Montana Water Supply Outlook Report – Spring 2024

Rocky Mountain Front near Dupuyer, March 27, 2024

Photo Credit: Michael Downey

This report was prepared by the Department of Natural Resources & Conservation on behalf of the Governor's Drought & Water Supply Advisory Committee

Summary of Recent Conditions

The 2023 water year (October 1, 2022 – September 30, 2023) closed following a spring and summer punctuated by extremes. The arrival of timely rains in late May extending to mid-June coupled with early warm temperatures gave a boost to both crops and rangelands that resulted in record harvests and plentiful forage in some locations, especially south central and southeast Montana. As is often the case, not all of Montana was so fortunate. Dry conditions and low stream flows persisted in the northwest giving way to widespread and severe drought by late July. Drought conditions worsened in August extending across the northern tier of Montana with extreme drought in northwest and north central Montana. The period from June 10 to August 20 was exceptionally dry resulting in record low stream flows and greatly diminished soil moisture in some areas. Conversely, the southern half of the state emerged from the long summer virtually drought free.

Despite much warmer than average temperatures last summer (May – September averaged 3.5 deg F above normal and was the 2nd warmest on record), precipitation beginning in late August through September was mostly above average. In October, dry conditions and above normal temperatures persisted in the northwest, but the eastern two-thirds and southwest Montana were generally cooler and wetter than average. Fall moisture provided a beneficial boost to soil moisture, stock ponds and small reservoirs across much of the state.

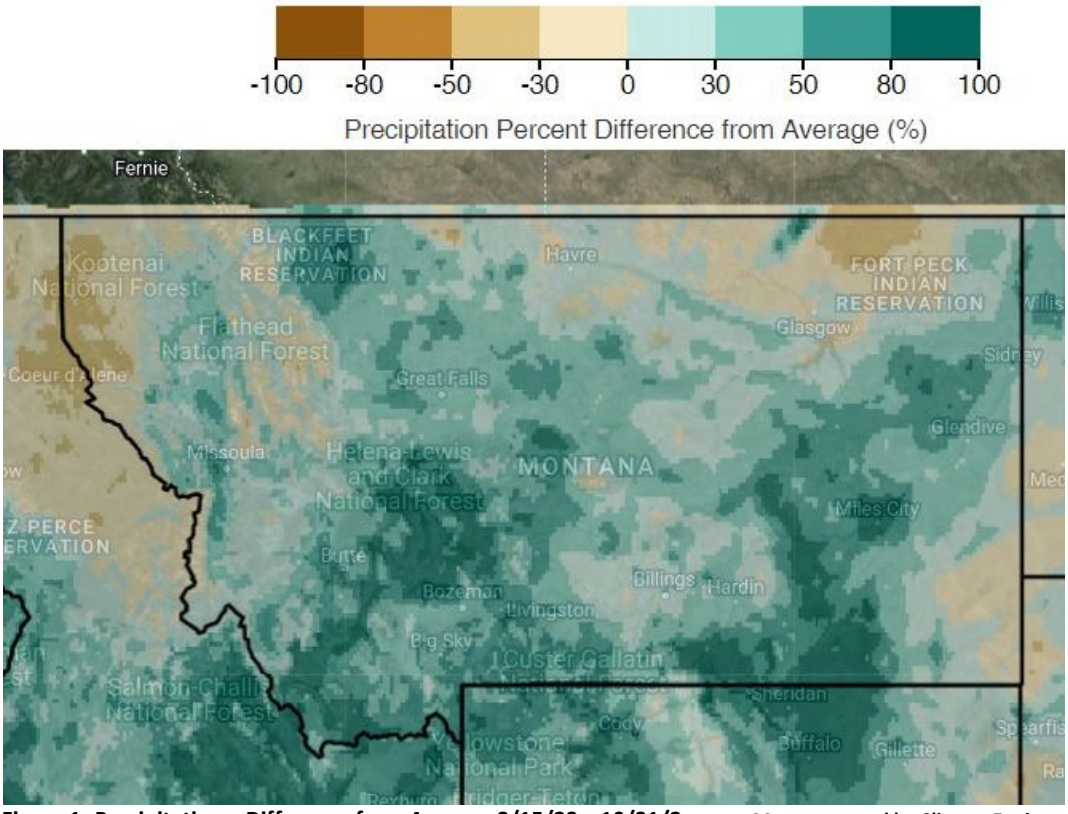


Figure 1- Precipitation – Difference from Average 8/15/23 – 10/31/2 **Map generated by Climate Engine**

The weather shifted quickly in November and December, with much warmer and drier conditions state-wide. December of 2023 was the warmest on record with the state-wide average exceeding 10 deg F above normal. The preceding 6-month period from July through December was also the warmest on record averaging 4 deg F above average. The dry and warm conditions in November and December left much of Montana nearly snow free by the New Year and many of Montana's high elevation Snow Telemetry (SNOTEL) Network sites set new record lows during this period.

Despite above average precipitation in January and February for most of Montana except the northwest and southeast, deficits resulting from the very warm and dry conditions in November and December have resulted in a widespread snow drought. As of April 1, snowpack in most Montana subbasins was well below 75 percent.

