January 2011 Calendar Year Runoff Forecast

2010 Runoff Year

Calendar Year 2010 was the third highest year of runoff in the Missouri River Basin above Sioux City with 38.8 MAF, behind 1978 and 1997 which was the highest year of runoff on record. 2010 was preceded by a very wet October 2009 that led to a very early and cold winter with above average plains snow pack. Mountain snowpack peaked late yet below the average peak accumulation. Runoff in the spring and summer was aided by large and frequent spring and summer storms that produced 125 to 150 percent of normal annual precipitation.

Antecedent Moisture Conditions

Precipitation beginning in September 2010 was over 200% of normal in the Northern Plains; however, precipitation departures were well below normal in October. November 2010 precipitation was 200% of normal in Montana, western North Dakota, and northern Wyoming, yet very dry throughout Nebraska and the eastern Dakotas. In December 2010 winter precipitation accumulations in the Missouri Basin above Sioux City, IA was greater than 200% of normal as a result of a jet stream path that channeled moisture through the northern Plains. Along and north of the Missouri River, especially in the James and Big Sioux River basins, precipitation accumulations were 300 to 400 % of normal. Soil moisture at the end of the month was generally in the 80th percentile for the entire basin with the exception of Wyoming. In the James, Big Sioux, Garrison and Oahe subbasins, soil moisture ranged from the 90 t0 99th percentile. The December 2010 runoff summation above Gavins Point Dam was 157% of normal, while the summation above Sioux City, IA, was 169% of normal.

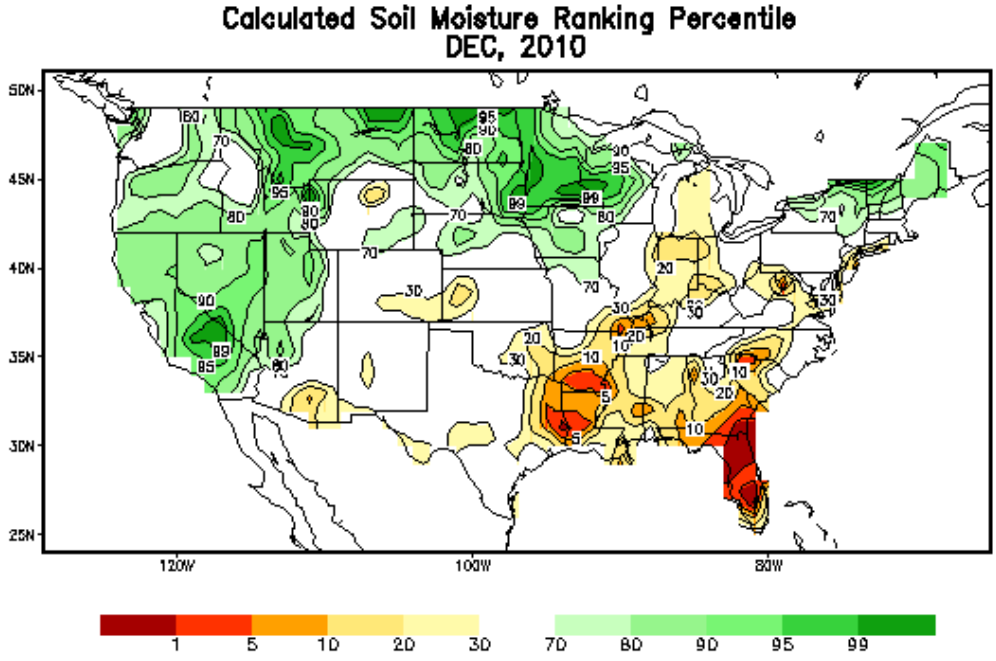


Figure 1 December 2010 Soil Moisture Conditions.

Plains Snow Pack

December precipitation and snowfall in the basin are summarized in Table 1. In all locations, precipitation and snowfall was well-above normal.

Table 1 December 2010 precipitation accumulations, departures, and snowfall in the Missouri River Basin.

	Precipitation, in	Departure, in	Snow, in	EOM Depth, in
Glasgow, MT	1.46	1.09	24.7	11.0
Great Falls, MT	1.56	0.89	24.6	10.0
Williston, ND	1.95	1.38	35.3	10.5
Bismarck, ND	1.40	0.96	21.1	11.0
Jamestown, ND	0.70	0.26	M	M
Aberdeen, SD	1.77	1.39	24.6	
Huron, SD	1.38	0.99	21.1	10
Pierre, SD	1.96	1.48	18.2	
Sisseton, SD	2.33	1.87	33.0	
Sioux Falls, SD	1.54	1.02	17.9	5
Watertown, SD	2.52	2.13	29.0	

According to NOAA's NOHRSC, 2 to 3 inches of SWE are present across North Dakota, northern South Dakota, and much of northeast Montana as of January 3, 2011. These accumulations are also present over a majority of the James River Basin and the upper half of the Big Sioux River Basin. Approximately 1 to 2 inches of SWE exist in the remainder of South Dakota and a small portion of northwest Iowa. Less than 1 inch of SWE is present in Nebraska and western Iowa. Compared to normal accumulated snowfall depths, snow depths in South Dakota and North Dakota are about 4 to 8 inches above normal. These conditions are similar to the conditions present on January 3, 2010, with the exception that there is less snow in Iowa, Nebraska, and southeast South Dakota in 2011.

