

**Upper Missouri River Basin
November 2012 Calendar Year Runoff Forecast
November 2, 2012**

**U.S. Army Corps of Engineers, Northwestern Division
Missouri River Basin Water Management
Omaha, NE**

Calendar Year Runoff Forecast

Explanation and Purpose of Forecast

The long-range runoff forecast is presented as the Calendar Year Runoff Forecast. This forecast is developed shortly after the beginning of each calendar year and is updated at the beginning of each month to show the actual runoff for historic months of that year and the updated forecast for the remaining months of the year. This forecast presents monthly inflows in million acre-feet (MAF) from five incremental drainage areas, as defined by the individual System projects, plus the incremental drainage area between Gavins Point Dam and Sioux City. Due to their close proximity, the Big Bend and Fort Randall drainage areas are combined. Summations are provided for the total Missouri River reach above Gavins Point Dam and for the total Missouri River reach above Sioux City. The Calendar Year Runoff Forecast is used in the Monthly Study simulation model to plan future system regulation in order to meet the authorized project purposes throughout the calendar year.

October 2012 Runoff

October runoff was 0.6 MAF (54% of normal) in the Missouri River basin above Sioux City, and 0.7 MAF (61% of normal) above Gavins Point.

2012 Calendar Year Forecast Synopsis

The calendar year runoff forecast above Sioux City, IA is **19.2 MAF** (78% of normal) and **17.3 MAF** (76% of normal) above Gavins Point Dam. This is an increase of 0.2 MAF from the October 1 forecast. Due to the amount of variability in precipitation that can occur over the next 3 months, the expected inflow ranges from the 19.5 MAF upper basic forecast to the 19.0 MAF lower basic forecast. The upper and lower basic forecasts provide a likely range of runoff scenarios that could occur given wetter-than-expected or drier-than-expected conditions. Given that 2 months are being forecasted on November 1 (10 months observed/2 months forecast), the range of greater than normal (upper basic) and lower than normal (lower basic) runoff is attributed to all 6 reaches for both months. The result is a range or “bracket” for each reach, and thus, for the total runoff forecast.

Current Conditions

Precipitation

For the majority of the Basin, overall precipitation accumulations during the month of October were well below normal (Figures 1 and 2), although in Eastern Montana and Northern North Dakota were above normal. Portions of Nebraska and South Dakota received less than 25% of the normal October precipitation. The precipitation departure over the three-month August-September-October period ranged from 75% down to 10% (Figure 3).

Temperature

October temperatures in the Basin were 1 to 4 degrees F below normal (see Figure 4). Ninety-day (90-day) temperature departures ending on October 31, 2012 are shown in Figure 5. During this time period, average daily temperatures also ranged from 1 to 3 degrees F below normal throughout the Missouri River basin.

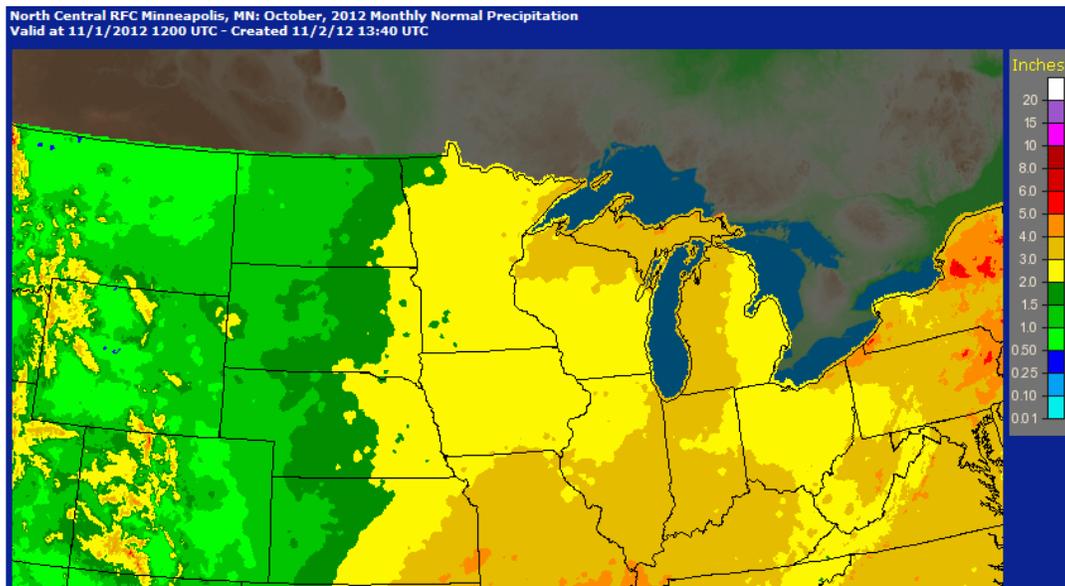


Figure 1. October 2012 Precipitation (inches). Source: National Weather Service.

