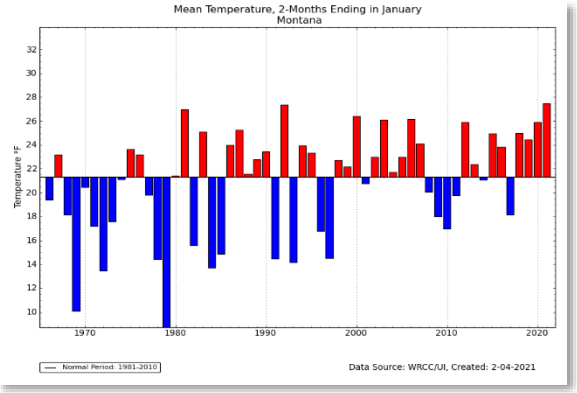
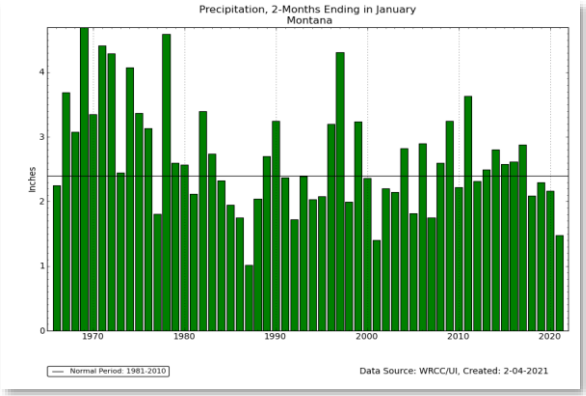
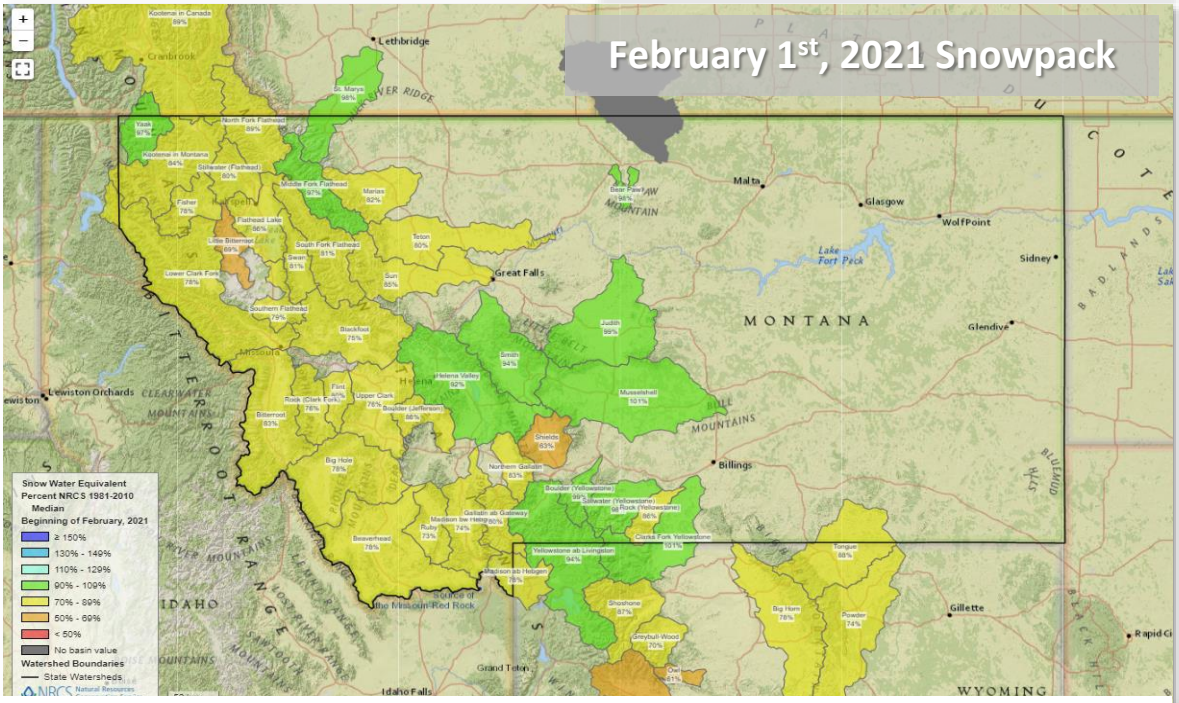
Montana
Water Supply Outlook Report
February 1st, 2021







Shown in the top two graphics are time-series plots dating back to 1965 showing the two-month average temperature and precipitation for December and January for the state of Montana. Statewide temperatures have been above average, and this past two-month period was the warmest since 1992. In addition, precipitation for the same time frame has been well below average and is the lowest two-month December and January total since 2000. As a result of these dry two months, snowpack across the state has declined since January 1st, with most basins in the state reporting below-normal snowpack on February 1st. Readers can find more information on weather and climate, precipitation, and snowpack in this month's report.

(To view larger versions of the time-sries graphics above, please click on the individual images)

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NRCS Snow Survey – Operational News

Technology Update

Network News –

The NRCS Montana Snow Survey Program maintains over 140 weather stations across Montana, Wyoming, and South Dakota. Mid-winter trips to the sites maintained by our office are made to check to ensure electronics are working as anticipated, making sure manual snowpack measurements verify the electronic readings, and sometimes fixing sensors or transmission equipment when they are experiencing issues.

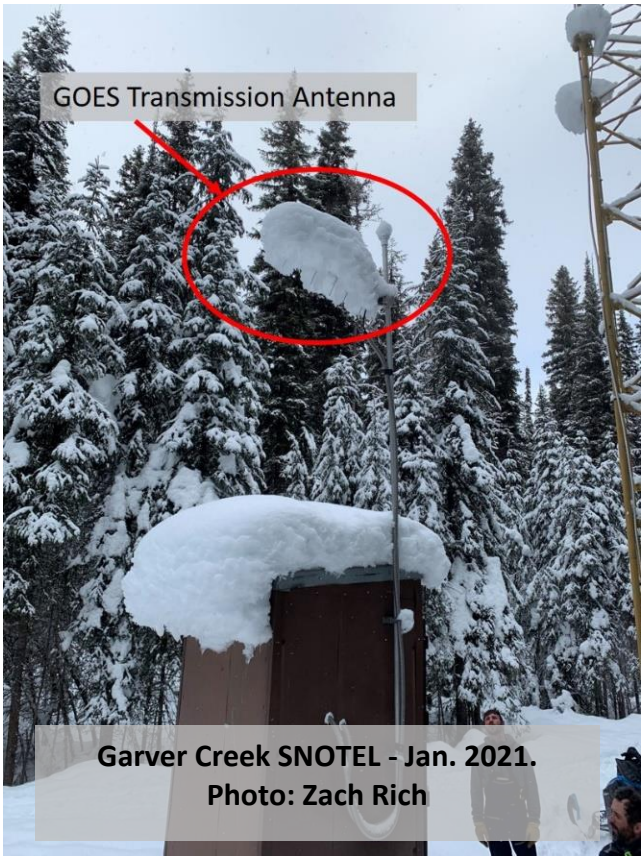
While the snowfall was far from record-setting this month, it was enough to cause some problems at some SNOTEL sites in the northwestern part of the state. Since mid-January, a handful of sites have had reporting issues, likely due to the heavy and wet snow that fallen.

The Garver Creek SNOTEL site, located a stone throw from the Canadian border in the Yaak River basin's headwaters, stopped reporting data on January 16th, 2021. The Montana Snow Survey staff made the long trek up to get the site back online before the February 1st report. We're happy to report that after much bushwhacking and sawing to get to the site, it was operational as of January 27th, 2021.

The issue at this site was something common to many SNOTEL sites west of the Divide, wet and heavy snow coating the transmission antenna. In this case (shown to the right), the snow had covered the antenna's transmit elements, making the site unable to communicate. While up north, the staff visited other locations with reporting issues, cleaned off antennas, and installed two new style antennas, which may help alleviate these issues in the future.

The NRCS Montana Snow Program staff works hard to ensure that our entire network operates as close to real-time as possible for our customers. While data outages are becoming less common with our move to new data loggers and telemetry systems, they still occur. Our staff tries to get down sites as quickly as possible to recover the lost data and get the site working for our customers. Sometimes, as shown in the picture above, just getting there can be tricky, and it can be challenging yet rewarding work.

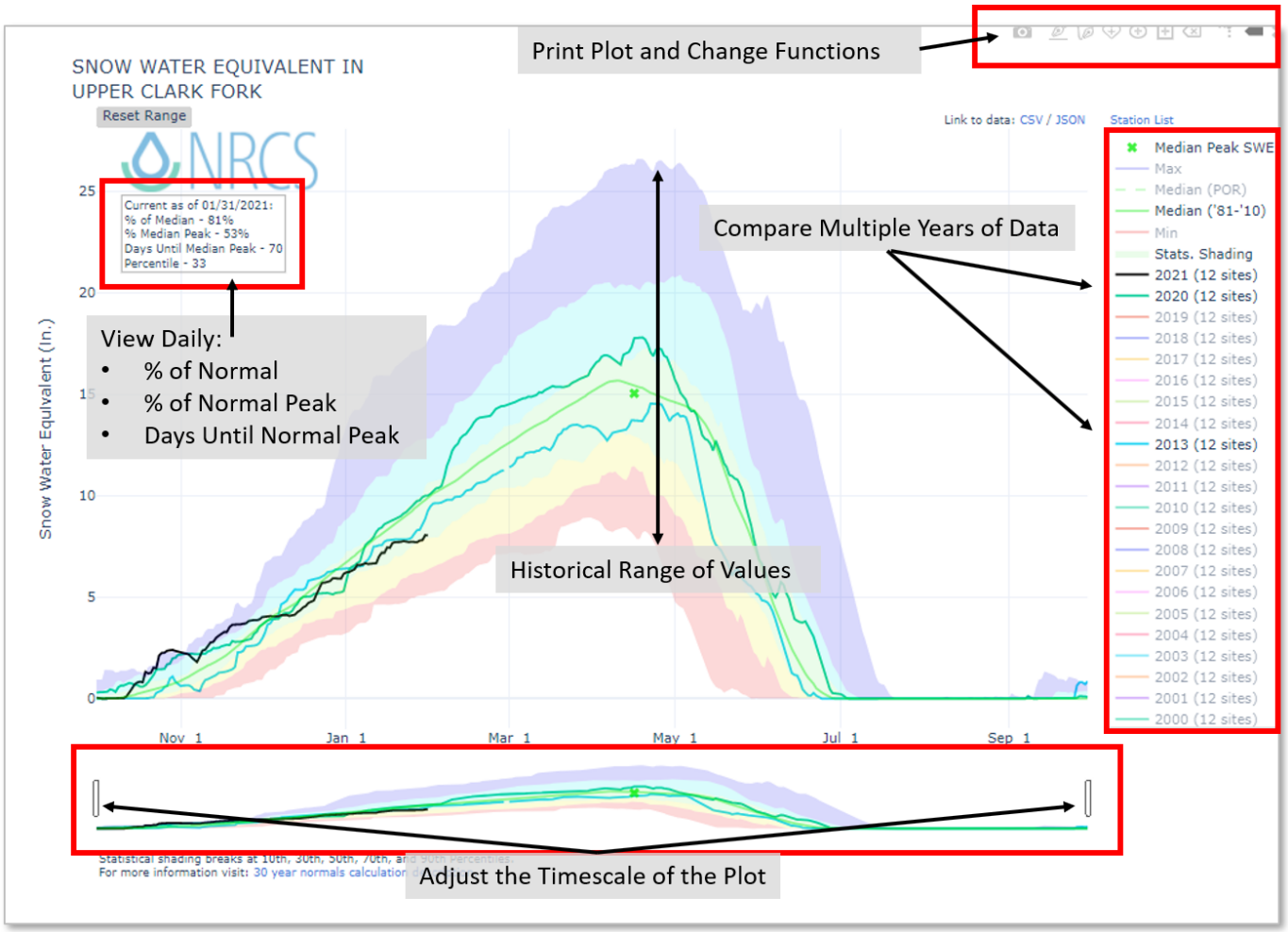
Garver Creek "Road" Access Jan. 2021. Photo: Zach Rich



Garver Creek SNOTEL - Jan. 2021. Photo: Zach Rich

NRCS Snow Survey – Product Highlights

Interactive Site and Basin Plots



In 2021, new interactive plots are available for several measurements collected by the NRCS Montana Snow Survey at mountain SNOTEL sites. Currently, plots are available for individual SNOTEL sites, and at the basin scale, for Snow Water Equivalent (SWE), Precipitation, and Air Temperature using daily data.

