



WY Conditions & Outlooks:

Precipitation, Temperatures, Drought, Floods, & Everything In-between

November 16, 2023



Presentation Outline

- **Current Conditions:** Overview
 - Drought, Temperature, Precipitation, Soils
 - Streamflow
- **Outlooks:**
 - Temperature & Precipitation
- **Highlight of the Month:**
 - El Niño effects on Wyoming and the difficulties of forecasting.
- **Questions**

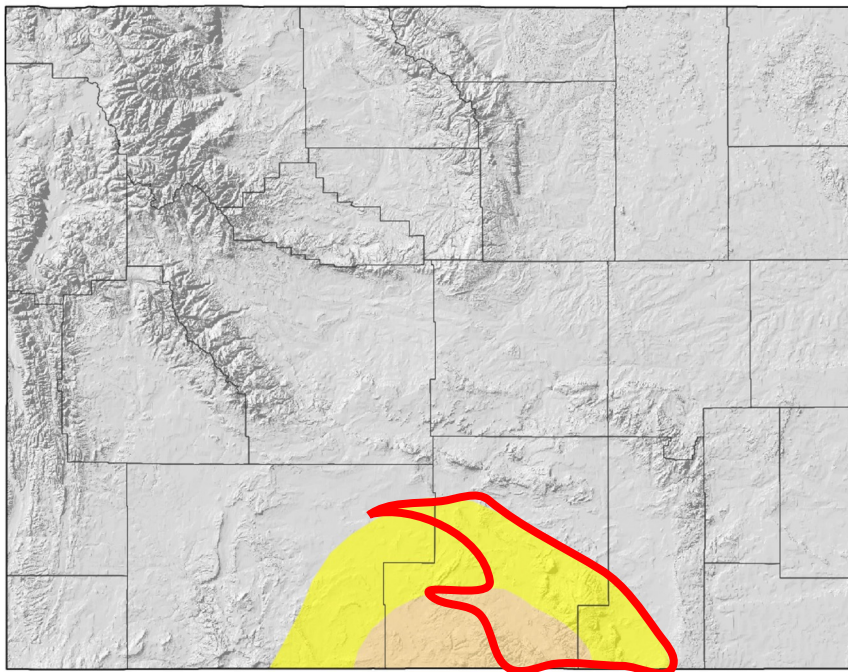


Current Conditions

US Drought Monitor for November 14, 2023

(Released Thursday, November 16, 2023)
Valid 8 a.m. EDT

US Drought Monitor for 14 Nov 2023



US Drought Monitor	
6.16%	D0 Abnormally Dry
2.73%	D1 Moderate Drought
0.00%	D2 Severe Drought
0.00%	D3 Extreme Drought
0.00%	D4 Exceptional Drought

Map Created by:
National Drought Mitigation Center
<https://droughtmonitor.unl.edu>



Map Layout Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



Drought Level	Percentile
None	>30
D0 (Abnormally Dry)	21 to 30
D1 (Moderate Drought)	11 to 20
D2 (Severe Drought)	6 to 10
D3 (Extreme Drought)	3 to 5
D4 (Exceptional Drought)	0 to 2

How are Drought categories assigned?
<https://youtu.be/45MQ1GB-uTc>

Degradations since the last webinar. Continued decline in conditions in the south-central part of the state.

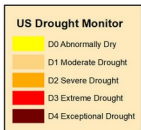
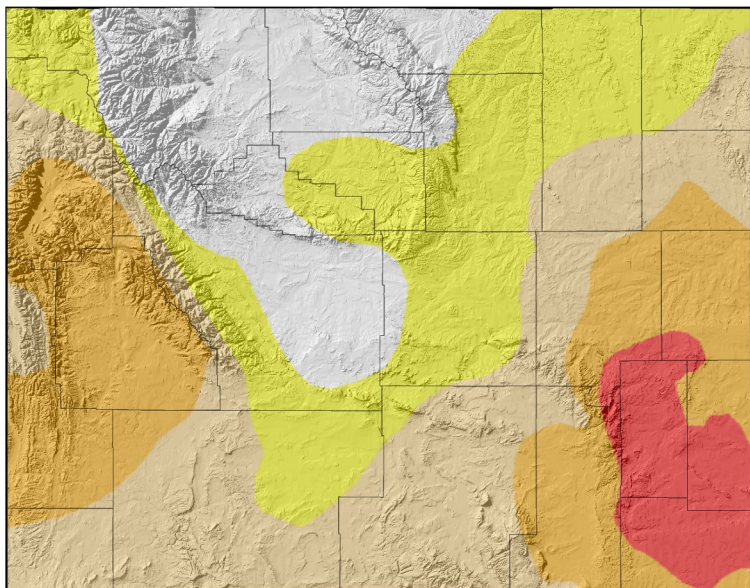
The U.S. Drought Monitor, is a weekly map of drought conditions produced jointly by the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture, and the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln. The U.S. Drought Monitor website is hosted and maintained by the NDMC. <http://droughtmonitor.unl.edu>

Map Layout Created 16 Nov 2023 <http://www.wrds.uwyo.edu>



One Year Ago

US Drought Monitor for 15 Nov 2022



Map Created by:
National Drought Mitigation Center
<https://droughtmonitor.unl.edu>



Map Layout Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>

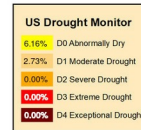
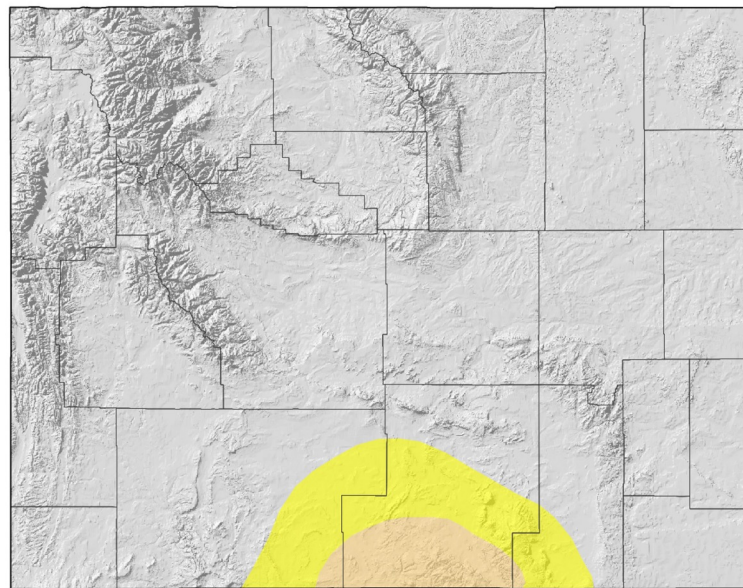


The U.S. Drought Monitor, is a weekly map of drought conditions produced jointly by the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture, and the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln. The U.S. Drought Monitor website is hosted and maintained by the NDMC. <http://droughtmonitor.unl.edu>

Map Layout Created 10 Dec 2022 <http://www.wrds.uwyo.edu>

Today

US Drought Monitor for 14 Nov 2023



Map Created by:
National Drought Mitigation Center
<https://droughtmonitor.unl.edu>



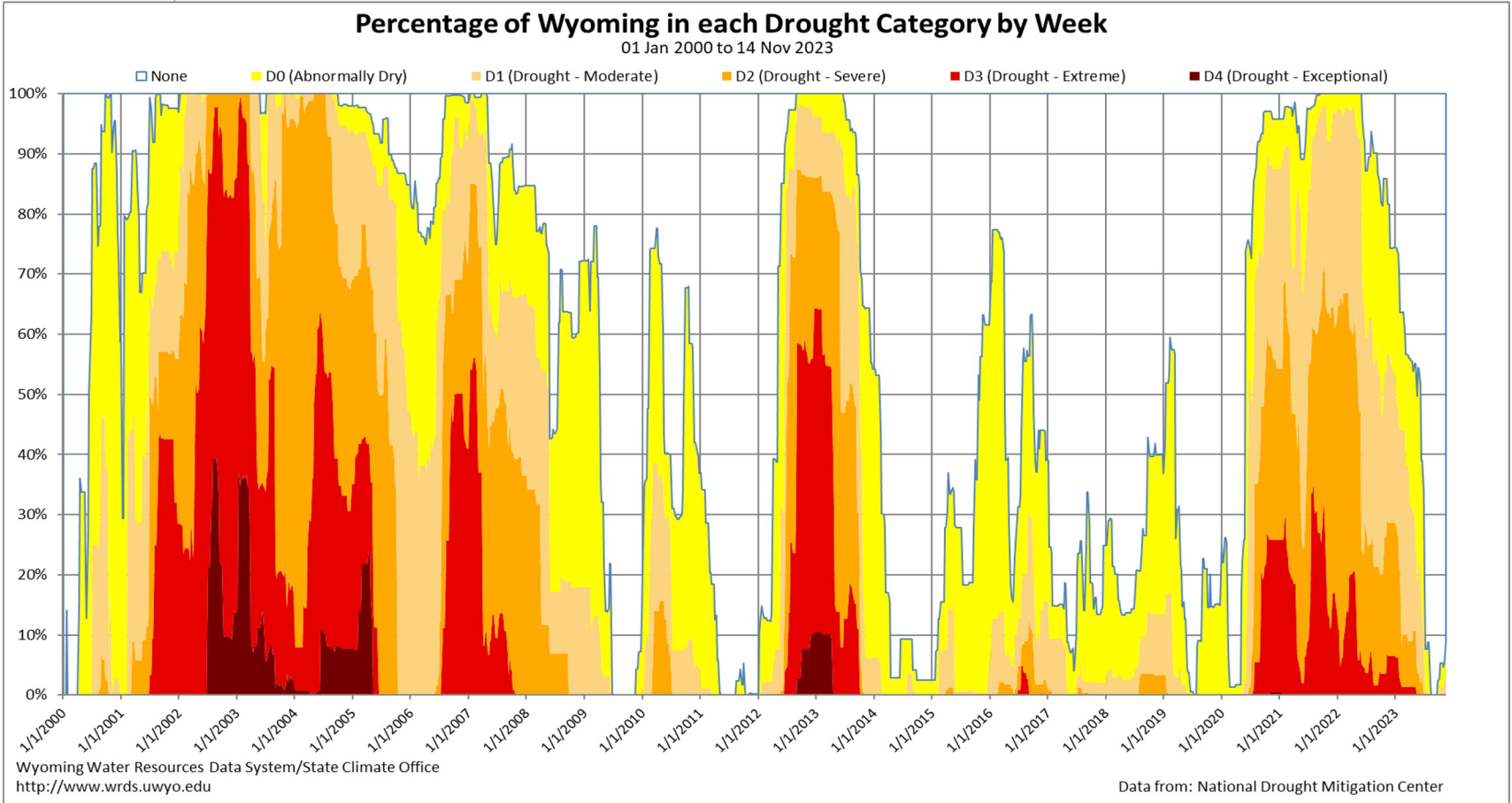
Map Layout Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



The U.S. Drought Monitor, is a weekly map of drought conditions produced jointly by the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture, and the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln. The U.S. Drought Monitor website is hosted and maintained by the NDMC. <http://droughtmonitor.unl.edu>

