Upper Missouri River Basin
March 2012 Calendar Year Runoff Forecast
March 1, 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.

February 2012 Runoff

February 2012 Missouri River runoff was 1,646 KAF (153% of normal) above Sioux City, and 1,472 KAF (149% of normal) above Gavins Point. Overall monthly temperatures were well-above normal allowing many tributaries to flow ice-free causing much higher than normal reservoir inflows. This was the second consecutive month of above normal runoff, resulting in a calendar year summation of 2,625 KAF (2.6 MAF) which is 144% of normal.

2012 Calendar Year Forecast Synopsis

The March 1 forecast for 2012 runoff above Sioux City, IA is **26.1 MAF** (105% of normal). The March 1 forecast for runoff above Gavins Point Dam is **22.7 MAF** (100% of normal). This is an increase of 0.5 MAF from the February 1 forecast due to continued above-normal runoff in February, modest increases in mountain snowpack, and the development of light to moderate plains snowpack in some regions of the basin. Due to the amount of variability in precipitation that can occur over the next 10 months, the range of expected inflow is quite large and ranges from the 35.2 MAF upper basic forecast to the 18.2 MAF lower basic forecast. The upper and lower basic forecasts provide a likely range of runoff scenarios that could occur given much wetter conditions or much drier conditions. The upper and lower basic forecasts are used in long-term regulation planning models to “bracket” the range of expected runoff given much wetter or drier conditions, respectively. Given that 10 months are being forecasted for this March 1 forecast (2 months observed/10 months forecast), the range of greater than normal (upper

basic) and lower than normal (lower basic) runoff is attributed to all 6 reaches for all 10 months. The result is a large range or "bracket" for each reach, and thus, for the total runoff forecast. As the year progresses, the range will lessen as the number of observed months increases and number of forecast months decreases.

Current Conditions

ENSO (La Niña)

The 2011 September-October-November period marked the onset of El Niño Southern Oscillation (ENSO) "La Niña" conditions when sea surface temperature (SST) anomalies fell below the -0.5 deg C departure. In 2010-2011, the onset of La Niña began with the 2010 June-July-August period, which was three months earlier than what occurred in 2011. The 2010-2011 La Niña ended during the April-May-June period.

During La Niña episodes, the Pacific Northwest and portions of the Northern Rockies in the Missouri River Basin are expected to receive greater than normal precipitation as mountain snowfall, and generally colder than normal temperatures in the Northern Plains, usually during the January-February-March period. Increased plains snowfall and accumulations are generally expected due to the colder than normal temperatures. La Niña episodes create storm track conditions that move through the Pacific Northwest to the Northern Plains (Missouri River basin). **So far the winter of 2011-2012 temperature pattern (warmer than normal) has not been typical of the expected temperature pattern during a La Niña episode. Though snowfall has been below normal over the plains, many portions of the upper Missouri River basin have experienced above normal precipitation.**

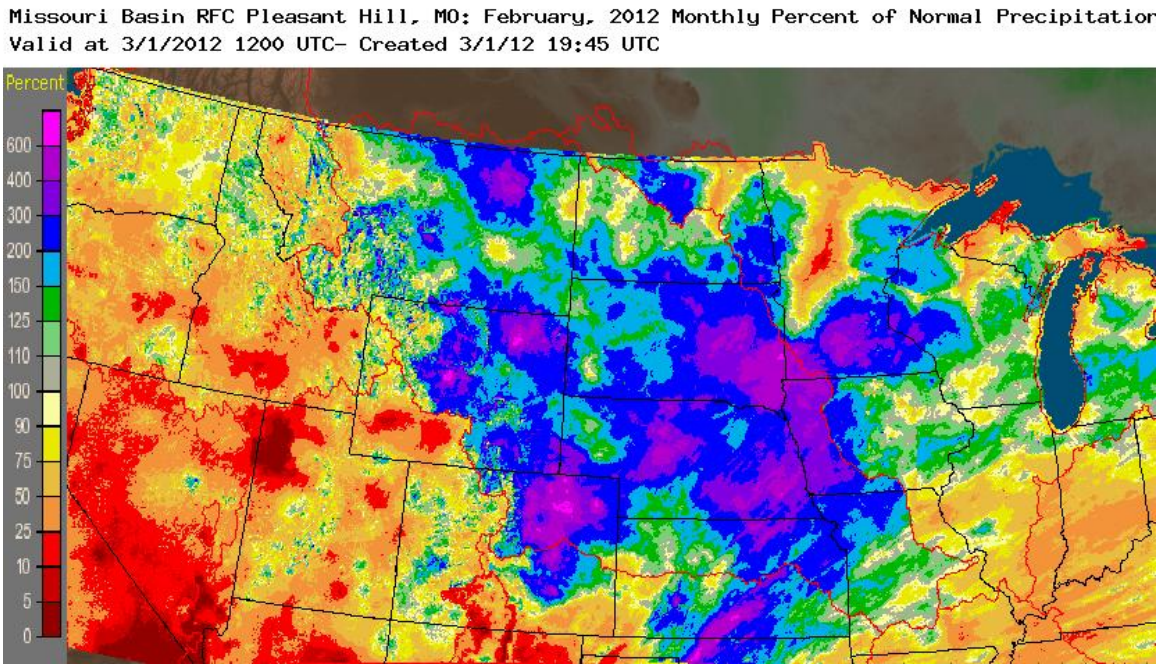
According to the NOAA Climate Prediction Center, sea surface temperatures are likely to transition to ENSO-neutral conditions during March-April-May 2012. Because the strength of impacts in the United States is not necessarily related to the exact strength of La Niña, CPC expects La Niña impacts to continue even as the episode weakens.

Precipitation

The February Climate Prediction Center precipitation outlook called for equal chances of precipitation in the Missouri River basin. Observed precipitation (see Figure 1) was above normal over a majority of the Missouri River basin as a result of several winter events that occurred during the last 10 days of February. The eastern half of South Dakota received more than 200% of normal precipitation, while many areas of the upper basin received between 125% and 200% of normal precipitation. Two notable February precipitation totals, which occurred mostly as rain, were 2.43 inches at Sioux Falls, SD and 2.24 at Sioux City, IA. The last event to occur in February produced much of this precipitation with amounts ranging from one-half inch to two inches of precipitation across the eastern half of South Dakota, western Iowa, and northern and eastern Nebraska. Average snowfall totals from this storm ranged from 6 to 10 inches over northeastern South Dakota while lesser amounts occurred in surrounding areas. Nonetheless, overall plains snowfall has been below average.

Over the 90-day period (December-January-February) in Figure 1, the precipitation accumulation map reveals that precipitation across the basin was above normal in many areas especially in the plains. These departures from normal were influenced largely by the recent February precipitation.

February 2012



December-January-February 2012

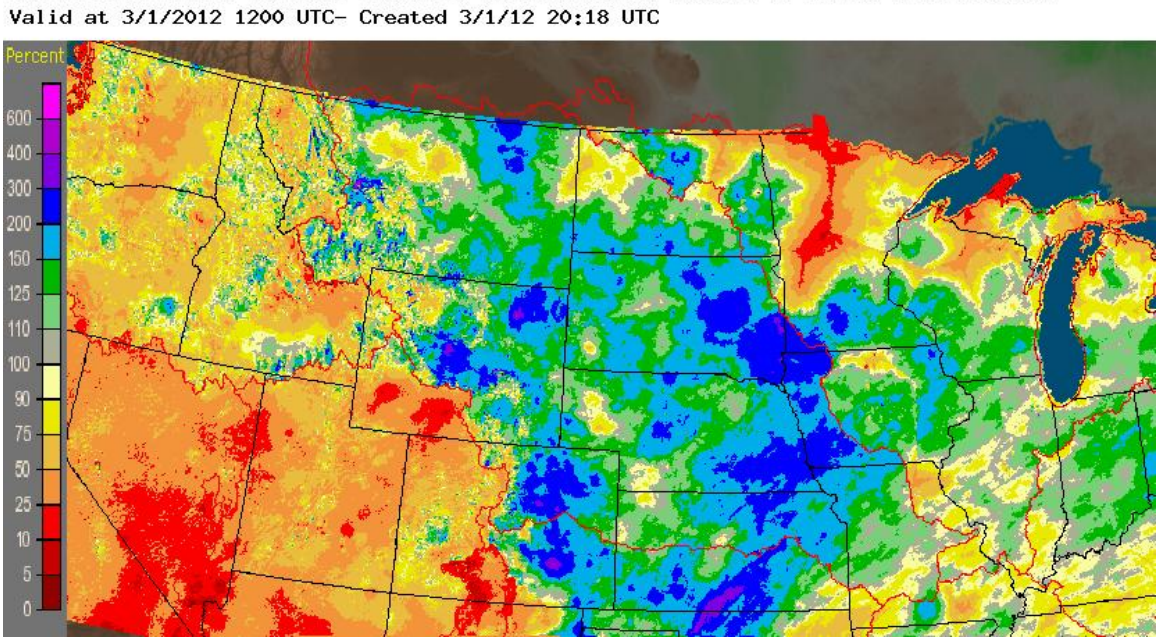


Figure 1. February 2012 and December-January-February 2012 Percent of Normal Precipitation

In comparison, February 2011 precipitation (see Figure 2) was similar in amount to 2012; however, almost all of the precipitation that occurred in 2011 was snowfall compared to a mix of snow and rain in 2012. Furthermore, the greatest precipitation departures in 2011 occurred over the upper basin above Sioux City, IA, whereas 2012 precipitation occurred throughout the basin with pockets of below normal to normal precipitation in the upper basin.

Please refer to the January and February Calendar Year Forecast narratives for information on the amount of precipitation that occurred in November and December 2011 as well as a comparison to the November and December 2010 precipitation amounts in the Missouri River basin.

February 2011

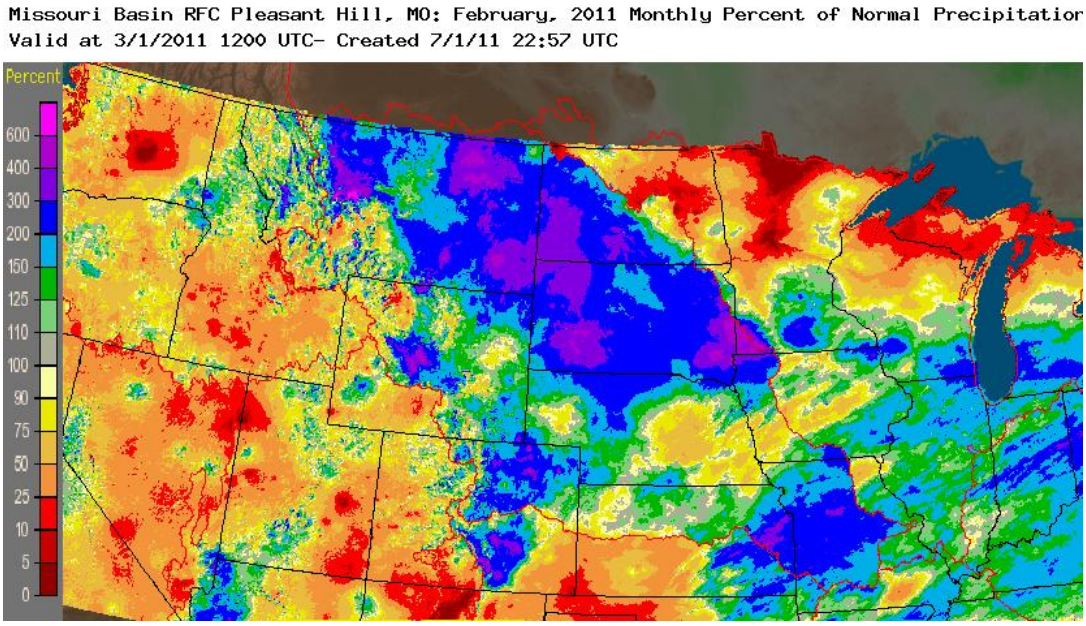


Figure 2. February 2011 Percent of Normal Precipitation.