Unlike the legacy plots, these new tools allow the user to interact with and control what is displayed, providing tools to look at how this year compares to historical data and much more. Tools in the top menu allow for control of the plot functions and for exporting any configuration made into an image file for display to others who may be interested. A quick summary is also included in the top left box, which summarizes the daily conditions.

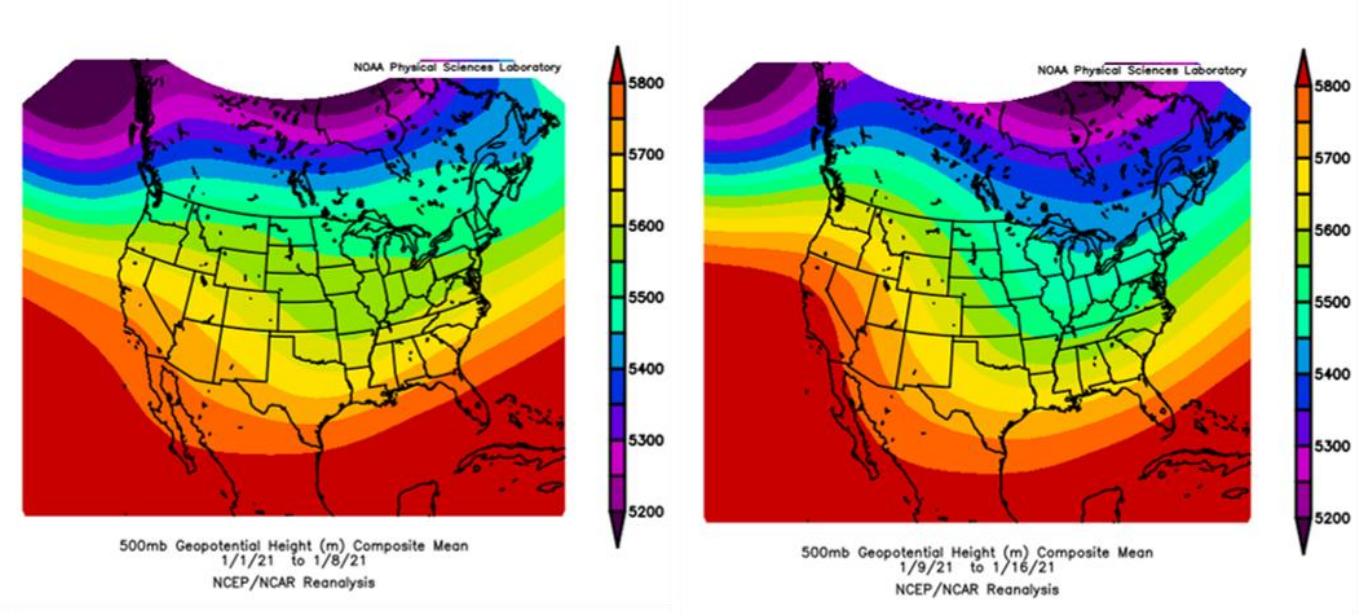
These plots have been integrated into many parts of the NRCS Montana webpages and the National Water and Climate Center's Interactive Map. When using the Interactive Map, these graphs will pop up for both the basin and station scale for whichever parameter you have selected (SWE or Precipitation). Clicking on the chart in the pop-up window will open a new window in your browser with a user-controlled version.

Interested parties can find standalone versions of these products on the NRCS Montana Snow Survey webpages in the Daily River Basin Conditions webpages, SNOTEL Site Data webpage, and Basin Plots webpage.

Monthly Weather: Weather and Climate

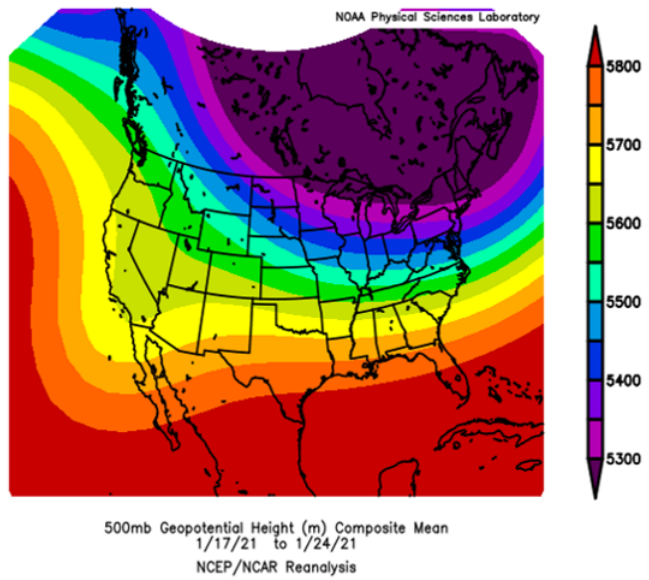
Circulation Patterns

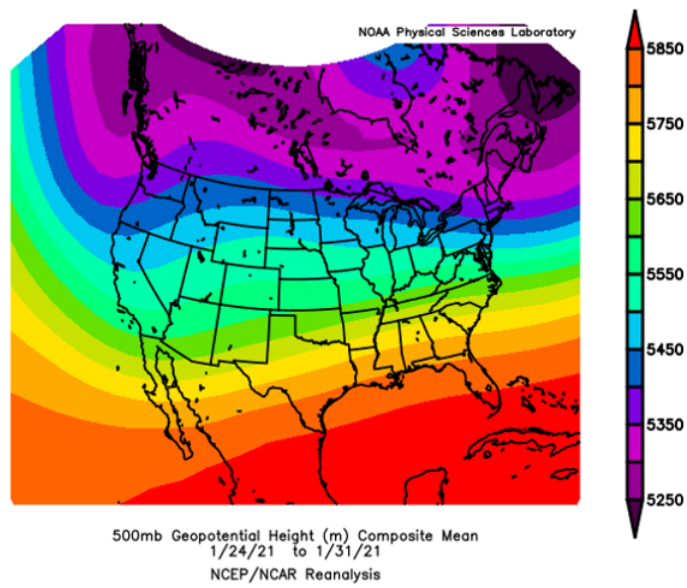
Unsettled weather began the month, and snow trickled in at many mountain locations. Totals were generally low in many areas of the state, but areas experienced elevated totals from the storm. South Central and SW MT received 0.5 to 2 inches of SWE between January 2nd and January 6th. Western Montana, along the Idaho and Canadian borders, also received 1 to 3 inches of SWE. Most other areas would receive snowfall during the period, but totals were on the lower side. During the second week of the month, snowfall favored locations along the Idaho border and northwest Montana after a strong frontal passage. This frontal passage, and following pressure gradient, caused significant wind damage and record-high valley temperatures across the state between January 12 and 14th. The days following would yield 1 to 3" of snow water in the Upper Clark, Bitterroot, and Big Hole River basins. Elsewhere in the state, high elevations would receive snowfall during this event, but the highest totals were focused along and west of the Divide.



500mb mean flow for the first two weeks of January. The pattern shown to the left during the first week of January was a continuation of what has been experienced so far this winter, with westerly flow dominating the period. At the end of the second week of the month, the overall pattern began to transition after a passing front brought high winds and well above average temperatures.

The third week of the month would see a transition to a rare (for this winter) intrusion of cold air from the northwest in Canada on January 17th, accompanied by moisture that would favor the southwest and central river basins for snowfall. From the 17th to the 18th, all SNOTEL sites in the Little Belt Mountains and Big Snowy Mountains would report the best storm so far this year, with 1 to 2 inches of SWE added to the snowpack in 48 hours, which would equate to around 24 inches of powder at Showdown Ski Area. During this same storm, north-facing ranges in the Gallatin River basin would also accumulate up to 1 inch of SWE. Unfortunately, the passage of this front would mark the beginning of yet another prolonged period without snowfall for many of the state's mountain ranges between January 18th and February 1st. The final week of the month experienced a shift to southwest flow, which would benefit the southwest river basins that have suffered from a lack of snowfall through much of this year.





500mb mean flow for the last two weeks of January 2021. The northwest flow shown to the left would favor the central and north facing ranges in the state with regards to precipitation, and significant snowfall occurred on January 17th in these areas. After this storm, prolonged dry weather persisted through the end of the month in most areas, however moist southwest flow delivered much needed snowfall to southwest Montana during the last five days of January.

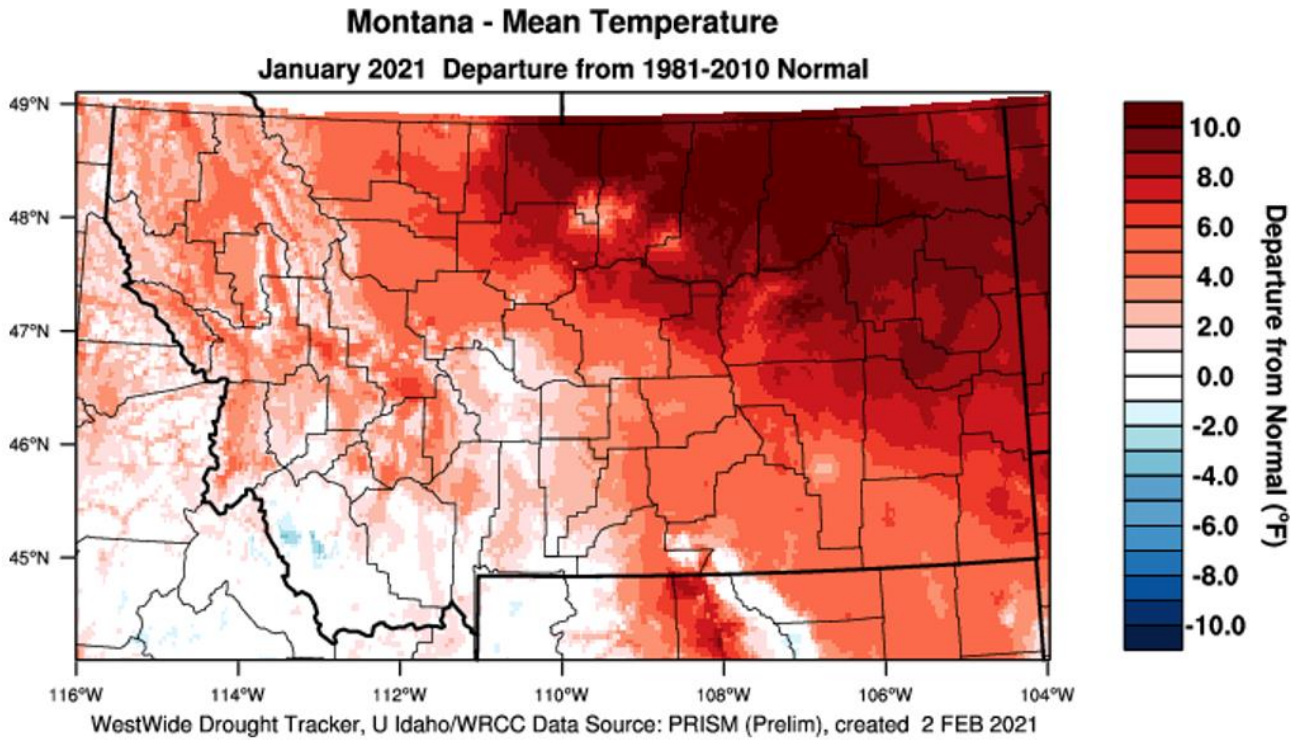
Air Temperatures

January would be recorded as above to well above normal for the average daily temperature for most Montana locations. Only one area, the Big Hole valley, would experience monthly average temperatures that were slightly below normal. Cold air trapping between January 21st and 25th caused very low temperatures in the Big Hole Valley, which influenced the monthly average.