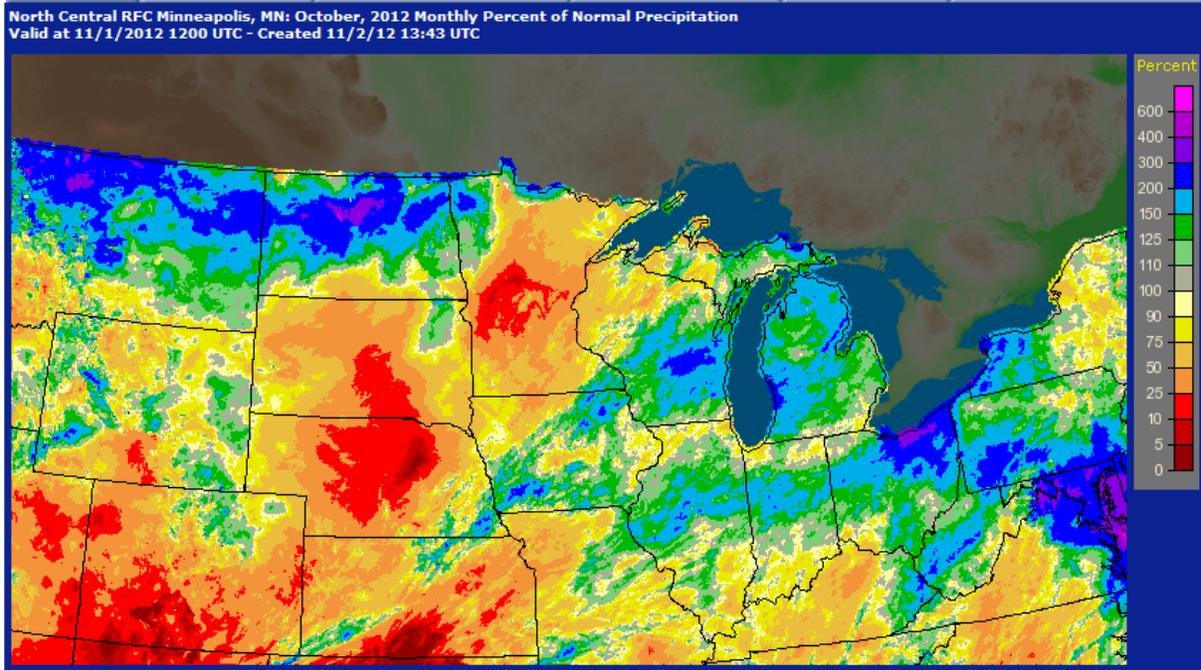


Figure 2. October 2012 Percent of Normal Precipitation. Source: National Weather Service.

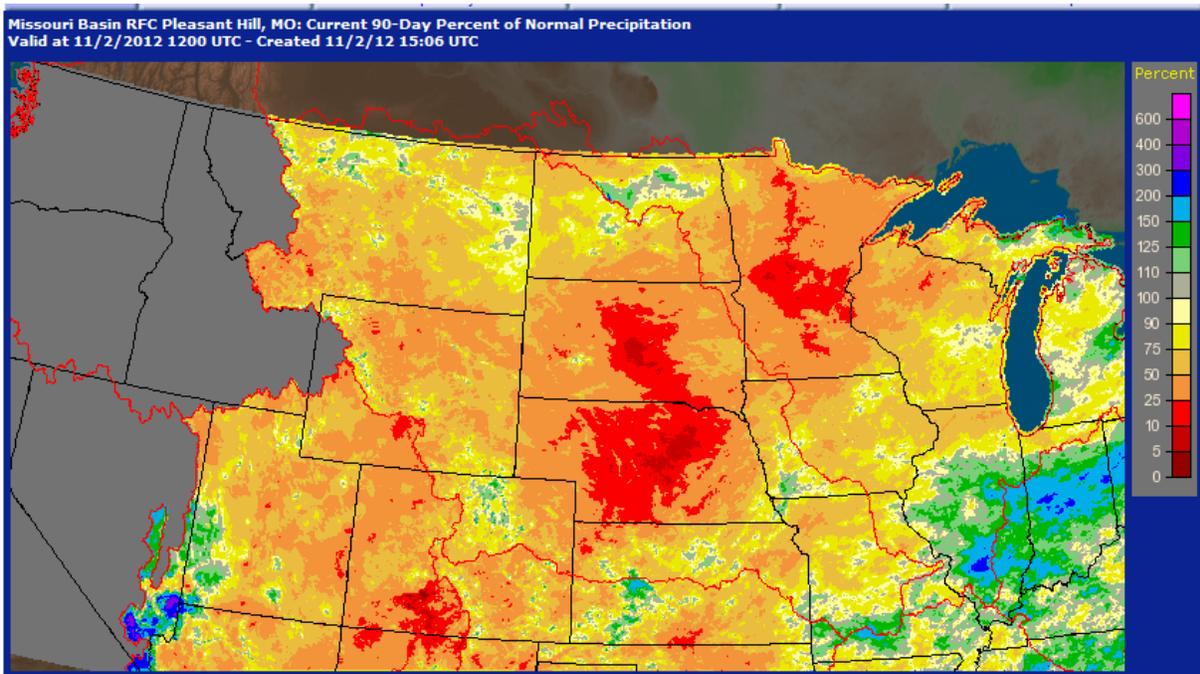


Figure 3. August-September-October 2012 Percent of Normal Precipitation. Source: National Weather Service.