Temperature

The February Climate Prediction Center temperature outlook called for an increased chance of above normal temperatures across most of the Missouri River basin with the greatest chance for above normal temperatures in the southeast portion of the basin (see February forecast discussion).

Average temperatures throughout the basin above Sioux City, IA during the month of February 2012 were above normal (Figure 3), especially north and east of the Missouri River where the mean temperature anomalies ranged from four to eight degrees Fahrenheit above normal. Temperature anomalies decreased to the west, and were near normal over a large portion of Wyoming and western Montana.

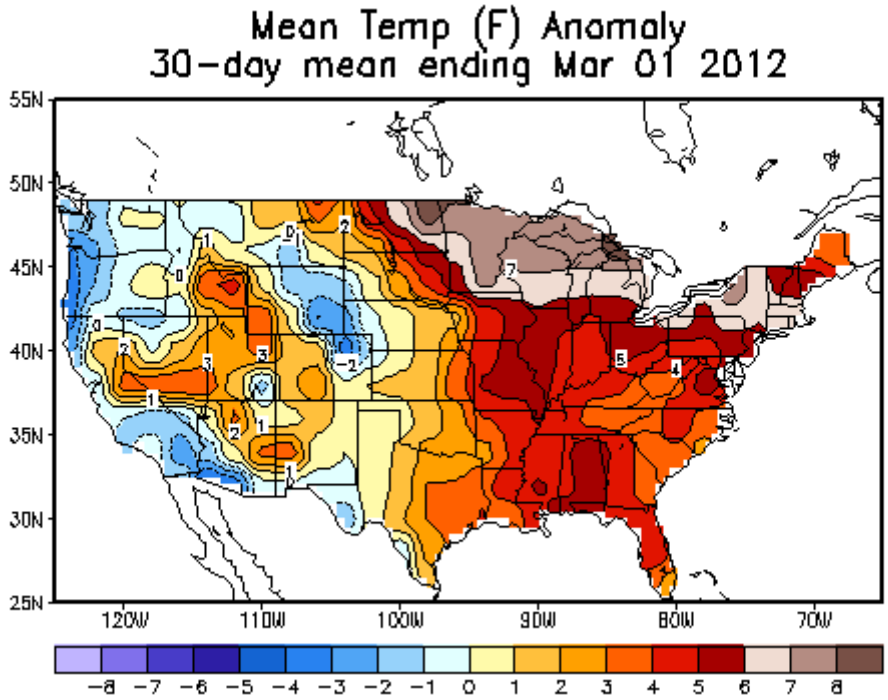


Figure 3. 30-day temperature anomaly (deg F) ending 1 Mar 2012.

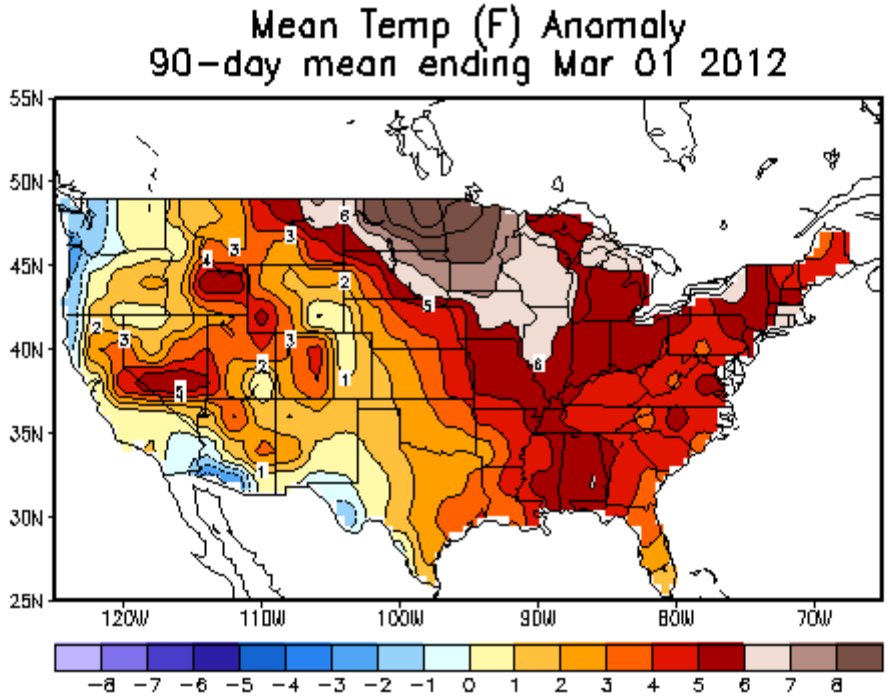


Figure 4. 90-day temperature anomaly (deg F) ending 1 Mar 2012.

Ninety-day (90-day) temperature departures ending on February 29, 2012 are shown in Figure 4. During the time period from December 1, 2011 to February 29, 2012, average daily temperatures have ranged from two to four degrees (F) above normal in the mountainous regions of the upper Missouri River

basin, and four to eight degrees above normal in the plains region of the upper Missouri River basin. In contrast, 90-day temperatures through March 1, 2011 (Figure 5) were two to four degrees (F) below normal in much of the upper basin with the exception of slightly above normal temperatures in the Yellowstone and Missouri River headwaters in Montana and Wyoming.

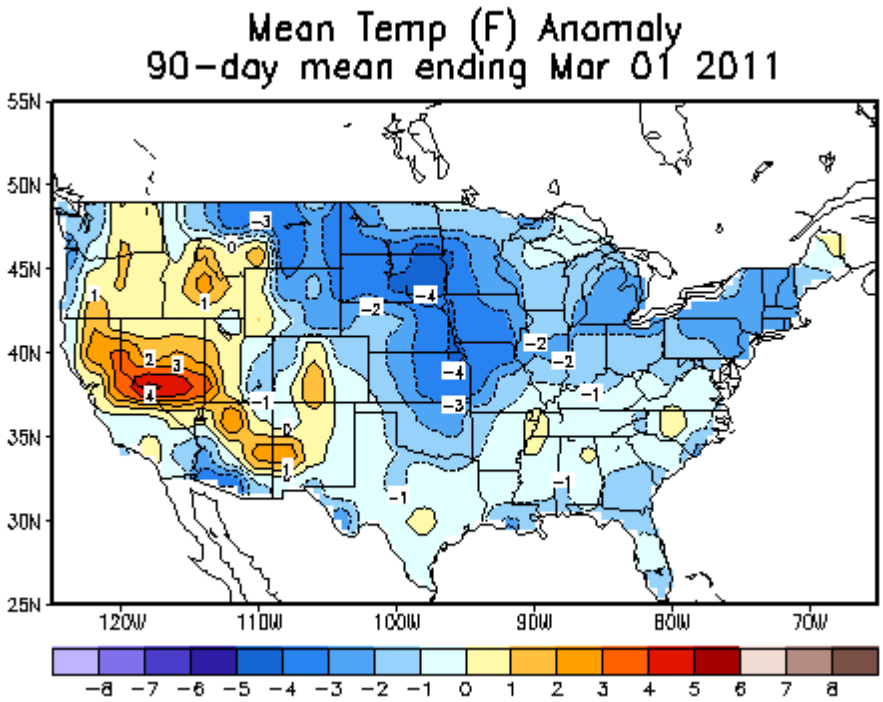


Figure 5. 90-day temperature anomaly (deg F) ending 01 Mar 2011.

Soil Moisture and Frost Conditions

Soil moisture conditions at the end of February 2012 were at or slightly above the median soil moisture condition (30th to 70th percentile) in much of the upper basin above Gavins Point (Figure 6). The exception was an area in eastern South Dakota where soil moisture ranked from the 5th to 30th percentile ranking. This area has experienced significant drying in the fall and winter as a result of above normal temperatures and below normal precipitation. Modeled soil moisture anomalies have been in the normal range in most of the upper basin (Figure 7); however, soil moisture anomalies in eastern South Dakota range from 20 to 80 millimeters below normal.

In contrast to February 2012, February 2011 soil moisture conditions were much wetter. Soil moisture percentile rankings (Figure 8) ranged from the 70th to the 99th percentile ranking across most of the upper Missouri River Basin. Particularly wet areas with rankings greater than the 90th percentile existed east of the Missouri River in the Dakotas and across North Dakota and the northern half of Montana. Positive soil moisture anomalies (Figure 9) ranged from 40 to 60 millimeters (<2.0 to 2.4 inches) over most of these areas, and up to 100 millimeters (4 inches) in northern North Dakota and eastern South Dakota. These extremely wet February conditions occurred as a result of much greater than normal fall 2010 precipitation followed by colder than normal temperatures during the winter.

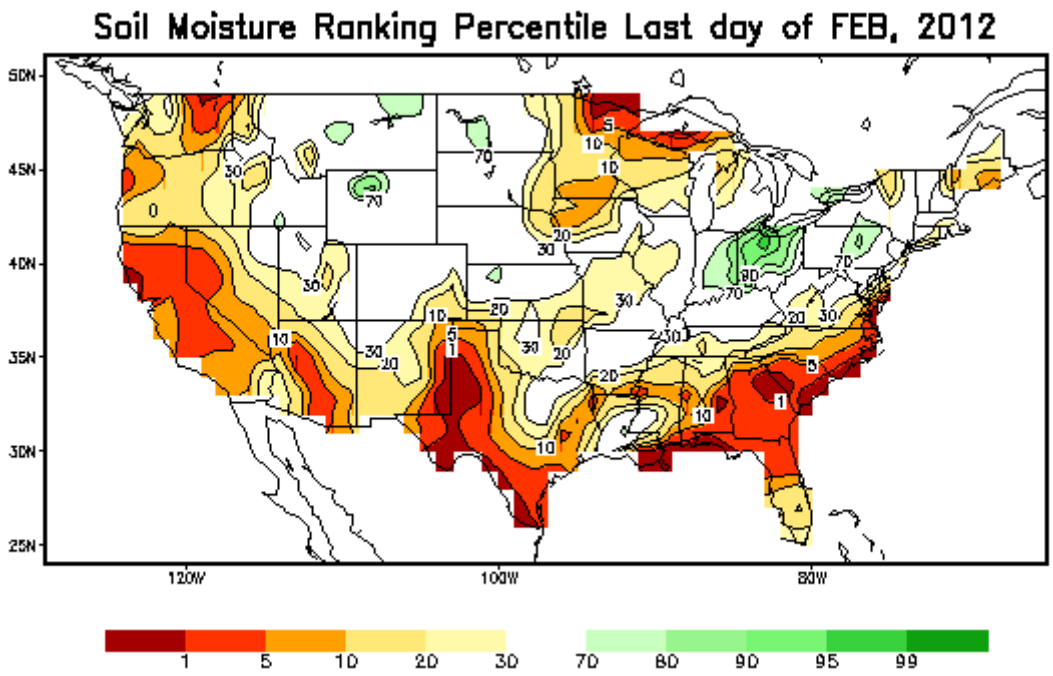


Figure 6. Calculated Soil Moisture Ranking Percentile on the last day of February 2012. Source: Climate Prediction Center. http://www.cpc.ncep.noaa.gov/cgi-bin/US_Soil-Moisture-Monthly.sh#