Current Drought Conditions

Drought conditions degraded through the summer reaching their highest point in early September with 40% percent of the state in moderate to extreme (D1 to D3) drought. Not since 2019 have drought conditions begun to ease so early in the fall – a testament to wetter conditions that arrived in late August, September and October. However, the exceptionally warm and dry November and December resulted in the onset of worsening drought conditions in late December, the earliest onset in recent memory. In late January and February, the extreme weather pattern shifted quickly with the arrival of average to much above average precipitation. While conditions improved in the north over the winter, conditions degraded significantly in the south, which moved from drought free to severe drought in some locations. Over the last six weeks, drought conditions have generally improved with the onset of average to above average precipitation and cooler temperatures.

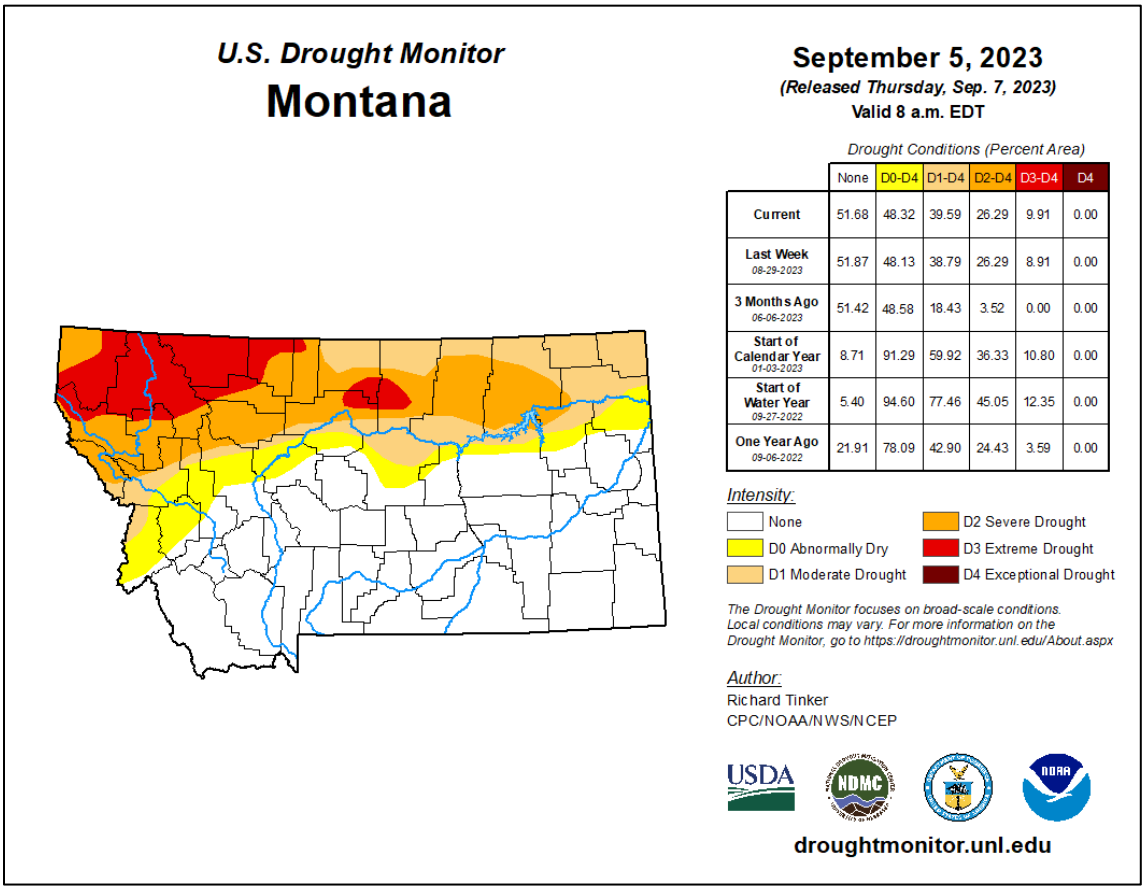


Figure 2 – Drought Categories, September 5, 2023

Warmer than average temperatures in late March and early April have continued to deplete the snowpack at all elevations. Conditions in northwest, northeast and southeast Montana may continue to degrade, as lower than average precipitation since the end of October may result in reduced stream run-off and subsoil infiltration. Drought conditions could worsen quickly there depending on the outcome and timing of spring precipitation and the onset of warmer temperatures. The greatly diminished snowpack and forecast for above average temperatures is likely to result in much below average stream flows by July or earlier. That said, April, May and June are typically Montana's wettest months and conditions could improve between now and the end of June. Figures 3 & 4 show current drought condition as of 4/11/24 and the change in drought categories since late September as compared with current conditions.