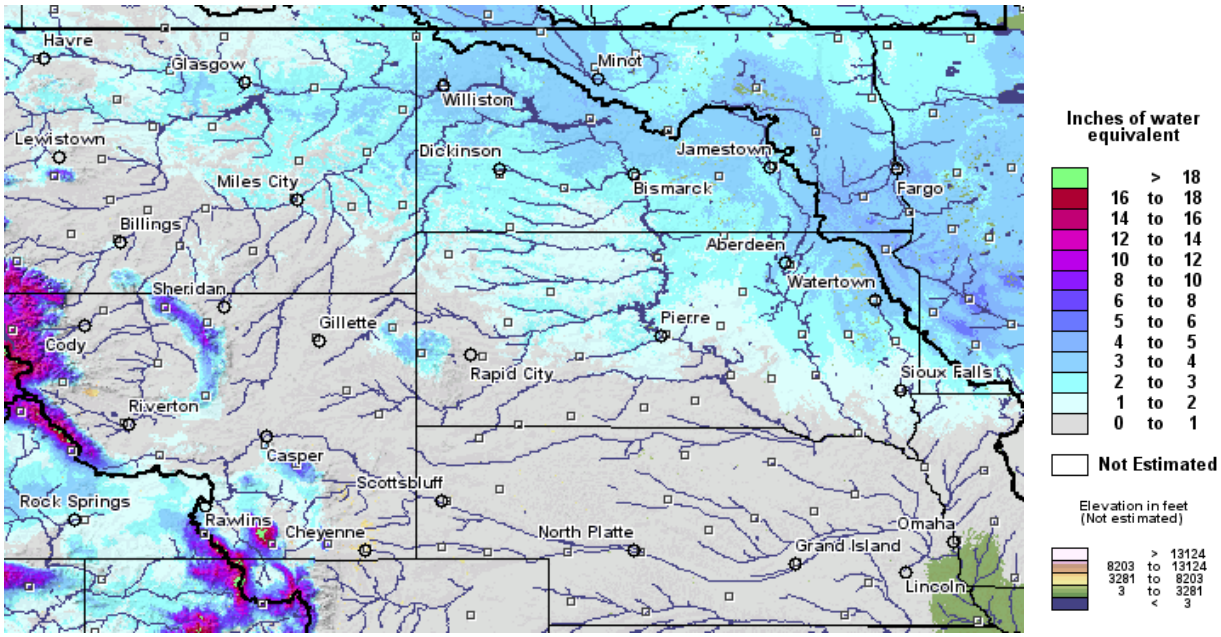


Figure 2 Plains Snow Water Equivalent (SWE) on January 3, 2011.

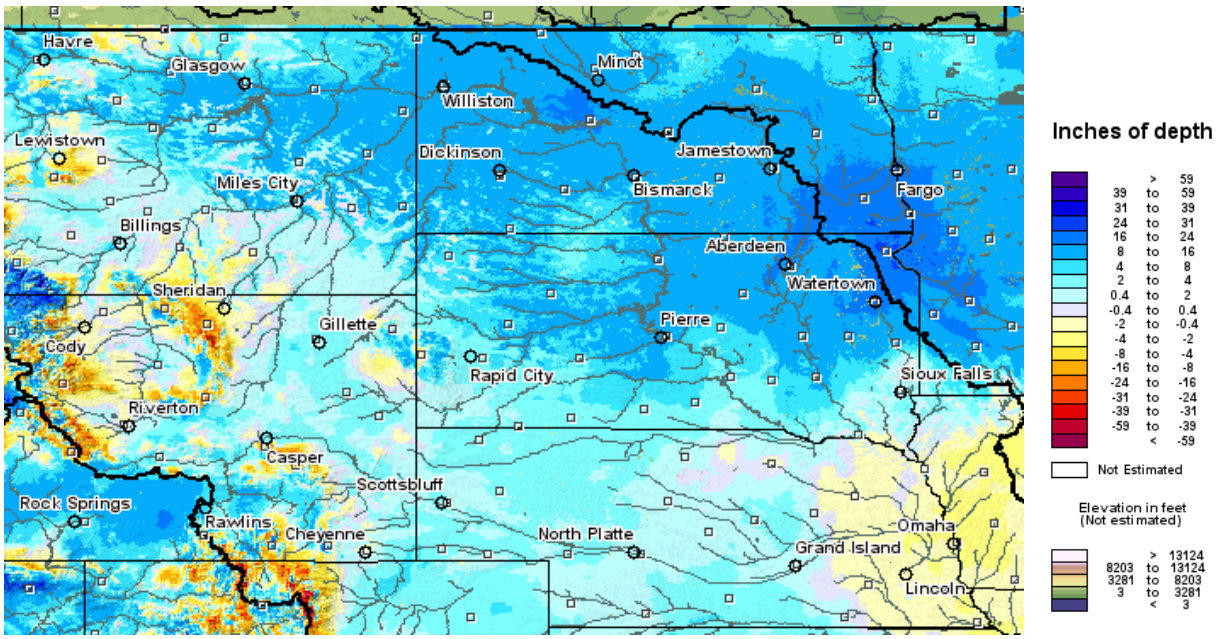


Figure 3 Plains Snow Depth Departure from Normal on January 3, 2011.

Mountain Snow Pack

Mountain snowpack as of January 3, 2011 was 111% of normal above Fort Peck and 111% of normal in the Fort Peck to Garrison reach. Missouri River Basin mountain snowpack normally peaks near on April 15. By January 1, normally 42% of the peak accumulation has occurred.

January 2011 Calendar Year Runoff Forecast

The overall calendar year 2011 runoff forecast is 25.0 MAF (110% of normal) above Gavins Point dam and 27.8 MAF (112% or normal) above Sioux City, IA.

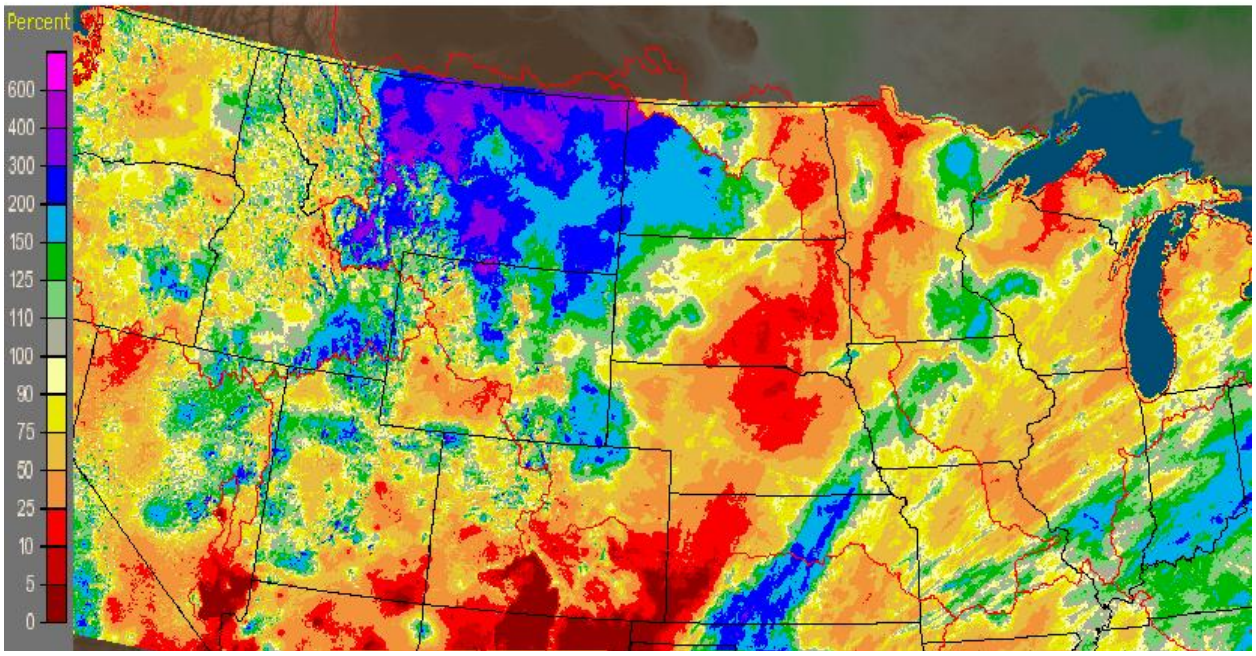
Due to higher than normal runoff in December 2010 and average temperature conditions, runoff volumes are expected to remain above normal in January and February.