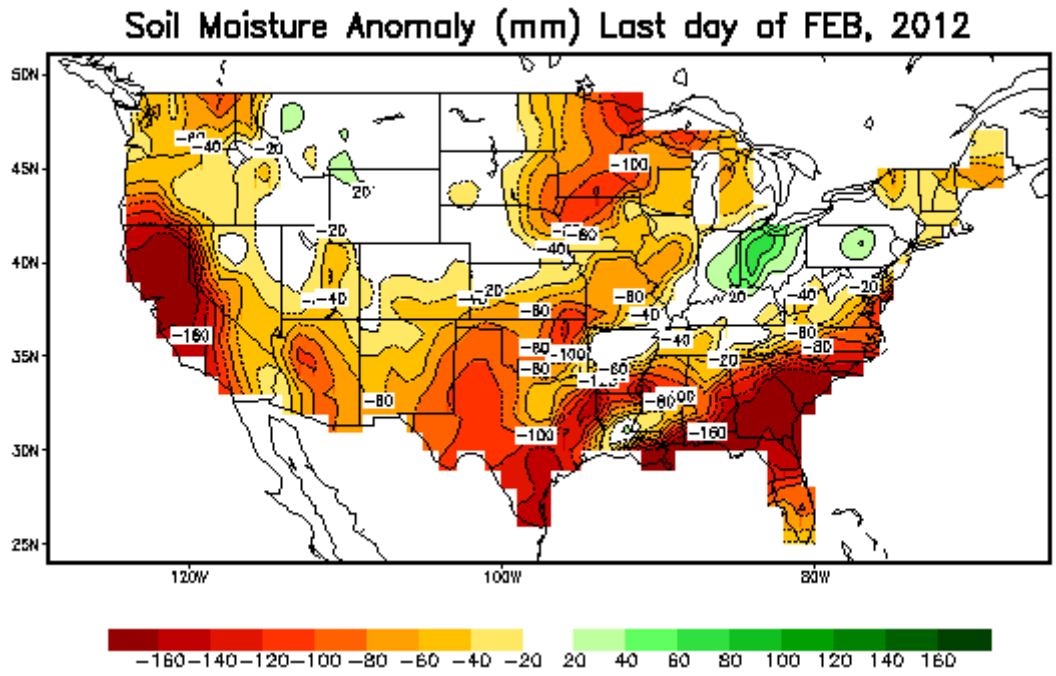


Figure 7. Calculated Soil Moisture Anomaly on the last day of February 2012. Source: Climate Prediction Center. http://www.cpc.ncep.noaa.gov/cgi-bin/US_Soil-Moisture-Monthly.sh#

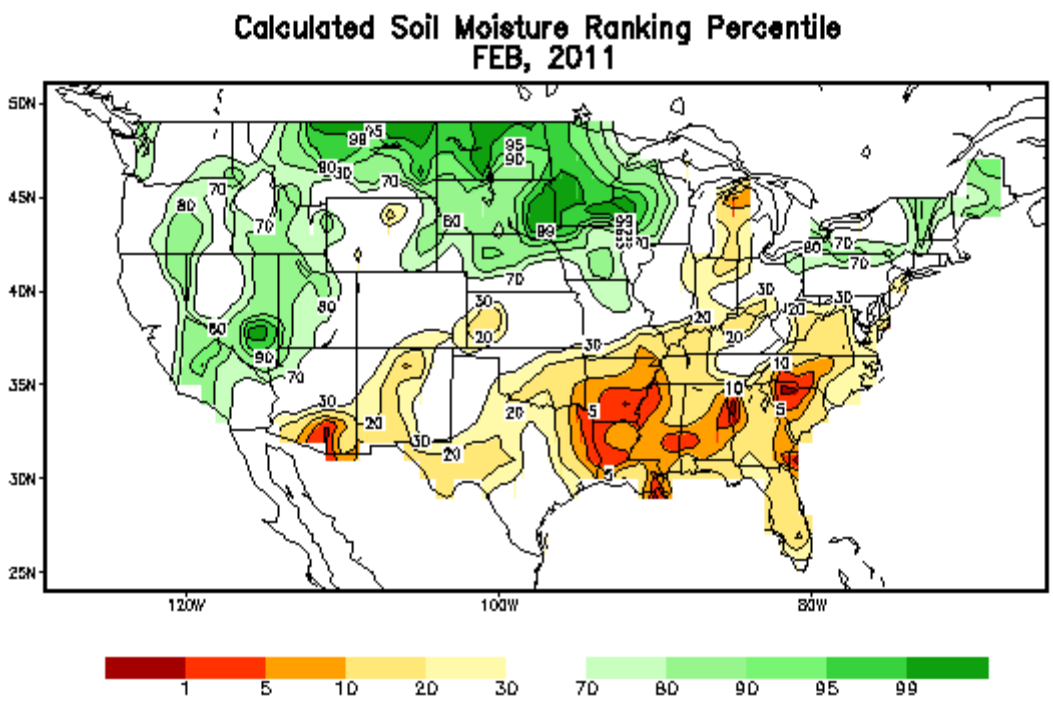


Figure 8. Calculated Soil Moisture Ranking Percentile in February 2011. Source: Climate Prediction Center. http://www.cpc.ncep.noaa.gov/cgi-bin/US_Soil-Moisture-Monthly.sh#

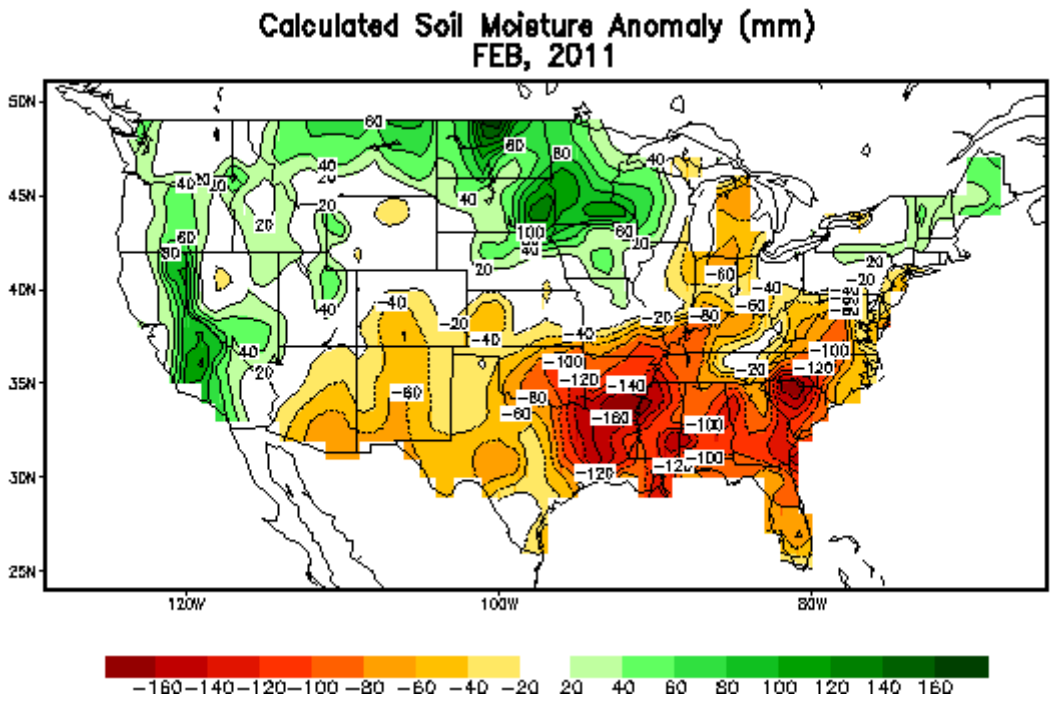


Figure 9. Calculated Soil Moisture Anomaly in February 2011. Source: Climate Prediction Center. http://www.cpc.ncep.noaa.gov/cgi-bin/US_Soil-Moisture-Monthly.sh#

For local observations of soil moisture, please refer to the end of this report for end-of-February 2012 soil moisture and frost conditions

Plains Snowpack

Plains snowpack is an important parameter that influences the volume of runoff occurring in the basin during the months of March and April. A common misperception is that the March-April runoff is a result of plains snowmelt only. Historically, about 25% of annual runoff occurs in March and April, during the time when plains snow is melting, due to both melting snowpack and rainfall runoff. Runoff occurs in March and April whether or not there is any plains snow to melt. Determining exact rainfall amounts and locations are nearly impossible to predict more than a week in advance. Thus, the March-April runoff forecast is formulated based on existing plains snowpack and existing basin conditions and hydrologic forecasts, which for this year primarily includes long-term precipitation outlooks.

Temperatures in February were well above normal in the Northern Plains, limiting additional snow accumulation. Plains snowpack as of March 2, 2012 is shown in Figure 10. On March 2 the NOHRSC snow model was adjusted to observed plains snow depths and water equivalents, so the March 1 map did not reflect the more accurate analysis. The heaviest areas of SWE ranging from 1.0 to 2.0 inches are spread throughout portions of central and eastern North and South Dakota. Other areas contain trace to 1.0 inch amounts of SWE according to NOHRSC.

March 2, 2012

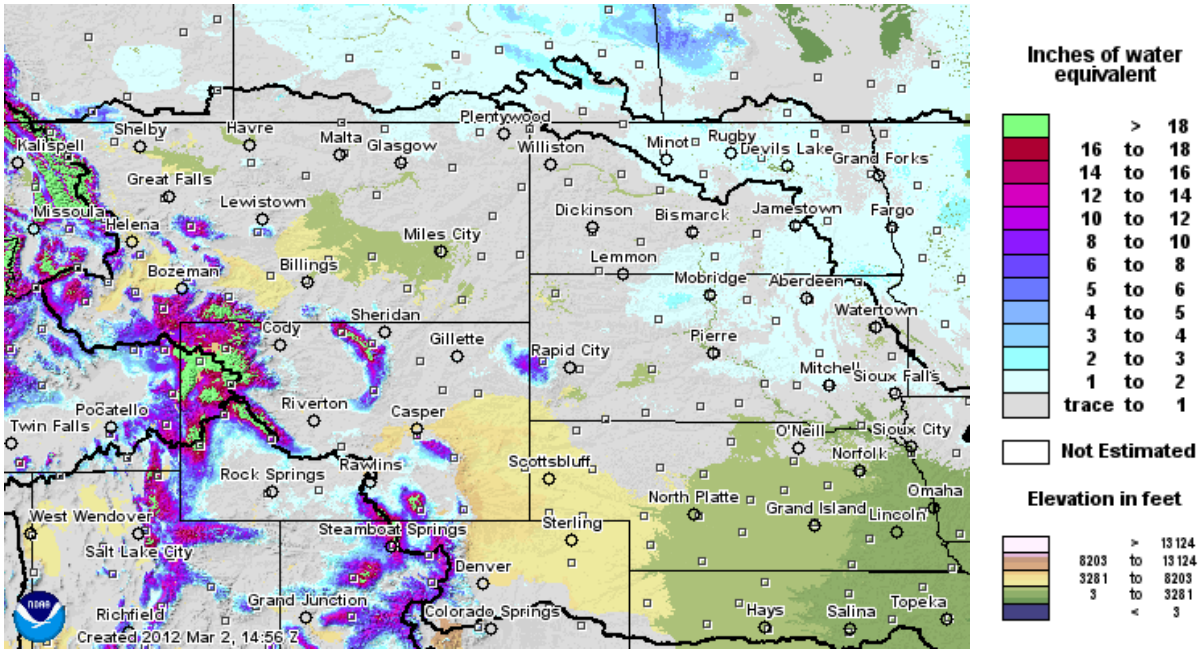


Figure 10. March 2, 2012 NOHRSC modeled plains snow water equivalent. Source: NOAA National Operational Hydrologic Remote Sensing Center. http://www.nohrsc.nws.gov/interactive/html/map.html

For runoff forecasting purposes, plains snow in the six mainstem reservoir reaches is classified has been classified as follows:

Table 1. January 1, February 1, and March 1, 2012 plains snowpack classification for runoff forecasting.