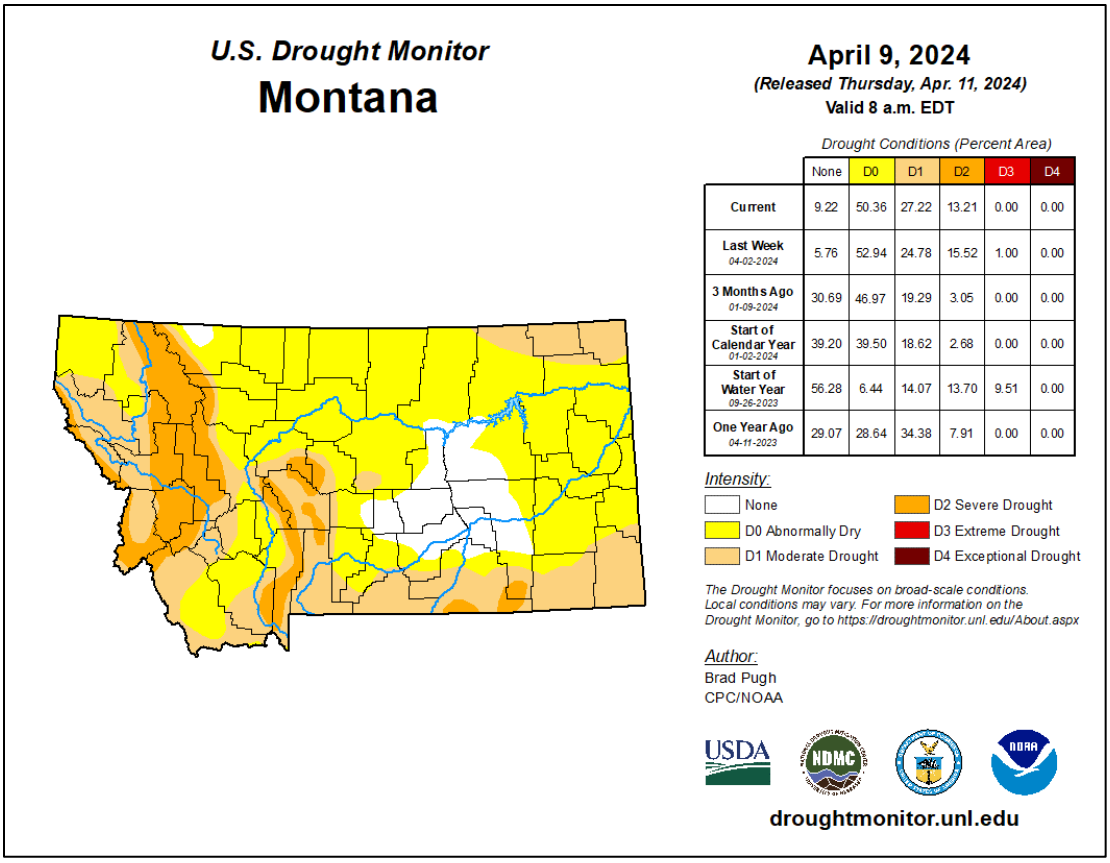


Figure 3 – Current Drought Categories

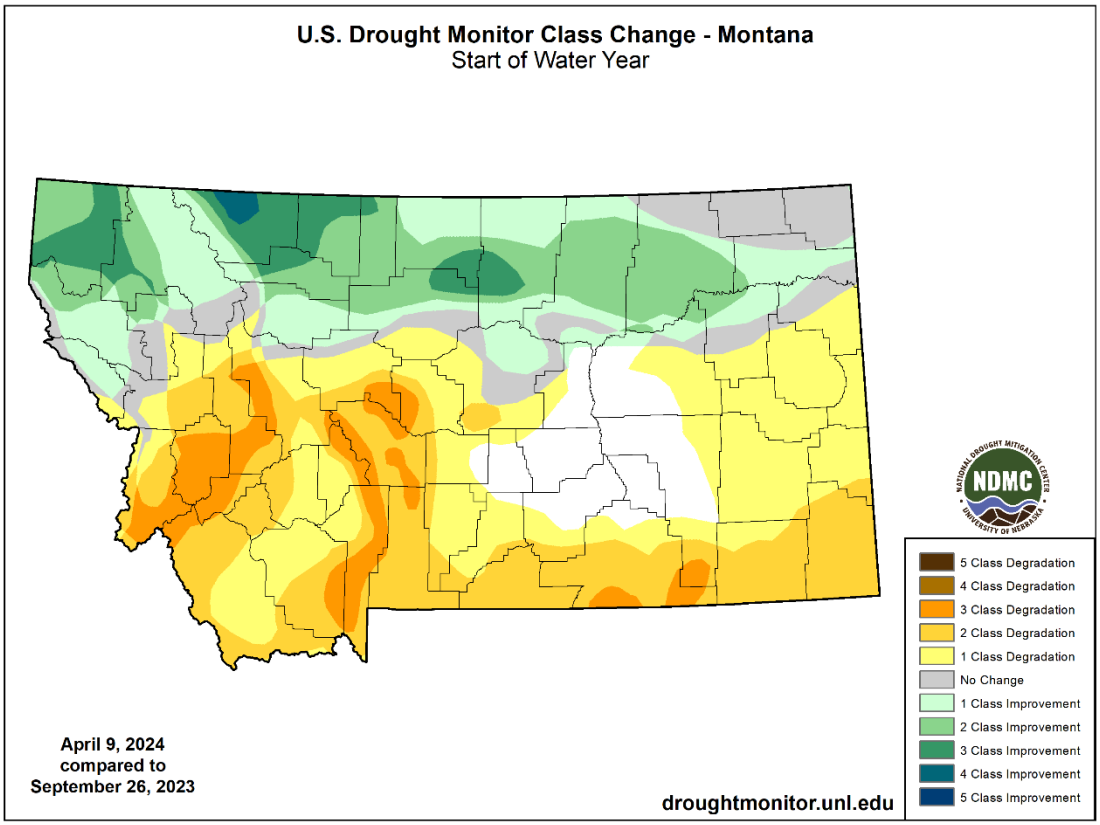


Figure 4 – Change in Drought Categories – 2024 Water Year

Snowpack:

Late October marked the onset of seasonal snowpack accumulation. Unfortunately, warm and dry conditions dominated Montana's weather pattern and the dry trend for most basins extended through the middle of January. Fall and early winter are the most important precipitation months in the northwest, and below normal accumulations were recorded in all watersheds in the region during these critical months. Record low snowpack dominated the winter until early February with many SNOTEL sites across Montana setting new record lows. Conditions shifted dramatically in February with all of Montana's river basins receiving much above normal precipitation except for the Tongue River Basin, which only received 69% of average. However, much warmer than average temperatures in February hampered increases in retained snowpack, particularly in low and mid-elevation sites.

March accumulations were mostly average except for the northeast, where some areas such as Glasgow received twice the average precipitation. Accumulations in the southeast and northwest were average to much below average. While temperatures in March turned cooler east of the Divide, the warm trend persisted in the northwest and southeast, further depleting the snowpack in those areas. According to the Natural Resources Conservation Service Snow Survey Program, of the 281 snow monitoring stations measured for April 1st, forty-six of those are currently the second lowest or lowest on record. 111 stations are still reporting a much below average snowpack (see Figure 5).

As we move through spring, April, May and June are typically some of the "wettest" months of the year in watersheds east of the divide. West of the divide, precipitation generally tapers off as summer approaches. With warmer than average temperatures forecast for the next 3 weeks and no clear signal for precipitation, it is possible that the lower elevation snowpack has already reached its peak for the season in most watersheds. High elevation sites will likely continue to increase snowpack into mid-May.

Water Year 2024 - Major Basin - Snowpack Percent of Normal ('91-'20)

Basin	Nov 1	Dec 1	Jan 1	Feb 1	Mar 1	Apr 1	May 1	Jun 1
Kootenai	62	64	62	67	77	78	-	-
Flathead	67	63	53	65	71	75	-	-
Upper Clark Fork	116	37	36	44	66	67	-	-
Bitterroot	144	35	50	60	73	72	-	-
Lower Clark Fork	90	58	47	55	66	73	-	-
Jefferson	91	48	51	55	73	80	-	-
Madison	86	58	54	57	73	85	-	-
Gallatin	81	52	54	53	65	76	-	-
Upper Missouri	125	41	33	41	71	73	-	-
Smith-Judith-Musselshell	116	63	49	51	65	67	-	-
Sun-Teton-Marias	121	48	26	34	53	57	-	-
St. Mary	77	72	51	55	65	79	-	-
Upper Yellowstone	103	60	55	55	65	79	-	-
Bighorn	117	85	75	74	85	95	-	-
Powder	93	60	51	51	63	67	-	-
Tongue	154	92	66	64	65	73	-	-
Bear Paw	-	-	41	31	50	67	-	-

Figure 5 – Monthly Snowpack, Percent of Normal by Basin USDA – NRCS – Snow Survey Program

Streamflow: (DNRC/USGS/Gaging Stations, USGS WaterWatch, Missouri Basin River Forecast Center)

Stream flows currently vary widely across Montana. It is a dynamic time of year and extremely difficult to determine if current flows are the result of melting snowpack or enhanced baseflow resulting from groundwater infiltration through the fall and a much warmer than average winter. It is most likely a combination of both. Gages indicating higher than normal flows are probably the result of premature snow melt due to warmer temperatures in late March and early April. On larger rivers such as the Missouri, low flows this time of year are also indicative of dam operators diminishing releases to fill reservoirs. Water managers will be watching streamflows closely in the coming weeks to develop better streamflow forecasts for late spring and early summer.

According to the Natural Resources Conservation Service (NRCS) April Water Supply Outlook Report, April-July streamflows are forecasted for 70-85% of normal in Montana. However, forecasts are near to above average in some watersheds in northwest Montana, southwest and southern Montana where water year precipitation is closer to average. Streams on the Rocky Mountain Front east of the Continental Divide are forecast for much below average flow. The forecasts for the Teton and Sun Rivers are near record lows for April-July streamflows. The Blackfoot River, Little Bighorn River, Musselshell River, Nevada Creek, Shields River, and Big Hole River near Wisdom are all forecast to have less than 60% of normal streamflows during the April-July period.

The translation of current snowpack into summer stream forecasts remains somewhat uncertain and will depend the rate of snowmelt and evaporation, which is driven primarily by temperature. Warmer temperatures will accelerate runoff, while cooler than average temperatures could suppress runoff, effectively extending the season. A prolonged period of high pressure with abundant sunshine, high daily temperatures, and nights with above freezing temperatures could release a substantial amount of water in a short period resulting in local and potentially regional flooding. Snowpack is a critical component of early season streamflow across the state, but it's not the only component. Total water year precipitation, peak snowpack accumulation, spring and summer precipitation and the departure from seasonal average temperatures all contribute to the overall water volume available during the growing season.