Mean Temp (F) Anomaly 30-day mean ending Oct 31 2012

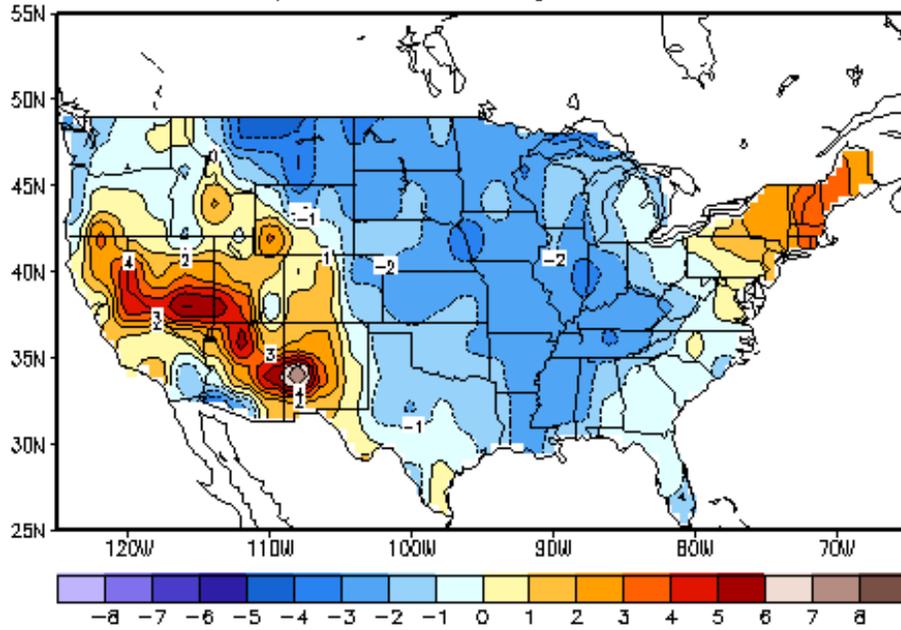


Figure 4. 30-day temperature anomaly (deg F) ending on October 31, 2012.

Mean Temp (F) Anomaly 90-day mean ending Oct 31 2012

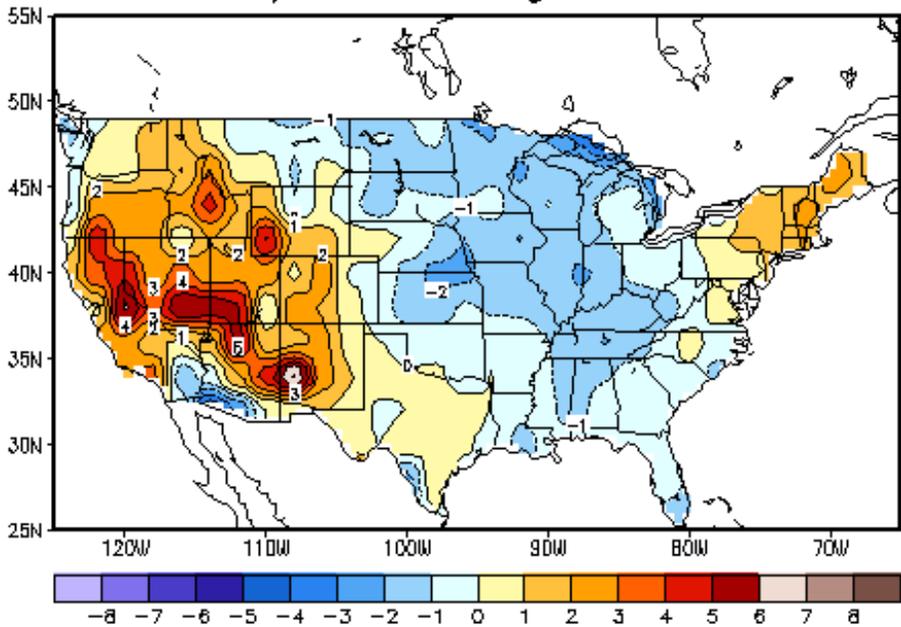


Figure 5. 90-day temperature anomaly (deg F) ending on Oct 31, 2012.

Soil Moisture Conditions

Soil moisture is factored into the forecast as an indicator of wet or dry hydrologic basin conditions. Typically when soil moisture conditions are wet or greater than normal, rainfall and snowmelt runoff is greater than when soil moisture is dry or less than normal. Not only is soil moisture a physical parameter that influences runoff, it can be used as an indicator of future monthly runoff.