Reservoir Reach	Plains Snowpack Classification		
	January 1, 2012	February 1, 2012	March 1, 2012
Above Fort Peck	None to Light	None	None to Light
Fort Peck to Garrison	None to Light	None	None to Light
Garrison to Oahe	None	None to Light	Light
Oahe to Fort Randall	None	None	Light
Fort Randall to Gavins Point	None	None	None to Light
Gavins Point to Sioux City	None to Light	None to Light	Light to Moderate

In contrast, plains snowpack on March 1, 2011 (Figure 11) was very extensive in aerial coverage and much greater in depth. An area of one-inch minimum SWE existed north a line extending from Sioux City, IA to Havre, MT. Heavy snow ranging from three to four inches of SWE covered a large area north of a line from Sioux Falls, SD, to Havre, ND. Throughout the area of heaviest snow cover, SWE amounts ranged from four to six inches, with possibly heavier amounts in concentrated areas.

March 1, 2011

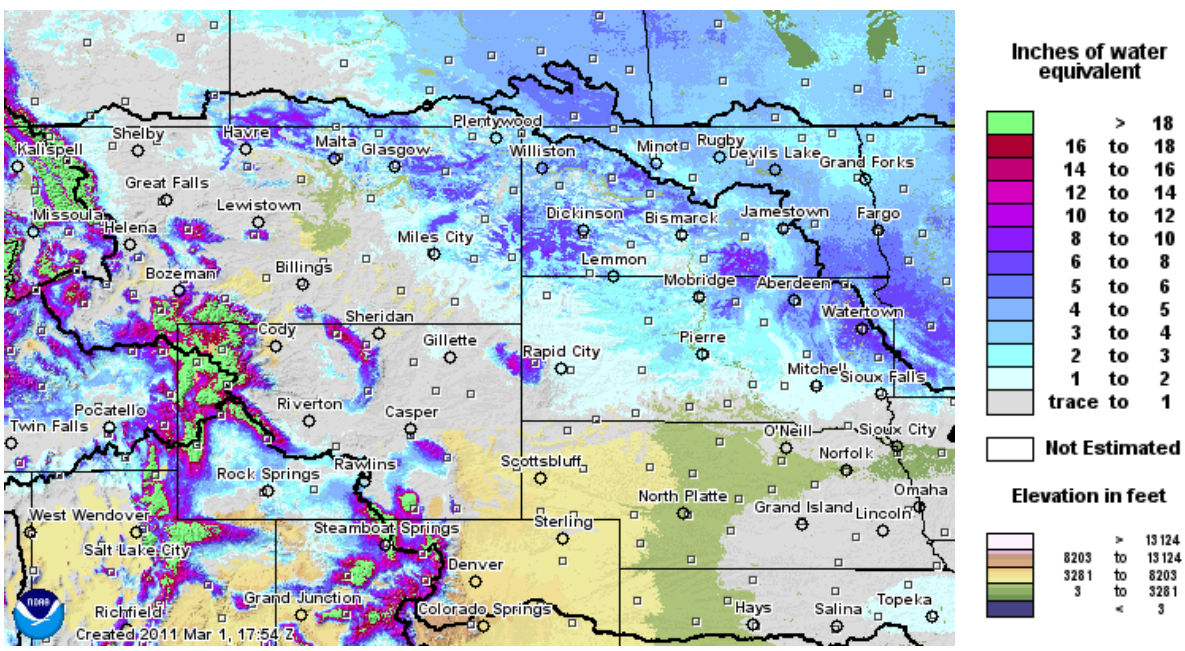


Figure 11. March 1, 2011 NOHRSC modeled plains snow water equivalent. Source: NOAA National Operational Hydrologic Remote Sensing Center. http://www.nohrsc.nws.gov/interactive/html/map.html

Mountain Snow Pack

Mountain snowpack is the primary factor used to predict May-June-July runoff volumes in the Fort Peck and Fort Peck to Garrison mainstem reaches. During the 3-month runoff period, about 50% of the annual runoff enters the mainstem system as a result of mountain snowmelt and rainfall runoff.

Greater than average mountain snow accumulations are usually associated with greater than average May-June-July runoff volumes, especially when mountain soil moisture conditions have been wetter than normal as in the past three years. For example, we would expect to see greater than average runoff from an average mountain snowpack this year due to wetter than normal soil moisture conditions.

As of March 1, 2012, the Corps of Engineers' assessment of the mountain snowpack was 94% of normal in the drainage area above Fort Peck (Figure 12), an increase from 87% of normal on February 1, 2012. Mountain snowpack was 105% of normal in the incremental drainage area between Fort Peck and Garrison (Figure 12), an increase from 96% of normal on February 1, 2012. In terms of peak snow accumulation, normally 79% has accumulated in the mountains by March 1. In comparison, March 1, 2011 snowpack was 110% of normal above Fort Peck, and it was 107% of normal between Fort Peck and Garrison. The NRCS depictions of the mountain SWE as a percent of normal SWE by mountain river basin as of March 1, 2012, are provided at the end of this report under the Additional Figures heading.

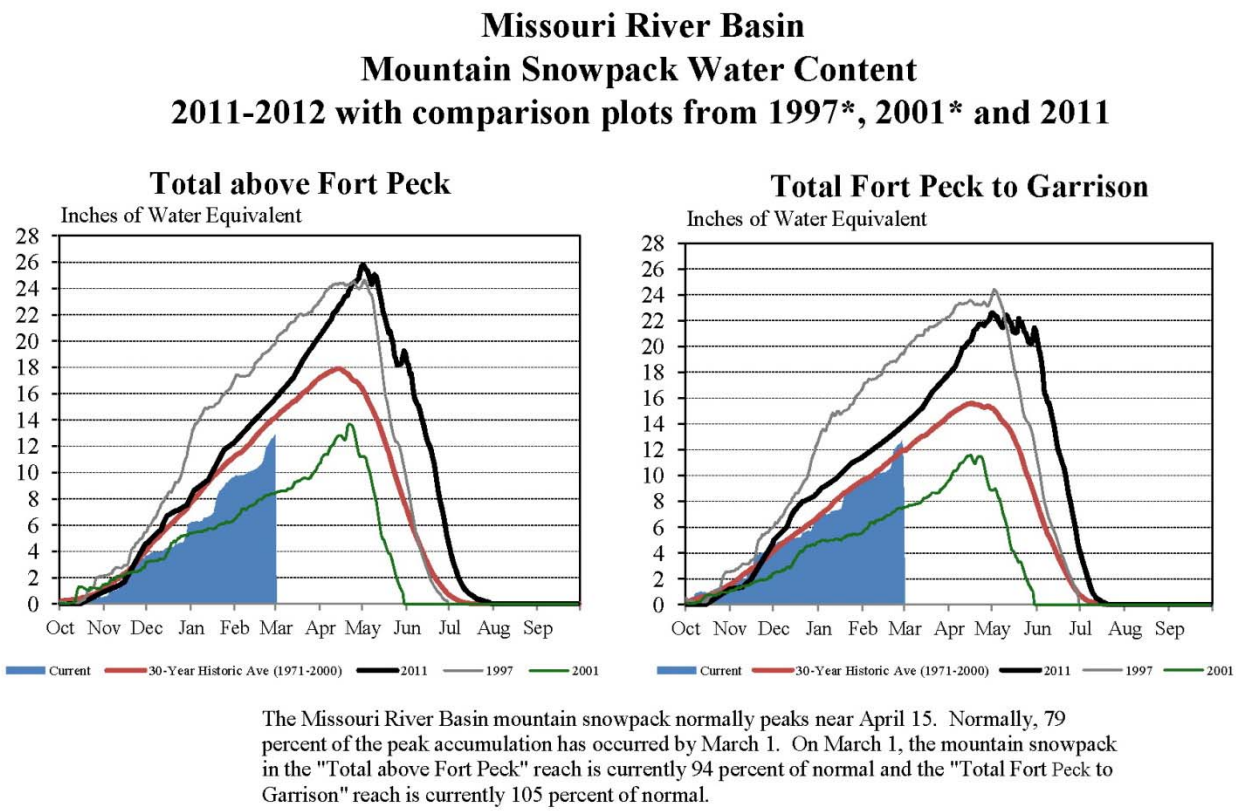


Figure 12. Mountain snowpack water content snow accumulation compared to normal and historic conditions. Corps of Engineers - Missouri River Basin Water Management.

Drought Analysis

According to the National Drought Mitigation Center (NDMC), Abnormally Dry (D0) conditions have persisted throughout the Dakotas, while there has been some relief in western and central Nebraska (see Figure 13). Particularly dry areas include the eastern quarter of South Dakota, southern Minnesota, northwest Iowa and northeast Nebraska, which are classified in Moderate (D1) to Severe (D2) drought categories.

Over the next three months through the end of May, the NDMC is predicting drought to develop across the western Dakotas (Figure 14) and drought to persist or intensify in eastern South Dakota, northeast Nebraska and northwest Iowa.

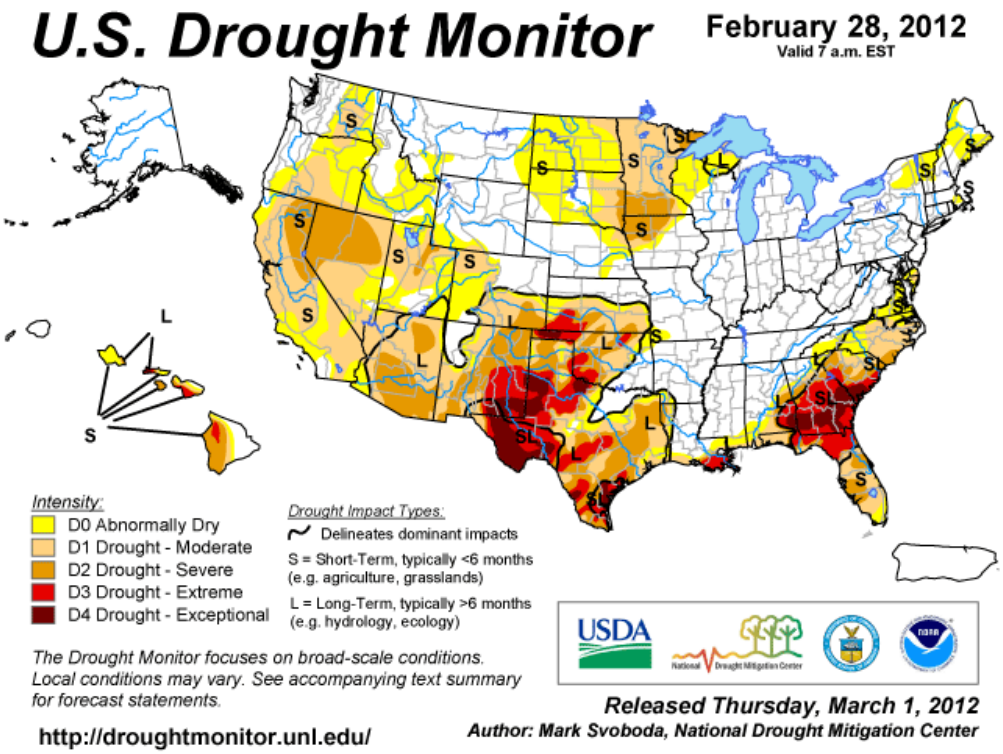


Figure 13. National Drought Mitigation Center U.S. Drought Monitors for February 28, 2012.