The biggest anomalies during January were found in the northeast and eastern half of the state, where temperatures ranged from 4 to 10 degrees above average. As you move west, temperatures moderated and were closer to normal, but this was again due to the cold air that came into the state during the latter half of the month. Like the Big Hole, this would lower the monthly average. Had the warm westerly pattern remained in place, this month would have been recorded as above average for all locations in the state.

While some valley locations set new record high temperatures mid-month, mountain temperatures at SNOTEL sites didn't set any records for high or low daily average temperatures during January. However, they were above average for periods of the month.

Another notable event that occurred this month was the severe winds and record warmth between January 13th and 14th that would cause significant damage across the state. During this event, wind gusts reached up to 93 miles per hour in the Crazy Mountains north of Livingston on January 13th, and wind speeds exceeded 70 miles per hour in many plains between the western mountains and Dakota borders. A somewhat rare mid-winter wildfire was also reported near Roundup during this time.



Average Temperature for January 2021. The monthly average temperature is calculated by taking the daily average temperature for each day, the averaging those together for the monthly period. As such, this does not represent the anomalies in the average daily high and low temperatures, however this month, they were also above normal for most locations in the state.

Precipitation – Overview

January precipitation would be recorded as below-average to well below average for most areas of the state. It was the second month in a row of below-average precipitation for many areas. Combined December and January totals illustrate how anomalously dry the last two months have been. One mountain region that has been exceptionally dry over the last two months is the Upper Clark Fork headwaters, which experienced the driest months of December and January on record at mountain locations. Elsewhere in the state, precipitation totals were well below average in the Milk and Sun-Teton-Marias River basins, Red Lodge area, and in eastern Montana over the last two months. Looking at state-wide totals (all stations in the state), this January was the driest since January of 2007. The combined December-January total was the driest since December-January of 2001.

This water year has been interesting so far. On the one hand, looking at water year precipitation totals, the picture across many river basins might appear to be a pretty one due to the abundant October precipitation. Even with two months of well below-average precipitation, many areas are near or even above normal for this time of year for water year precipitation. On the other hand, there has been a drying trend over the last few months, and it is still to be determined what impact the October precipitation will have when it comes time for growing and runoff seasons.

Snowpack – Overview

After a disappointing month snowfall wise, snowpack totals on February 1st are down from January 1st in almost all river basins. As noted in the earlier sections of this report, snowfall was hit or miss throughout the month, with only a few storm systems passing through the state. During the first half of the month, storms favored basins west of the Divide, while the circulation patterns during the latter half of the month favored the central and southwest river basins.

All river basins west of the Divide have seen a decrease in snowpack percentages from January 1st, falling from near normal to below normal for this date. Entering January, these basins were still benefitting from early October snowfall, which helped to boost the early season snowpack numbers. However, two back to back months of below-normal snowfall finally outweighed the surpluses in October and November. The dryness west of the Divide this month was striking, as January is typically the "snowiest" month of the snow season. Only two significant storm systems impacted the region, the first on January 3rd and the second on January 12th. Most SNOTEL sites west of the Divide would experience a prolonged dry spell from January 18th until the 30th, receiving little to no snowfall during the period. An example of how dry it was in January on the west-side is the North Fork Jocko SNOTEL site, located in the southern Mission Range, which received only 3.6 inches of SWE during the month. This area typically receives heavy snowfall during January and is one of the “snowiest” locations in the state, with a normal accumulation of 9.5 inches. This month’s low total would tie a record low monthly total set in 2017. West of the Divide, the highest snowpack totals can be found in the Yaak River basins (97%), and the lowest can be found in the Blackfoot River (77%) and Little Bitterroot River (69%) basins.

Unlike the basins west of the Divide, some river basins on the east-side would hold on to near-normal snowpack conditions due to favorable flow patterns during the latter half of January. While snowfall trickled into the east-side basins during the first two weeks of January, two storms during the latter half of the month were the most significant. Mid-month, cold northwest flow delivered a quick shot of snowfall to the central ranges and north-facing regions of the southern ranges. During the end of the month, moist southwest flow delivered abundant moisture to far southwest Montana, which has been well below normal for snowfall this winter, and this storm helped to raise snowpack totals before the month ended. Currently, the St. Mary, Bears Paw Mountains, Helena Valley, Smith-Judith-Musselshell, and some Upper Yellowstone sub-basins have snowpack that is near to slightly below normal for February 1st. Elsewhere, the Sun-Teton Marias in north-central Montana dropped 30% this month and is currently 83% of normal, the snowpack in southwest Montana experienced modest increases and ranges from 77% to 79% of normal, and the Shields River basin in south-central Montana is the lowest in the state at 63% of normal.

On February 1st, 60 to 70 percent of the peak snowpack has accumulated west of the Divide. The front-loading of snowpack in these western basins means that snowpack recovery is less likely by spring runoff, but not impossible. The amount of snowfall needed to improve to a normal peak before runoff begins in these areas varies, but in general, it ranges from 125 to 145 percent of normal. East of the Divide, where 55 to 65 percent of the peak snowpack has typically accumulated, the make or break spring and early summer months are yet to come. The amount needed to recover before runoff is slightly lower in these areas, ranging from 120 to 130 percent of normal snowfall.

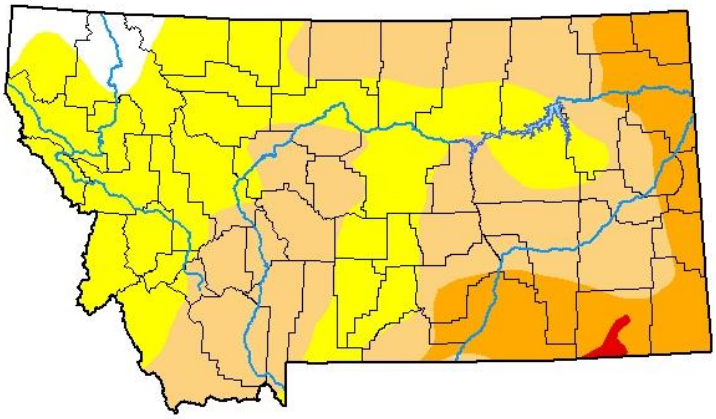
With more optimistic forecasts for snowfall in the next 14 days and beyond, there may be some signs that more favorable weather patterns may return to the state and start this recovery. You don’t have to look far back in time to find a miracle February 1st to March 1st snowpack recovery. On February 1st, 2019, the snowpack looked similar to this year, and after the month our office referred to as “Februburied,” the snowpack was in much better shape on March 1st. Come on, Februburied!

Reservoirs - Overview

Reservoir storage values typically change very little during the winter months and are in the same condition as last month. Most regions have reservoir storage that is near to above average for February 1st. The reservoirs mentioned last month (Fresno and Gibson) continue to have storage that is below average for this date.

Drought

The most recent National Drought Monitor map, released on February 2nd, 2021, shows drought over a large portion of Montana, with D0 expanding this month into areas west of the Divide due to well below-average January precipitation totals. In addition to the expansion west of the Divide, D0 and D1 expansion occurred east of the Divide along the Rocky Mountain Front and in the northern third of the state along the Hi-Line. Looking at the actual surface area in some category of drought, this is the most land area covered by these classifications on February 1st since February 1st, 2008. This is something for producers to be aware of entering the growing season should warm and dry conditions persist.



February 2, 2021
(Released Thursday, Feb. 4, 2021)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	3.34	96.66	56.54	16.21	0.36	0.00
Last Week 01-26-2021	14.45	85.55	48.25	16.21	0.36	0.00
3 Months Ago 11-03-2020	9.42	90.58	49.77	8.20	0.36	0.00
Start of Calendar Year 12-29-2020	36.37	63.63	34.41	8.27	0.36	0.00
Start of Water Year 09-29-2020	11.86	88.14	40.59	4.22	0.02	0.00
One Year Ago 02-04-2020	96.50	3.50	0.00	0.00	0.00	0.00

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

As of December 23rd, 2020, numerous primary and contiguous counties in eastern Montana fall within Secretarial Drought Designations. A map of these designations for Crop Year 2020 can provide information on whether your county meets assistance requirements.

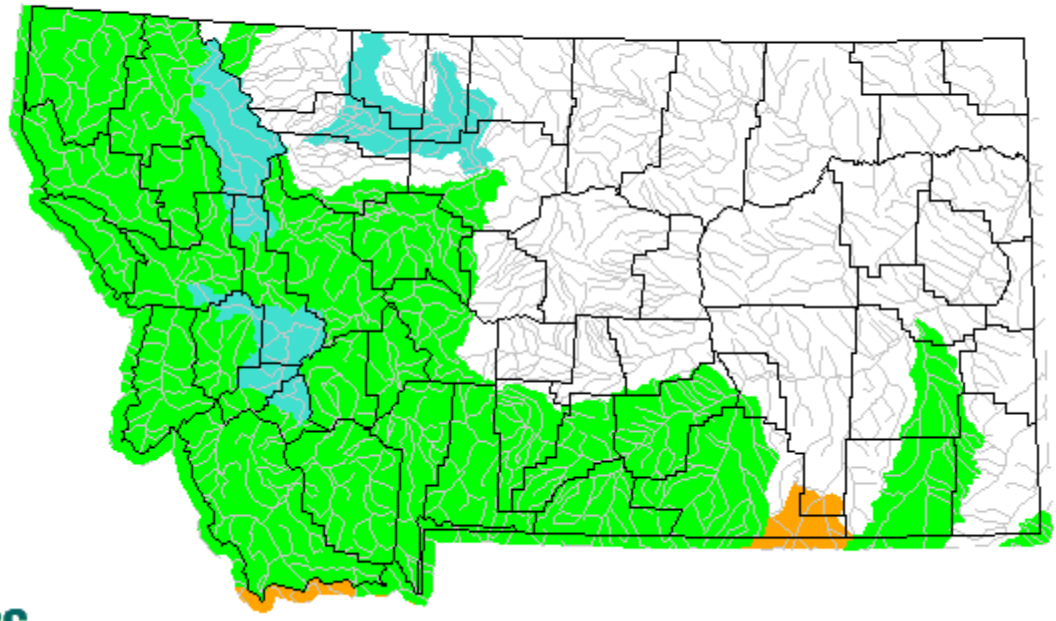
If you would like more information about current drought conditions or require assistance due to drought, the links below can help you gather information and assist you in getting in touch with the appropriate agencies.