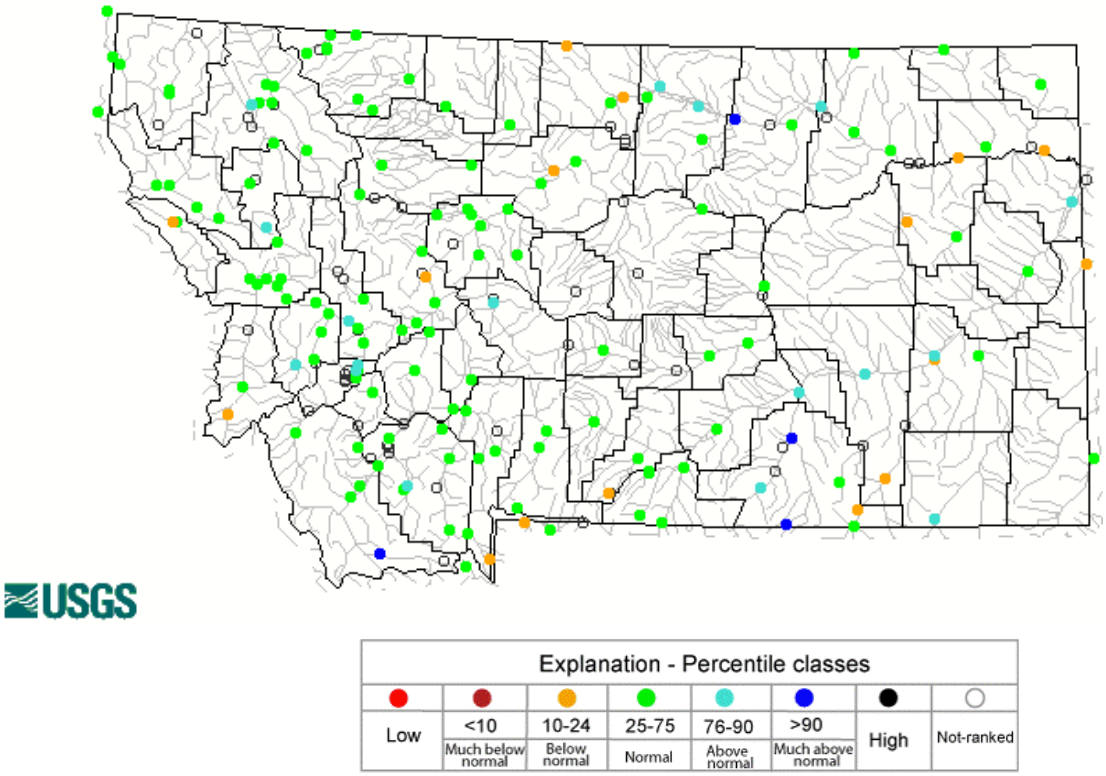


Figure 6 – Real-time streamflow as compared to historical streamflow for Wednesday April 10, 2024

Reservoirs: (Bureau of Reclamation Reservoirs, State Reservoirs)

Water elevations at most state water projects across Montana are currently above average. Those higher levels are due in part to wetter than average conditions last fall and, in central and southern Montana, lower demand during last summer's irrigation season that increased winter carryover. Higher reservoir elevations this spring are partly due to warmer than average temperatures that have accelerated spring run-off. Water managers are also retaining run-off earlier than usual in anticipation of diminished inflows due to the lower snowpack. For example, Dead Man's Basin reservoir at the end of March was 126% of normal with 64,633 acre-feet of storage. Last year at this time, Dead Man's Basin held only 42,614 acre-feet, the result of three years of severe drought and high irrigation demand. This year's increased carry-over and increased retention in anticipation of reduced run-off have improved prospects for water storage this spring despite the low snowpack in most basins.

The Bureau of Reclamation (USBOR) and Army Corps of Engineers (USACE) are actively managing large reservoir projects across the state. Hungry Horse, Lake Kootenai, and Flathead Lake are likely to receive below average inflows due to low snowpack. How that translates into lake levels this summer will depend on how rapidly run-off occurs, streamflow post run-off, summer precipitation and evaporation. The Missouri headwaters and mainstem reservoirs are all expected to fill due to increased carry-over from last year and recent improvements in snowpack in southwest Montana and the Upper Missouri River Basin. The Bureau of Reclamation has concerns with water supply in the Milk River Project due to low reservoir carry-over and low snowpack in the St. Mary River Basin.

Soil Moisture:

Soil Moisture data from Montana's Mesonet Soil Moisture Monitoring Network looks promising and improved over recent years at this point in the season. Both modeled and individual station data show average to much above average soil moisture across much of Montana. Some stations show diminished values in the northwest, northeast, and southeast corners of the state. With this network in the early stages of build-out, many stations have less than 5 years of monitoring data. This shorter period of record means those sites are less reliable as indicators of average soil moisture but are useful as near-term indicators of changes in soil moisture due to factors such as recent precipitation and the impacts of evaporation from wind, temperature and plant transpiration.

