for the week centered on 1 March 2023. Anomalies are computed with respect to the 1991-2020 base period weekly means.

<https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/>



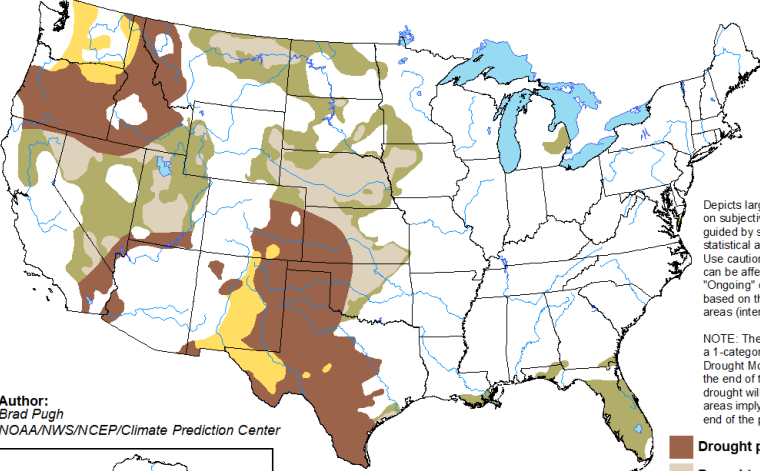
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# OUTLOOK: FIRE & DROUGHT

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

Valid for March 16 - June 30, 2023  
Released March 16



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

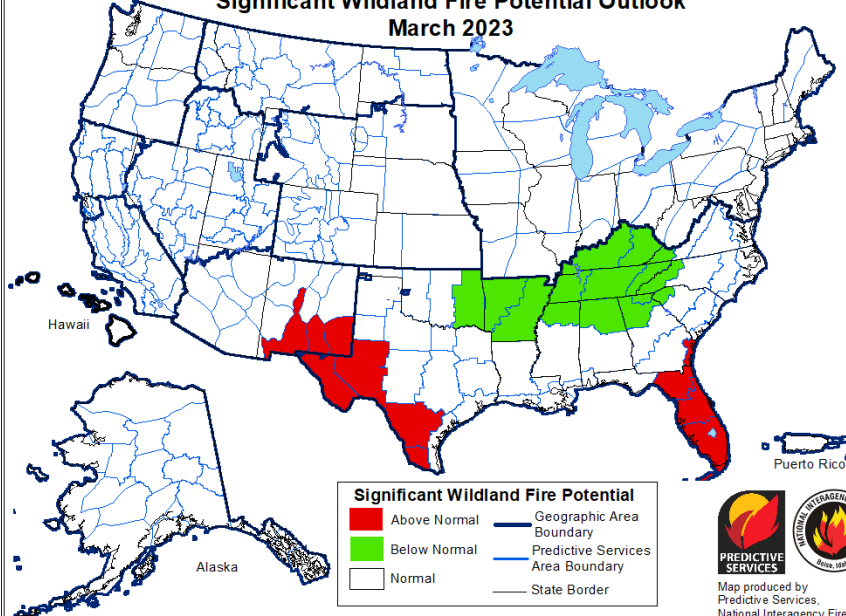


<http://go.usa.gov/3eZ73>

Author:  
Brad Pugh  
NOAA/NWS/NCEP/Climate Prediction Center



## Significant Wildland Fire Potential Outlook March 2023



- | Significant Wildland Fire Potential   |   |
|---|---|
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #FF0000; border: 1px solid black; margin-right: 5px;"></span> Above Normal | <span style="display: inline-block; width: 15px; border-bottom: 1px solid black; margin-right: 5px;"></span> Geographic Area Boundary         |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #00FF00; border: 1px solid black; margin-right: 5px;"></span> Below Normal | <span style="display: inline-block; width: 15px; border-bottom: 1px solid blue; margin-right: 5px;"></span> Predictive Services Area Boundary |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #FFFFFF; border: 1px solid black; margin-right: 5px;"></span> Normal       | <span style="display: inline-block; width: 15px; border-bottom: 1px solid black; margin-right: 5px;"></span> State Border                     |



Above normal significant wildland fire potential indicates a greater than usual likelihood that significant wildland fires will occur. Significant wildland fires should be expected at typical times and intervals during normal significant wildland fire potential conditions. Significant wildland fires are still possible but less likely than usual during forecasted below normal periods.

Map produced by Predictive Services, National Interagency Fire Center, Boise, Idaho  
Issued March 1, 2023  
Next issuance April 1, 2023

[https://www.cpc.ncep.noaa.gov/products/expert\\_assessment/sdo\\_summary.php](https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php)

[https://www.predictiveservices.nifc.gov/outlooks/month1\\_outlook.png](https://www.predictiveservices.nifc.gov/outlooks/month1_outlook.png)



**Central Region Climate & Drought Outlook**  
Zachary Hoylman, Montana Climate Office  
University of Montana  
Missoula, MT - 3/16/2023

# SUMMARY



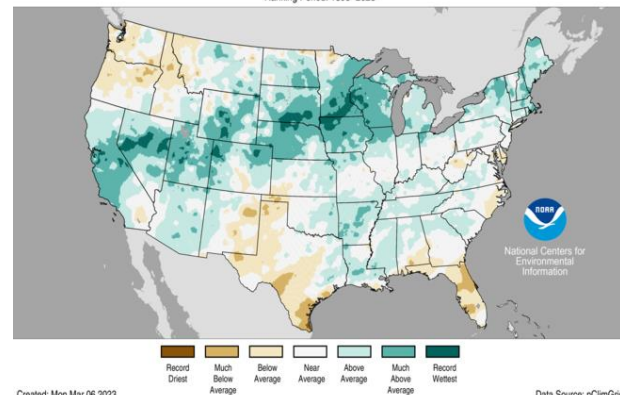
## - Recent Conditions

- **Precipitation: WET!** Especially in the western great lake states
- **Temperature:** It has been a very warm winter for the midwest, relatively normal in the upper Missouri river basin
- **Snow:** Lots of snow in the upper Miss. / upper Mo.
- **Streamflow:** Elevated risk of flooding in the upper Miss.
- **Drought:** Improving in the north, extreme in south

## - Outlooks

- **Short term:** Leaning wet and cool
- **Long term:** Leaning normal/warm and normal/dry
- **ENSO Forecast:** Transitioning to neutral
- **Fire:**

Total Precipitation Percentiles  
December 2022–February 2023  
Ranking Period: 1895–2023





**Thank You!**  
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**Montana  
Climate  
Office**



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