Drought Links:

- USDA Drought Portal (News and Impacts)
- Farm Services Agency News – Montana (Information on Programs and Deadlines)
- Farm Services Agency – National (Disaster Assistance Programs)
- List of Available Disaster Emergency Services (Drought/Fire)
- Montana Department of Natural Resources and Conservation (Drought Management)

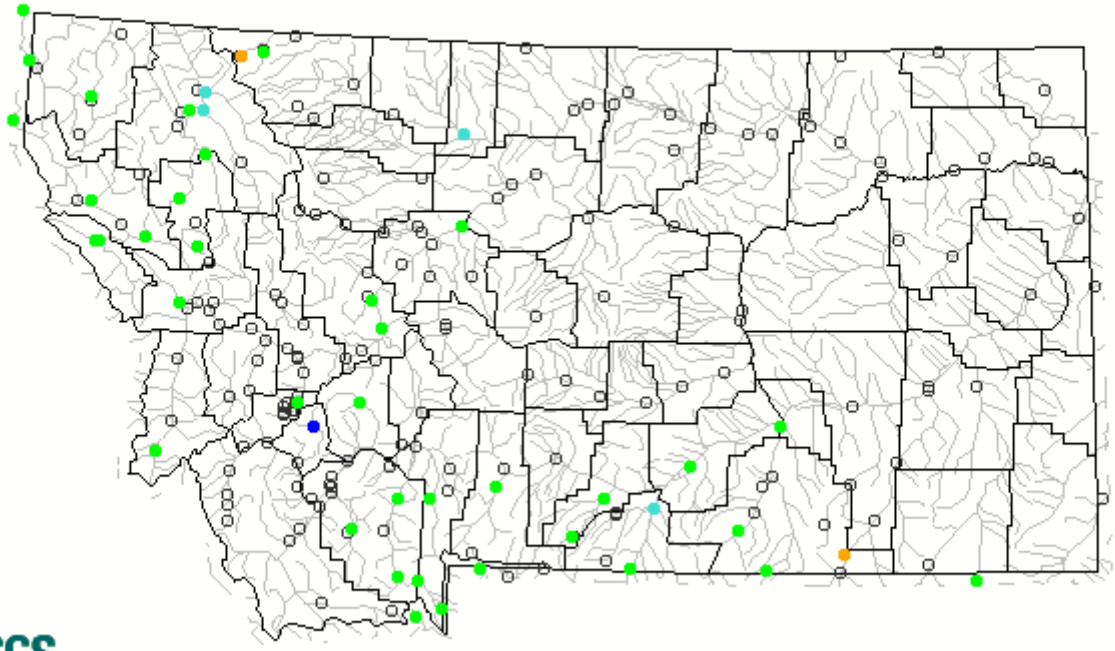
Current Streamflows

Monday, February 01, 2021



USGS

Monday, February 01, 2021



USGS

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		

Streamflow Forecast Charts

In 2019, a decision was made to discontinue Montana's forecasts for January and February based on the long lead time before the snowpack reaches peak accumulation and runoff begins. Due to the uncertainty inherent in these long lead time forecasts, the skill for early forecasts was very low, meaning there could be significant error (high or low) with the issued forecasts when compared to the observed flows for spring and summer.

However, we understand that there are non-traditional needs and some who are willing to accept these forecasts' low skill. If the discontinuation of these forecasts has impacted your operations, please let us know. We would embrace a discussion on how we can suit your needs and potentially issue limited point forecasts in the future.

Volumetric streamflow forecasts are produced for Montana rivers and streams between March and June for the spring and summer periods. Forecasts are typically available for use in online tools by the fifth business day of these months. The monthly reports between March and June will include the forecasts in the section below.

How Forecasts Are Made

Most of the annual streamflow in the Western United States originates as snowfall that has accumulated high in the mountains during winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Predictions are based on careful measurements of snow water equivalent at selected index points. Precipitation, temperature, soil moisture and antecedent streamflow data are combined with snowpack data to prepare runoff forecasts. Streamflow forecasts are coordinated by Natural Resources Conservation Service and National Weather Service hydrologists. This report presents a comprehensive picture of water supply conditions for areas dependent upon surface runoff. It includes selected streamflow forecasts, summarized snowpack and precipitation data, reservoir storage data, and narratives describing current conditions.

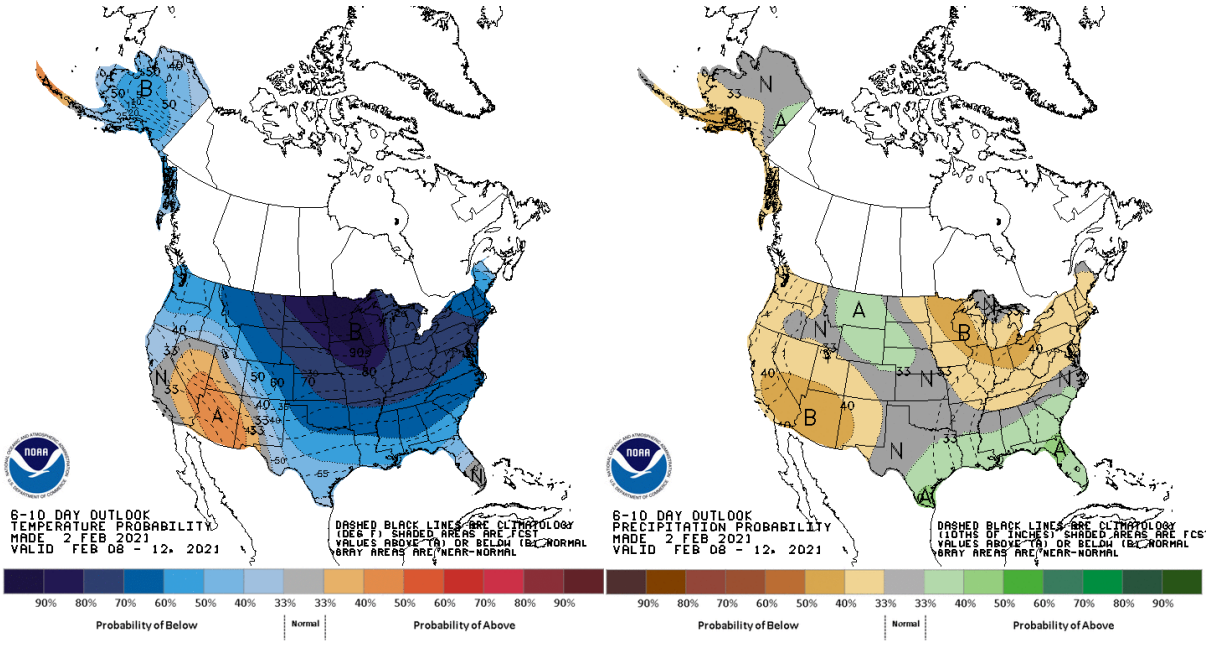
Snowpack data are obtained by using a combination of manual and automated SNOTEL measurement methods. Manual readings of snow depth and water equivalent are taken at locations called snow courses on a monthly or semi-monthly schedule during the winter. In addition, snow water equivalent, precipitation and temperature are monitored on a daily basis and transmitted via meteor burst telemetry to central data collection facilities. Both monthly and daily data are used to project snowmelt runoff.

Forecast uncertainty originates from two sources: (1) uncertainty of future hydrologic and climatic conditions, and (2) error in the forecasting procedure. To express the uncertainty in the most probable forecast, four additional forecasts are provided. The actual streamflow can be expected to exceed the most probable forecast 50% of the time. Similarly, the actual streamflow volume can be expected to exceed the 90% forecast volume 90% of the time. The same is true for the 70%, 30%, and 10% forecasts. Generally, the 90% and 70% forecasts reflect drier than normal hydrologic and climatic conditions; the 30% and 10% forecasts reflect wetter than normal conditions. As the forecast season progresses, a greater portion of the future hydrologic and climatic uncertainty will become known and the additional forecasts will move closer to the most probable forecast.

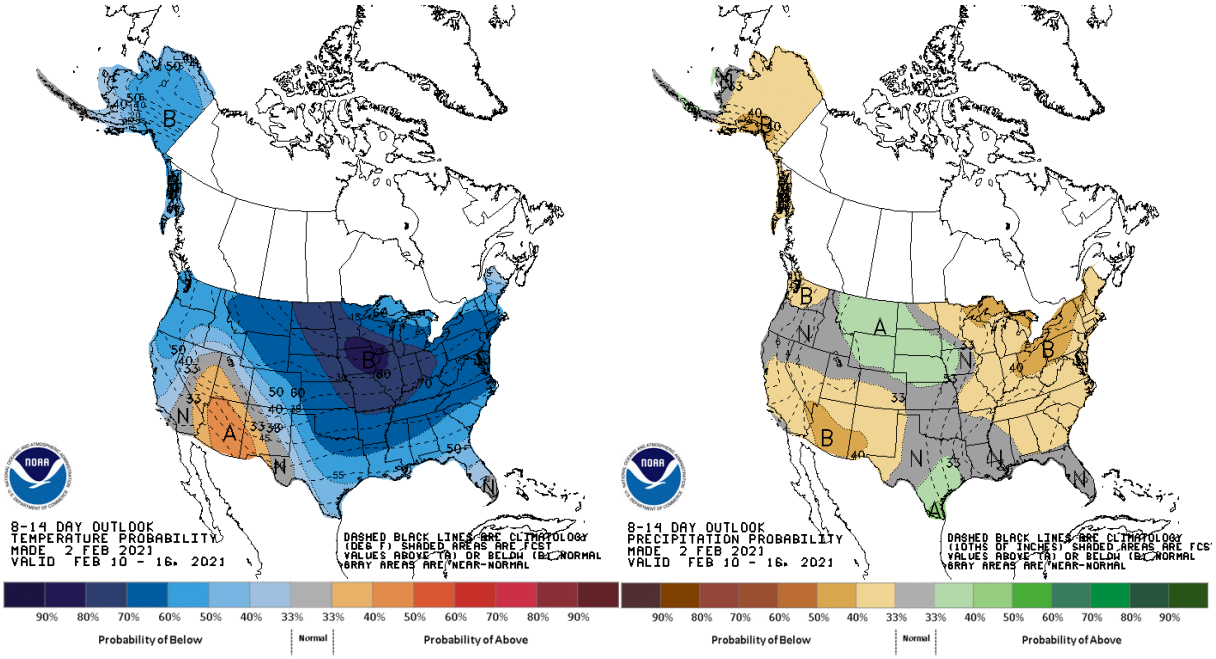
Looking Ahead

Medium and Long-range forecasts issued by [NOAA's Climate Prediction Center](#) are finally starting to indicate an increased likelihood of a colder and wetter pattern for Montana in the coming 6 to 14 days and beyond. Short-range forecasts for the first week of February look favorable for snowfall across many of the state's mountain ranges, with southwest flow during the week yielding to northwest flow during the first weekend. Beyond that period, medium-range forecasts continue to indicate better than normal chances of below-normal temperatures and an increased likelihood of near to above-normal precipitation through the end of the second week of the month. Long-range forecasts issued in late January for the February through April period mimic the medium-range forecasts with above-normal chances of colder and wetter conditions persisting into spring. Perhaps La Nina was just late to the party this year?