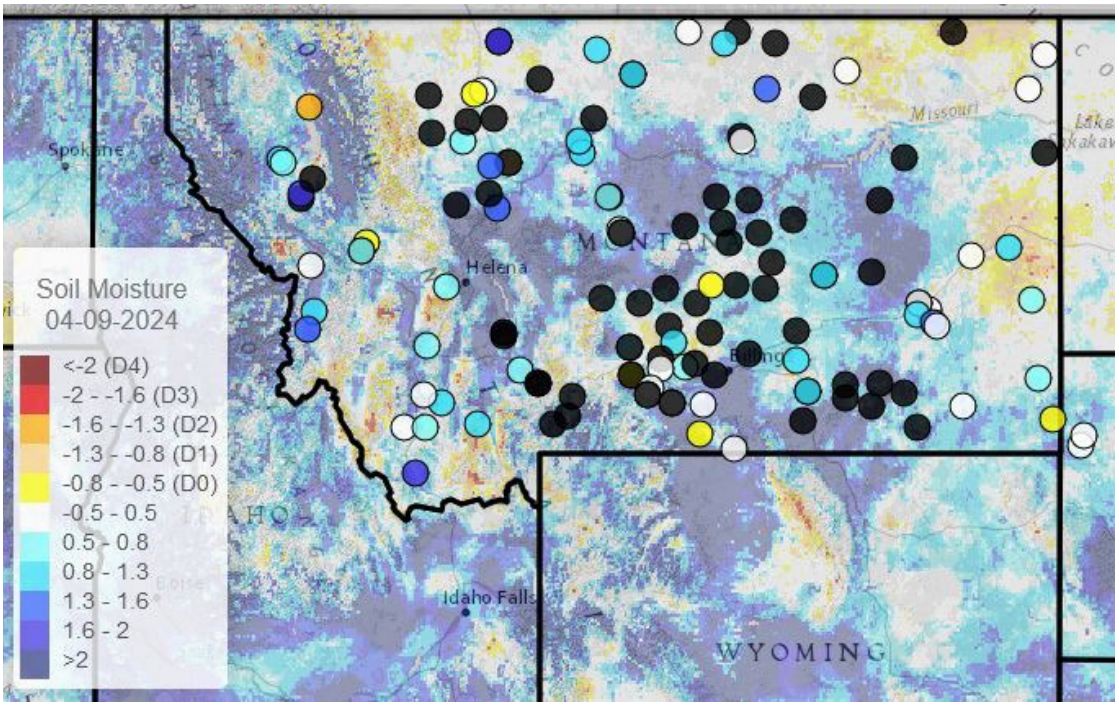


Figure 7 – SPoRT Soil Moisture Model **UMRB Drought Indicators Dashboard - MT Climate Office**

Drought Outlook:

Extreme variability in temperature, precipitation accumulation and spatial extent over the last six months have made the status of current water supply and drought conditions difficult to characterize. This variability coupled with three years of above average temperatures and below average precipitation in some locations has resulted in drought conditions that vary from (abnormally dry (D0) to severely dry (D2) statewide. While conditions eased considerably across southern Montana in 2023, moving into the spring and summer northwest, north central and northeast Montana are especially vulnerable due to multi-year precipitation deficits and a very warm winter. Looking ahead, the average to above average precipitation last fall may prove critical as we emerge from a notably warmer and drier winter than we experienced in 2022-23. Conditions this summer will hinge on both temperature and precipitation over the next three months. Everyone should prepare for a challenging summer ahead. The next 60 days are especially critical for precipitation and will likely determine conditions for summer and early fall. However, even the benefits of a cool and wet spring could vanish quickly with the onset of unusually hot and dry conditions.