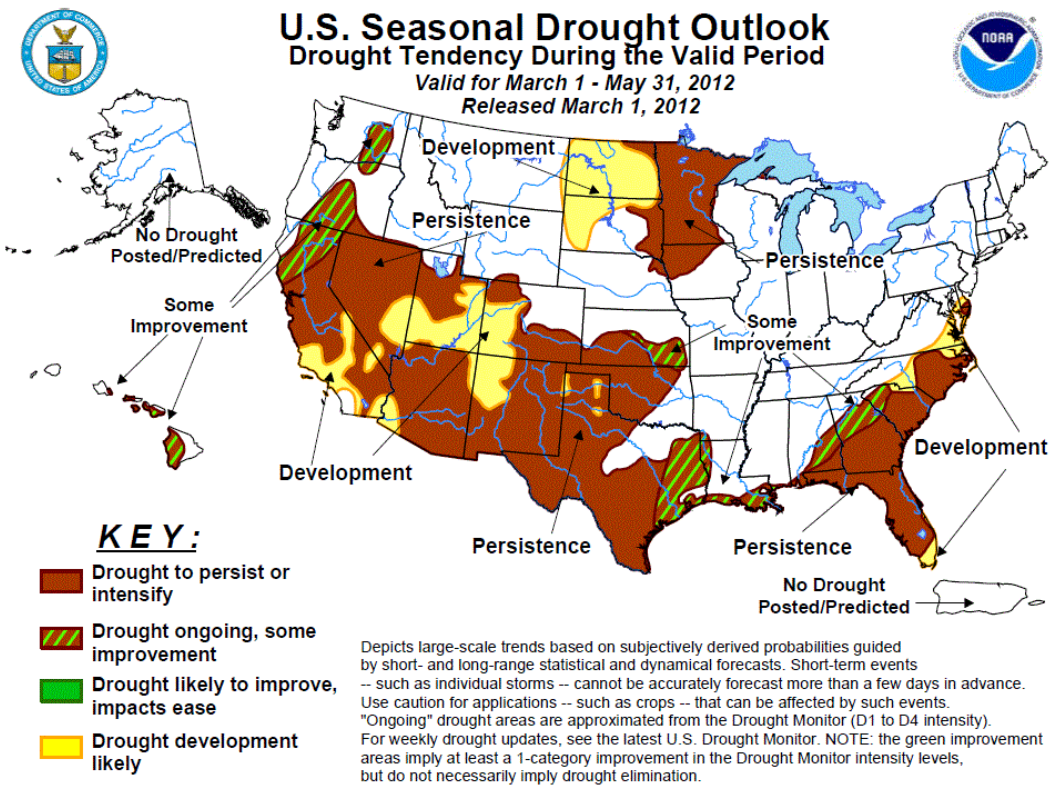


Figure 14. National Drought Mitigation Center U.S. Drought Seasonal Drought Outlook for Mar-Apr-May 2012.

Climate Outlook

According to the NOAA Climate Prediction Center, La Niña is likely to transition to ENSO-neutral conditions during March-April-May 2012. Because the strength of impacts in the United States is not necessarily related to the exact strength of La Niña, CPC expects La Niña impacts to continue even as the episode weakens.

La Niña winters in the Missouri River Basin are associated with cooler than normal temperatures and possible above normal precipitation. The factors that have influenced weather so far are positive Arctic and North Atlantic Oscillations, which have limited the intrusion of cold air masses into the contiguous United States. According to the Climate Prediction Center, this has been the biggest difference in weather patterns between the winters of 2010-2011 and 2011-2012.

The 6-10 Day (Figure 15) and 8-14 Day (Figure 16) Outlooks indicate temperatures are very likely to be above normal through March 15 in all of the upper Missouri River basin, while precipitation has equal chances for being above normal, normal or below normal in most areas. The exception is an increased chance for above normal precipitation in the Northern Rockies of western Montana.

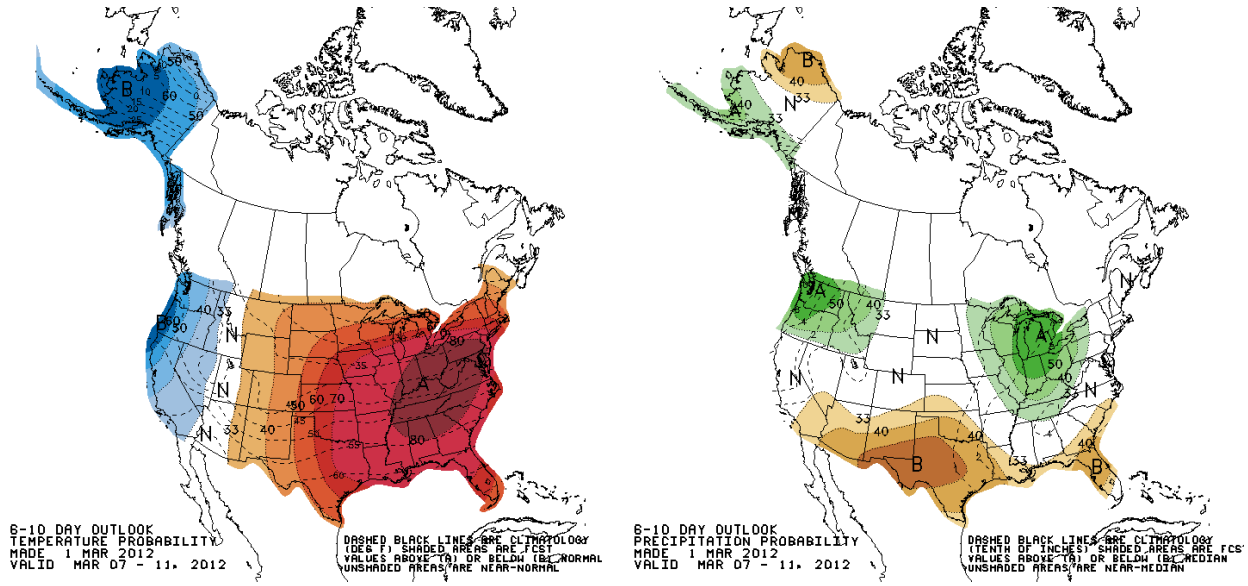


Figure 15. CPC 6-10 day temperature and precipitation outlooks.

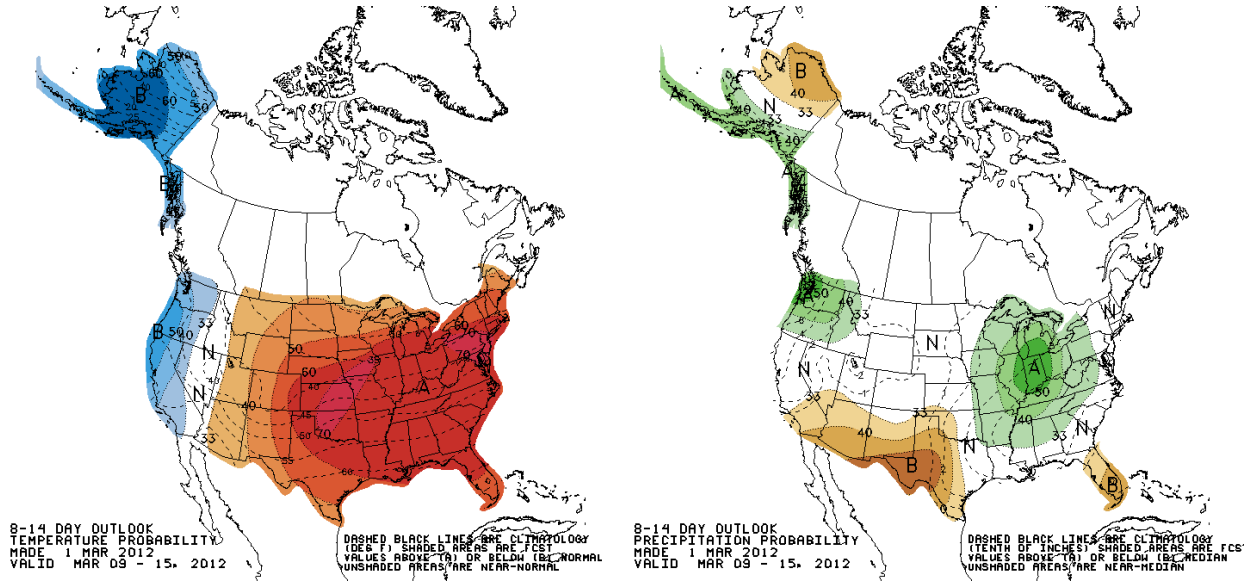


Figure 16. CPC 8-14 day temperature and precipitation outlooks.

The temperature outlook for March (Figure 17) indicates increased chances for above normal temperatures throughout much of the Missouri River Basin, while the precipitation outlook indicates equal chances for below normal, normal and above normal precipitation in the Upper Basin. Western Montana still has an increased chance for above normal precipitation through the end of March. This increased chance for above normal precipitation is a result of lingering La Niña impacts in the northwestern U.S. Lingering impacts of La Niña are also reflected in increased chances for above normal precipitation in the Ohio River Basin.

The three-month March-April-May period reflects a weakening La Niña and likely transition to ENSO-neutral conditions, leading CPC forecasters to forecast equal chances for above normal, normal, and

below normal temperatures in much of the upper basin, and increased chances for above normal temperatures in the eastern half of the basin (Figure 18). Because there is not a strong climate signal that would indicate what will happen with precipitation, there are equal chances for above normal, normal and below normal precipitation across the upper basin.

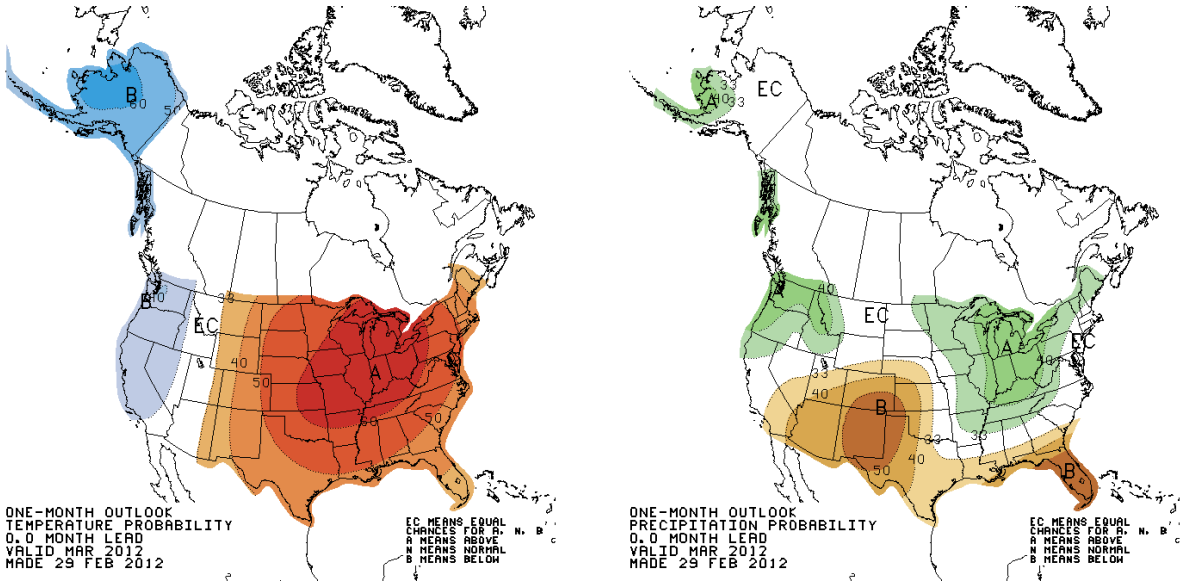


Figure 17. CPC March 2012 temperature and precipitation outlooks.