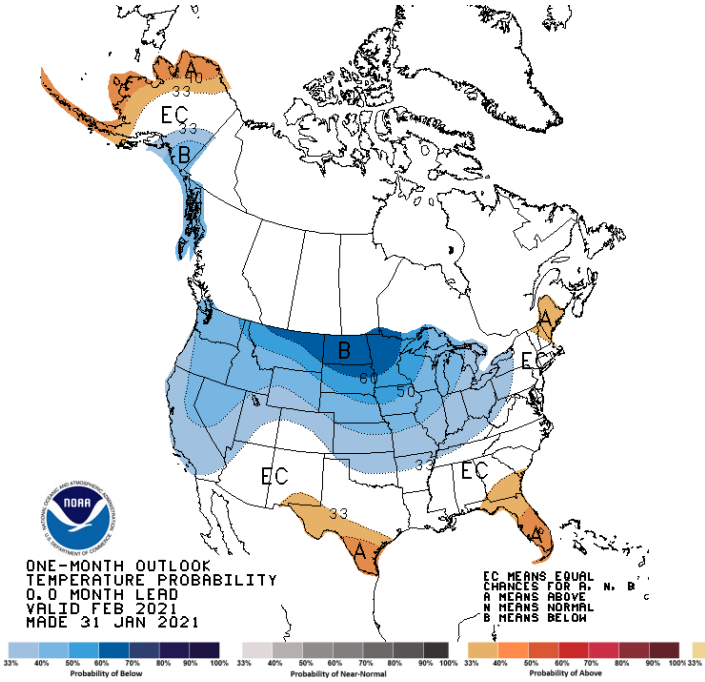
6 to 10 Day Outlook (Published Feb 2, 2021)

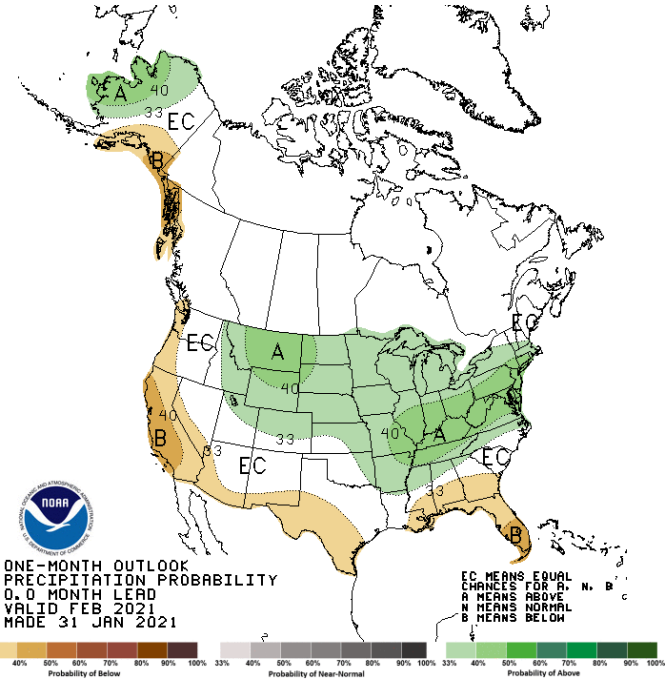


8 to 14 Day Outlook (Published Feb 2, 2021)

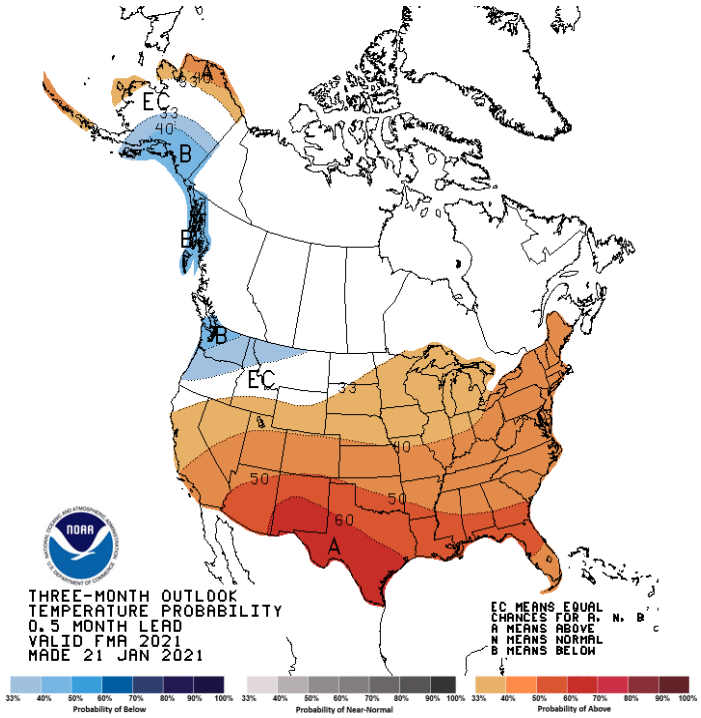


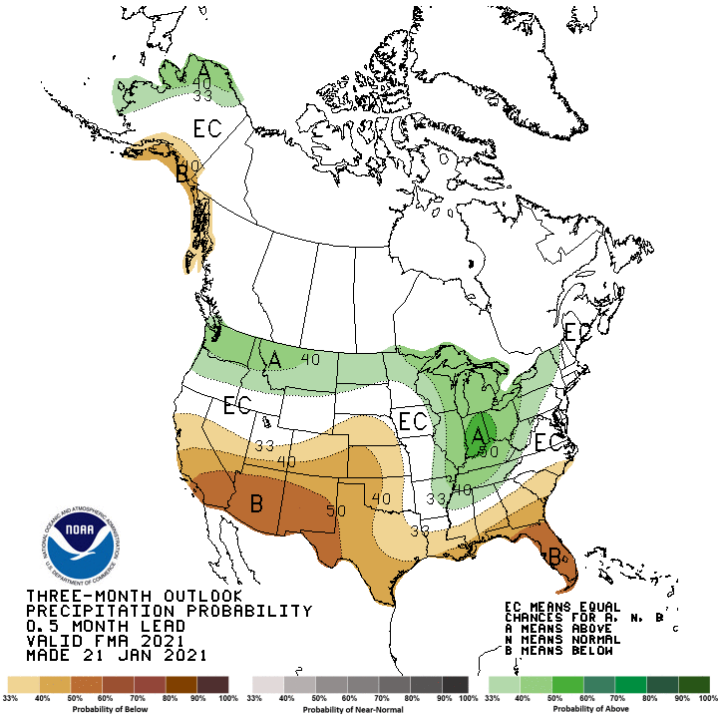
One Month Outlook (Published Jan 31, 2021)





Three Month Outlook (Published Jan 21, 2021)





Data Table and Maps

2/1/2021	Snow Water Equivalent		Precipitation		Reservoir Storage	
	% Normal	*Monthly Change %*	*Monthly % Avg*	*Water Year % Avg*	*% Average*	*% Capacity*
Columbia River Basin						
Kootnenai in Montana	86	-7	78	100	0	not reported
Flathead in Montana	84	-14	64	103	120	76
Upper Clark Fork	78	-12	52	88	110	74
Bitterroot	83	-11	70	100	147	37
Lower Clark Fork	78	-11	66	88	0	not reported
Missouri River Basin						
Jefferson	78	-1	79	82	110	51
Madison	77	+8	92	80	108	80
Gallatin	79	+3	92	87	103	53
Helena Valley	92	-5	72	100	97	73
Smith-Judith-Musselshell	95	+8	92	90	160	79
Sun-Teton-Marias	83	-30	52	112	108	56
St. Mary	100	-15	74	106	194	56
Milk (Bears Paw Mtns)	98	-57	56	112	84	32
Yellowstone River Basin						
Upper Yellowstone	89	-7	72	100	107	67
Bighorn	76	-7	58	75	107	69
Tongue	88	+2	87	99	153	52
Powder	74	-1	63	74		

Color Scale	<50%	51 to 70%	71 to 90%	91% to 110%	>110%

- **To view the current monthly Basin Data Report report**, with individual data points used to generate the table above, please visit the Monthly Statewide Overview webpage and visit the "NRCS Basin Reports" section.

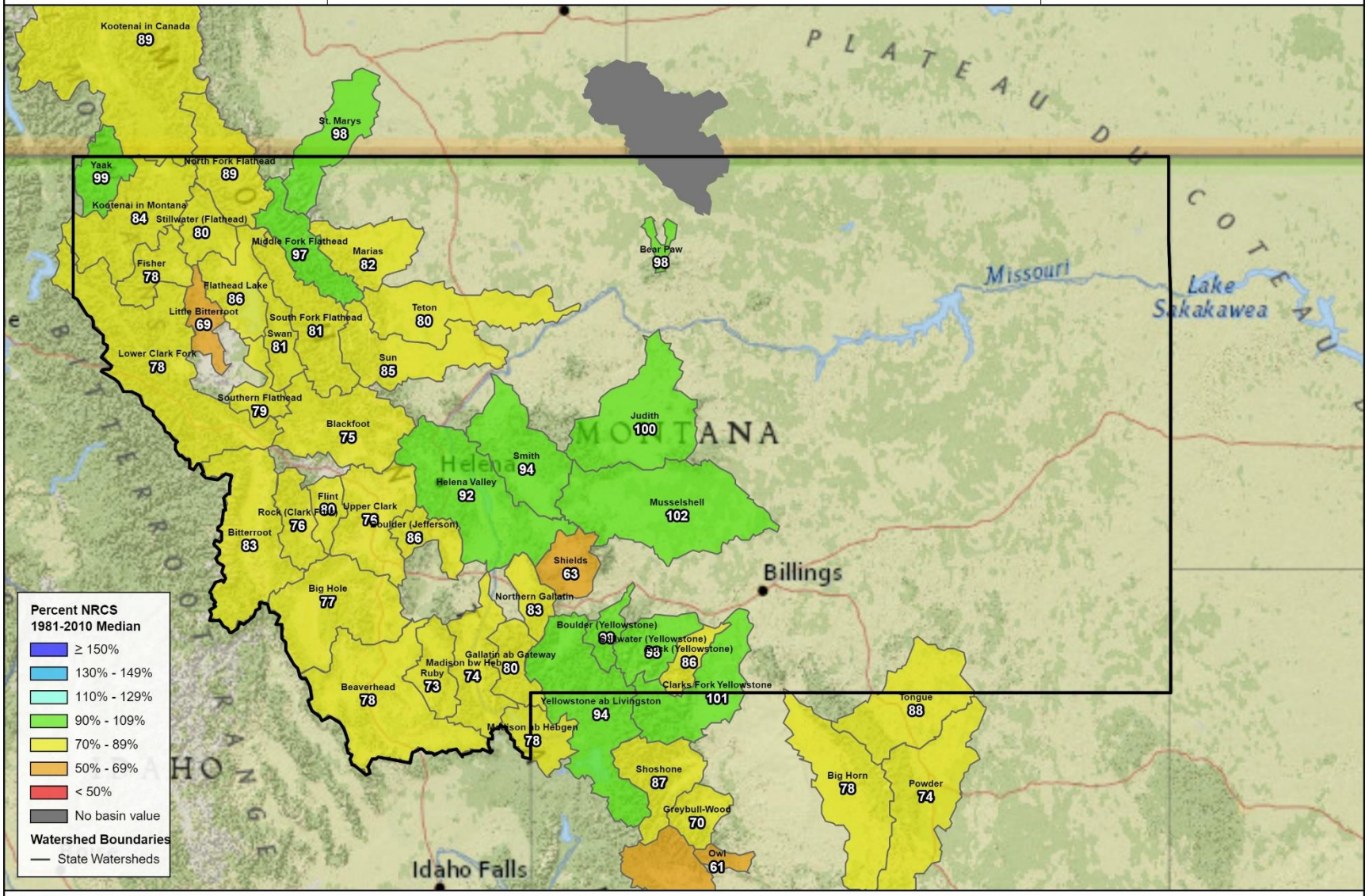
- **To view reports for previous months**, please visit the Basin Data Reports webpage and select the daily, or monthly, report of interest