Map Layout Created 16 Nov 2023 <http://www.wrds.uwyo.edu>

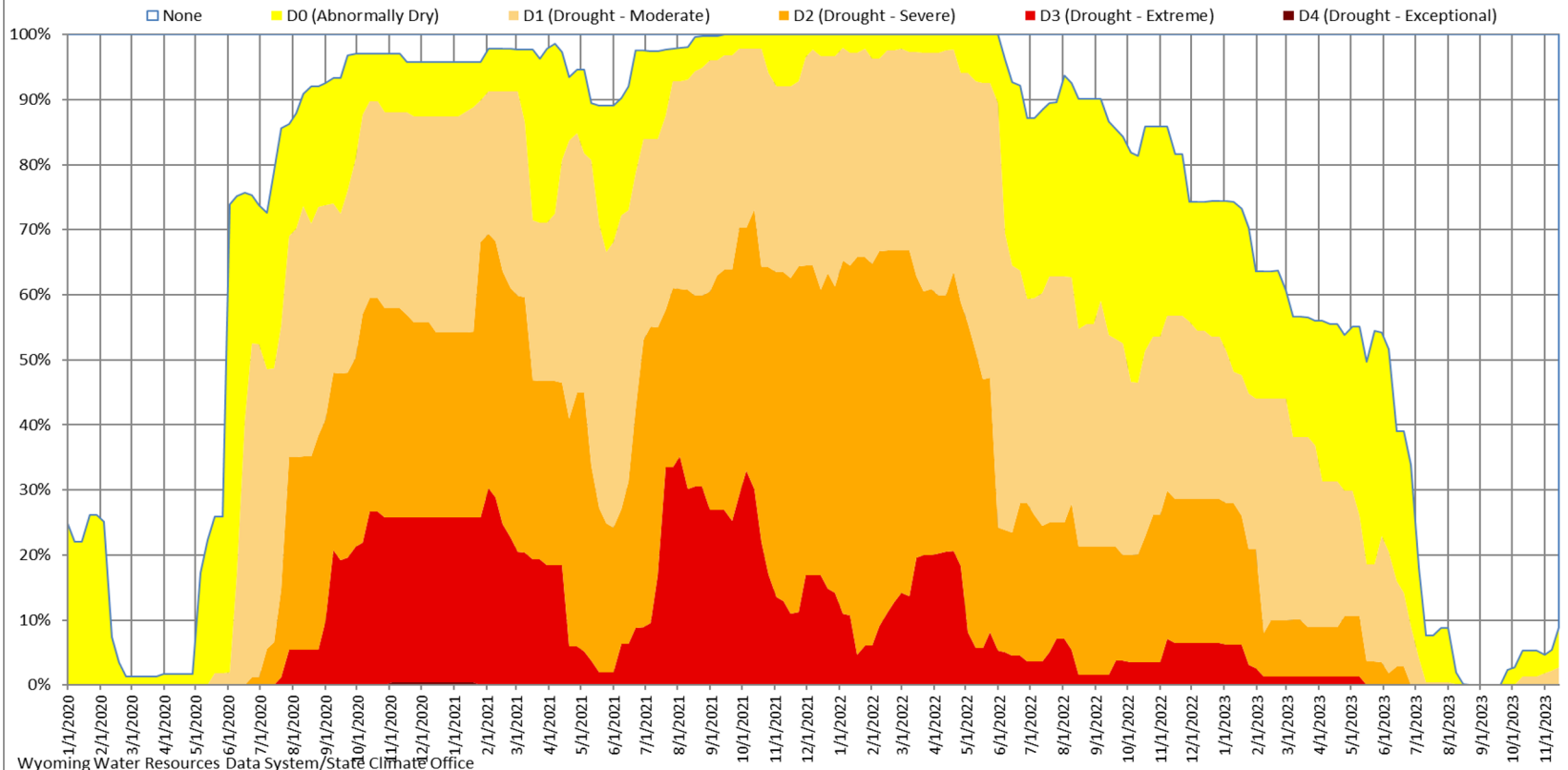
Wyoming Area Affected: 8.89% D0-D4 ; 2.73% D1-D4





Percentage of Wyoming in each Drought Category by Week

01 Jan 2020 to 14 Nov 2023



91.11%

2.73%

14-Day Precipitation Percentile (02 Nov 2023 to 15 Nov 2023)

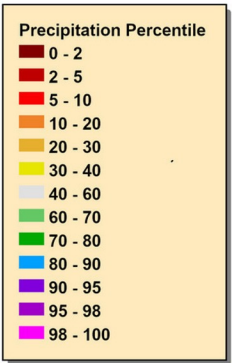
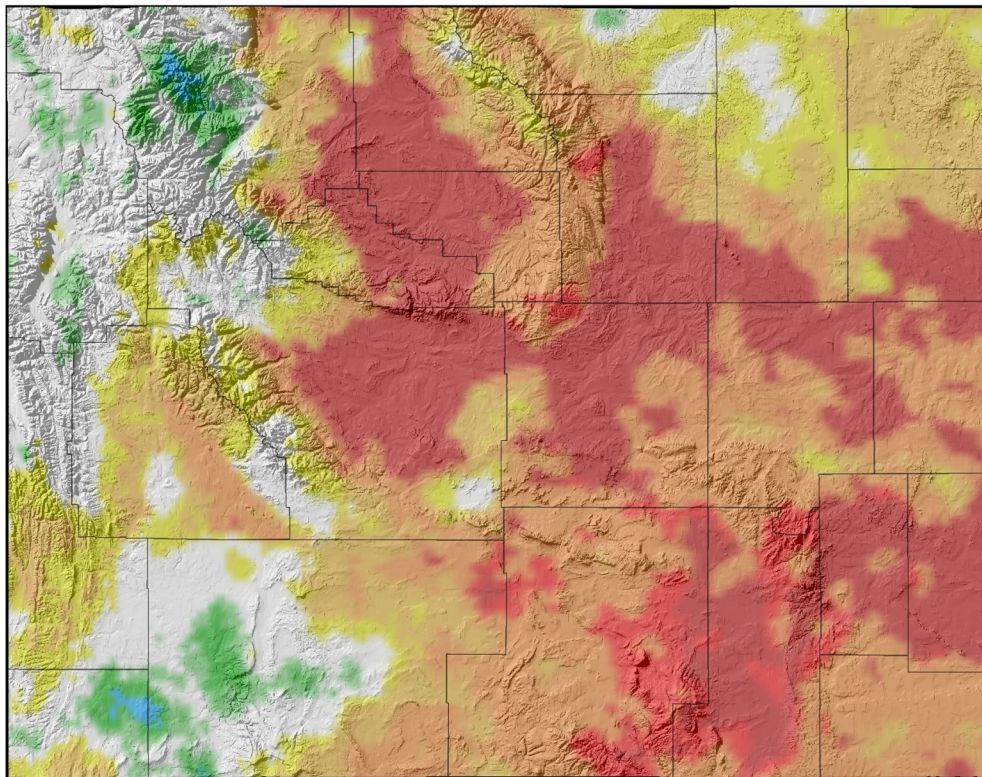
14-Day Precipitation (Percentile) for 02 Nov 2023 to 15 Nov 2023

Above Median:

- Far Southwest
- Far Northwest

Below Median (Areas of Concern):

- Eastern three-quarters of Wyoming



Precipitation Data
PRISM Climate Group
<http://prism.oregonstate.edu>



Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



Provisional data, subject to revision

90-Day Precipitation Percentile (18 Aug 2023 to 15 Nov 2023)

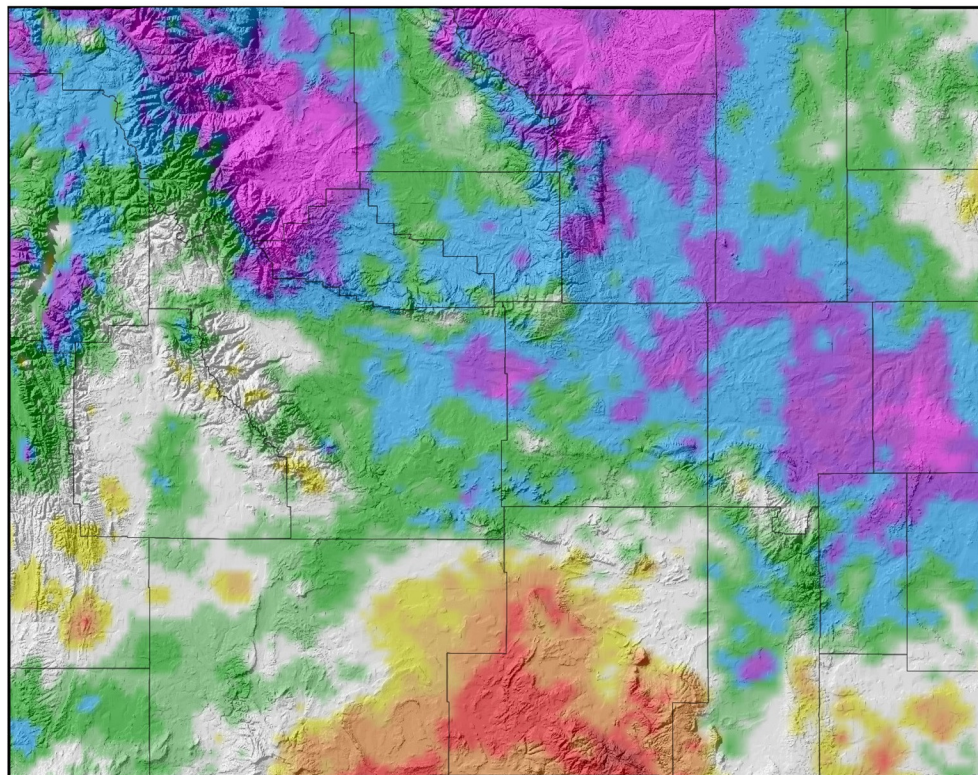
90-Day Precipitation (Percentile) for 18 Aug 2023 to 15 Nov 2023

Above Median:

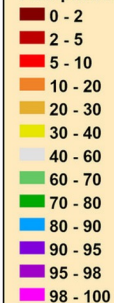
- Southwest
- Northern two-thirds of Wyoming

Below Median (Areas of Concern):

- Eastern Sweetwater Co
- Much of Carbon Co
- Laramie Co



Precipitation Percentile



Precipitation Data
PRISM Climate Group
<http://prism.oregonstate.edu>



Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>

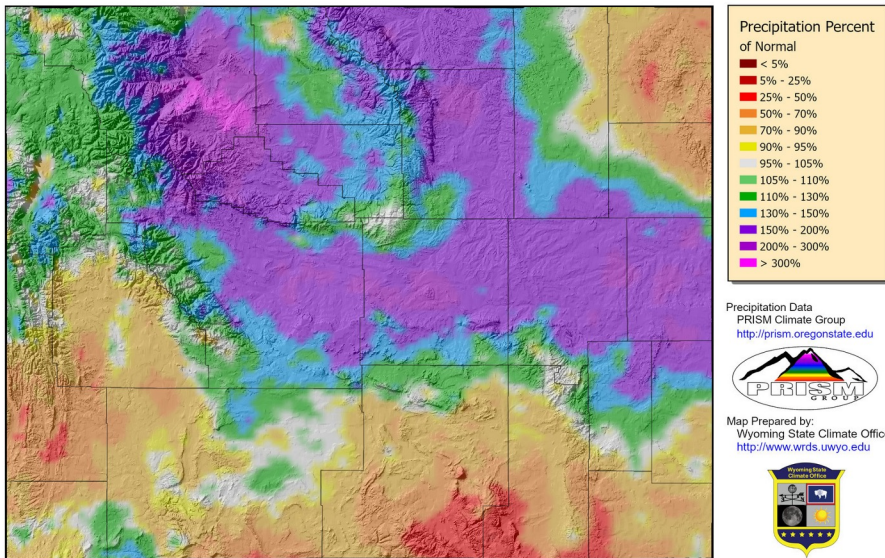


Provisional data, subject to revision

“Year”-to-Date Precipitation (Percent of Average)

Current Water Year

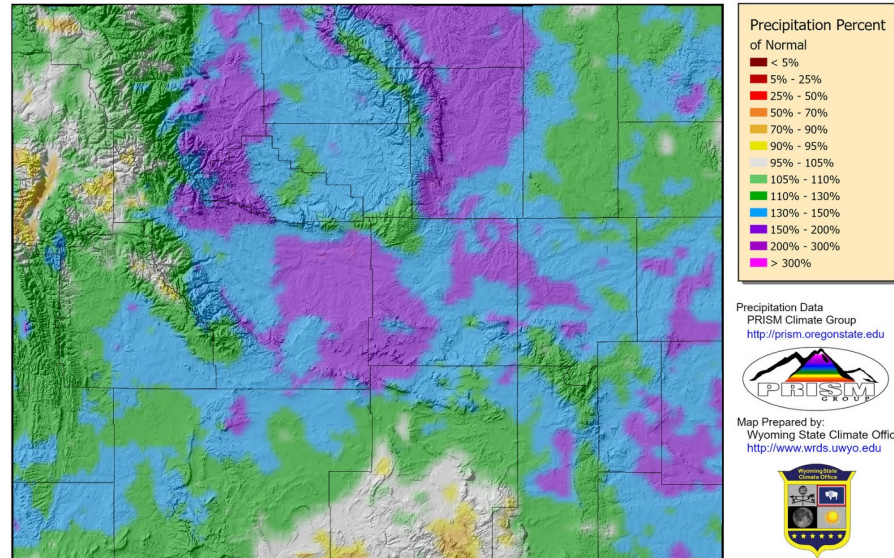
Water-Year Precipitation (Percent of 1991-2020 Average) for 01 Oct 2023 to 15 Nov 2023



Provisional data, subject to revision

Current Calendar Year

Calendar-Year Precipitation (Percent of 1991-2020 Average) for 01 Jan 2023 to 15 Nov 2023



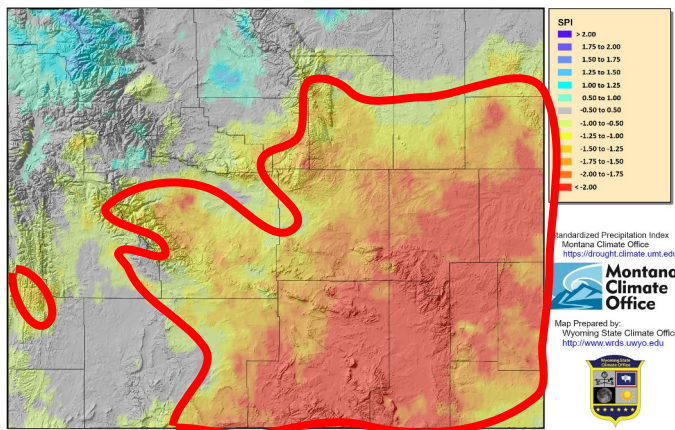
Provisional data, subject to revision

Monthly and Normal precipitation data from PRISM Climate Group, Copyright ©2021, PRISM Climate Group, Oregon State University, <http://prism.oregonstate.edu>
Map Created 16 Nov 2023 <http://www.wrds.uwyo.edu>
Daily averages created from PRISM daily precipitation grids

Monthly and Normal precipitation data from PRISM Climate Group, Copyright ©2021, PRISM Climate Group, Oregon State University, <http://prism.oregonstate.edu>
Map Created 16 Nov 2023 <http://www.wrds.uwyo.edu>
Daily averages created from PRISM daily precipitation grids

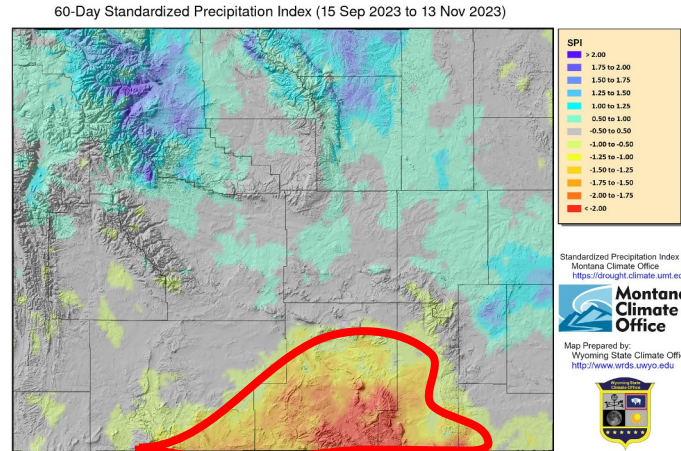
Note: a water year is October 1 through September 30 of the following year.