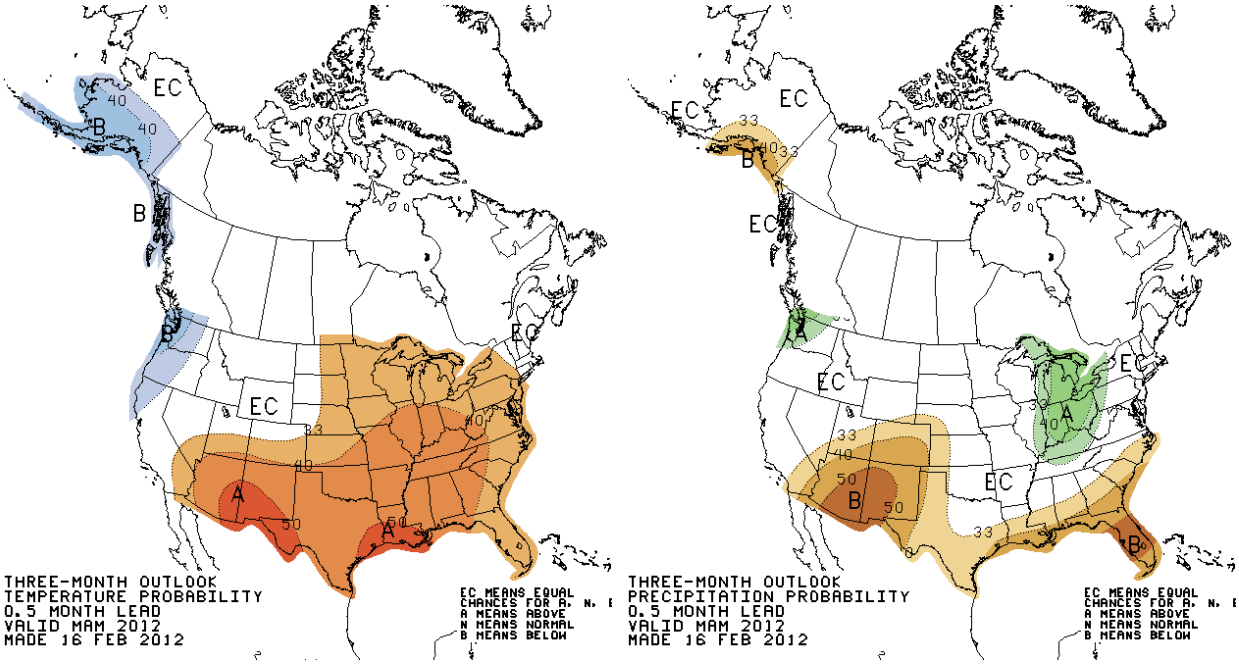


Figure 18. CPC March-April-May 2012 temperature and precipitation outlook.

According to the CPC outlook, there are Equal Chances for above normal, normal, and below normal temperatures and precipitation throughout most of the upper Missouri River basin in June-July-August 2012 (Figure 19), though there is a possibility for the Northern Rocky Mountains to receive below normal precipitation with above normal temperatures. In September-October-November, the CPC climate outlook (Figure 20) is indicating there are increased chances for above normal temperatures throughout the Missouri River basin, along with an increased chance for precipitation in the central plains. In the December-January-February outlook there are equal chances for above normal, normal and below normal temperatures and precipitation (Figure 21).

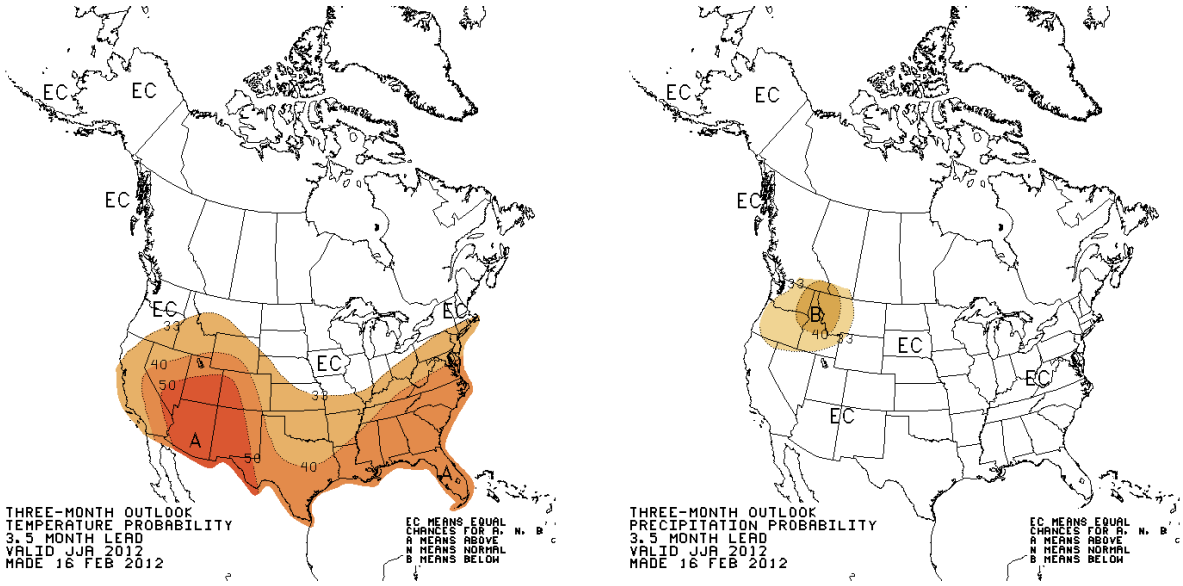


Figure 19. CPC June-July-August 2012 temperature and precipitation outlook.

.

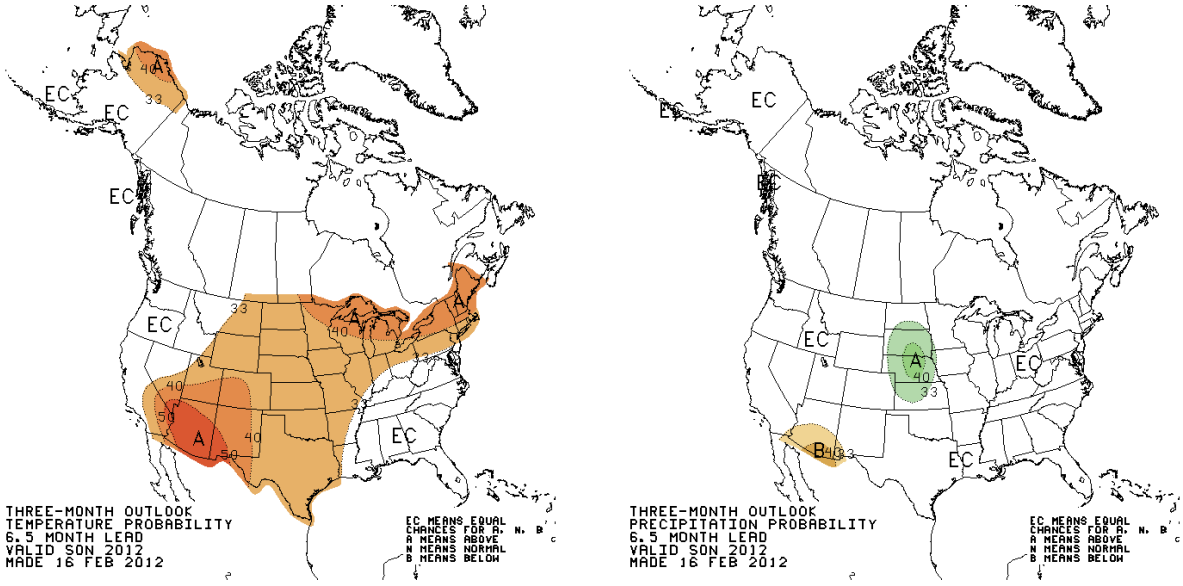


Figure 20. September-October-November 2012 temperature and precipitation outlook.

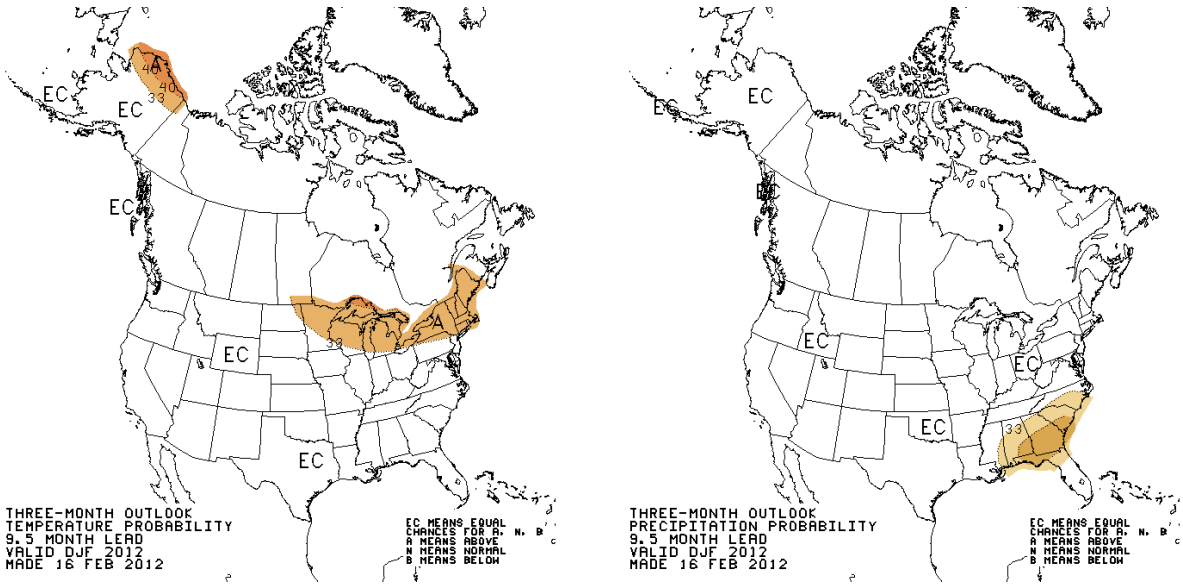


Figure 21. CPC December-January-February 2012 temperature and precipitation outlook.

March 2012 Calendar Year Runoff Forecast

As stated earlier in this report the March 1 forecast for 2012 runoff above Sioux City, IA is 26.1 MAF (105% of normal). The March 1 forecast for runoff above Gavins Point Dam is 22.7 MAF (100% of normal).

Factors taken into consideration while preparing the 2012 forecast include: soil moisture content, the presence of soil frost, the presence of high water tables in some regions, plains snowpack, mountain snowpack, and the CPC's monthly and seasonal temperature and precipitation outlooks.

March-April

Plains snow is a significant factor influencing the volume of runoff in March and April; however, precipitation and air temperatures during this time period as snow and rainfall and soil moisture are also very important factors that need consideration. Factors taken into consideration in updating the March and April runoff forecast were: 1) plains snow cover, 2) a higher probability for warmer than normal temperatures, 3) an equal chance probability for above, normal, and below normal precipitation and 4) drier than normal soil moisture in the eastern Dakotas and slightly wetter than normal soil moisture in the western Dakotas and Montana.

During the month of February average monthly temperatures were well-above normal, limiting the development of plains snowpack during the first half of February. Precipitation was normal to above-normal in the upper Missouri River basin as a result of several winter events that occurred during the last 10 days of February. The most recent event produced one-half inch to two inches of precipitation across the eastern half of South Dakota, western Iowa, and northern and eastern Nebraska. Average snowfall totals ranged from 6 to 10 inches over northeastern South Dakota while lesser amounts occurred in surrounding areas. Nonetheless, overall plains snowfall has been below average. Aside from the estimated 1 to 2.5 inches of SWE on the ground in the Dakotas, the remainder of the upper basin has trace to 1-inch amounts of SWE (much less than in 2011!).