The accumulation of plains snow is above normal in the Northern Plains. Snowfall is expected to be above normal especially in Montana and North Dakota, while temperatures through March are expected to be slightly below normal, favoring above average plains accumulations. The March-April runoff volumes for Fort Peck, Garrison, Oahe and Sioux City were based on the "Moderate" (formerly the "~~a~~Average" category) plains snow cover condition category~~runoff during snow accumulation years~~, while in the ~~Fort Peck, Oahe,~~ Fort Randall and ~~the~~ Gavins Point reaches, runoff volumes were based on the ~~l~~"Light" plains snow cover condition category~~runoff during snow accumulation years~~. The "Light" category represents basinwide snow accumulations and runoff that would result in above average March-April runoff. The plains snow volume forecasts based on plains snow accumulation years resulted in ~~128~~141% of normal runoff in March and ~~120~~130% of normal runoff in April above Sioux City.

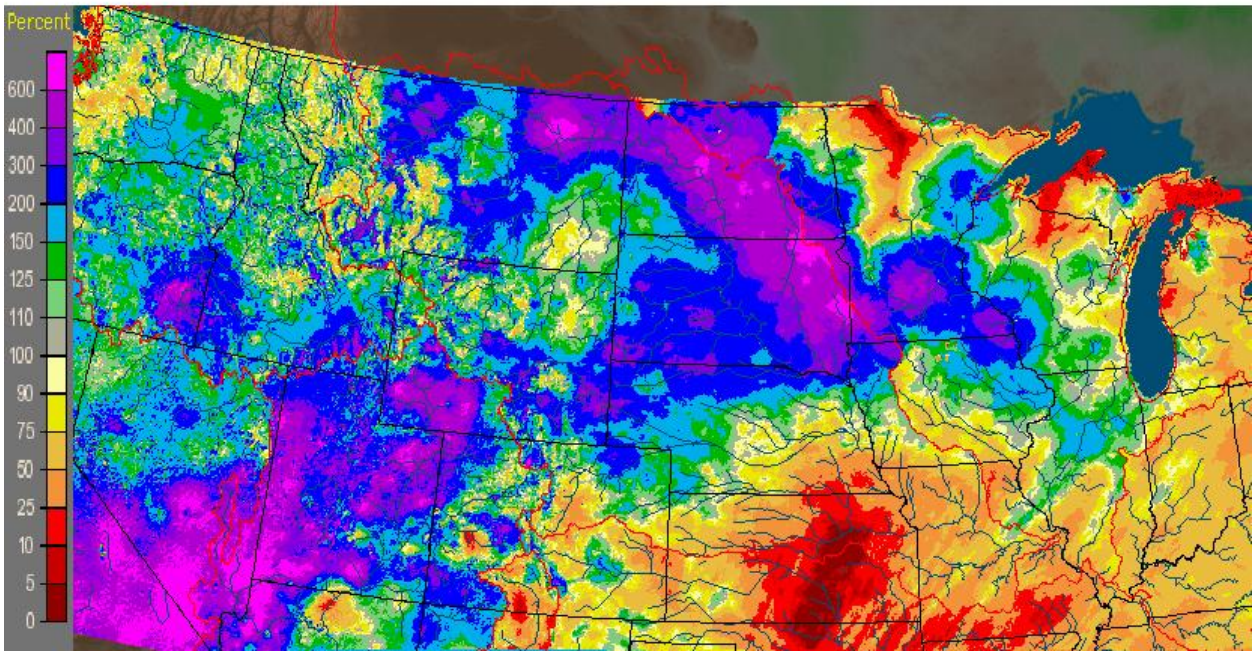
May – July runoff determined primarily by mountain snow accumulation is estimated to be ~~111~~106% of normal, which is a direct correlation to the percent of mountain snowpack.

Runoff in the Gavins Point to Sioux City subbasin is expected to be above normal throughout the remainder of the 2011 calendar year as a result of wet antecedent moisture conditions and much higher than average monthly runoff in 2010. Oahe, Fort Randall, and Gavins Point reaches return to normal runoff volumes in May 2011. Fort Peck and Garrison reaches return to normal in August 2011.

Missouri Basin RFC Pleasant Hill, MO: November, 2010 Monthly Percent of Normal Precipitation
Valid at 12/1/2010 1200 UTC- Created 12/3/10 21:43 UTC



Missouri Basin RFC Pleasant Hill, MO: December, 2010 Monthly Percent of Normal Precipitation
Valid at 1/1/2011 1200 UTC- Created 1/3/11 13:45 UTC



February 2011 Calendar Year Runoff Forecast

2011 January Runoff

January 2011 runoff above Sioux City, IA, was 170.8% of normal at 1280.8 KAF. Fort Peck received 437.4 KAF (140%), Garrison received 308.5 KAF (118%), Oahe received 115.8 KAF (965%), Fort Randall received 86.4 KAF (346%), Gavins Point received 67 KAF (67%), and the Sioux City reach received 266 KAF (664%).

Antecedent Moisture & Precipitation

Soil moisture conditions on January 30, 2011 continue to rank very high in the Northern Plains including eastern Montana and the Dakotas, and the Northern Rockies in Montana and northwest Wyoming (Figure 1). Soil moisture conditions rank in at least the 70th percentile, with particularly wet areas ranking 90 percent or higher. The Upper Missouri basin in the Northern Rockies, northeast Montana, northern North Dakota, and eastern South Dakota all rank in the 99th percentile for soil moisture. Wetter than normal conditions also exist in southeast Wyoming, much of Nebraska and Iowa.

Precipitation during the month of January was well-above normal throughout most of the Missouri River basin (Figure 2). Greater than 175% of normal occurred throughout much of the basin upstream of Rulo, NE. As a result, Northern Plains and Northern Rockies snow accumulations benefitted greatly.

Mountain Snow Pack

Mountain snowpack as of January 31, 2011 was 112% of normal above Fort Peck and 111% of normal in the Fort Peck to Garrison reach. Missouri River Basin mountain snowpack normally peaks near on April 15. By January 1, normally 61% of the peak accumulation has occurred.