30-Day
→
Oct 15 - Nov 13



Provisional data, subject to revision
Standardized Precipitation Index Created by Montana Climate Office <https://drought.climate.umt.edu>
Map Created 15 Nov 2023 <http://www.wrds.uwyo.edu>

60-Day
→
Sept 15 - Nov 13

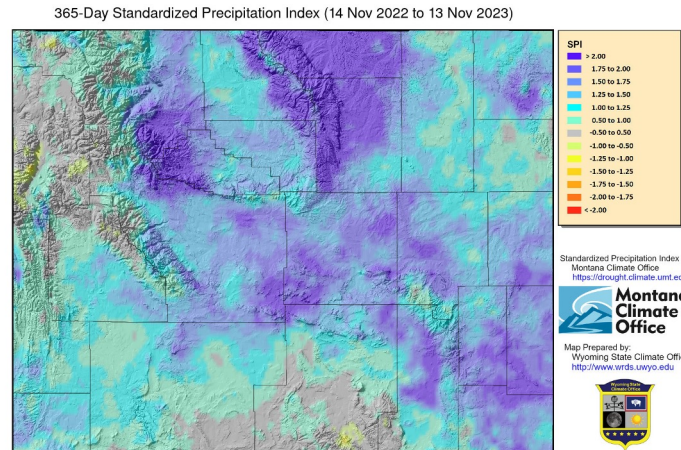


Provisional data, subject to revision
Standardized Precipitation Index Created by Montana Climate Office <https://drought.climate.umt.edu>
Map Created 15 Nov 2023 <http://www.wrds.uwyo.edu>

Standardized Precipitation Index (SPI)

Short term: Southeastern two-thirds, dry
Long term: Wet

1-Year
→

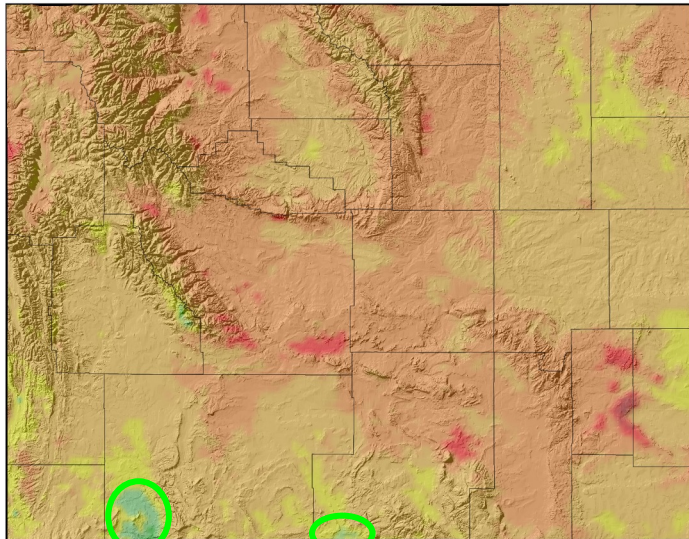


Provisional data, subject to revision
Standardized Precipitation Index Created by Montana Climate Office <https://drought.climate.umt.edu>
Map Created 15 Nov 2023 <http://www.wrds.uwyo.edu>

14-Day Average **Minimum** Temperature (02 Nov to 15 Nov)

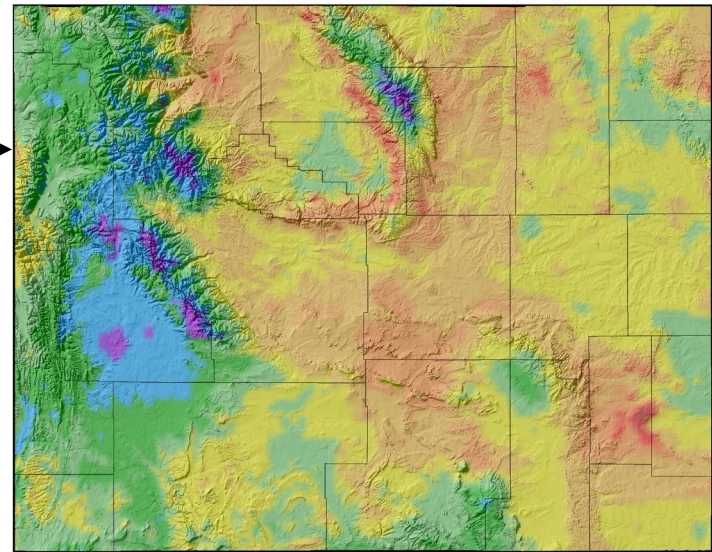
- Most lows below freezing
- Exceptions on western foothills of the Bighorns and a few other areas (central, Platte Co, Johnson Co)

14-Day Average Minimum Temperature (Departure from 1991-2020 Average) for 02 Nov 2023 to 15 Nov 2023



Temperature Data
PRISM Climate Group
<http://prism.oregonstate.edu>

Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



Temperature Data
PRISM Climate Group
<http://prism.oregonstate.edu>

Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>

Provisional data, subject to revision

Daily Temperature data from PRISM Climate Group, Copyright ©2021, PRISM Climate Group, Oregon State University, <http://prism.oregonstate.edu>
Map Created 16 Nov 2023 <http://www.wrds.uwyo.edu>
Temperature averages created from PRISM daily tempWYerature grids

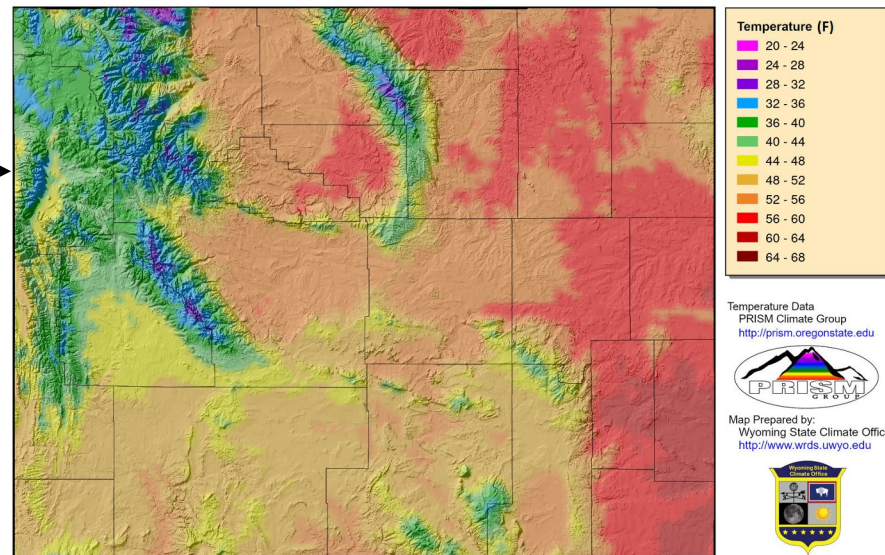
14-Day **Departure from Normal** Average **Minimum** Temperature

- Generally 3-9F above average statewide
- Some pockets 9-15F above average
- Scattered areas up to 3F above average
- Two areas in the far south a little below average

14-Day Average Maximum **Maximum**

Temperature (02 Nov to 15 Nov)

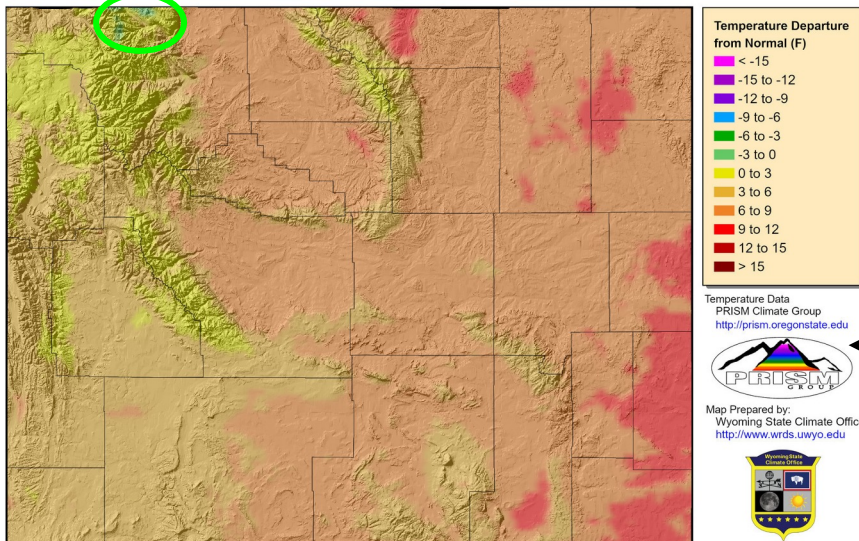
- Highs still ≥ 32 except very high elevations
- Mountainous regions in 20s



Provisional data, subject to revision

Daily Temperature data from PRISM Climate Group, Copyright ©2021, PRISM Climate Group, Oregon State University, <http://prism.oregonstate.edu>
Map Created 16 Nov 2023 <http://www.wrds.uwyo.edu>
Temperature averages created from PRISM daily tempWYerature grids

14-Day Average Maximum Temperature (Departure from 1991-2020 Average) for 02 Nov 2023 to 15 Nov 2023



Provisional data, subject to revision

14- Day *Departure from Normal* Average **Maximum** Temperature

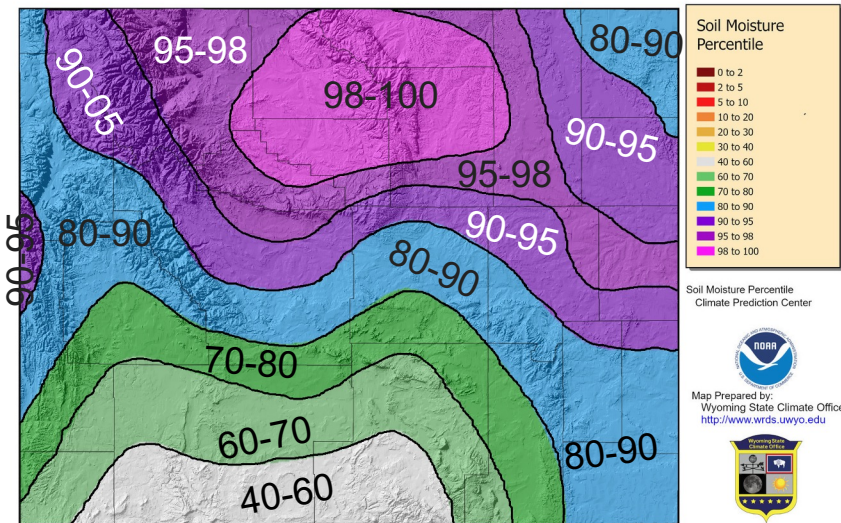
- 0-3F above average Northwest and Bighorns
- 3-6F above average Green River Basin, BHS
- 6-9F above average eastern two-thirds
- 9-12F above average far eastern plains and scattered other east-of-Divide pockets