Two independent estimates of soil moisture are presented in this report. Figure 6 shows the Climate Prediction Center's calculated soil moisture ranking percentiles for October 2012. Figure 7 shows the Variable Infiltration Capacity model soil moisture percentiles as of November 1, 2012.

Both soil moisture rankings depict very dry soil moisture conditions throughout the upper Missouri River basin; however, there are some differences in the model results. CPC soil moisture conditions in the upper Missouri River basin rank from the 20th to the 1st percentile, which is extremely dry, while the VIC model soil moisture conditions rank from the 20th to a level just below the 2nd percentile. CPC's soil moisture places the driest soil conditions in southern Montana, southern South Dakota, Wyoming, Nebraska and Iowa. The VIC model places the driest soil moisture conditions throughout most of the upper Missouri River basin with the exception of central Montana. In our analysis of the influence of soil moisture on forecast runoff, neither model takes preference over the other. As an indicator of future monthly runoff, soil moisture conditions suggest runoff will be well-below average when considered along with the temperature and precipitation outlooks, which are discussed in more detail later in this write-up.

In comparison to this time last year, the CPC's soil moisture percentile rankings in much of the upper basin were in the 80th to 95th percentile. Runoff during the 2011 October-December period was 139% of normal.

Soil Moisture Ranking Percentile Last day of OCT, 2012

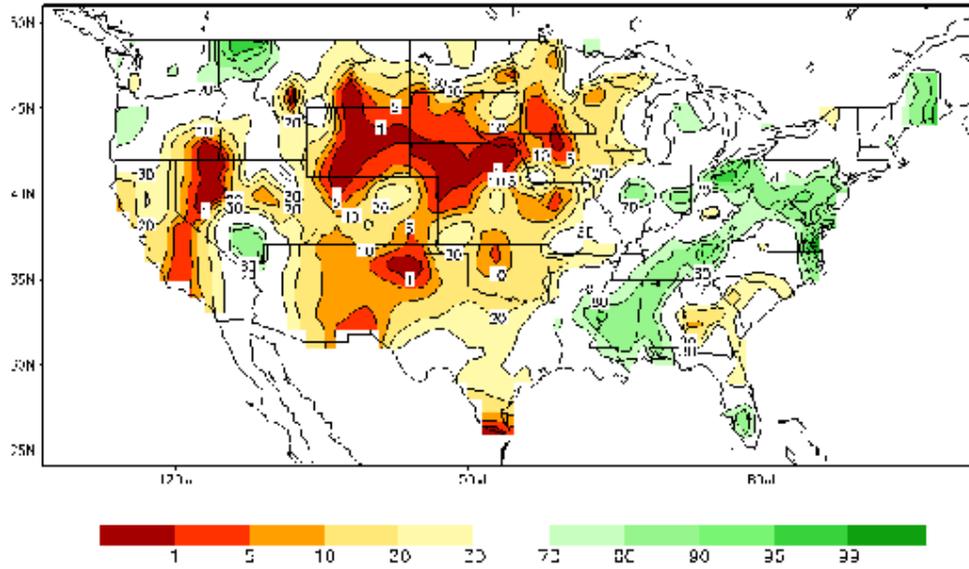


Figure 6. Calculated Soil Moisture Ranking Percentile for October 2012. Source: Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