Plains Snow Pack

Plains snow pack as snow water equivalent (SWE) is shown in Figure 3 and snow depth departure from normal is in Figure 4. For comparison, SWE in the Missouri River basin on January 31 of 2009 and 2010 are shown in Figures 5 and 6, while peak SWE in 2009 and 2010 are shown in Figures 7 and 8, respectively.

Basinwide ~~P~~plains snow pack in the Fort Peck subbasin is characterized as "Light" to "Moderate"~~Average~~, when compared to all runoff years in which snow accumulations influenced March-April runoff. In ~~while in~~ the Fort Peck to Garrison reach it is characterized as "Moderate" compared to all runoff years in which snow accumulation influenced March-April runoff. According to NOAA's NOHRSC snow model (Figure 3), about 1-3 inches of SWE are present in the Fort Peck subbasin, while 3-5 inches cover much of the Fort Peck to Garrison subbasin, especially in the Milk River basin and the Yellowstone River basin downstream of Miles City, MT, and the lower half of the Little Missouri basin. It is not uncommon for the NOHRSC model to show 5-6 inches of SWE on the plains in the lower Milk River basin and along the Missouri River and its tributaries between Fort Peck Dam and Williston, ND. SWE measurements by the NWS in northeast Montana ranged from 3.0 to 6.5 inches. Snow water equivalent in the Fort Peck to Garrison reach on January 31, 2011, is greater than the snow pack that

existed on January 31 in 2009 (Figure 5) and 2010 (Figure 6). It bears some similarities to the peak amounts that occurred on April 2, 2009 (Figure 7), and March 15, 2010 (Figure 8); however, it is too early in the season to make an accurate prediction of runoff based on snow pack alone.

Plains snow pack in the Oahe reach is characterized as ~~Average~~"Moderate". The ~~S~~snow depths in this subbasin ~~is~~are well above average and plains SWE is 2-4 inches according to the NOHRSC snow model (Figure 3).

Plains snow pack in the Fort Randall and Gavins Point subbasins are characterized as "Light". In the Fort Randall subbasin, SWE ranges from 0.5-2.0 inches of SWE, while less snow exists in the Gavins Point subbasin (Figure 3).

Plains snow pack in the Sioux City subbasin is characterized as "Moderate". NOHRSC snow model estimates (Figure 3) indicate 3-5 inches of SWE in the upper two-thirds of the James River basin and upper half of the Big Sioux River basin, and about 1.5-2.0 inches of SWE in the lower portions of the basin. Cooperative observer measurements verify that 4 inches of SWE exist in the middle and upper James and the upper Big Sioux basins. Similar amounts of SWE were present in the Sioux City subbasin as of January 31, 2010 (Figure 6); however, field verifications in 2010 indicated NOHRSC's modeled estimates were about one inch too high.

Climate Outlook

From February - April, there is a higher probability that temperatures will continue to fall below normal in the Northern Plains and Rocky Mountains with more normal temperatures in Nebraska, Kansas, and Missouri. This should increase the likelihood that the Northern Plains snow pack and mountain snow pack will persist later into spring with limited melting.

With regard to temperatures, there is a higher probability that above normal precipitation will occur in the Northern Rockies and Plains from February - April, with precipitation trending to below normal accumulations in Colorado, Nebraska, Kansas, and western Missouri. The higher probabilities of precipitation in the Northern Rockies and Plains, combined with cooler temperatures indicate snow accumulation trends will continue at their existing above-normal pace, followed by a later season melt.

February 2011 Calendar Year Runoff Forecast

The overall calendar year 2011 runoff forecast is 25.2 MAF (111% of normal) above Gavins Point dam and 28.4 MAF (114% of normal) above Sioux City, IA.

The accumulation of plains snow is above normal in the Northern Plains. In the Fort Peck subbasin, snow accumulation is characterized as "~~l~~Light"; however, in the Fort Peck to Garrison subbasin, the snow accumulation is considered to be ~~m~~"Moderate" in much of the Milk, lower Yellowstone River, Little Missouri, and Missouri River basins. The snow accumulation in the Oahe subbasin is ~~average~~"Moderate", while it is "Light"~~light~~ in the Fort Randall and Gavins Point subbasins. The Sioux City reach contains "M~~m~~oderate" snow accumulations in a majority of its river basins. Mountain snow

accumulations as a percent of long-term averages are 112% of normal in the Fort Peck subbasin and 111% of normal in the Fort Peck to Garrison subbasin.

NOAA's Climate Prediction Center outlook indicates higher probabilities of precipitation in the Northern Rockies and Plains. Combined with cooler temperatures through April, snow accumulation trends will continue at their existing above-normal pace.

With regard to March and April runoff, the higher than average snow pack has led us to set the percent of normal runoff above Gavins Point at 132% of normal in March and 135% of normal in April. Including the Gavins Point to Sioux City reach, the accumulated runoff forecast above Sioux City is 139% of normal in March and 138% of normal in April. The May-July runoff above Fort Peck will be 106% of normal while in the Fort Peck to Garrison reach it will be 103% of normal. All runoff is expected to return to normal above Gavins Point by August 2011 with the exception of the Sioux City subbasin. High antecedent moisture conditions, moderate snow pack, and high historic streamflows will continue to produce well-above normal runoff throughout the calendar year.

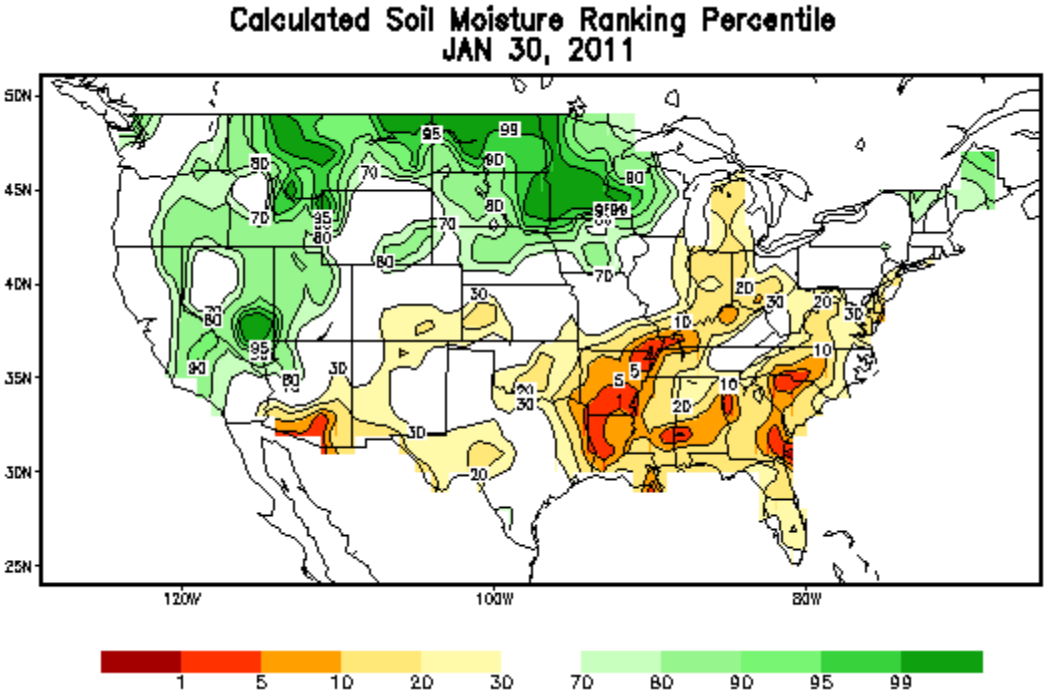


Figure 1 End of January 2011 Soil Moisture Ranking Percentile.