Soil Moisture Percentile

Two Weeks Ago

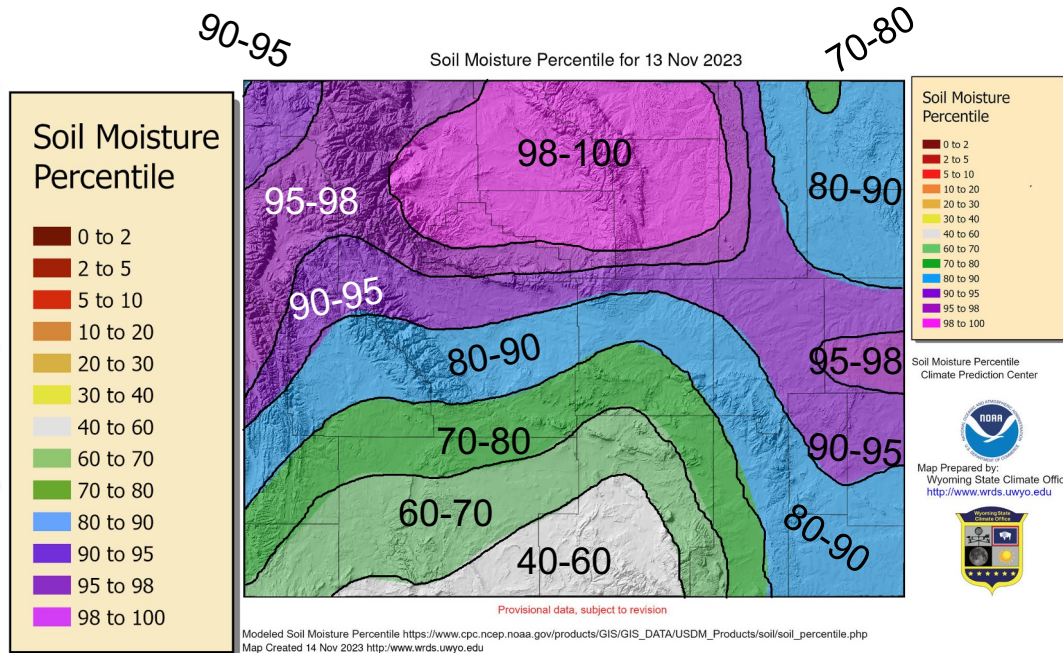
13 Nov 2023

Soil Moisture Percentile for 02 Nov 2023



Provisional data, subject to revision

Soil Moisture Percentile for 13 Nov 2023



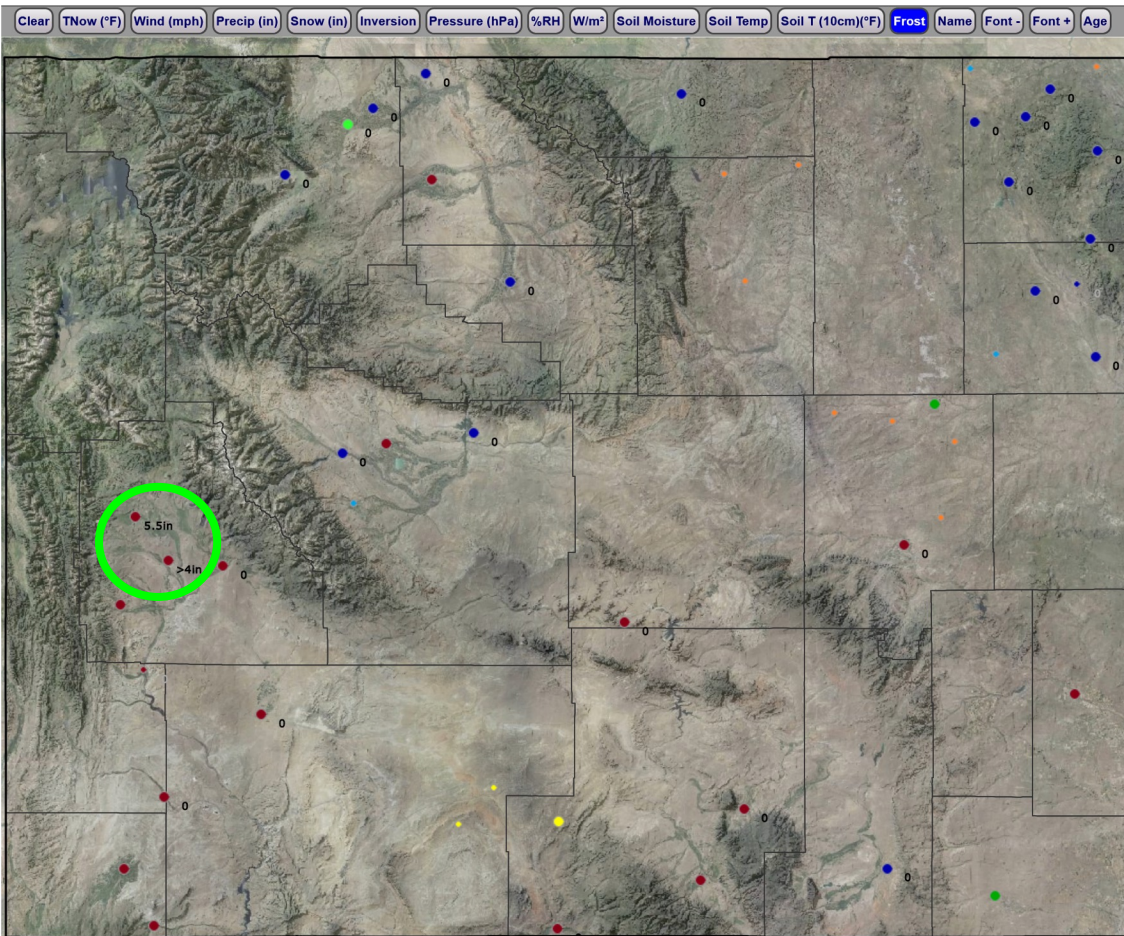
Provisional data, subject to revision

Modeled Soil Moisture Percentile https://www.cpc.ncep.noaa.gov/products/GIS/GIS_DATA/USDM_Products/soil/soil_percentile.php
Map Created 03 Nov 2023 <http://www.wrds.uwyo.edu>

Modeled Soil Moisture Percentile https://www.cpc.ncep.noaa.gov/products/GIS/GIS_DATA/USDM_Products/soil/soil_percentile.php
Map Created 14 Nov 2023 <http://www.wrds.uwyo.edu>

Improvements or Status Quo almost statewide
except for some deterioration in the southwest.

Frost



Wyoming Mesonet

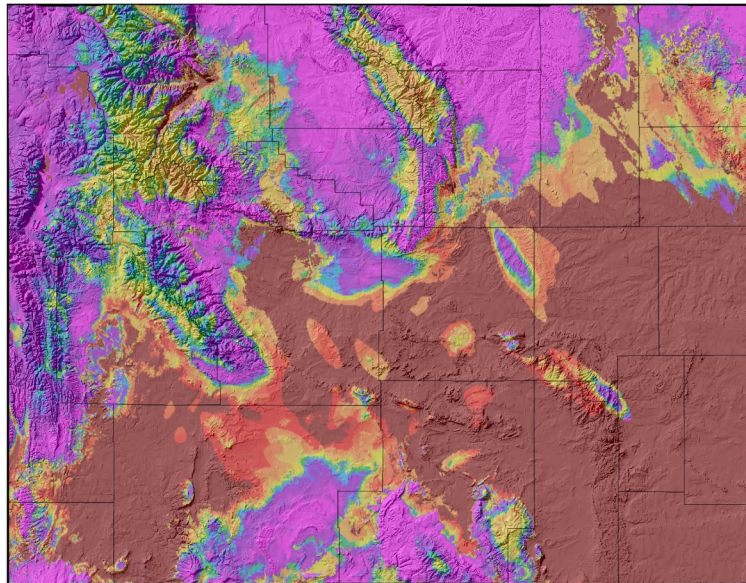
- SEO WACNET
 - UMRB (UW USACE)
 - Scheduled 2024
 - BLM
 - USDA-ARS
 - UW-Ext
- Small Dots: Obs > 2 hours old

Ground starting to freeze. Upper Green has some areas of persistent frozen soils now. Other areas have been getting intermittent freezes for a few weeks now.

Snow Water Equivalent (SWE) % of Average

16 Nov 2022 (One Year Ago)

Snow Water Equivalent Percent of Average (2004-2020) for 16 Nov 2022



Snow Water Equivalent
NOHRSC
<https://doi.org/10.7265/N5TB14TC>



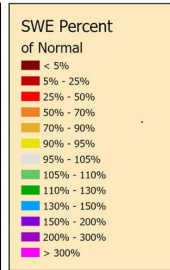
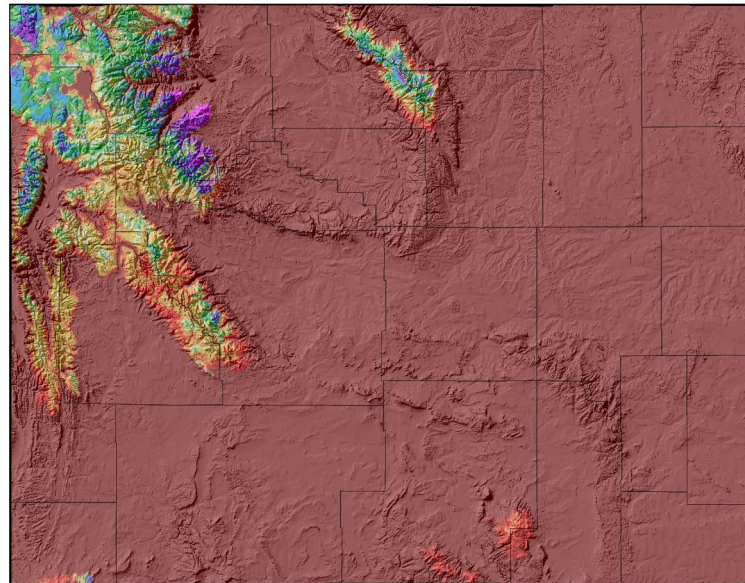
Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



Provisional data, subject to revision

16 Nov 2023

Snow Water Equivalent Percent of Average (2004-2020) for 16 Nov 2023



Snow Water Equivalent
NOHRSC
<https://doi.org/10.7265/N5TB14TC>



Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



Provisional data, subject to revision

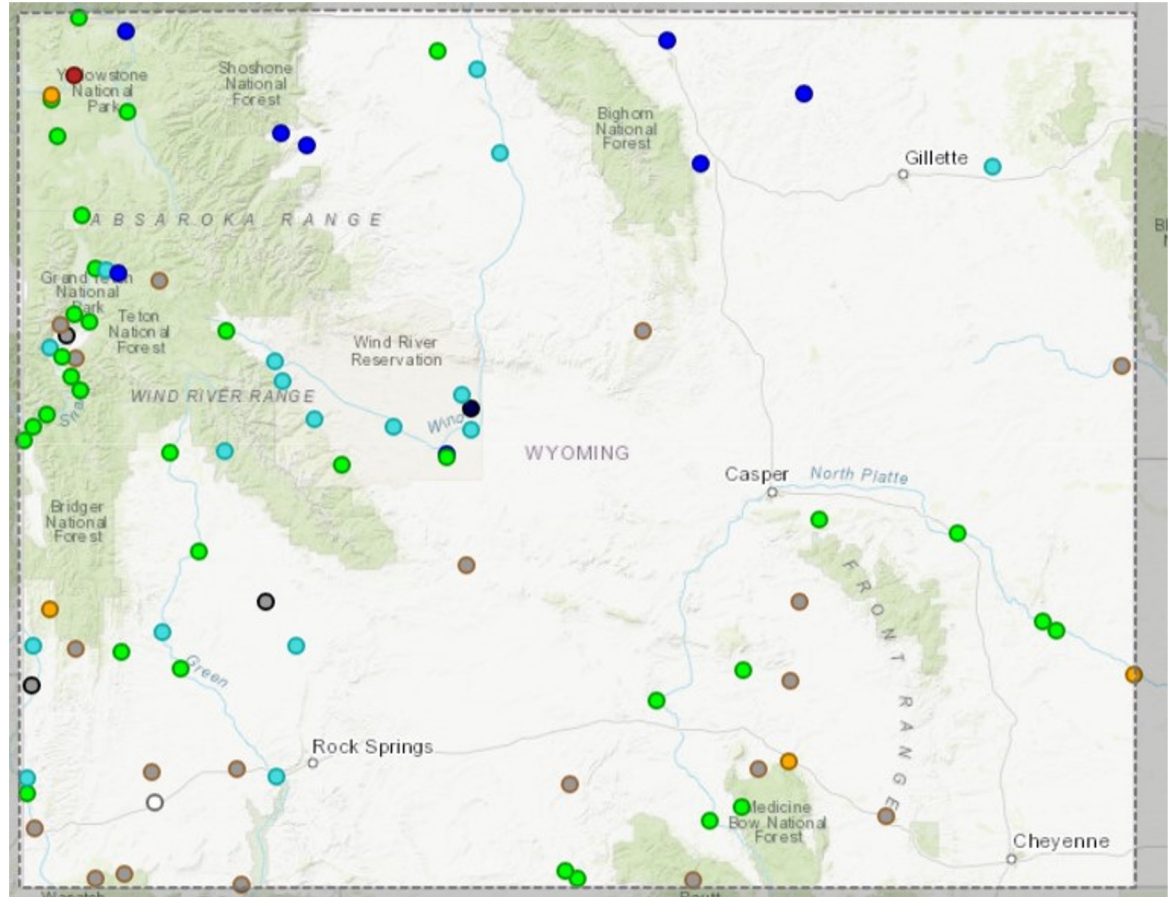
Modelled Snow Water Equivalent from National Operational Hydrologic Remote Sensing Center. 2004. Snow Data Assimilation System (SNODAS) Data Products at NSIDC, Version 1. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center.
doi: <https://doi.org/10.7265/N5TB14TC>.
Daily Percentiles and Percentages created by Wyoming State Climate Office
Map created 16 Nov 2022