Snow Water Equivalent

Snow Water Equivalent - Sub-Basin - Feb.1, 2021

Percent NRCS 1981-2010 Median

February 1st, 2021



USDA Natural Resources Conservation Service
United States Department of Agriculture

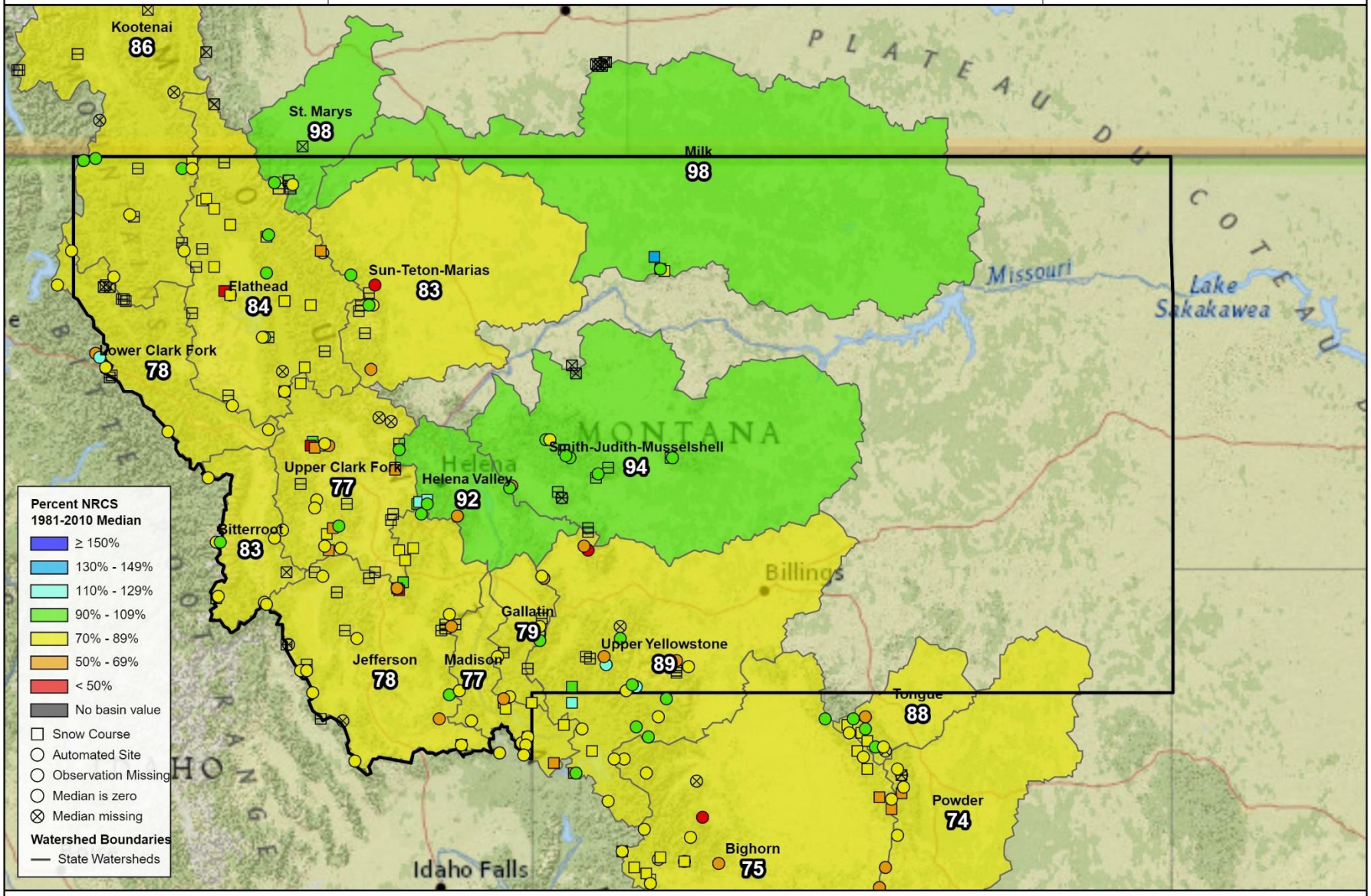
Created 2-02-2021

Snow Water Equivalent

Snow Water Equivalent - Major Basin - Feb.1, 2021

Percent NRCS 1981-2010 Median

February 1st, 2021



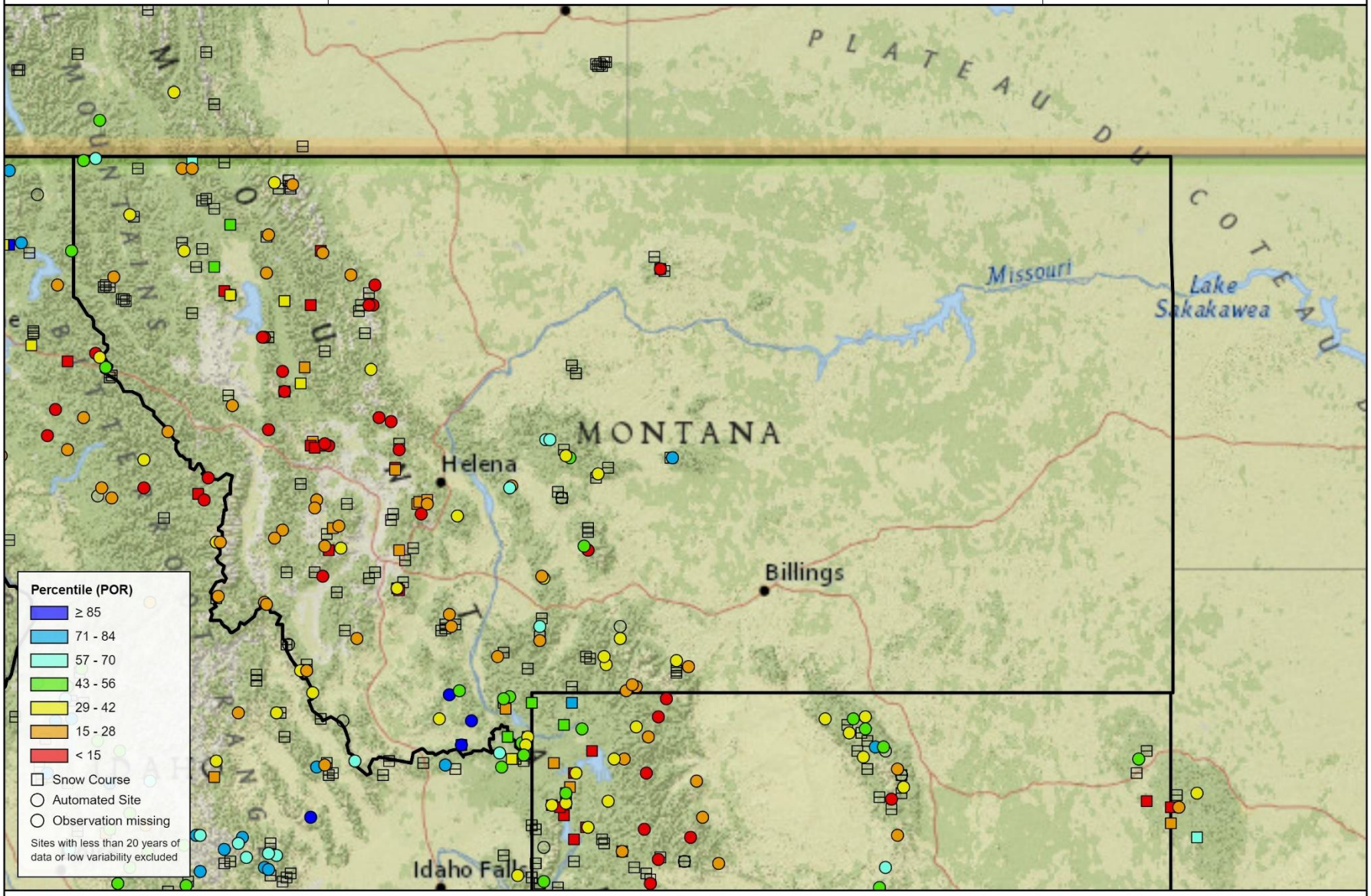
USDA Natural Resources Conservation Service
United States Department of Agriculture

N

0 20 40 80 120 160 200 Miles

Created 2-02-2021

Snow Water Equivalent Delta	Snow Water Equivalent - Monthly Change Percentile - Feb.1, 2021 Percentile (POR)	February 1st, 2021 - January 1st, 2021