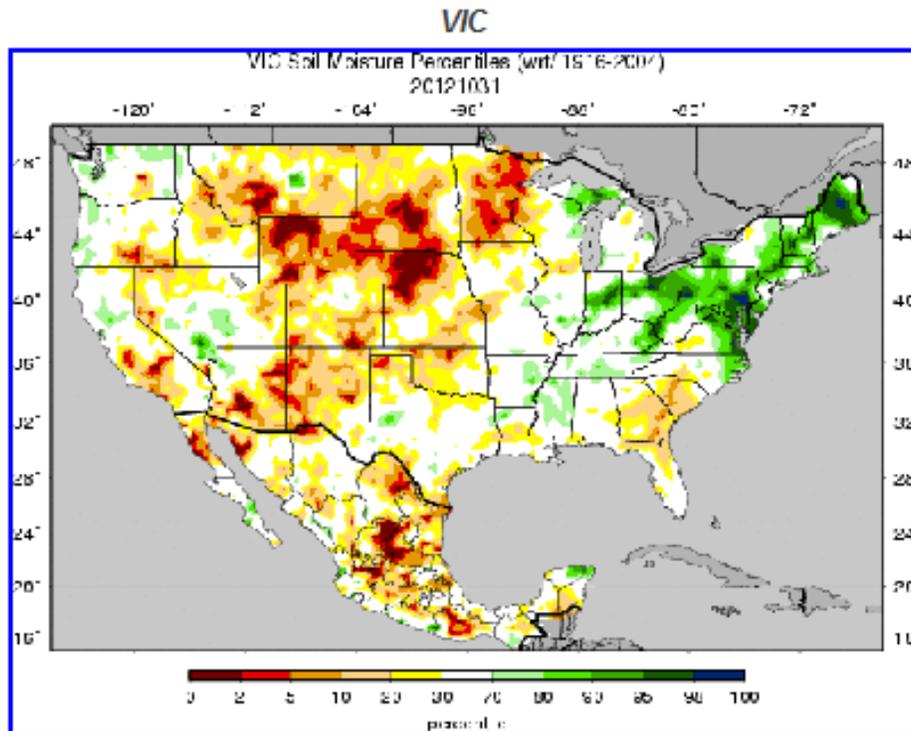


Figure 7. VIC modeled soil moisture percentiles as of November 1, 2012. Source: University of Washington. http://www.hydro.washington.edu/forecast/monitor/curr/conus.mexico/main_sm.multimodel.shtml

Drought Analysis

Drought conditions remained relatively the same in October as they did in September according to the National Drought Mitigation Center's (NDMC) drought monitor (Figure 8). Some form of drought is now affecting almost the entire upper Missouri River basin. Extreme (D3) and Exceptional (D4) Drought categories have expanded north and are now being seen over the southern half of South Dakota and portions of Wyoming.

The seasonal drought outlook effective from November 1, 2012 to January 31, 2013 is shown in Figure 9. The U.S. Seasonal Drought Outlook is predicting persistent drought in areas already impacted by drought, with some improvement in Montana and North Dakota

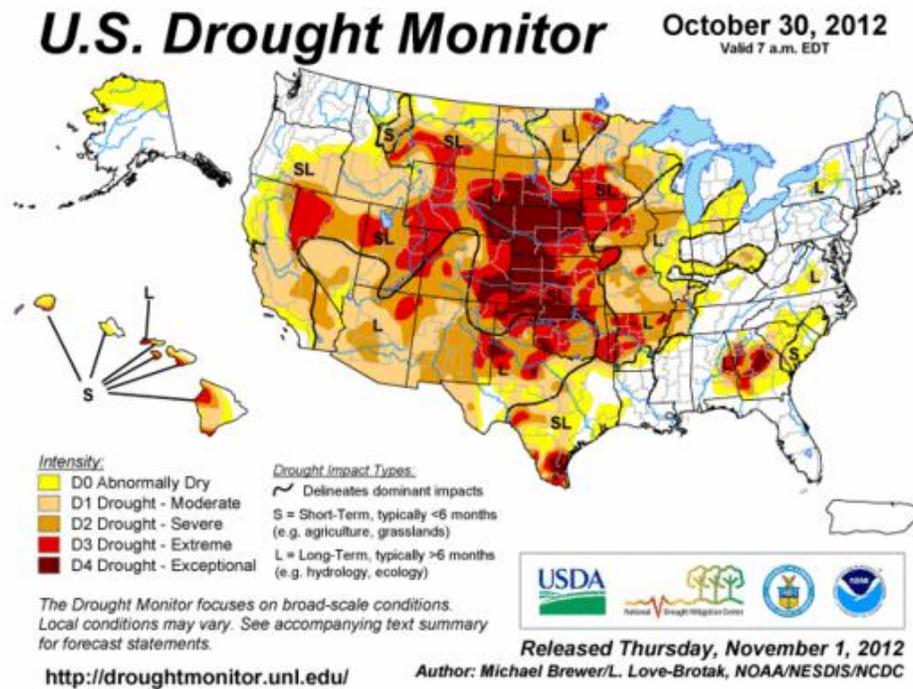


Figure 8. National Drought Mitigation Center U.S. Drought Monitors for October30, 2012.