Modelled Snow Water Equivalent from National Operational Hydrologic Remote Sensing Center. 2004. Snow Data Assimilation System (SNODAS) Data Products at NSIDC, Version 1. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center.
doi: <https://doi.org/10.7265/N5TB14TC>.
Daily Percentiles and Percentages created by Wyoming State Climate Office
Map created 16 Nov 2023

Streamflow Status

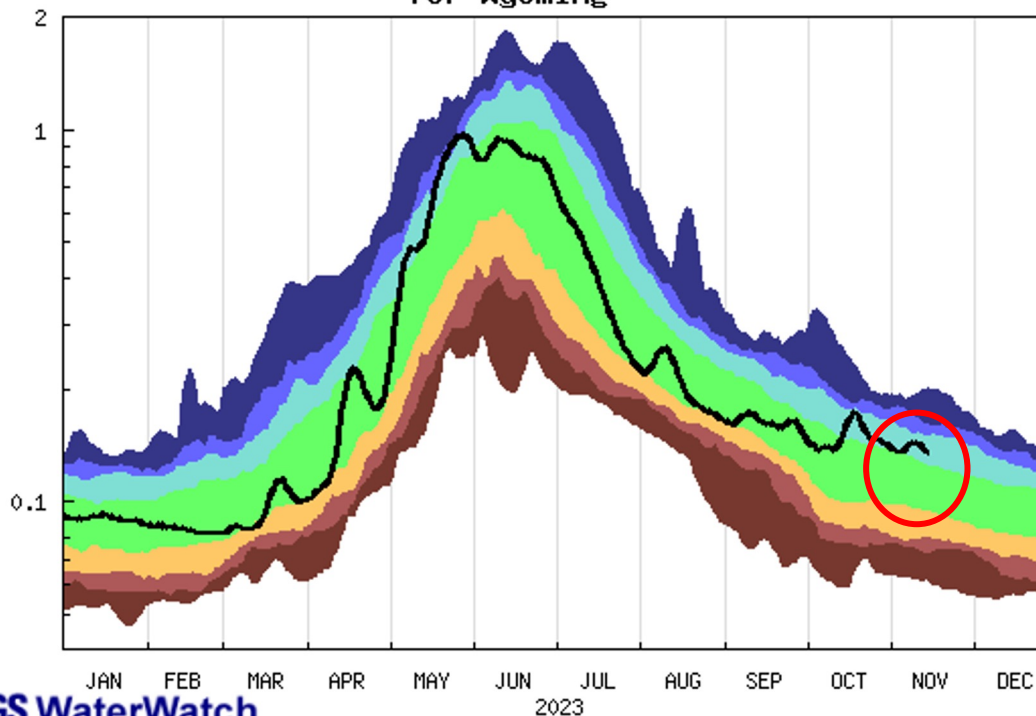
Streamflow: Status

- Above flood stage
- All-time high for this day
- Much above normal
- Above normal
- Normal
- Below normal
- Much below normal
- All-time low for this day
- Not flowing
- Not ranked
- Measurement flag
- Recent measurement unavailable



WY Duration Hydrograph of 7-day runoff

Duration hydrograph of 7-day average runoff
for Wyoming



Fall Streamflow

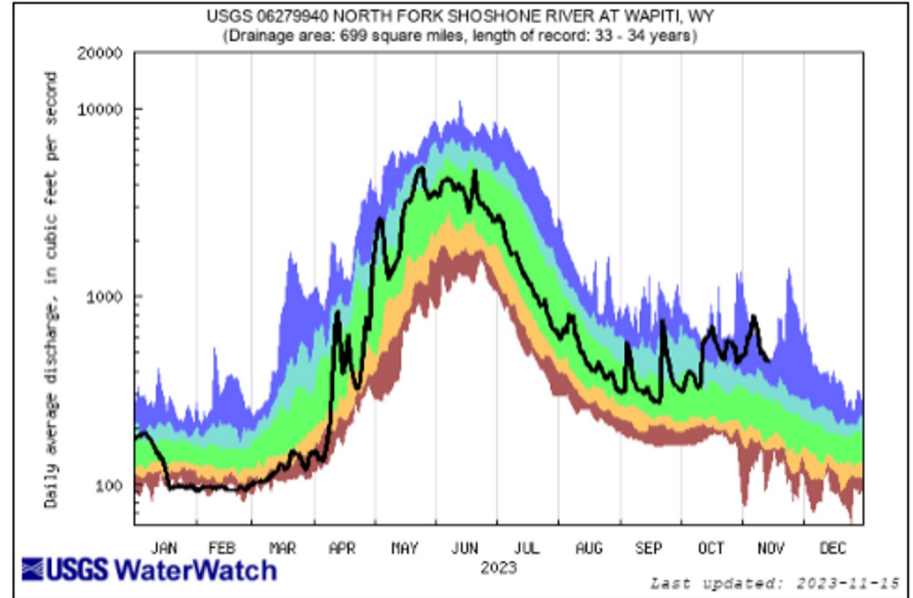
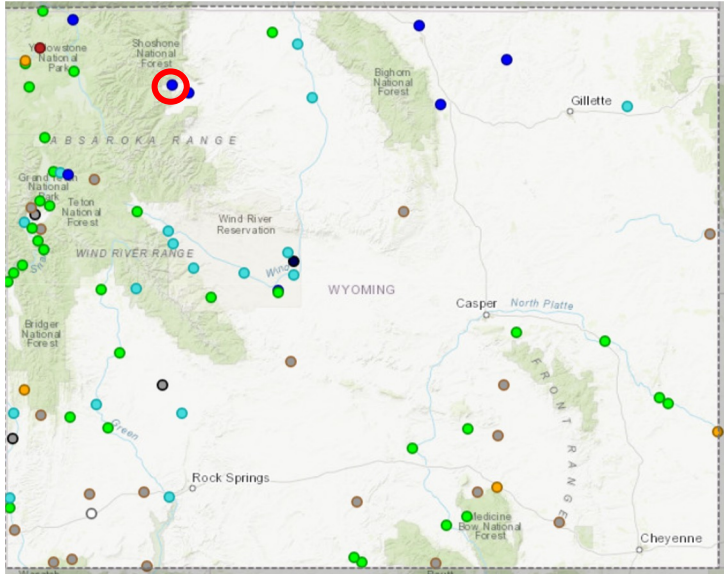
- Fall precipitation continues to sustain normal & above flow conditions.
- Above Normal (> 75 percentile) since mid-October.

Explanation - Percentile classes							
lowest-5th percentile	6-9	10-24	25-75	76-90	91-94	95th percentile - highest	Runoff
Severe hydrologic drought	Moderate hydrologic drought	Below normal	Normal	Above normal	Much above normal		

<https://dashboard.waterdata.usgs.gov/>

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

Select WY Streamflows



<https://dashboard.waterdata.usgs.gov/>

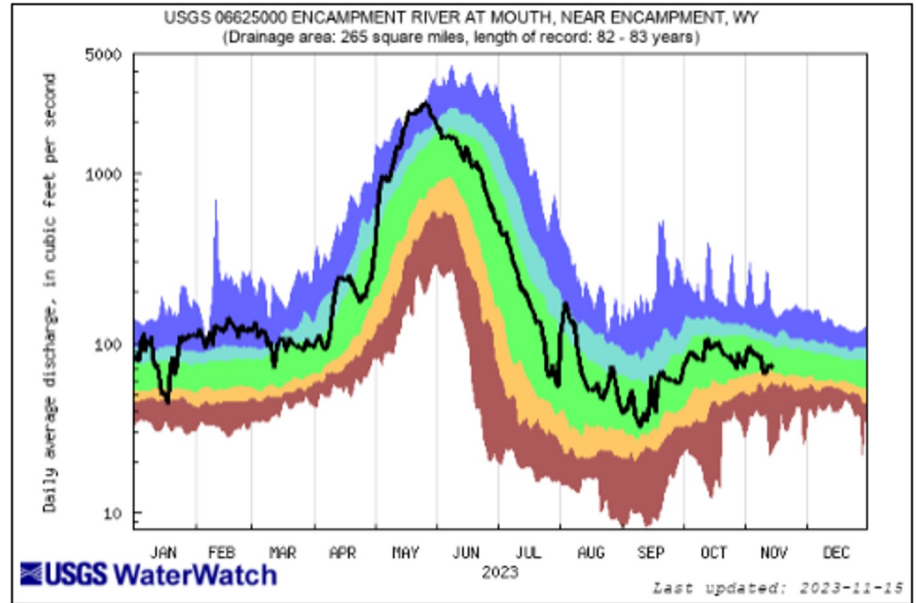
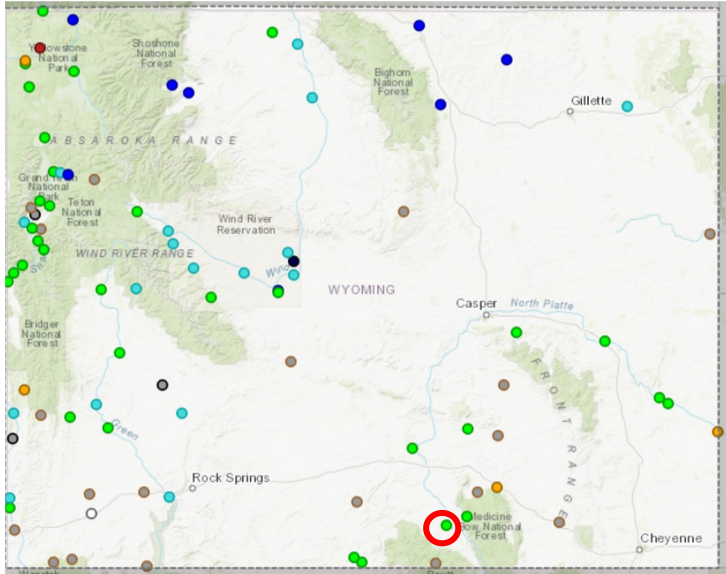
<https://waterdata.usgs.gov/>

Explanation - Percentile classes						
lowest-10th percentile	5	10-24	25-75	76-90	95	90th percentile - highest
Much below Normal	Below normal	Normal	Above normal	Much above normal		Flow

Encampment River at Mouth, Near Encampment, WY

Last updated November 16, 2023

Select WY Streamflows



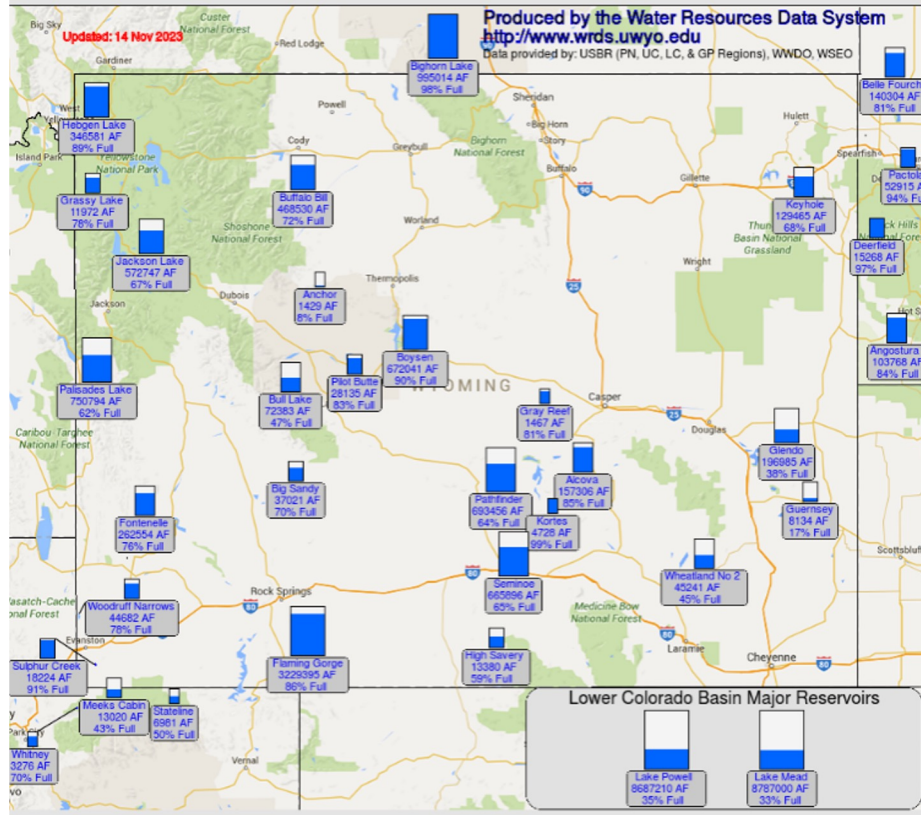
<https://dashboard.waterdata.usgs.gov/>

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

Explanation - Percentile classes						
lowest-10th percentile	5	10-24	25-75	76-90	95	90th percentile - highest
Much below Normal	Below normal	Normal	Above normal	Much above normal		Flow