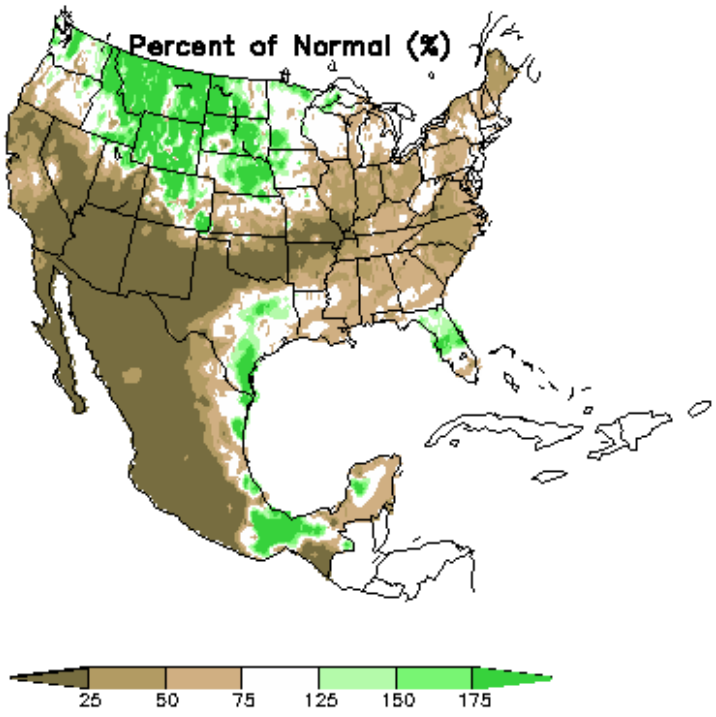


Figure 2 30-day precipitation as a percent of normal, ending January 31, 2011.

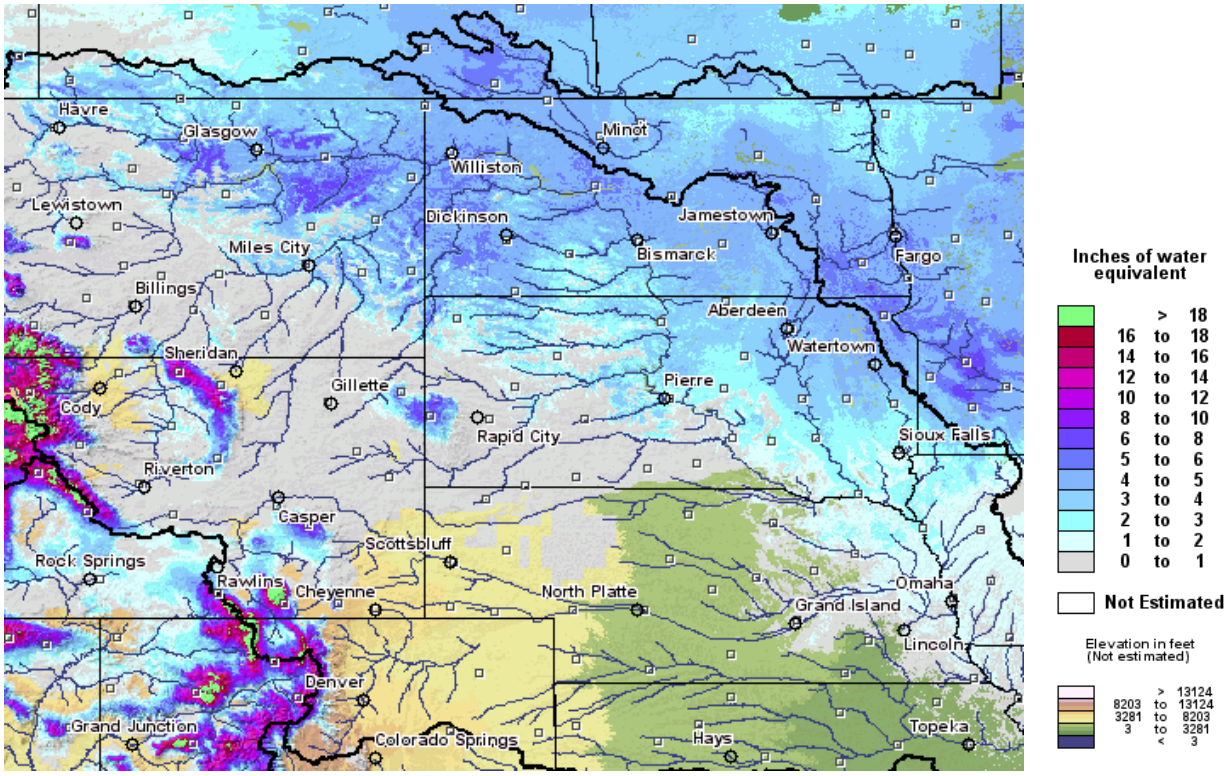


Figure 3 Plains Snow Water Equivalent (SWE) on January 31, 2011.