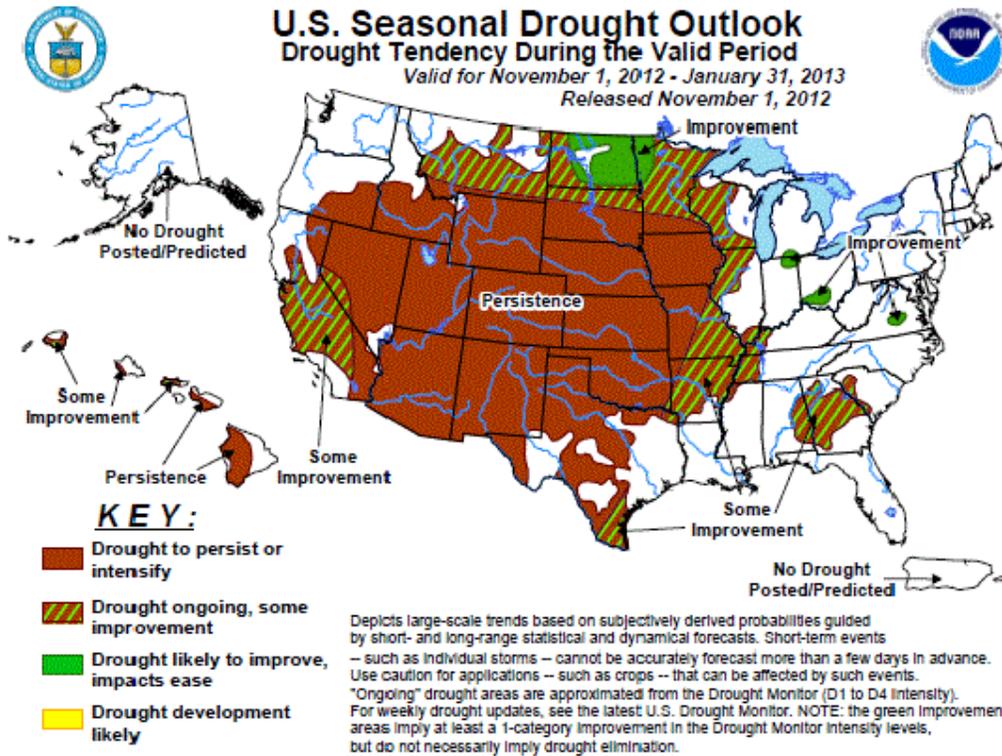


Figure 9. National Drought Mitigation Center U.S. Drought Seasonal Drought Outlook for November 1, 2012 – January 31, 2012

Climate Outlook

ENSO-neutral conditions continue in the equatorial Pacific, with weakening El Nino conditions. According to the CPC, El Nino conditions are likely to develop during Fall 2012. The last time El Nino conditions persisted in the equatorial Pacific was during the fall and winter of 2009-2010. During El Nino (warm) episodes, winters in the upper portions of the Missouri River basin have a tendency to be warmer and drier than normal.

The 8-14 Day (Figure 10) Outlooks indicate that temperatures are very likely to be above normal in the majority of the Basin. The probability for above normal precipitation is greater for much of the Missouri River basin through mid-November.

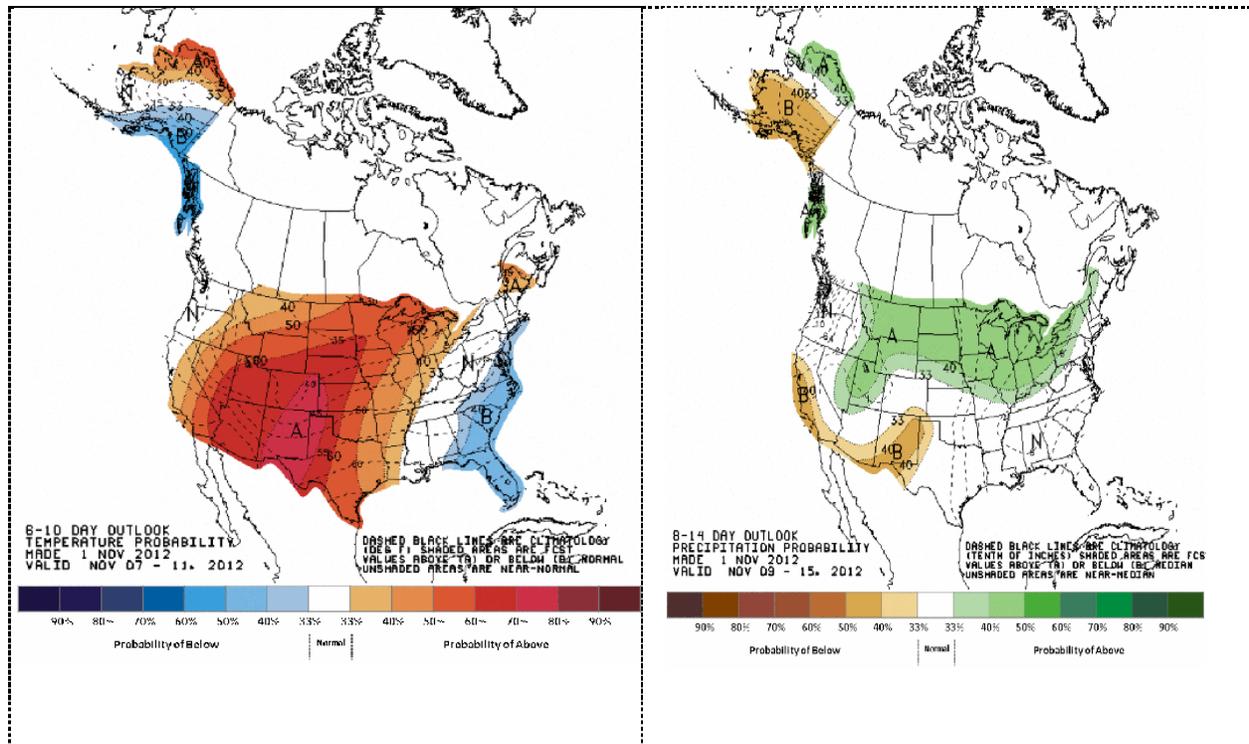


Figure 10. CPC 8-14 day temperature and precipitation outlooks.