WY Reservoirs

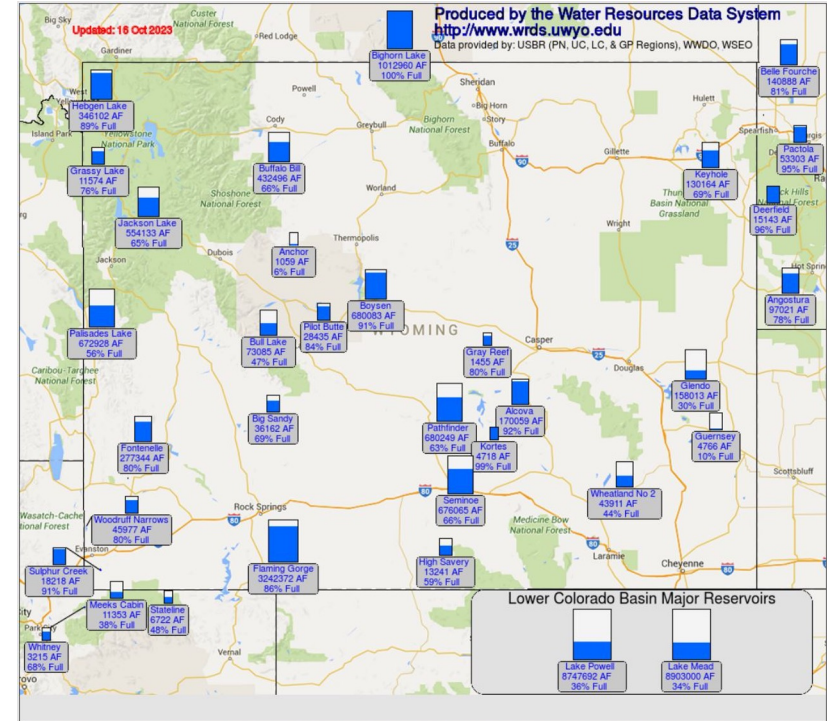
November 16, 2023



http://www.wrds.uwyo.edu/surface_water/teacups.html

- Minor changes (+/-) in reservoir storage
- Most are in between 60-98% full

Oct 16, 2023

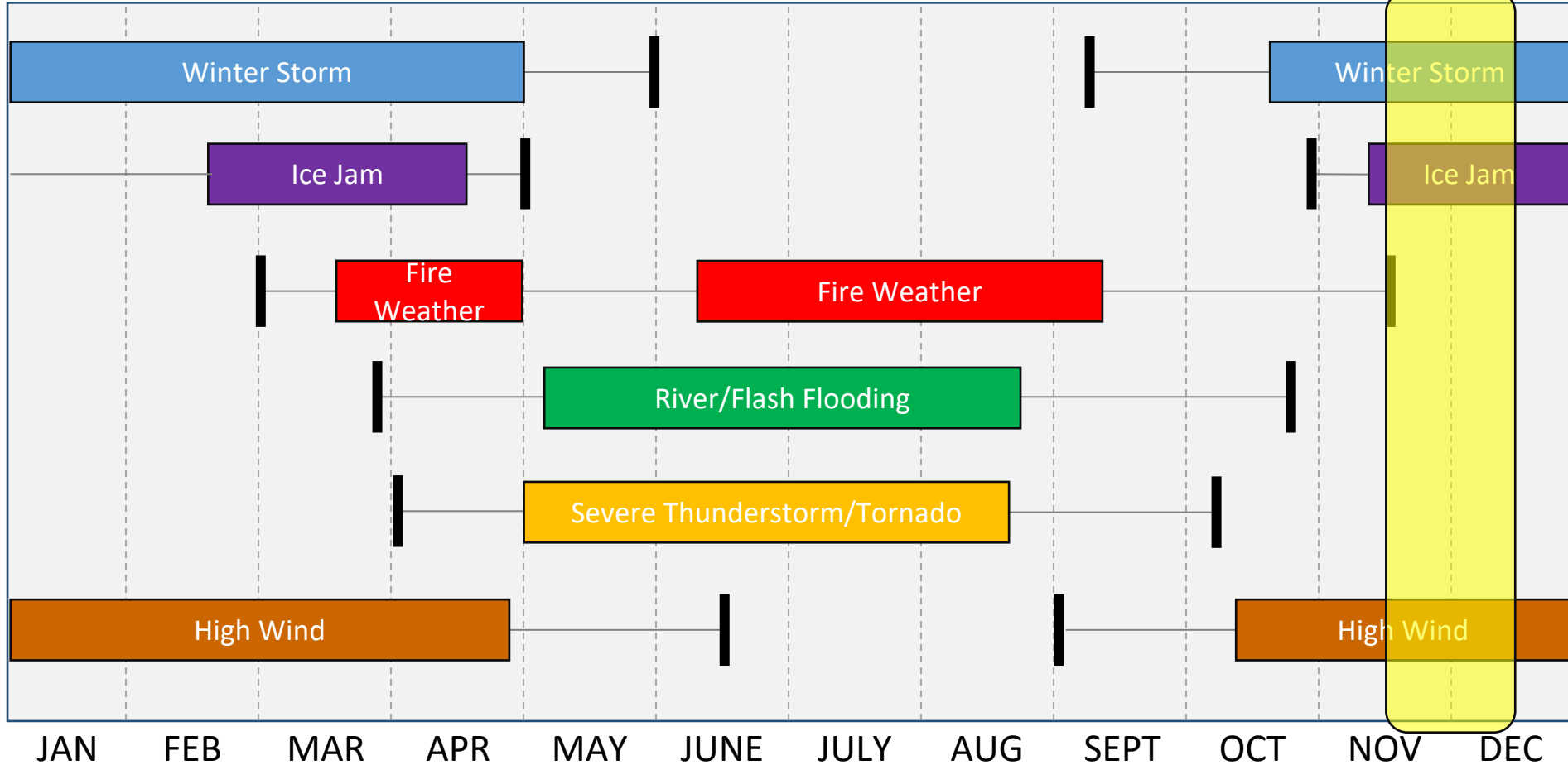




Weather Info & Forecasts



NWS Wyoming Typical Hazard Calendar

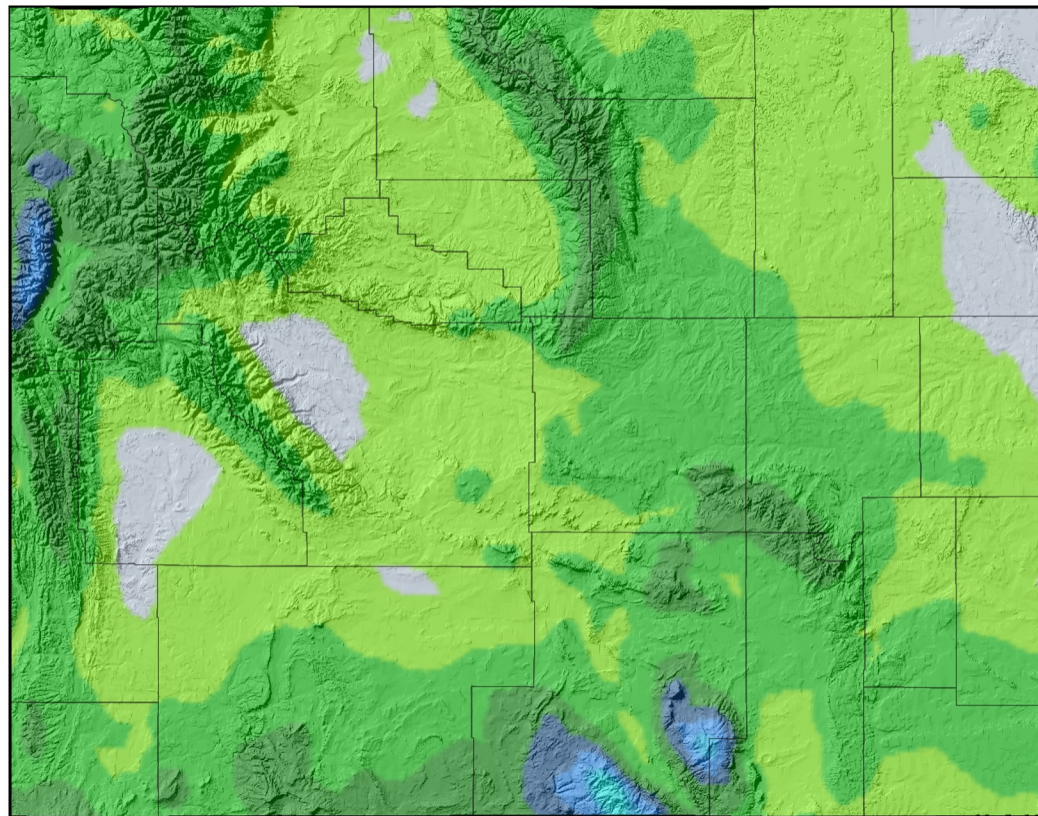




7-Day Total Precipitation Forecast

(Nov 16 - Nov 23)

7-Day Quantitative Precipitation Forecast 16 Nov 2023



Forecast:
Weather Prediction Center



Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



- Unseasonably warm. 5 to 10 degrees above average for most
- Precipitation across south today through tonight
- Next chance for precipitation Sunday into Monday



8-14 Day Outlooks (Nov 23 - Nov 29)

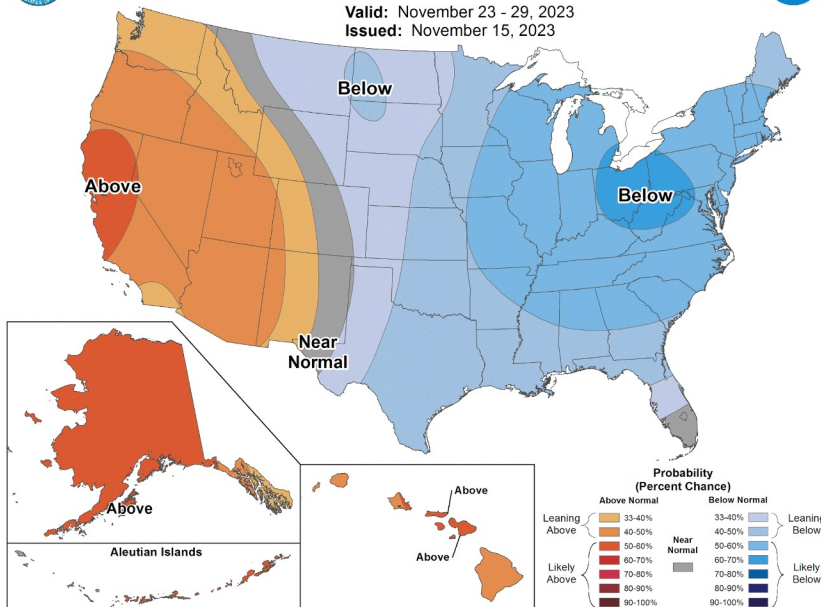
https://bit.ly/CPC8_14Day



8-14 Day Temperature Outlook



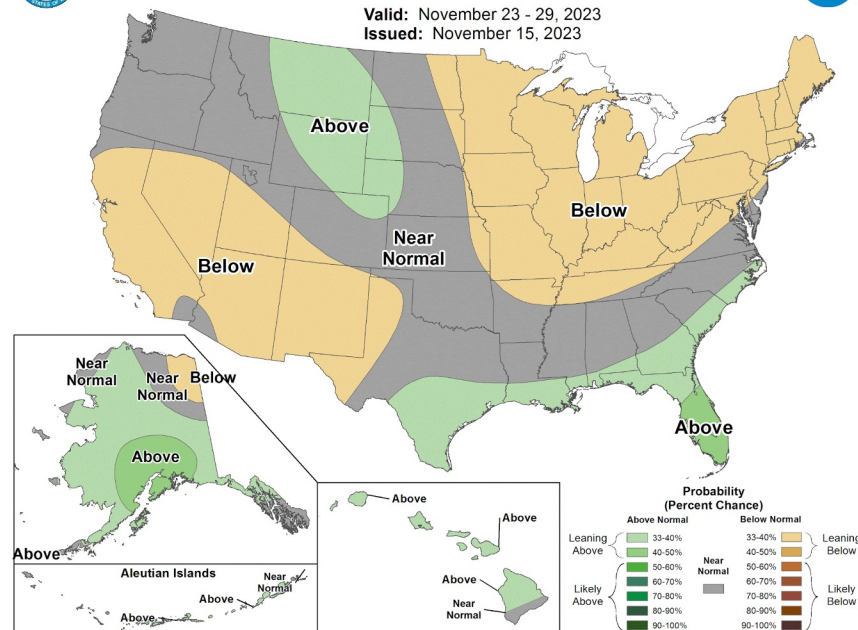
Valid: November 23 - 29, 2023
Issued: November 15, 2023