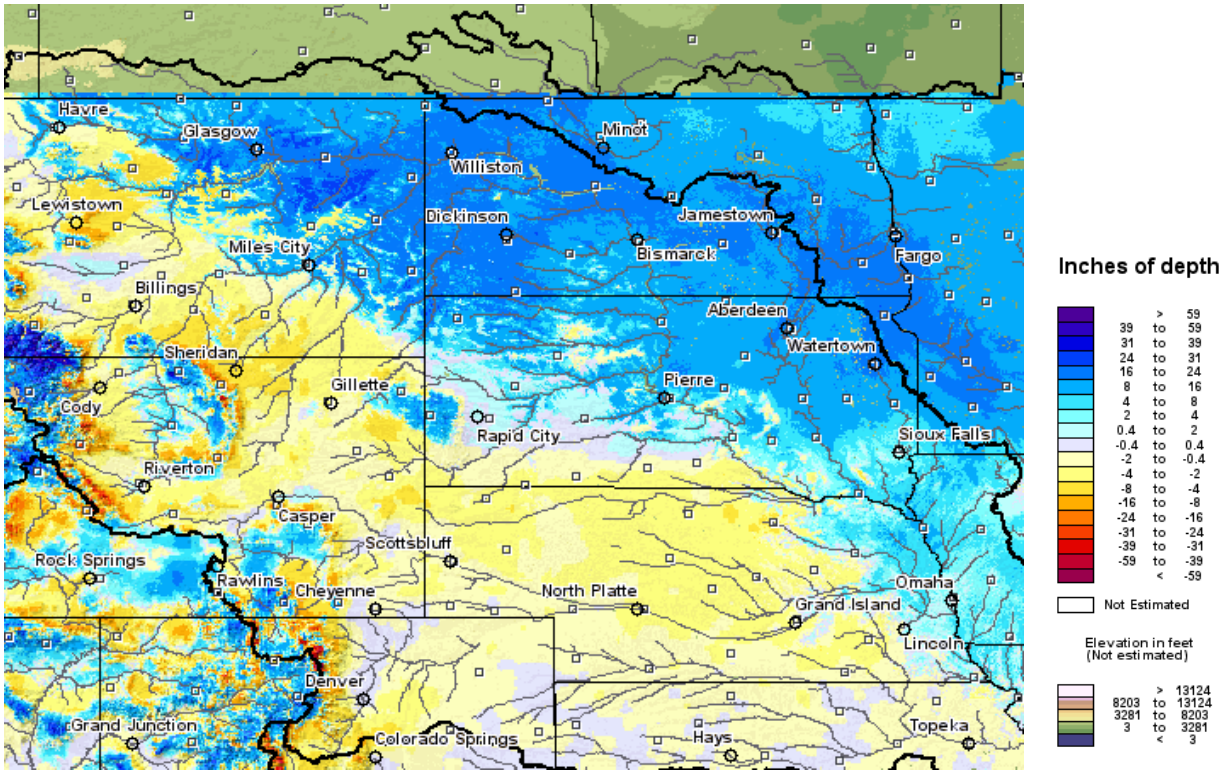


Figure 4 Plains Snow Depth Departure from Normal on January 31, 2011.

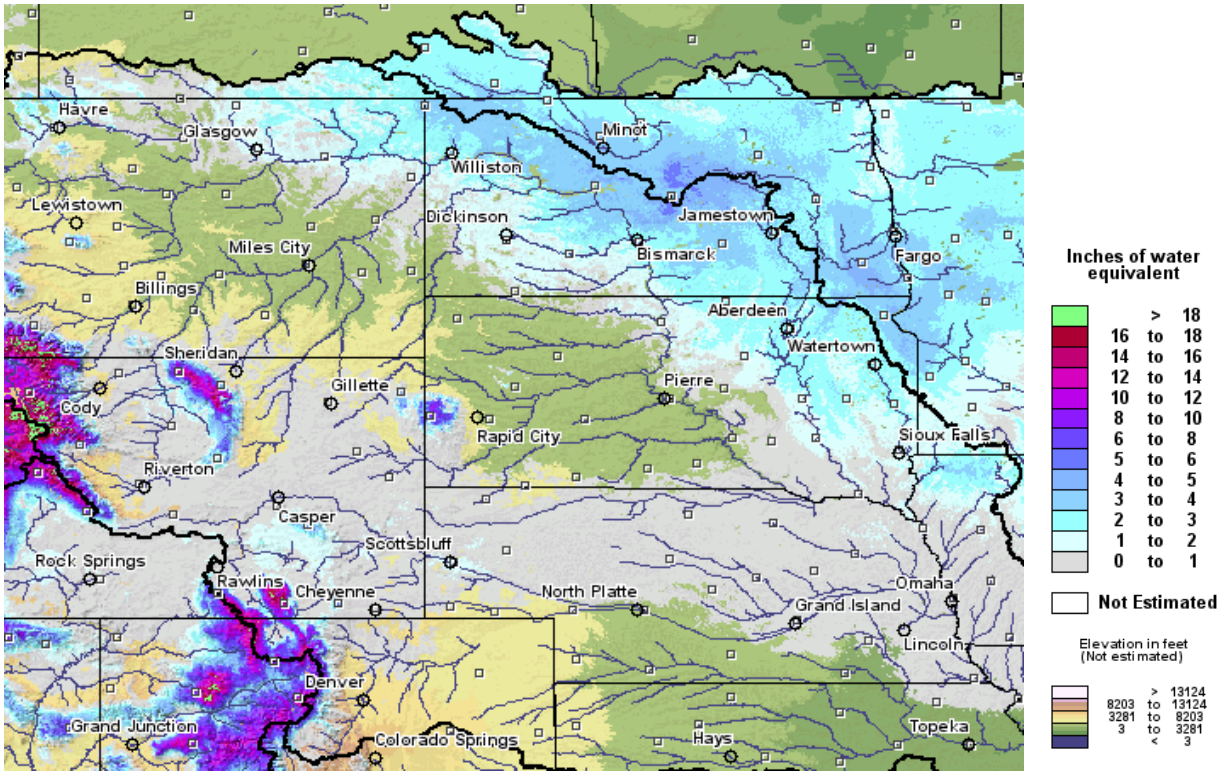


Figure 5 Plains SWE on January 31, 2009.