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N

0 20 40 80 120 160 200 Miles

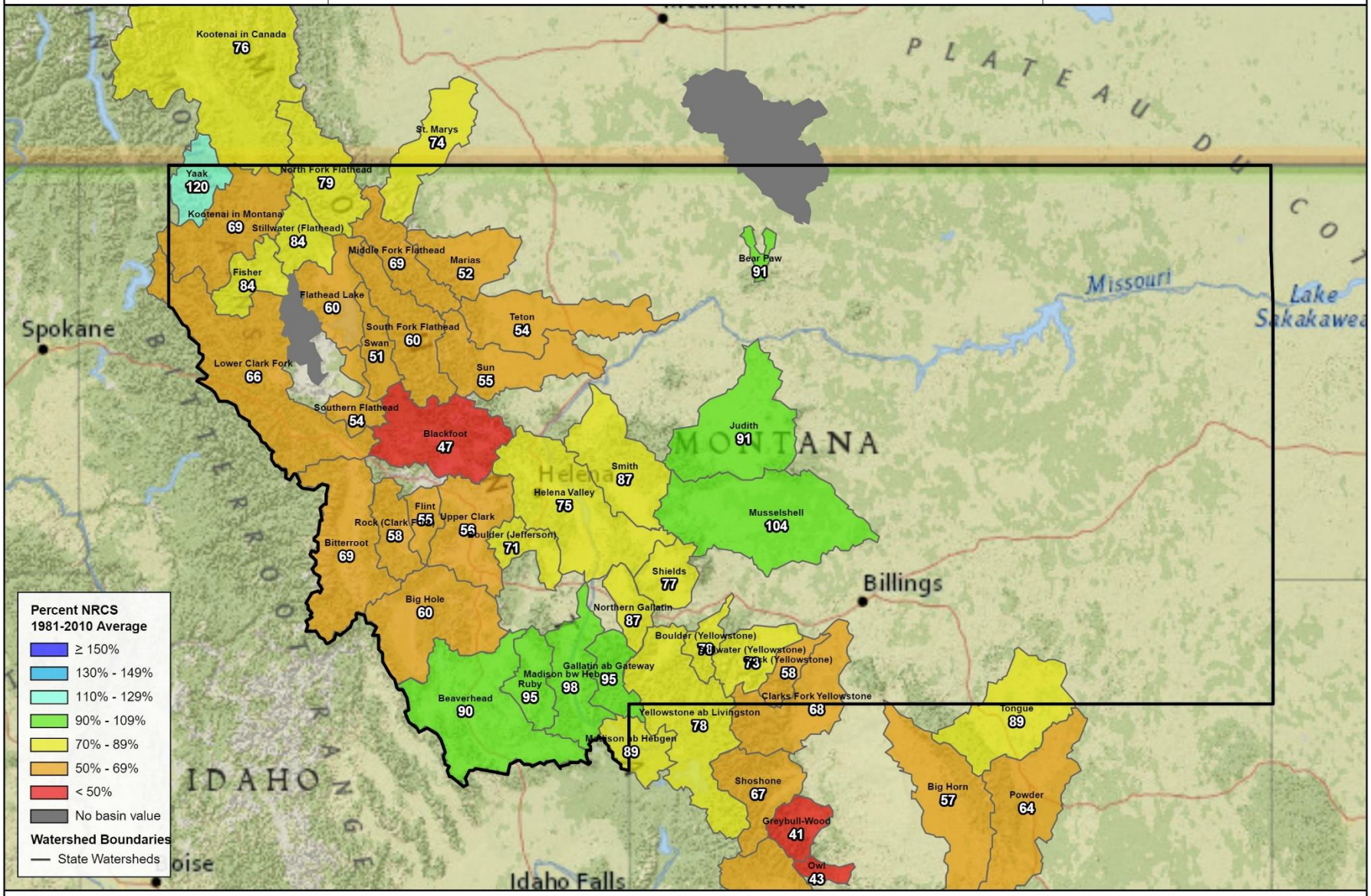
Created 2-02-2021

1 month Precipitation

Monthly Precipitation - Mountain - Feb. 1, 2020

Percent NRCS 1981-2010 Average

January 1, 2021 - January 31, 2021



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N

0 20 40 80 120 160 200 Miles

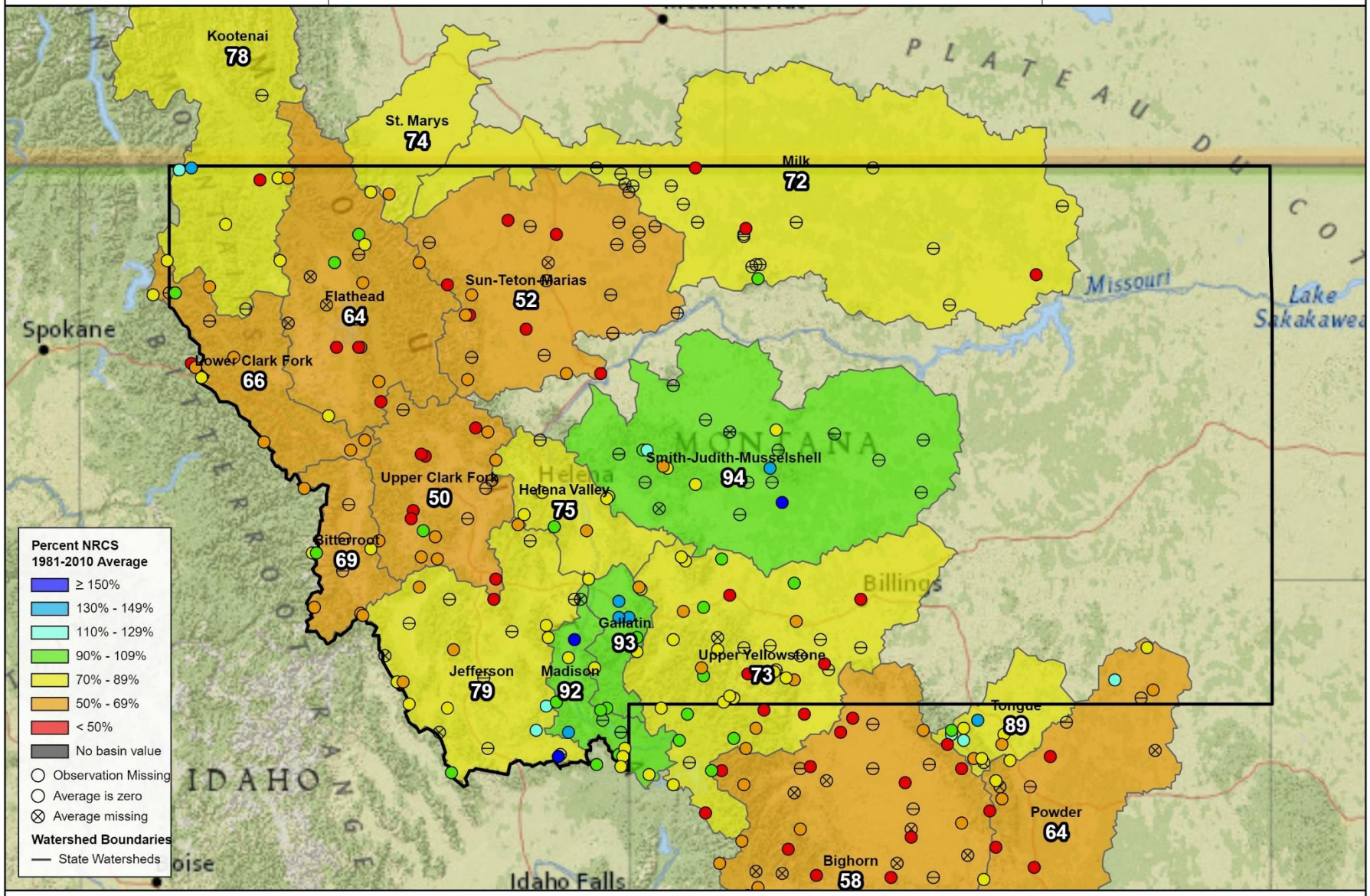
Created 2-02-2021

1 month Precipitation

Monthly Precipitation - Mountain & Valley - Feb. 1, 2020

Percent NRCS 1981-2010 Average

January 1, 2021 - January 31, 2021



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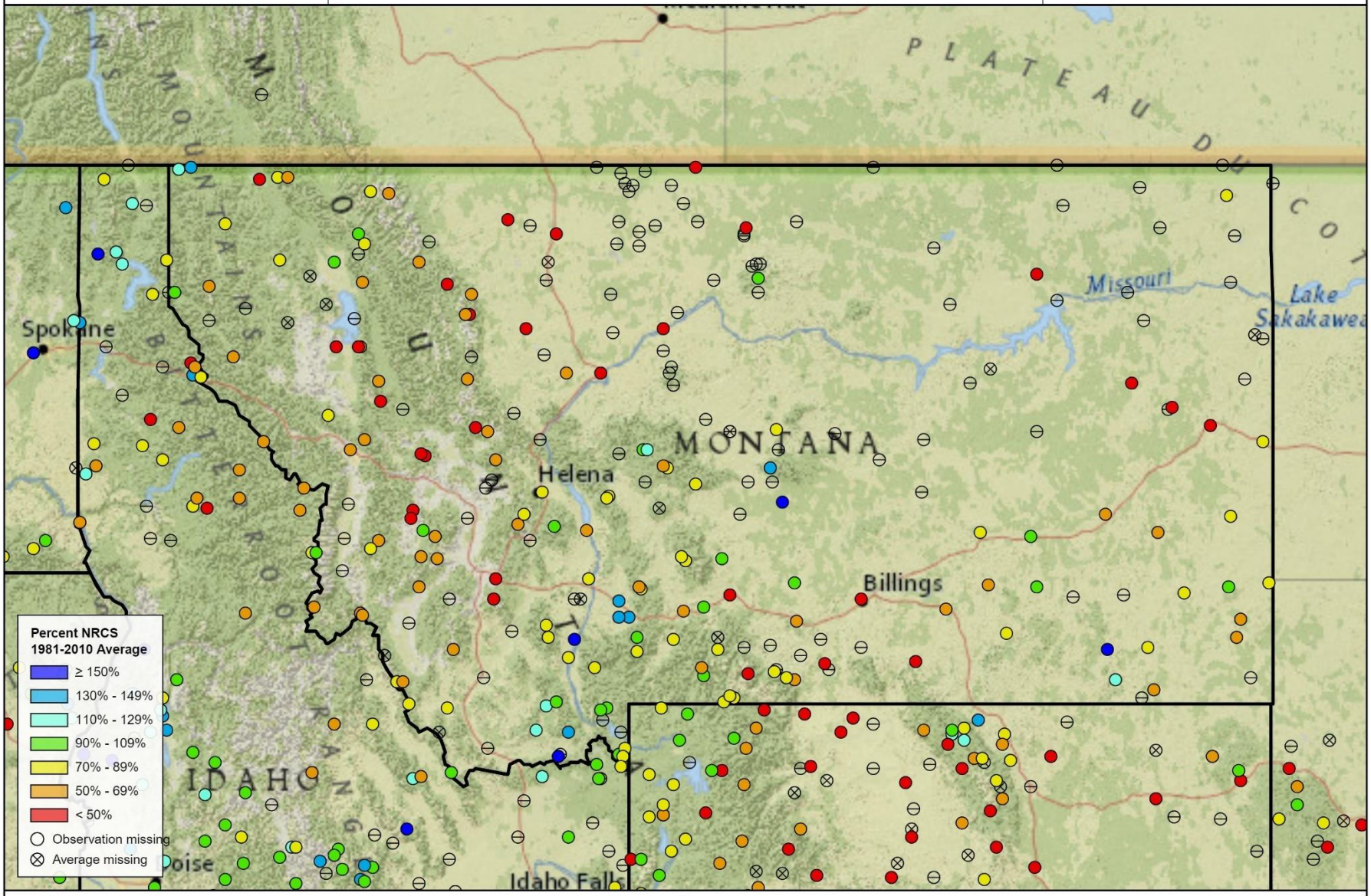
N

0 20 40 80 120 160 200 Miles

Created 2-02-2021

1 month Precipitation	Monthly Precipitation - All Stations - Feb. 1, 2020 Percent NRCS 1981-2010 Average	January 1, 2021 - January 31, 2021