8-14 Day Precipitation Outlook



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



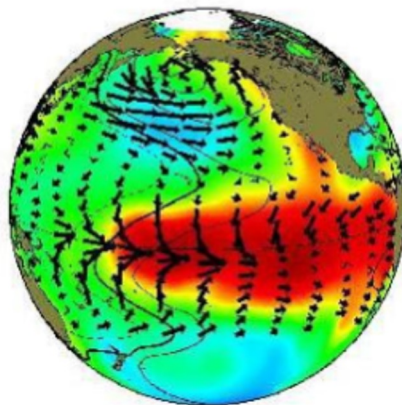
Slight lean toward above normal for southwest
Slight lean toward below normal for northeast

Weak signal for above-normal precipitation for most of the state

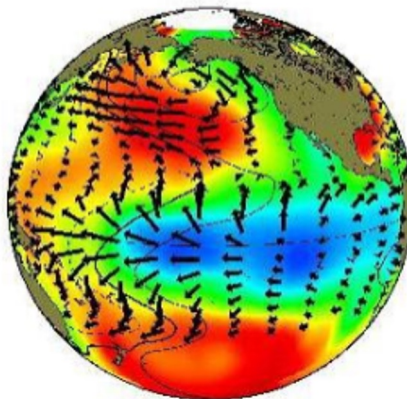


Understanding El Niño/La Niña & Seasonal Outlooks

El Niño



La Niña

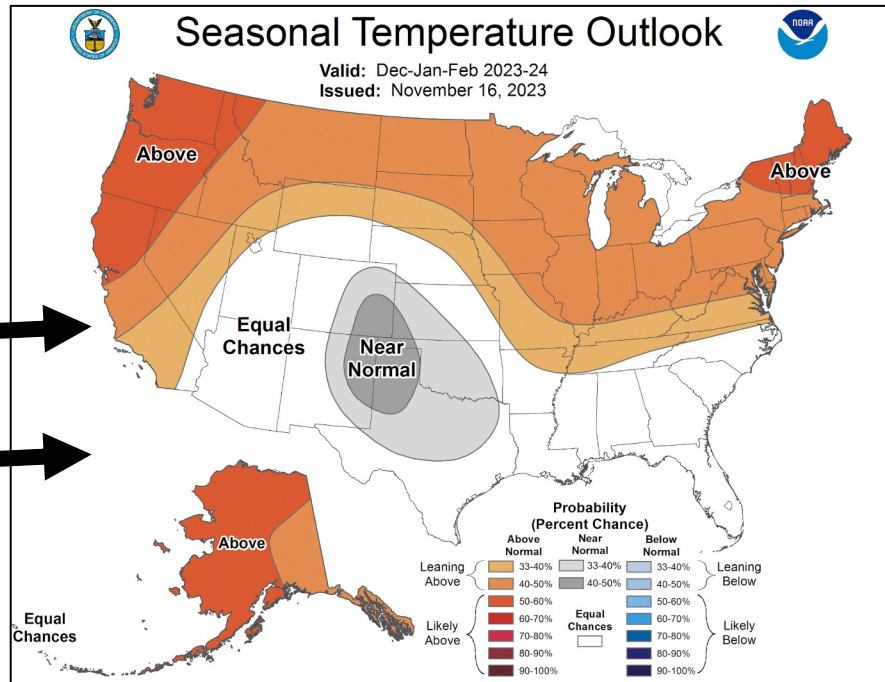
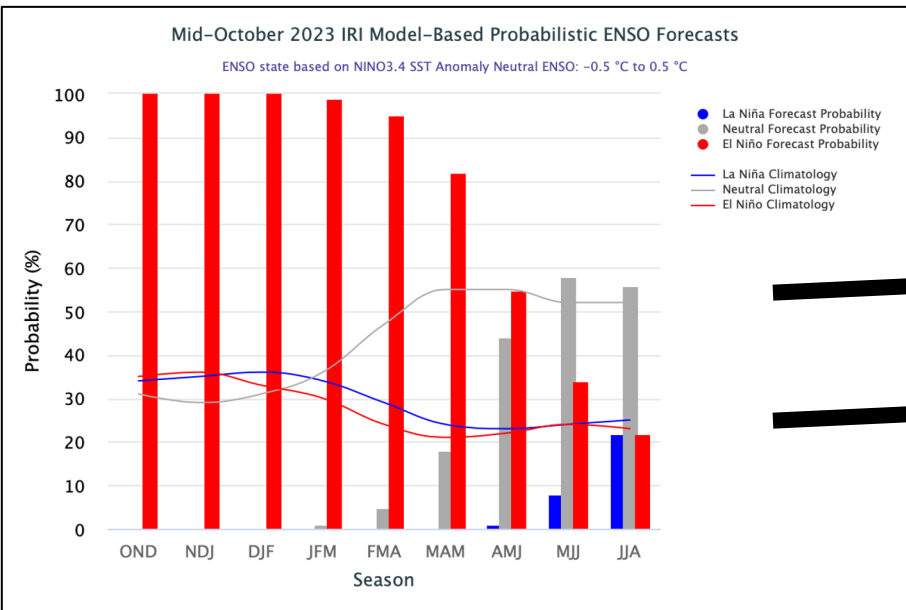


- The atmosphere interacts with the ocean (both are fluids)
- Above or below normal ocean temperatures affect the atmosphere
- Temperatures in the equatorial Pacific are tracked
- ENSO = “El Niño-Southern Oscillation” = The proper full name for this weather-climate phenomena
- Three “states” or “phases”
 - El Niño
 - La Niña
 - ENSO-Neutral

- A warmer (or cooler) than average equatorial Pacific ocean will influence winds & moisture patterns over specific areas of the globe
- Ocean temperatures affect where the jet stream is located, on average, over the course of several months
- Reminder: Jet streams are the areas of fast moving upper-atmosphere air, generally located between the equator and the poles
 - One can picture the jet stream as the the train tracks that weather system ride on
- If the jet stream is over an area “more often than usual” this can mean more precipitation (or heat) for some, and less for others



Understanding El Niño/La Niña & Seasonal Outlooks



- At local WY NWS offices, we are not climate science experts (we focus on next 7 days)
- Thankfully we know some at the Climate Prediction Center, and they create helpful graphics
- Graphics show how ENSO patterns translate to “above” or “below” normal for both Temperature & Precipitation



1-Month Outlooks (December)

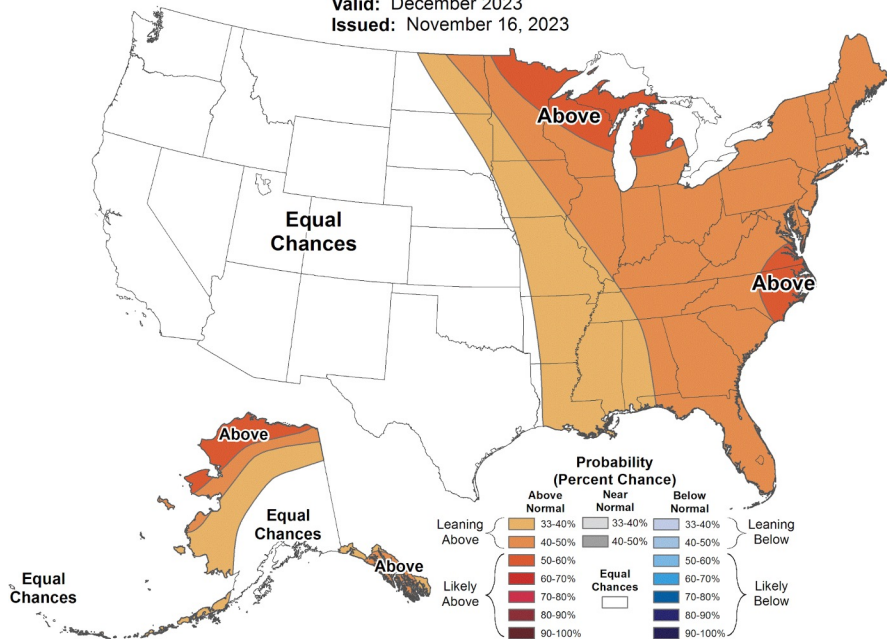
cpc.ncep.noaa.gov/products/predictions/30day/



Monthly Temperature Outlook



Valid: December 2023
Issued: November 16, 2023



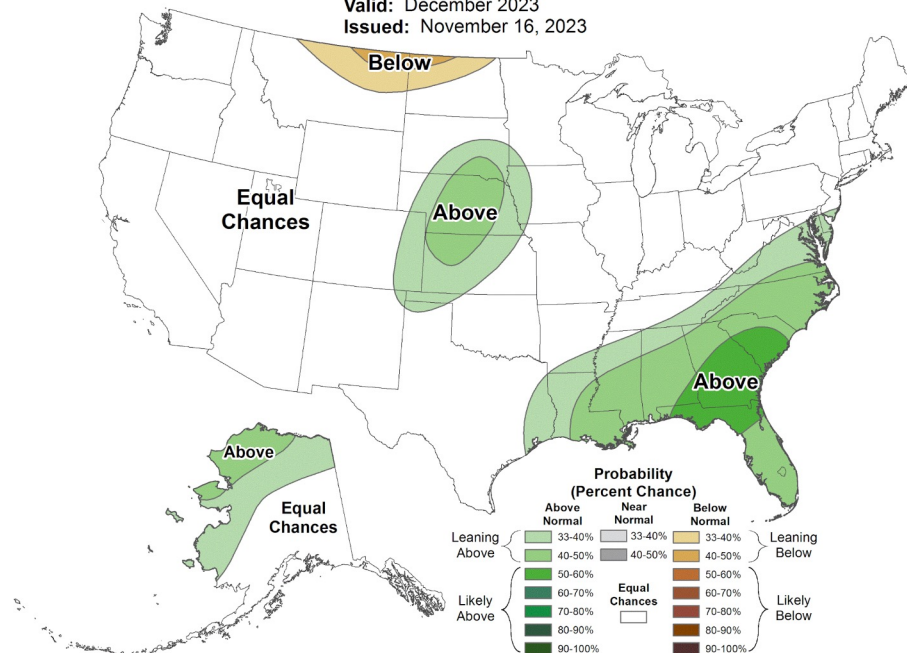
No clear signal from the global weather pattern: Near climatology is best forecast



Monthly Precipitation Outlook



Valid: December 2023
Issued: November 16, 2023



No clear signal from the global weather pattern: Near climatology is best forecast



Winter Season Outlooks (Dec-Jan-Feb)

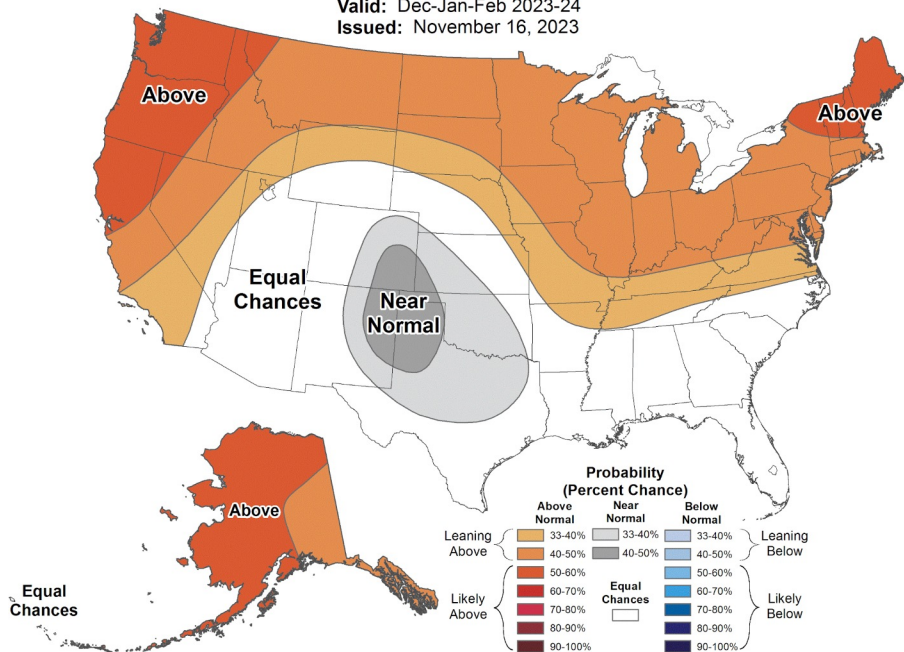
https://bit.ly/CPC_Seasonal



Seasonal Temperature Outlook



Valid: Dec-Jan-Feb 2023-24
Issued: November 16, 2023



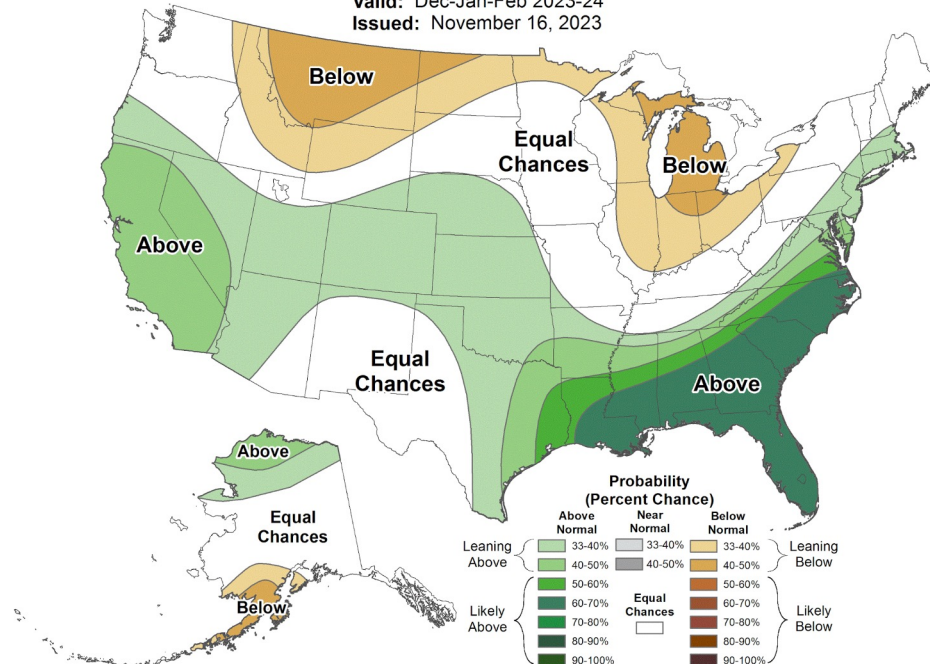
Slight lean toward above normal for the northern half of WY