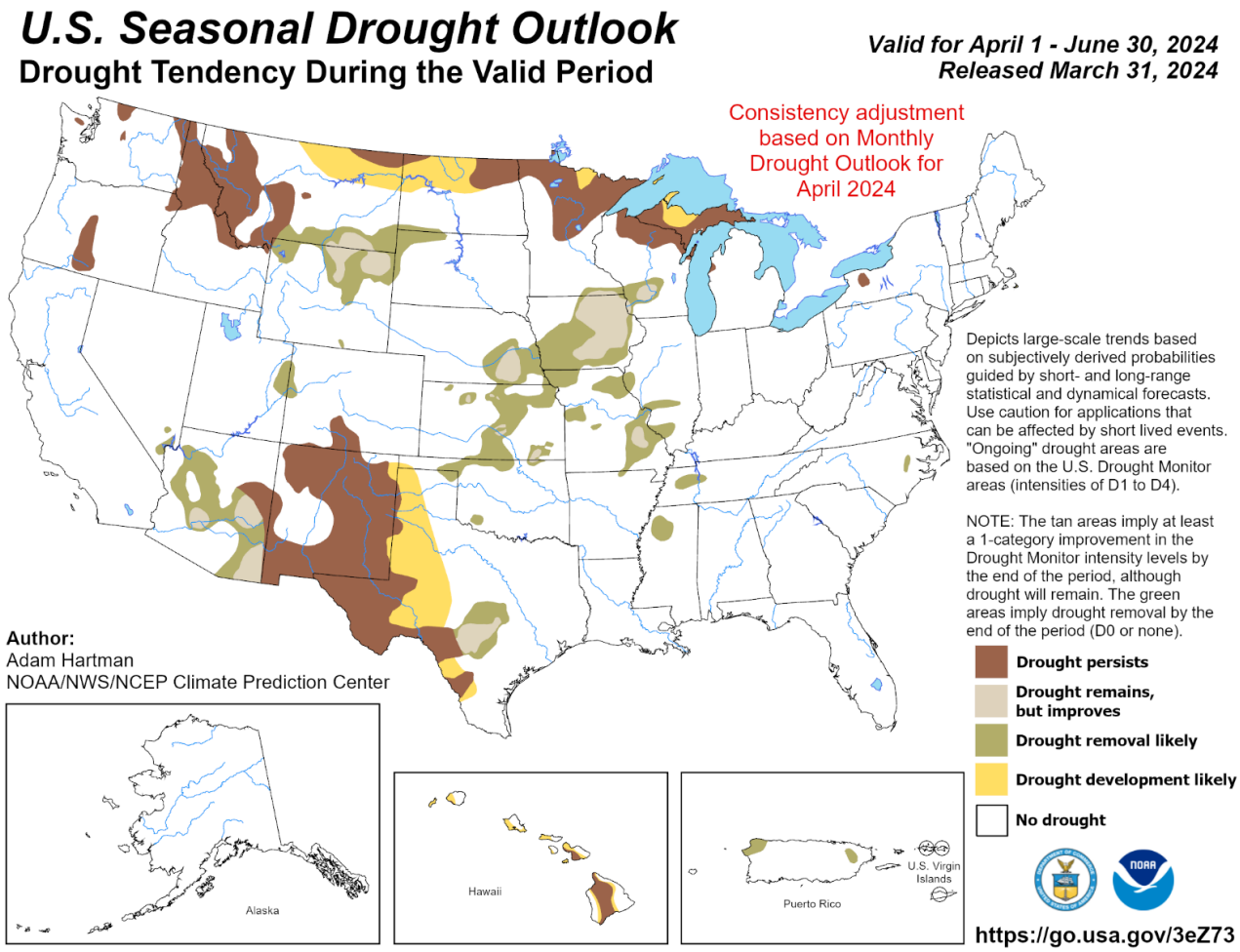


Figure 8 – Seasonal Drought Outlook Apri1 1 – June 30

Long Term Forecast:

The long-term outlook (3 months) leans to above average temperatures in western Montana with no clear indication across the rest of the state. The long-term precipitation forecast indicates the potential for above normal precipitation in the southeast but does not offer any specific direction for remainder of the state. The long-term precipitation outlook is substantially better for the Great Plains and the southeastern U.S. Over the next 3 months, there is a 40 – 60 percent probability for above normal temperatures across most of the country.

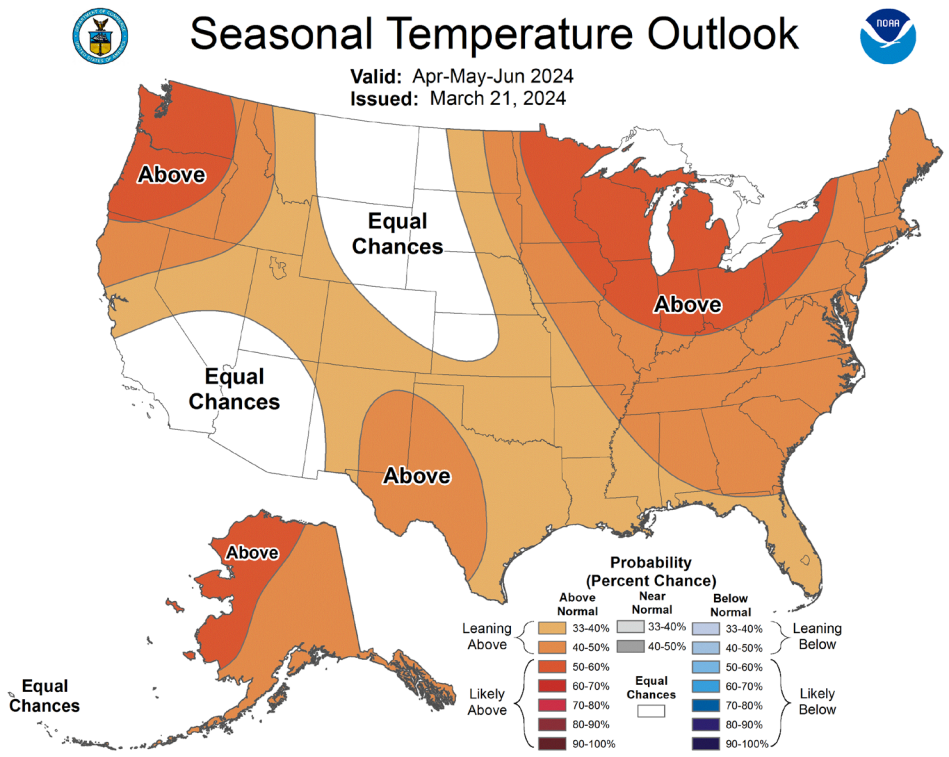


Figure 9 – Seasonal Temperature Outlook Apri1 1 – June 30 **Climate Prediction Center**