In the Fort Peck, Garrison, Oahe, Fort Randall and Gavins Point reaches, March-April runoff is forecast to be about the same as the previous February forecast predicted. The additional plains snowfall and the outlook for equal chances of precipitation were the primary reasons why the runoff forecast was sustained. The fraction of runoff divided between March and April was adjusted so that more runoff is forecast for March than April due to the fact that temperatures have been well-above normal and temperatures are forecast to be above normal in March, leading to more runoff caused by snowmelt in March. The exception is in the Sioux City reach, where travel times in the James and Big Sioux Rivers historically delay the entry of a majority of the runoff into the Missouri River until April. Runoff into the Sioux City reach has been much higher than average in the past 30 years, so even though 2011-2012 plains snowfall is below average, runoff is forecast to be about 150% of the long-term average in this reach in March and April.

May-June-July

During the May-June-July period, the mainstem system receives 50% of its annual runoff as a result of mountain snowmelt and spring and summer precipitation. This is the most active period for precipitation in the Missouri River Basin, so runoff can vary significantly as a result of the above or below normal rainfall. The significance of accurately forecasting the May-June-July runoff for the Fort Peck and Garrison reaches is based on the fact that, historically, an average of 9.2 MAF of runoff occurs during these 3 months into these 2 projects. That is 37% of the total annual runoff into the system.

For this 3-month period, the most reliable method for predicting runoff into Fort Peck and Garrison reservoirs is through regression equations that relate mountain snowpack, precipitation, and temperature to runoff. Using existing mountain snowpack (94% of normal in the reach above Fort Peck and 105% of normal in the reach between Fort Peck and Garrison) and the CPC 3-month outlooks of spring precipitation and temperatures, the May-June-July runoff is forecast to be less than normal (93%) in the Fort Peck reach and slightly above normal (102%) in the Garrison reach, which are slight increases in runoff from the previous February forecast. Soil conditions are about normal, and the climate outlook is forecasting equal chances for precipitation and temperatures through May when snow could accumulate. The best prediction for May-June-July runoff will be possible when the mountain snow reaches its peak accumulation sometime in April.

Runoff in the Oahe, Fort Randall and Gavins Point reaches is forecast to be below normal based on normal to below normal soil moisture conditions, developing drought conditions in the Dakotas, and the fact that there is no strong climate signal influencing weather in the basin. Runoff in the Sioux City reach is forecast to be about 151% of normal, a decrease since February's forecast. .

August through December

During the August through December period, runoff is forecast to be slightly below normal in all reaches from above Fort Peck to Gavins Point, primarily due to the equal-chances for above normal, below normal or normal precipitation and increased chances for above normal temperatures during the fall. As the year progresses and the August through December precipitation and temperature outlooks are updated with more detail, these values may change.

NRCS Water Supply Outlook

USDA NRCS National Water & Climate Center
* - DATA CURRENT AS OF: March 04, 2012 01:51:42 PM
- Based on March 01, 2012 forecast values

PRELIMINARY MISSOURI RIVER BASIN FORECASTS

Forecast Point	period	50% (KAF)	% of avg	max (KAF)	30% (KAF)	70% (KAF)	min (KAF)	30-yr avg
Lima Reservoir Inflow (2)	APR-JUL	62	65	96	76	48	28	96
	APR-SEP	65	63	106	81	49	24	104
Clark Canyon Reservoir Inflow (2)	APR-JUL	86	66	171	120	52	1.29	131
	APR-SEP	101	65	194	139	63	8.2	156
Jefferson R nr Three Forks (2)	APR-JUL	645	83	1070	815	475	220	780
	APR-SEP	690	80	1160	880	500	220	860
Hebgen Reservoir Inflow (2)	APR-JUL	350	89	415	375	325	285	395
	APR-SEP	450	89	530	480	420	370	505
Ennis Reservoir Inflow (2)	APR-JUL	560	82	700	615	505	420	680
	APR-SEP	710	84	875	775	645	545	850
Missouri R at Toston (2)	APR-JUL	1650	80	2340	1930	1370	955	2050
	APR-SEP	1910	80	2720	2240	1580	1100	2390
Smith R bl Eagle Ck (2)	APR-JUL	145	109	200	168	122	89	133
	APR-SEP	158	106	225	185	131	92	149
Gibson Reservoir Inflow (2)	APR-JUL	440	96	545	480	400	335	460
	APR-SEP	480	95	590	525	435	370	505
Marias R nr Shelby (2)	APR-JUL	395	95	575	465	325	215	415
	APR-SEP	395	90	585	475	315	205	440
Lake Sherburne Inflow (2)	APR-JUL	102	97	117	108	96	87	105
	APR-SEP	117	96	134	124	110	100	122
St. Mary R at Int'l Boundary (2)	APR-JUL	445	102	545	485	405	345	435
	APR-SEP	515	100	620	555	475	410	515
Milk R at Western Crossing (3)	MAR-JUL	39	95	61	48	30	16.7	41
	MAR-SEP	41	95	65	51	31	16.6	43
	APR-JUL	32	97	51	40	24	13.2	33
	APR-SEP	34	94	55	42	26	13.3	36
Milk R at Eastern Crossing (2,3)	MAR-JUL	85	102	145	109	61	25	83
	MAR-SEP	90	103	154	116	64	26	88
	APR-JUL	61	101	106	79	43	16.5	61
	APR-SEP	68	98	115	87	49	21	69
Beaver Ck nr Havre	MAR-JUL	6.4	67	11.7	8.5	4.3	2.0	9.6
	APR-JUL	5.3	61	14.1	7.9	3.6	1.99	8.7

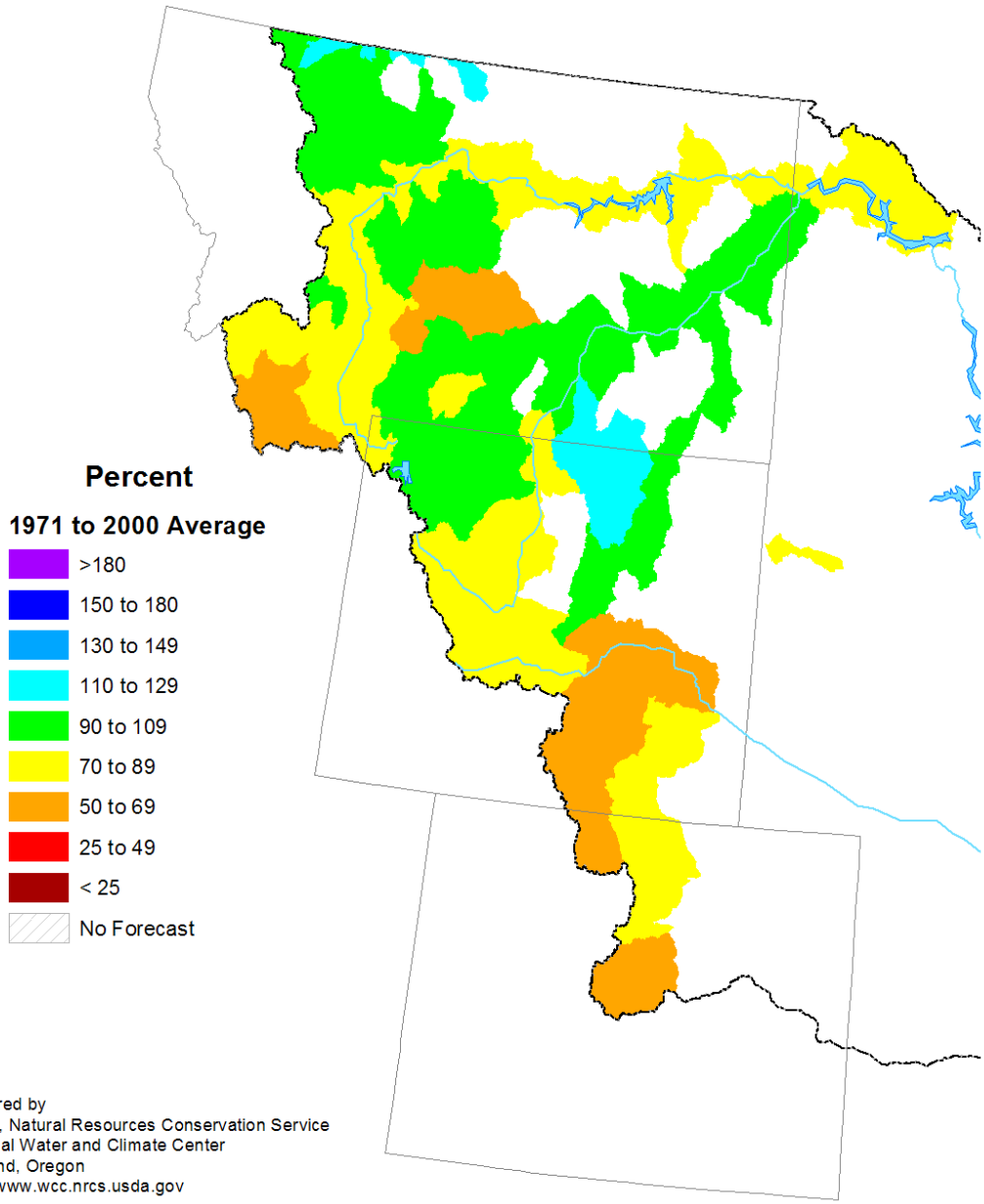
PRELIMINARY YELLOWSTONE RIVER BASIN FORECASTS

Forecast Point	period	50% (KAF)	% of avg	max (KAF)	30% (KAF)	70% (KAF)	min (KAF)	30-yr avg
West Rosebud Ck nr Roscoe (2)	APR-JUL	56	93	65	60	52	47	60
	APR-SEP	71	92	83	76	66	59	77
Wind R ab Bull Lake Ck (2)	APR-JUL	415	95	525	460	370	305	435
	APR-SEP	505	94	635	555	455	375	535
Bull Lake Ck nr Lenore	APR-JUL	145	98	176	157	133	114	148
	APR-SEP	178	98	215	194	162	140	182
Boysen Reservoir Inflow (2)	APR-JUL	645	90	1030	800	490	260	717
	APR-SEP	710	88	1140	885	535	280	809
Greybull R nr Meeteetse	APR-JUL	157	106	194	172	142	120	148
	APR-SEP	215	108	265	235	196	167	200
Shell Ck nr Shell	APR-JUL	69	115	84	75	63	54	60
	APR-SEP	81	113	98	88	74	64	72
Bighorn R at Kane (2)	APR-JUL	1030	103	1550	1240	820	510	1000
	APR-SEP	1130	102	1700	1360	900	565	1110
NF Shoshone R at Wapiti	APR-JUL	490	107	590	530	450	390	460
	APR-SEP	550	106	660	595	505	440	520
SF Shoshone R nr Valley	APR-JUL	240	107	285	260	220	194	225
	APR-SEP	275	104	325	295	255	225	265
Buffalo Bill Reservoir Inflow (2)	APR-JUL	760	106	920	825	695	600	720
	APR-SEP	840	104	1020	910	770	665	805

Bighorn R nr St. Xavier (2)	APR-JUL	1660	103	2290	1920	1400	1030	1610
	APR-SEP	1800	102	2510	2090	1510	1090	1760
Little Bighorn R nr Hardin	APR-JUL	155	121	200	174	136	108	128
	APR-SEP	175	122	225	196	154	123	144
Tongue R nr Dayton (2)	APR-JUL	114	119	145	127	101	83	96
	APR-SEP	128	117	162	142	114	94	109
Tongue River Reservoir Inflow (2)	APR-JUL	280	127	390	325	235	170	220
	APR-SEP	310	124	425	355	265	194	250
NF Powder R nr Hazelton	APR-JUL	11.8	123	15.0	13.1	10.5	8.6	9.6
	APR-SEP	12.7	122	16.0	14.1	11.3	9.4	10.4
Powder R at Moorhead	APR-JUL	270	132	385	315	225	156	205
	APR-SEP	295	128	415	345	245	177	230
Powder R nr Locate	APR-JUL	310	132	445	365	255	175	235
	APR-SEP	335	129	480	395	275	190	260

March 1, 2012 Streamflow Forecast was not available at the time the Calendar Year Forecast was made.