Seasonal Precipitation Outlook



Valid: Dec-Jan-Feb 2023-24
Issued: November 16, 2023



Slight lean toward drier for northwest
Slight lean wetter for southeast



Highlight of the Month: El Niño's Effect on Wyoming and The Difficulties of Forecasting

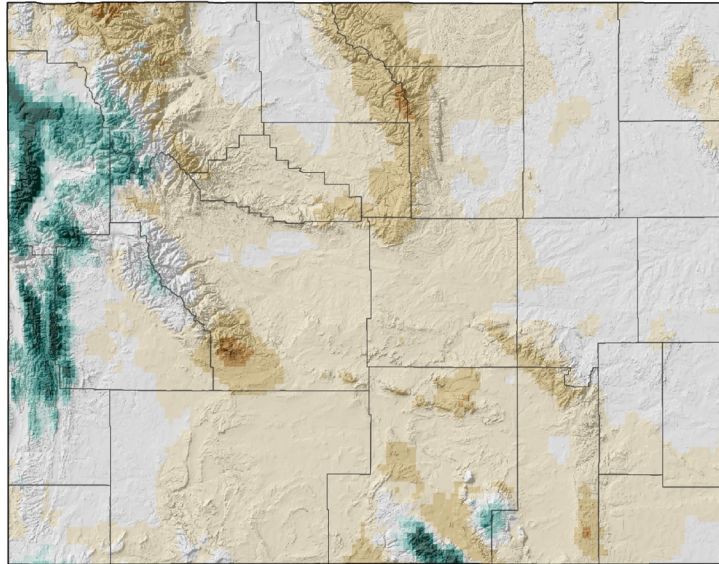
Dec-Feb Precipitation Departures from Average (two El Niño Events of the same strength [1.8/Strong])

1958

1958 DJF Precipitation Departure from 1950-1922 Average

1973

1973 DJF Precipitation Departure from 1950-1922 Average



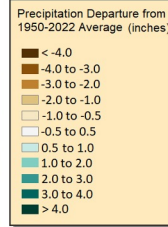
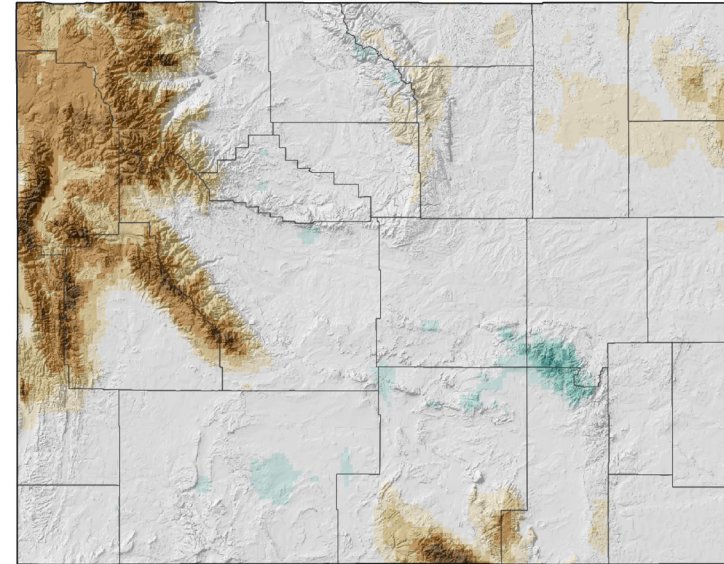
Precipitation Data
PRISM Climate Group
<http://prism.oregonstate.edu>



Map Prepared by:
Wyoming State Climate Office
<http://www.wrds.uwyo.edu>



Provisional data, subject to revision



Precipitation Data
PRISM Climate Group
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Map Prepared by:
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Calculations and Map Layout Created 25 Sep 2023 by Wyoming State Climate Office, <http://www.wrds.uwyo.edu>

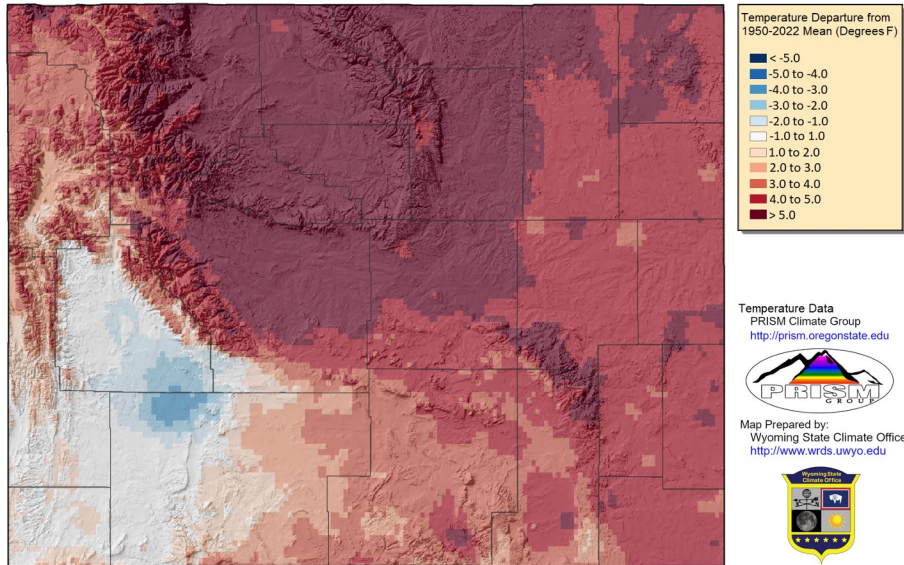
Monthly Precipitation data from PRISM Climate Group, Copyright 2023, PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>
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Differences in locations and amounts of precipitation during two similar El Niño events.

Dec-Feb Temperature Departures from Average (two El Niño Events of the same strength [1.8/Strong])

1958

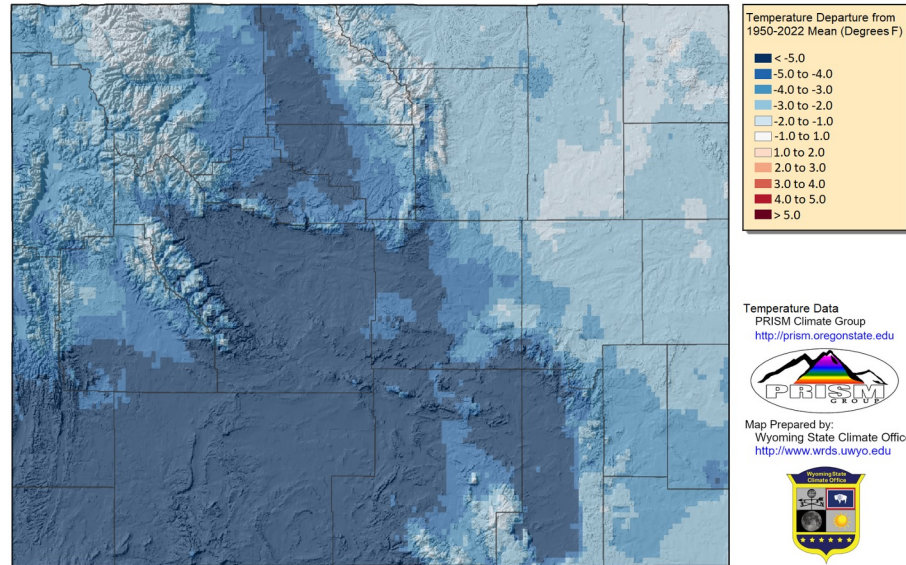
1958 DJF Average Temperature Departure from 1950-1922 Average



Provisional data, subject to revision

1973

1973 DJF Average Temperature Departure from 1950-1922 Average



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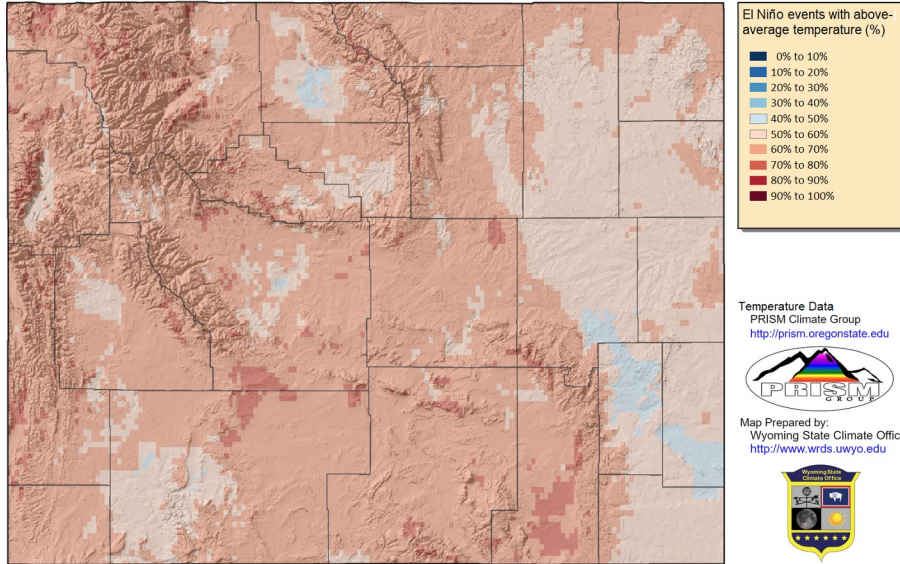
Monthly Temperature data from PRISM Climate Group, Copyright 2023, PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>
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Drastic differences in temperatures during two similar El Niño events

Dec-Feb Temperature and Precipitation during El Niño

Temperature

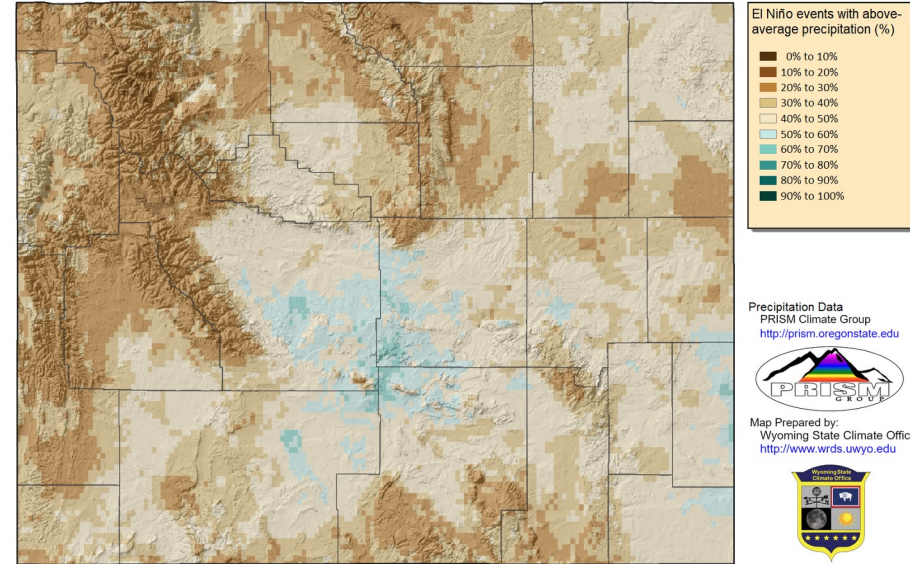
DJF Percentage of El Niño Events with Temperatures above the 1950-1922 Average



Provisional data, subject to revision

Precipitation

DJF Percentage of El Niño Events with Precipitation above the 1950-1922 Average



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Frequency of above/below average temperature and precipitation during the last 25 El Niño events.



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The WY Conditions Monitoring Team (WCMT) organized and hosted this webinar. The WCMT is a collaborative effort of state, federal, tribal, and university partners that monitor conditions & impacts throughout WY weekly – and communicate this info to the U.S. Drought Monitor & others.

Learn more at:

<https://drought.wyo.gov>

Thank you!