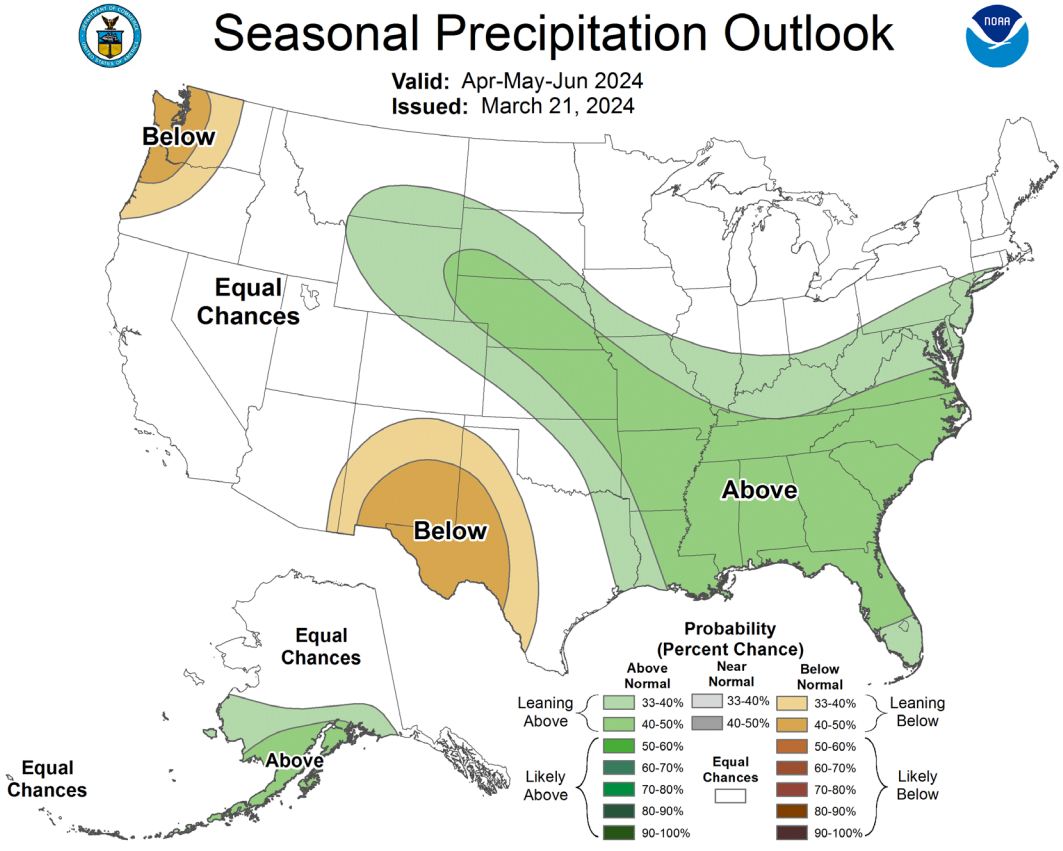


Figure 10 – Seasonal Precipitation Outlook Apri1 1 – June 30 **Climate Prediction Center**

Key Take-Aways:

- Much of the state, particularly the north half of Montana, is entering its fourth consecutive year of abnormally dry or drought conditions. Despite an exceptionally warm winter and record low snowpack, wetter than average conditions last fall greatly improved soil moisture ahead of this summer.
- There is additional opportunity to add to the mountain snowpack in the coming weeks, however, lack of snow in the mid and low elevations likely precludes the addition of snowpack in those areas. The outlook for spring and summer runoff is currently poor and stream flows are likely to taper off earlier than usual this summer.
- Outside of the northwest, Montana's reservoirs benefitted this year from high carry-over in 2023. While Montana's state and federal water projects are expected to fill this spring, conditions for the summer will depend on late spring and summer inflows which are expected to fall short due to low snowpack.
- Warmer than average temperatures in late March have hastened snowmelt in the lower and mid elevations, and the potential for local flooding has increased over the next several weeks. Despite the low snowpack, a rain on snow event could result in severe to extreme flooding in some locations.
- The next 8 weeks is a critical period. Depending on temperatures and accumulated precipitation, conditions have the potential to improve or degrade statewide. Everyone that relies upon streamflows for a water source should prepare for a challenging summer following the warm and dry winter and low snowpack.

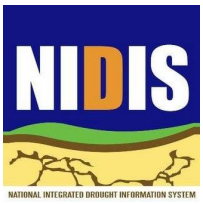
Drought Evaluation Tools and Resources – The following resources provide useful tools that the Department of Natural Resources & Conservation (DNRC) and their partners use to evaluate drought and water supply conditions on a weekly basis across Montana.

Upper Missouri River Drought Indicators Dashboard
Montana Drought Impacts Reporter
NRCS Interactive Precipitation Portal
Climate-At-A-Glance
USGS Water Watch Dashboard
Montana Mesonet Data Downloader

Working on behalf of the Governor's Drought and Water Supply Advisory Committee, DNRC has compiled this Spring Water Supply and Drought Outlook. This report provides a synopsis of statewide conditions gleaned from multiple sources and offers links to additional resources with more in-depth information.

In partnership with other state and federal agencies and Tribes, experts in climate science, snowpack, streamflow and weather information collect and evaluate drought and water supply data on a weekly basis year-round. This information is distilled into weekly recommendations to the U.S. Drought Monitor which tracks drought conditions nationally. Much of the information contained in this report comes from the Montana Climate Office, NRCS Water Supply Outlook Reports, U.S. Drought Monitor, Climate Prediction Center, National Integrated Drought Information System and others. Please contact Michael Downey, at DNRC (mdowney2@mt.gov) if you have any questions or feedback about any of the information contained in this report. Keep an eye out for the next drought update in late June.

This report would not be possible without the ongoing participation and contributions of our local, university, state, Tribal and federal partners, some of which are listed on the following page:



This report was developed by DNRC on behalf of the Governor's Drought & Water Supply Advisory Committee pursuant to MCA 2-15-3308(5).