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N

0 20 40 80 120 160 200 Miles

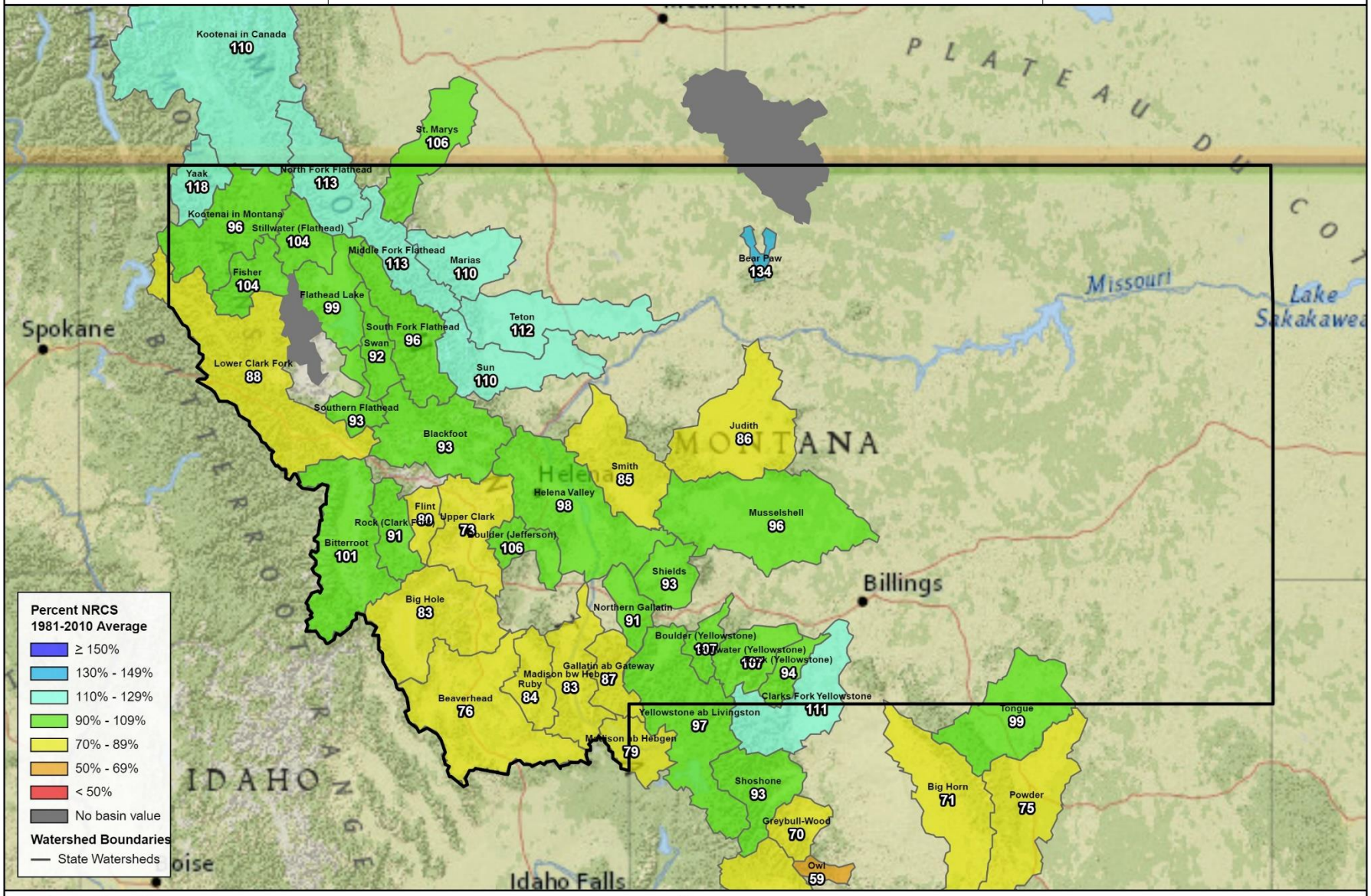
Created 2-02-2021

Water Year to Date Precipitation

Water Year Precipitation - Mountain - Feb. 1, 2020

Percent NRCS 1981-2010 Average

October 1, 2020 - January 31, 2021



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N

0 20 40 80 120 160 200 Miles

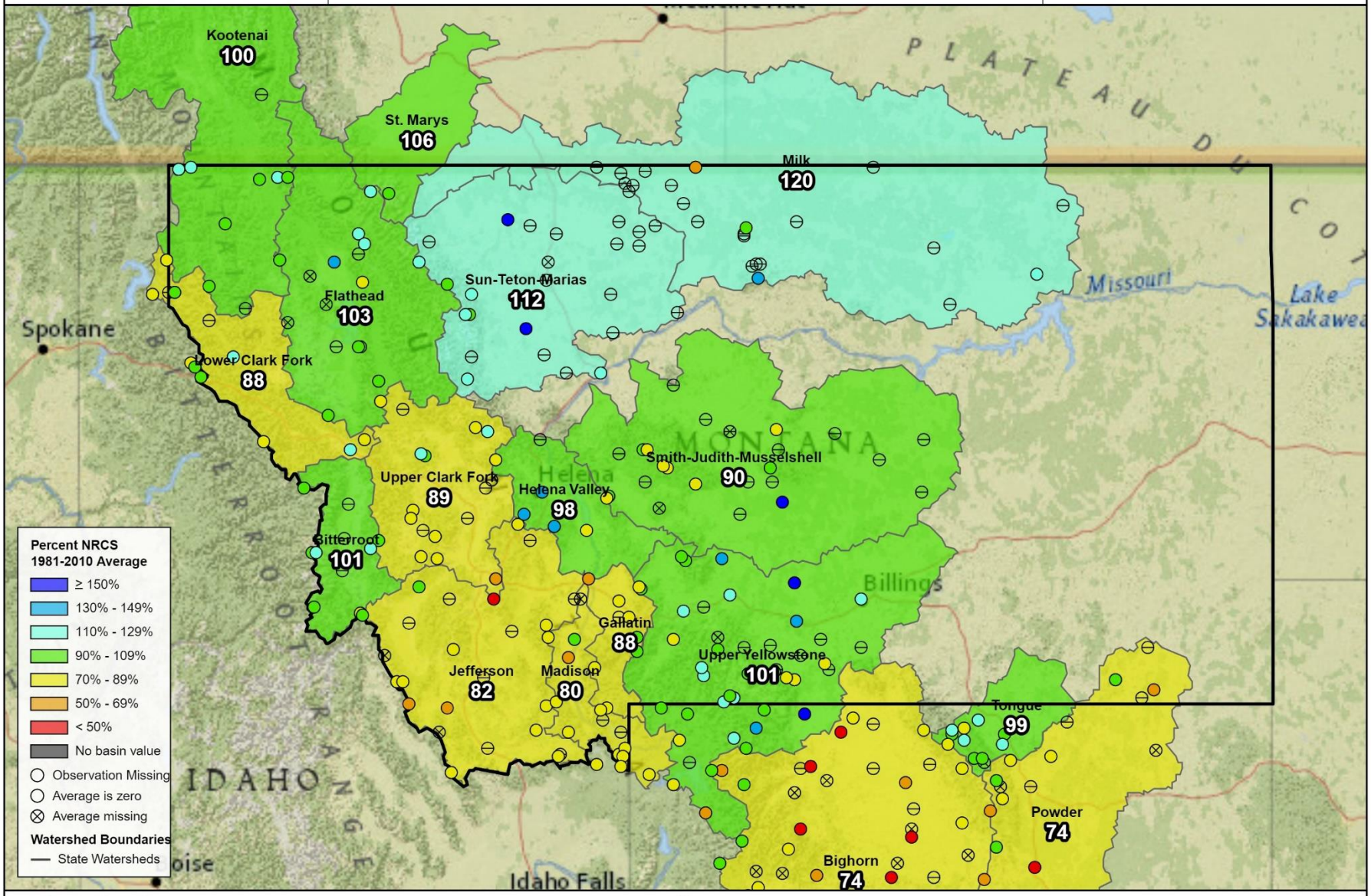
Created 2-02-2021

Water Year to Date Precipitation

Water Year Precipitation - Mountain & Valley - Feb. 1, 2020

Percent NRCS 1981-2010 Average

October 1, 2020 - January 31, 2021



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N

0 20 40 80 120 160 200 Miles

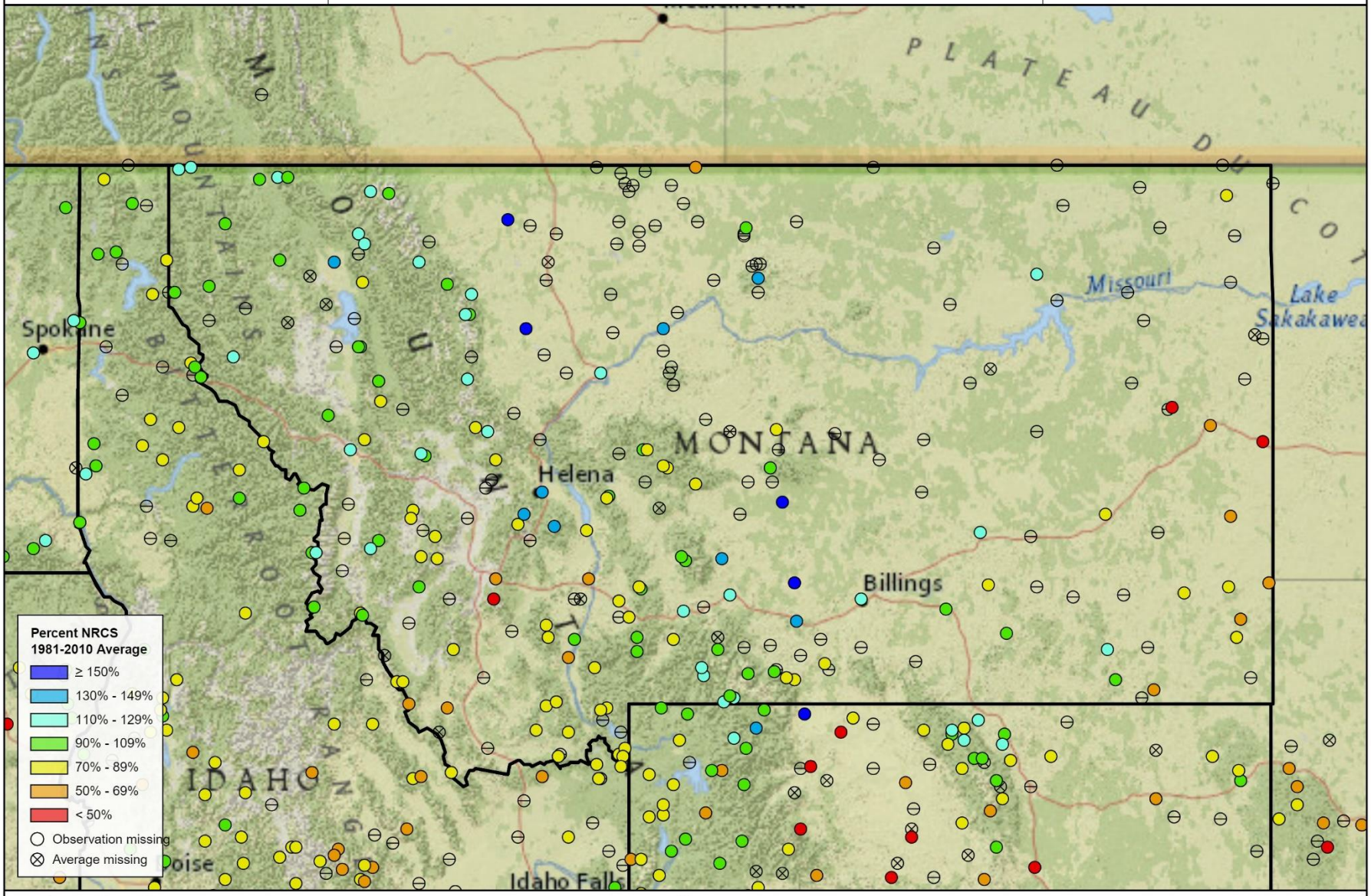
Created 2-02-2021

Water Year to Date Precipitation

Water Year Precipitation - All Stations - Feb. 1, 2020

Percent NRCS 1981-2010 Average

October 1, 2020 - January 31, 2021



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N

0 20 40 80 120 160 200 Miles

Created 2-02-2021

WSOR Web Page Access

The links below will take you to web pages dedicated to the individual river basins and statewide overview for presenting the monthly data. Users are encouraged to interact with the maps presented, select different maps using the drop-down menu, and hover over or click on points or basins of interest to view data and plots.

All of the same information that was traditionally included in the legacy monthly river basin summaries is available in these pages. However, if there are sections of the river basin summaries that you miss, please send an email so that we can continue to improve these new webpages and products.

Monthly Data - Interactive Web Pages		
Monthly Data - Statewide Overview		
Monthly Statewide Overview		
Monthly Data - River Basin Summaries		
Columbia River Basin	**Missouri River Basin**	**Yellowstone River Basin**
Kootenai	**Jefferson**	**U. Yellowstone**
Flathead	**Madison**	**Wyoming**
Upper Clark	**Gallatin**	
Bitterroot	**Helena Valley**	
Lower Clark	**Smith-Judith**	
	Sun-Teton	
	St. Mary	
	Milk	

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Montana Water Supply Outlook Report

Natural Resources Conservation Service