During November the Climate Prediction Center is predicting increased chances for above normal temperatures for the majority of the Basin (Figure 11). The probability for above, below and normal precipitation is equal chances in the majority of the Basin in November, except for Montana and North Dakota. The CPC 3-month outlook is predicting an increased probability for above normal temperatures in the Missouri basin through January; with equal chances for above, below and normal precipitation in the Western portion of the Basin, and below chances for precipitation in the Eastern portion of the Basin (Figure 12). The January – March 2013 CPC Outlook (Figure 13) contains a forecast similar to the November - January 2013 outlook for temperature, but equal chances for above, below and normal precipitation in the Basin.

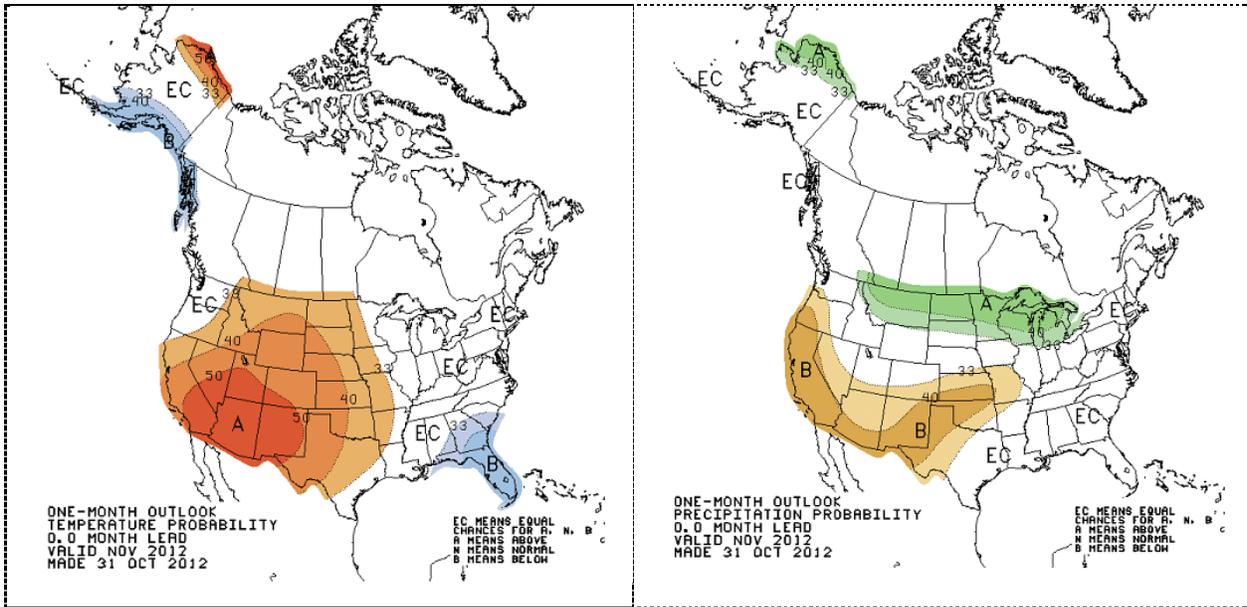


Figure 11 CPC November 2012 temperature and precipitation outlooks.

