In Brief

- April and May saw the return of generally normal temperatures across Montana. A series of cold storms have given way to warm spring weather across most of the state. This has accelerated snowmelt in the high country and has led to flood conditions in western and central Montana.

- Soil moisture is high across Montana, though drying is occurring in the southwestern and eastern parts of the state.

- Abnormally dry conditions (the level just below drought conditions) exist in northwestern Montana. Evapotranspiration is also lower than normal in northwestern Montana, suggesting plant communities there are already experiencing the effects of dry conditions.

- The NOAA seasonal forecast for June–August is for warmer than normal conditions in western Montana and equal chances of warmer or cooler conditions for the rest of the state. Summer is likely going to be wetter than normal across most of Montana.
IN A WORD...

Weather and climate forecasters use words and information in very particular ways that may be different from what we are accustomed to. Here is a list of terms we use in this newsletter:

**Weather and Climate** — The difference between weather and climate is timescale. *Weather* is the day-to-day interaction of factors like temperature, humidity, precipitation, cloudiness, visibility, and wind. To understand *climate* at a given place requires looking at weather trends over relatively long periods of time—months, years, and decades. In addition to studying weather, scientists examine climate trends or cycles of variability to understand the bigger picture of long-term changes.

**Temperature and Precipitation** — Throughout this newsletter, we report past temperature and precipitation data derived directly from the GridMET daily 4-km-gridded meteorological dataset from the University of Idaho. Temperature data are reported as seasonal averages; precipitation data are reported as seasonal total precipitation. Our three-month temperature and precipitation forecasts come from NOAA’s Climate Prediction Center.

**Normal(s)** — Climatologists use the term “normal” to compare current conditions or forecasts, such as temperature or precipitation, to the past. Here, the normal value is the statistical mean (the average) for a given measurement in a specific place during a specific period of time. Climatologists use the most recent 30-year period, rounded to the nearest decade, to define normal in North America: 1981–2010. The goal is to look far enough back in time to capture variation in weather patterns, but not so far as to be irrelevant to recent conditions. In 2021, we will start using the 1991–2020 period.

**Drought** — The US Drought Monitor identifies general areas of drought and labels them by intensity. Maps of drought intensity are used by policy-makers, resource managers, and agricultural producers to make decisions. More information about the US Drought Monitor can be found at the US Drought Monitor website.

**La Niña/El Niño** — El Niño and La Niña are the warm and cool phases of a recurring climate pattern across the tropical Pacific, the *El Niño Southern Oscillation (ENSO)*. When ENSO is between warm and cool phases, conditions are called ENSO Neutral. ENSO is one of several global climate phenomena that affect Montana’s weather patterns, and ENSO conditions often guide seasonal climate projections for Montana. Current ENSO conditions and up-to-date projections are available on NOAA’s ENSO website.

**Root Zone Soil Wetness** — Root Zone Soil Wetness is a measure of how much water has saturated the soil. More specifically, it’s the relative saturation between completely dry (indicated by a 0) and completely saturated (indicated by a 1) between 0 and 100 cm depth. In the maps in this newsletter, soil saturation comes from NASA’s Soil Moisture Active Passive (SMAP) satellite program “SPL4SMGP” data product. Soil moisture is mapped using a combination of radar and radiometer measurements from space and surface observations at an approximately 9-km spatial resolution.

**Evapotranspiration** — Evapotranspiration (ET) is a joint measure of evaporation of water from the Earth’s surface, and plant transpiration, or water vapor that exits a plant’s leaves during the process of photosynthesis. ET is one of the factors that climatologists look at when assessing and predicting drought. When atmospheric demand for water is high (i.e., when the air is dry), ET should be high. If ET is low, this might indicate that there is not enough water available to plants to support photosynthesis. In the maps in this newsletter, ET comes from the MODIS Global Evapotranspiration Project, run in part by the Numerical Terradynamic Simulation Group at the University of Montana. ET is mapped at an approximately 4-km spatial resolution.
Late Spring 2019 Review

Temperature
After one of the most bitterly cold winters on record, April and May saw the return of near normal temperatures across Montana. A series of cold storms (see the graph, below) has been punctuated by warm spring weather across most of the state. Western Montana has seen warmer than normal temperatures—especially at high elevations—which has led to rapid snowmelt and slightly less snowpack than normal for late spring. Eastern Montana remains cooler than normal.