Missouri River Basin
Spring and Summer Streamflow Forecasts
as of February 1, 2012



Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

NOAA Water Supply Forecast

Table 2. Comparison of Fort Peck forecasts. NOAA/NRCS forecasts and outlooks are unregulated volumes.

NOAA/NRCS Forecast	Issue Date	Time Period	Runoff kaf	% of Mean
Seasonal Water Supply (Official Forecast)*	Feb 1 2012**	Apr-Sep	3460	80%
Seasonal Ensemble Outlook*	Feb 28 2012	Apr-Sep	5243	124%
Monthly Ensemble Outlook*	Feb 28 2012			
February		Mar	331	N/A
March		Apr	716	N/A
April		May	1448	N/A

*All NOAA/NRCS forecasts are the 50% exceedence forecast.

** The Seasonal Water Supply Forecast was not available on March 1.

Table 3. Comparison of Garrison forecasts. NOAA/NRCS forecasts and outlooks are unregulated volumes. The Corps forecast is the combined Fort Peck and Garrison runoff volumes.

NOAA/NRCS Forecast	Issue Date	Time Period	Runoff kaf	% of Mean
Seasonal Water Supply (Official Forecast)*	Feb 1 2012**	Apr-Sep	9300	83%

*All NOAA/NRCS forecasts are the 50% exceedence forecast.

** The Seasonal Water Supply Forecast was not available on March 1.

Field Verification of Conditions

Corps of Engineers mainstem project offices and some volunteer plains snow observers reported local hydrologic factor field conditions during the last week of February. Their observations are summarized below.

COE Garrison. Surface soil moisture was moist with frost present.

COE Oahe. Soil moisture conditions were moist at the soil surface. Soil frost was reported at about a one-foot depth.

COE Fort Randall. Surface soils received some moisture from snowmelt; however, the overall profile is pretty dry. The Fort Randall project manager reported that Pickstown, SD was much drier than Yankton. Soil moisture in Pickstown was dry to very dry. In Yankton it was normal. Last month the frost depth near Fort Randall was zero due to a lack of soil moisture. Near Chamberlain, topsoil soil moisture ranged from normal to moist but was dry underneath, and the frost depth was below average.

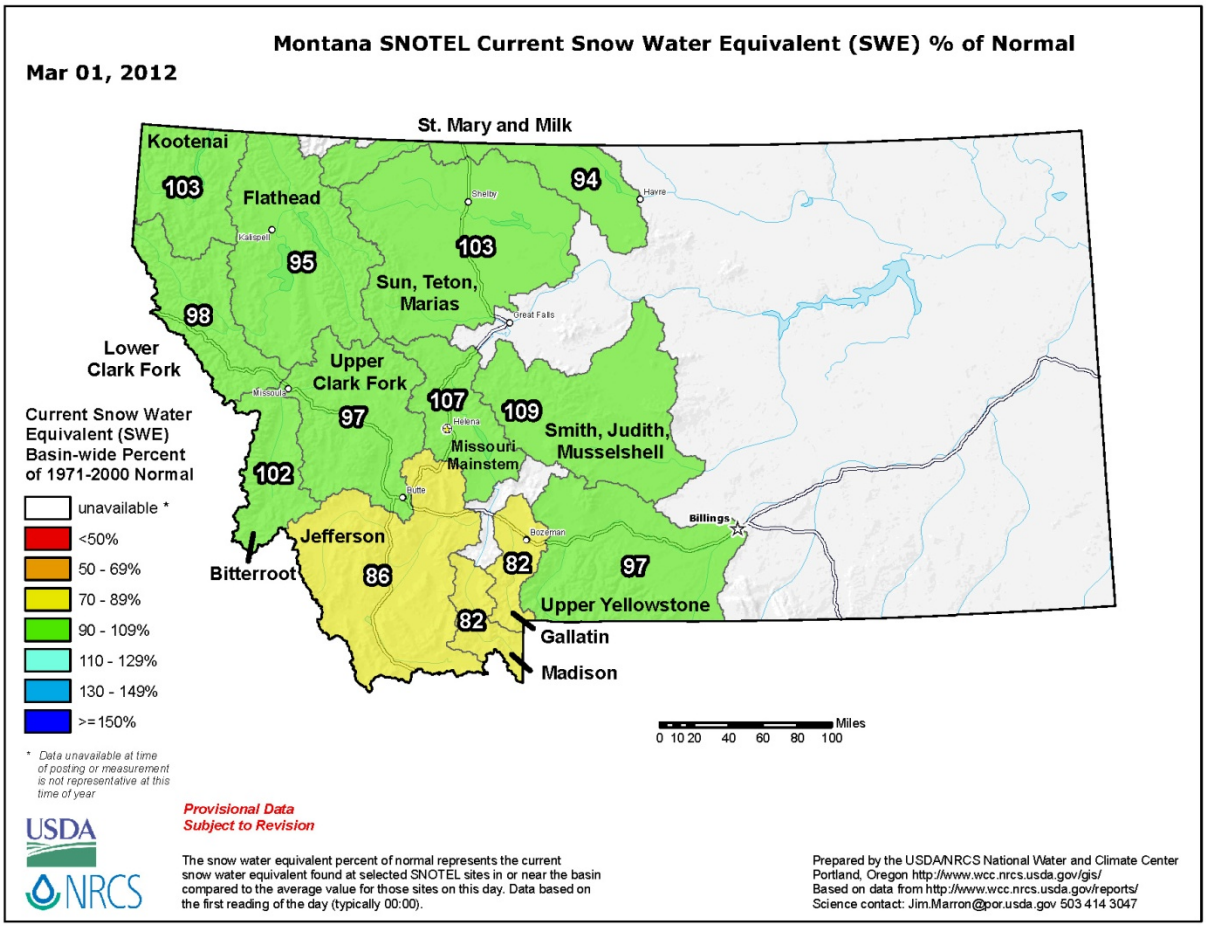
COE Gavins Point. At the end of February there was shallow soil frost and dry to normal soil moisture.

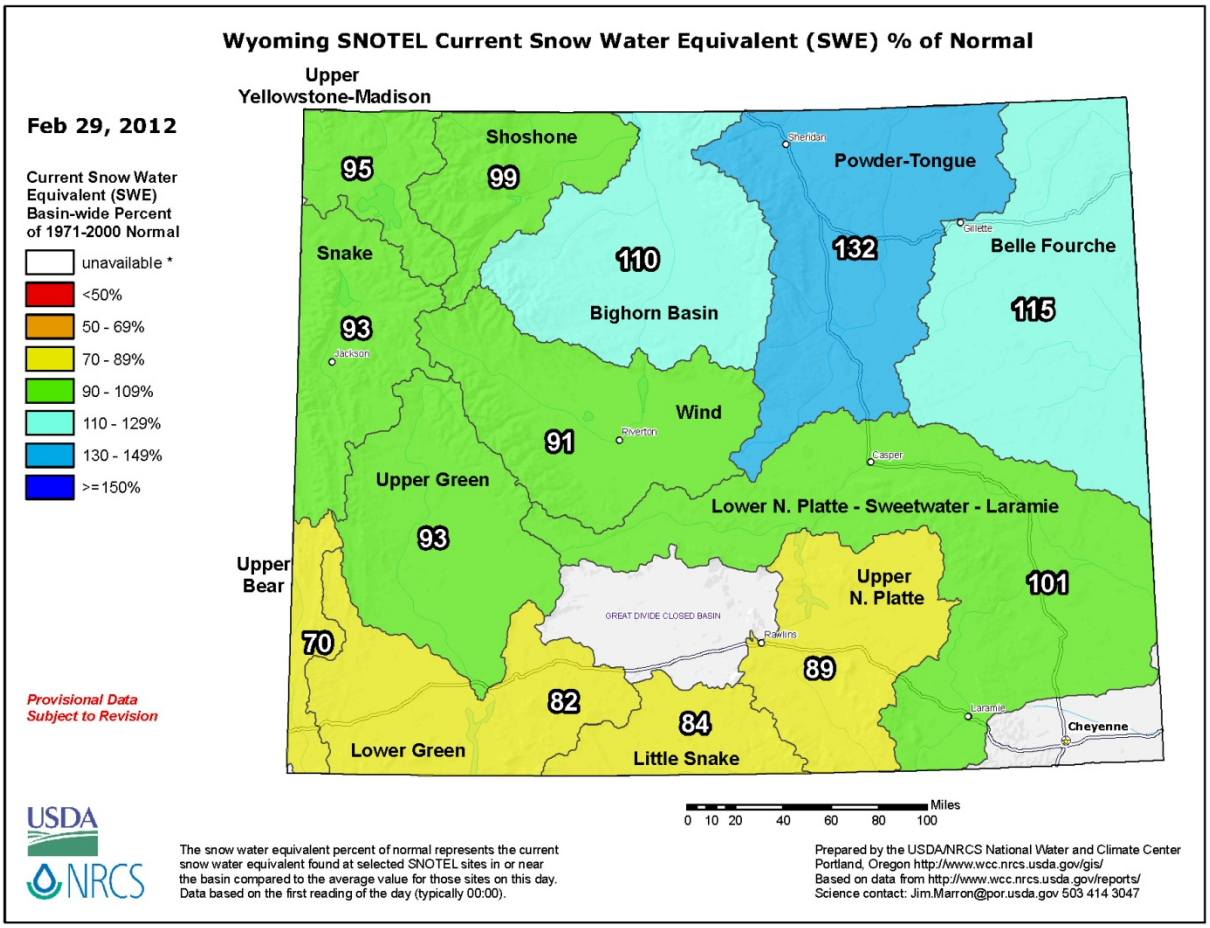
COE Jamestown-Pipestem. Subsoil moisture was wet and soil frost was reported at a depth of 24 inches.

Southeast South Dakota. According to a Union County snow survey observer, soil moisture conditions were dry and frost was evident, but thin. He expected the frost to disappear as soon as temperatures began to warm.

Eastern South Dakota. Near Hayti, SD, surface soil moisture conditions were dry.

Additional Figures




Wyoming SNOTEL Current Snow Water Equivalent (SWE) % of Normal
Feb 29, 2012
Current Snow Water Equivalent (SWE) Basin-wide Percent of 1971-2000 Normal
unavailable *
<50%
50 - 69%
70 - 89%
90 - 109%
110 - 129%
130 - 149%
>=150%
Provisional Data Subject to Revision
Upper Yellowstone-Madison
95
Shoshone
99
Snake
93
Jackson
110
Bighorn Basin
Sheridan
Powder-Tongue
132
Gillette
Belle Fourche
115
Wind
Riverton
91
Upper Green
93
Casper
Lower N. Platte - Sweetwater - Laramie
Upper Bear
70
GREAT DIVIDE CLOSED BASIN
Rawlins
Upper N. Platte
89
101
82
Lower Green
84
Little Snake
Laramie
Cheyenne
Miles
0 10 20 40 60 80 100
USDA
NRCS
The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).
Prepared by the USDA/NRCS National Water and Climate Center Portland, Oregon http://www.wcc.nrcs.usda.gov/gis/
Based on data from http://www.wcc.nrcs.usda.gov/reports/
Science contact: Jim.Marron@por.usda.gov 503 414 3047