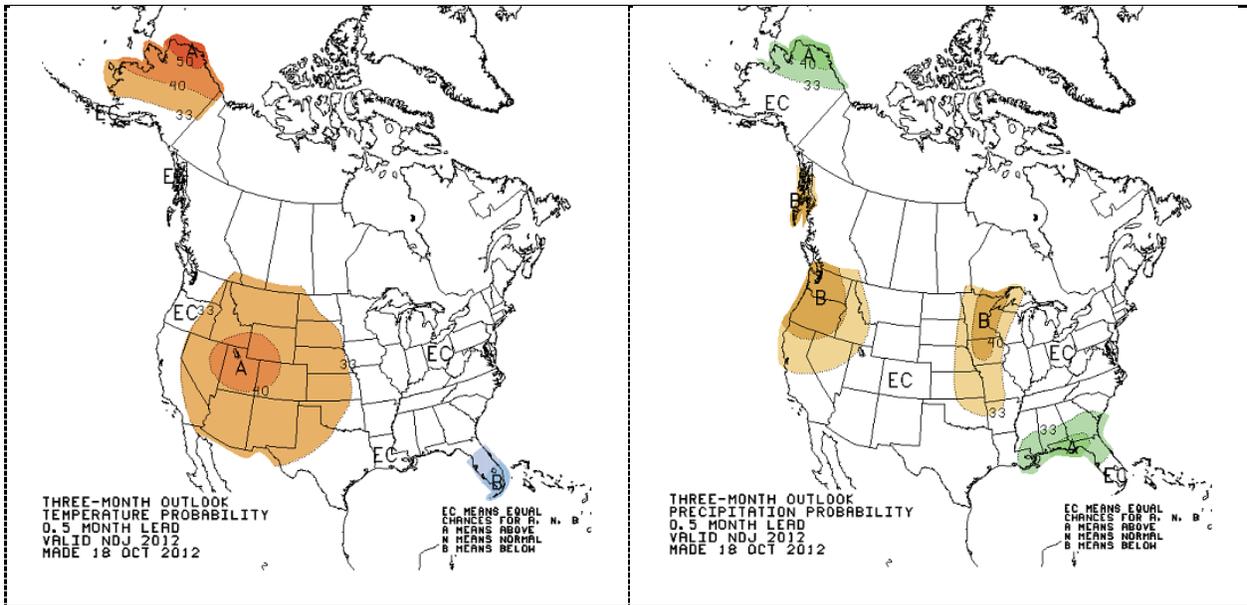


Figure 12. CPC November-December-January 2012/2013 temperature and precipitation outlooks.

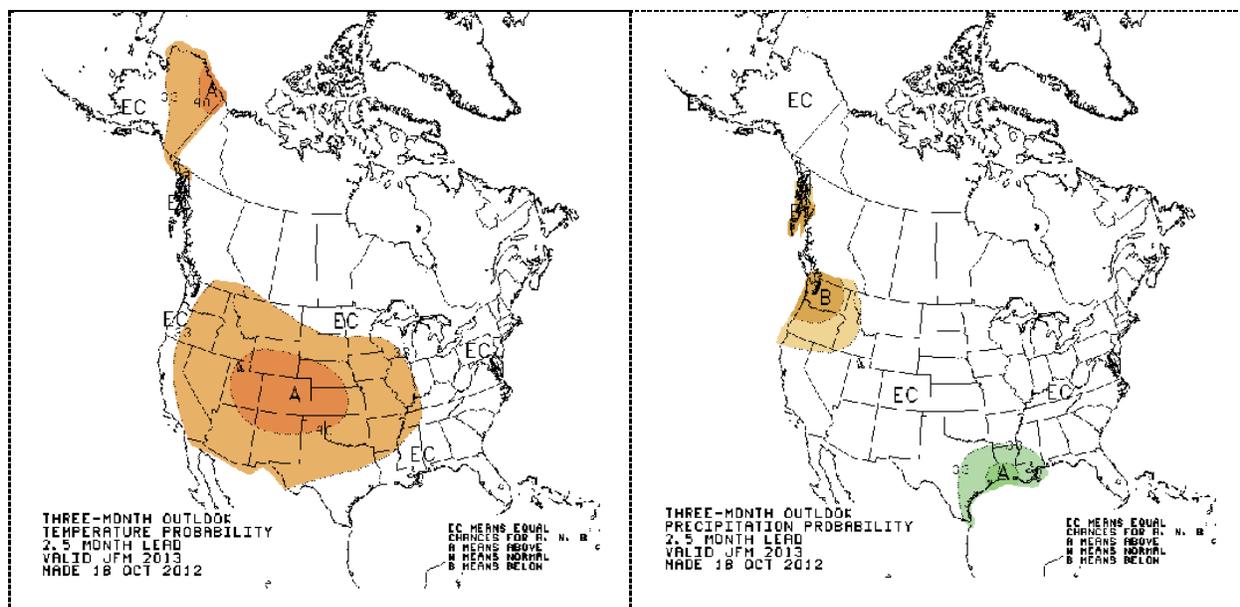


Figure 13. CPC January-February-March 2013 temperature and precipitation outlooks.

Summary – November 2012 Calendar Year Runoff Forecast

The November 1 calendar year runoff forecast above Sioux City, IA is **19.2 MAF** (78% of normal) and **17.3 MAF** (76% of normal) above Gavins Point Dam. This is an increase of 0.2 MAF from the October 1 forecast. Due to the amount of variability in precipitation that can occur over the next 2 months, the expected inflow ranges from the 19.5 MAF upper basic forecast to the 19.0 MAF lower basic forecast.

The November–December runoff forecasts for all reaches were determined by first comparing the September–October 2012 runoff period with historic runoff periods. From this data, average November–December runoff volumes to be used as a starting point for the November–December 2012 runoff forecast were computed from a range of runoff volumes that occurred within a narrow range of historic runoff years similar to September–October 2012. These runoff volume forecasts were justified by evaluating the influence that current soil moisture conditions, antecedent precipitation conditions, precipitation and temperature outlooks would have on the November–December runoff.

November runoff is forecast to be 0.6 MAF (59% of normal). December runoff is forecast to be 0.5 MAF (67% of normal). Though some improvement to runoff is expected during the remainder of 2012, extremely dry soil moisture conditions and the unclear precipitation forecast could limit the amount of runoff that occurs.