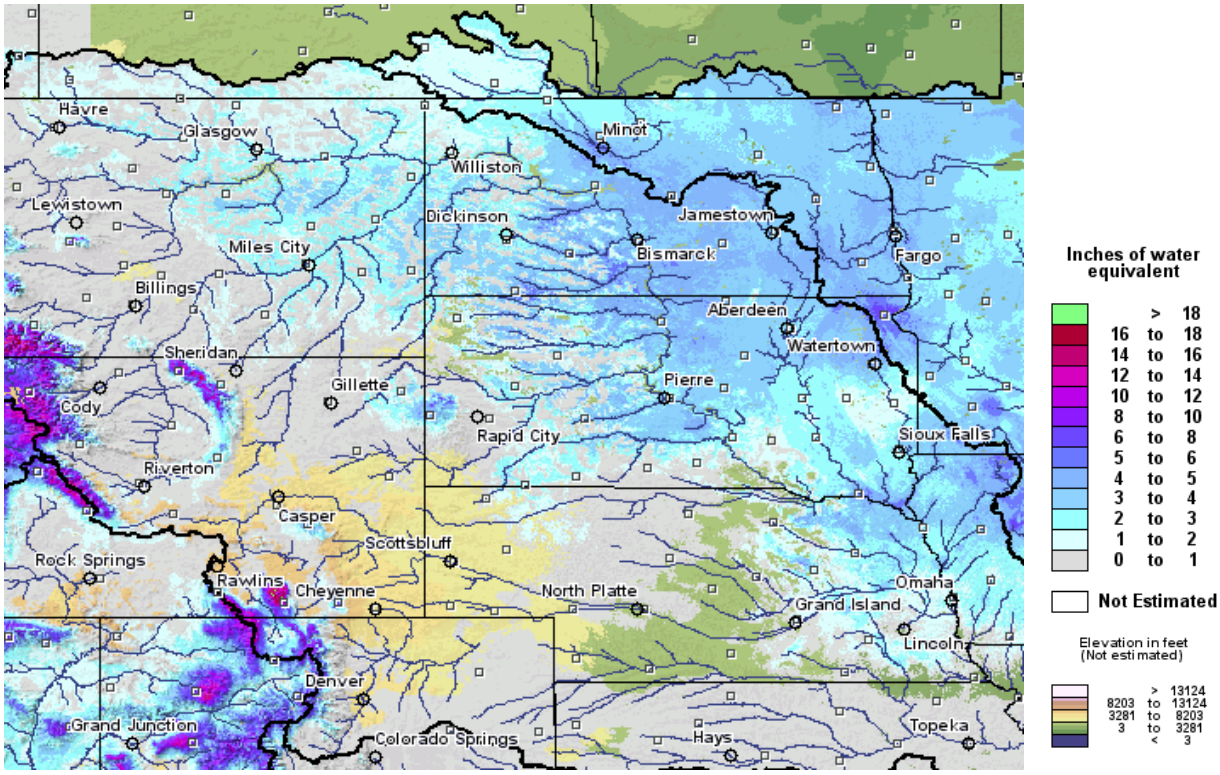


Figure 6 Plains SWE on January 31, 2010.

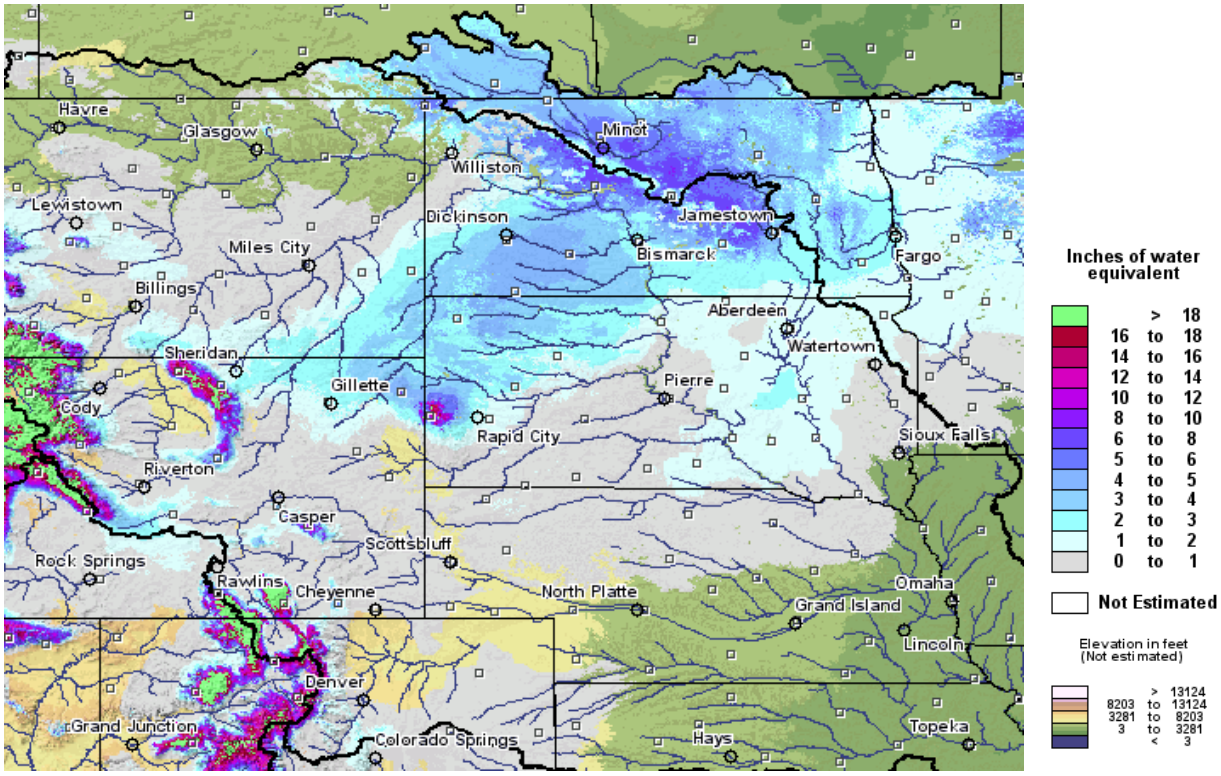


Figure 7 Plains SWE on April 2, 2009.