The graph to the right compares historical daily temperatures (shaded bands and dashed lines) to current daily temperatures so far in 2019 (solid-jagged lines) across Montana. The shaded bands represent the range of recorded temperatures during the 1981–2010 period on any given day. The red bands and lines represent the high temperatures and the blues bands and lines represent the lows. The dashed red and blue lines represent the average high and average low temperatures during the 1981–2010 period.

Precipitation
Precipitation in April and May has been quite variable across Montana. Southwestern Montana has seen less precipitation than normal, while other regions of the state have seen upwards of 200 percent of normal precipitation. The above normal precipitation has increased yield prospects but it has also delayed spring planting in many locations. Flooding is a growing concern across Montana—very wet storms during mid-May have pushed the Bitterroot, Clark Fork, and Musselshell rivers above flood stage, and precipitation forecasts are for wetter than normal conditions to continue.

The graph to the right compares historical daily precipitation (shaded band and dashed line) to current daily precipitation so far in 2019 (vertical bars) across Montana. The shaded band represent the range of recorded precipitation during the 1981–2010 period on any given day. The dashed line represents the average precipitation during the 1981–2010 period.
Soil Moisture

Soil moisture is factored into drought and flood forecasts as an indicator of wet or dry basin conditions. Soils in southwestern and eastern Montana—which have seen lower than normal precipitation—have begun drying out, while soil moisture remains very high across much of the rest of the state (the blue areas in the map).

Evapotranspiration

Evapotranspiration (ET), or the amount of water vapor leaving the Earth’s surface through evaporation and plant photosynthesis, reflects both the amount of plant-available water and the atmospheric demand for water (i.e., how dry the air is). This map shows the deviation from normal ET so far this spring. The green areas experienced greater amounts of ET than their normal amounts from 2000–2018 (the period of record); the brown areas experienced less ET. We look at the decline in ET below normal values as an early indicator of potential drought conditions. The Montana Climate Office will continue monitoring conditions in northwestern Montana for potential drought impacts as we move into summer.

In the graph to the right, the green line represents the average ET through the year, and the green band represents the extremes recorded during the 2000–2018 period. The jagged black line represents this year’s conditions; the jagged red line represents the 2018 conditions, for reference. Across Montana, 2019 ET has remained above average—reflecting that atmospheric demand was met by wetter than normal soil conditions.

Drought

The US Drought Monitor has categorized northwestern Montana as abnormally dry going into early summer. This aligns with the evapotranspiration patterns and precipitation deficits from earlier this spring.
**El Niño Update**

The El Niño Southern Oscillation (ENSO) is a natural seasonal fluctuation in the sea surface temperature of the Pacific ocean near the equator. El Niño events have a strong influence on winter weather and a moderate influence on summer weather across Montana, and less of an influence during the rest of the year. Historically during an El Niño, June–August precipitation is slightly higher than normal, and temperature is generally cooler than normal. As you’ll see, the climate forecasts for the next few months generally reflect these patterns.

These maps show what an average El Niño April–June looks like relative to normal. Keep an eye on the NOAA ENSO outlook ([https://www.climate.gov/enso](https://www.climate.gov/enso)) for the latest ENSO conditions and predictions as we head into late spring.

Late spring in Ninemile Valley. Cooler than normal temperatures and lots of precipitation has maintained snowpack across much of the northern Rockies.

PHOTO: ADA SMITH
Temperature
NOAA’s Climate Prediction Center (CPC) is projecting that temperatures will likely be warmer than normal across western Montana this summer, with equal chances of cooler or warmer temperatures over the rest of the state. Warmer temperatures may accelerate the arrival of drought conditions in western Montana.

Precipitation
The CPC has increased its seasonal precipitation forecast across much of Montana to “likely wetter” conditions for this summer. Keep in mind that while the CPC is projecting wetter conditions, this map doesn’t reflect how much wetter is it likely to be, or the intensity of precipitation events.
About Montana Drought & Climate and the Montana Climate Office

Montana Drought & Climate is a USDA-funded project of the Montana Climate Office (MCO) at the W.A. Franke College of Forestry & Conservation at the University of Montana, in collaboration with the Montana State University Extension Service. The MCO is an independent state-designated body that provides Montanans with high-quality, timely, relevant, and scientifically-based climate information and services. We strive to be a credible and expert source of information for decision makers that rely on the most current information on climate to make important decisions. It is also the role of the MCO to assist stakeholders in interpreting climate information or adapting climate products to their needs.

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Please send us stories, photos, feedback, and questions! Your story about how you use this information, photos of your farm or ranch, or your question could be featured in the next newsletter.

Please contact mtdrought@umontana.edu with questions and comments, or to be removed from our mailing list.