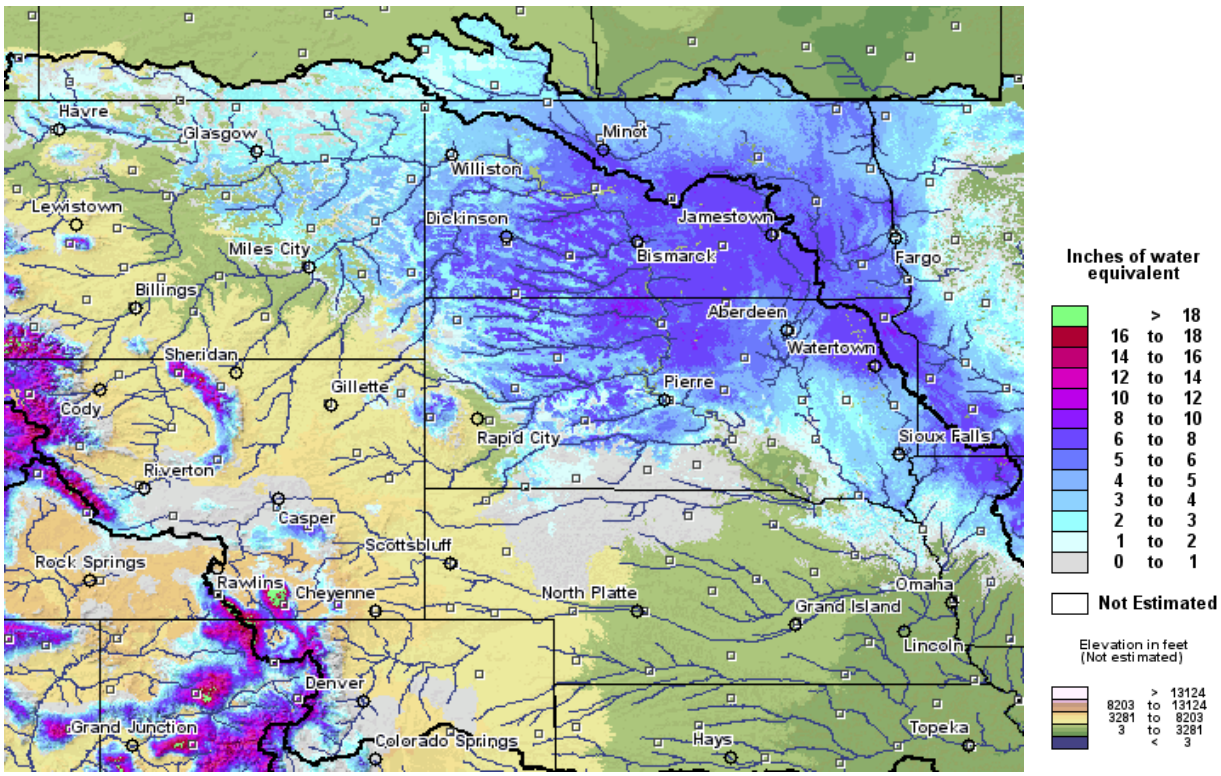


Figure 8 Plains SWE on March 15, 2010.

March 2011 Calendar Year Runoff Forecast

2011 February Runoff

February 2011 runoff above Sioux City, IA, was 217% of normal at 2,333 KAF, partly due to some early plains snow melt runoff. Fort Peck received 580 KAF (161%), Garrison received 457 KAF (128%), Oahe received 318 KAF (354%), Fort Randall received 217 KAF (443%), Gavins Point received 236 KAF (182%), and the Sioux City reach received 524 KAF (570%).

Antecedent Moisture & Precipitation

Soil moisture conditions on February 28, 2011 continue to rank very high in the Northern Plains including eastern Montana and the Dakotas, and the Northern Rockies in Montana and northwest Wyoming (Figure 1). Soil moisture conditions rank in at least the 70th percentile, with particularly wet areas ranking 90 percent or higher. The Upper Missouri basin in the Northern Rockies, northern Montana, northern North Dakota, and eastern South Dakota all rank in the 95th percentile or higher. Wetter than normal conditions also exist in southeast Wyoming, much of Nebraska and Iowa.

Precipitation during the month of February was well-above normal throughout most of the Missouri River basin (Figure 2). Greater than 175% of normal occurred throughout much of the basin upstream of Rulo, NE. As a result, Northern Plains and Northern Rockies snow accumulations benefitted greatly.

Mountain Snow Pack

Mountain snowpack as of February 28, 2011 was 110% of normal above Fort Peck and 108% of normal in the Fort Peck to Garrison reach. Missouri River Basin mountain snowpack normally peaks near on April 15. By March 1, normally 79% of the peak accumulation has occurred.

Plains Snow Pack

The Plains snow pack on March 1, 2010, contains pockets of relatively heavy snow cover within a ~~l~~"Light" to ~~average~~ "Moderate" cover according to the Plains Snow Cover Condition methodology used for forecasting March-April runoff by snow cover. It ~~-~~extend~~ings~~ from north central Montana through eastern Montana and across the Dakotas. Very little snow cover exists in Iowa or Nebraska.

Above Fort Peck Lake, snow cover is "L~~l~~ight", while in the reach between Fort Peck and Garrison Dams, overall snow cover is considered "~~l~~Light to "~~m~~Moderate" due to good overall coverage and pockets of heavy SWE ranging from 3-5 inches in the Milk River Basin and in tributary areas north of the Missouri River reach between Fort Peck and Garrison. "Light" to "~~m~~Moderate" SWE ranging from 2-4 inches covers portions of the lower Yellowstone River, the Little Missouri River and areas surrounding Lake Sakakawea.

Snow cover surrounding Oahe is considered ~~l~~"Light" with SWE estimates generally equal to 2 inches and not exceeding 3 inches. Snow cover surrounding the Fort Randall and Gavins Point reaches is "~~l~~Light" with SWE amounts of about 1 inch.

In the Gavins Point to Sioux City reach, SWE amounts diminished in southern portions of the James and Big Sioux basins as a result of snowmelt during the middle of February, while limited melt occurred in the lower James and Vermillion Rivers. Following the snowmelt, a very heavy winter storm produced 10 to 20 inches of snow over eastern South Dakota. "Moderate" to ~~h~~"Heavy" snow cover exists from Mitchell, SD to Sioux Falls, SD, northward to the state line. SWE ranges from 3-4 inches with some pockets of 5 and 6 inches in the northernmost portion of the Big Sioux Basin. The James River Basin above Jamestown, ND, contains an average of 3.77 inches of SWE, compared to 3.8 inches at that time in 2010.

Compared to 2010, SWE in 2011 are greater than 2010 in the Milk River Basin and the Garrison reach. SWE is less in the Oahe to Gavins Point reaches, while it is similar in amount in the Sioux City reach with the exception of the southern portions of the James and Big Sioux River which has much less SWE than at this time in 2010.

Climate Outlook

During the next five days temperatures in the Missouri Basin will be several degrees below normal in Montana and the Dakotas, and about normal in all other areas. This pattern is likely to prevail into mid-March.

In terms of precipitation, the next five days will be dry with continued snow accumulations in the Rocky Mountains. Through mid-March the probability of precipitation throughout the Missouri Basin will be above average.

In March, the Climate Prediction Center is forecasting a greater probability of below normal temperatures in Montana, Wyoming and the Dakotas, while equal chances of above or below normal temperatures in all other areas of the Missouri Basin. With regard to precipitation, the CPC is forecasting increased chances of precipitation in Montana, Wyoming, and the Dakotas, while there are equal chances of above or below normal precipitation (see Figures 6 and 7)

During the March – May period, temperatures will trend toward cooler than normal in Montana and the Dakotas while they will likely be normal in all other areas. Overall precipitation probabilities will be normal in Montana, Wyoming and the Dakotas with a trend toward drier than normal conditions extending from Colorado through Nebraska and Kansas into western Iowa.

March 2011 Calendar Year Runoff Forecast

The overall calendar year 2011 runoff forecast is 25.4 MAF (112% of normal) above Gavins Point Dam, which is an increase of 0.2 MAF from the February 2011 forecast. The summation above Sioux City is 29.8 MAF (120% of normal), an increase from 28.4 MAF.

With regard to March and April runoff, the areas of "~~m~~Moderate" to "~~h~~Heavy" snow pack will cause above average runoff into the system. Despite some early snowmelt, an increase in the snowmelt runoff volume is expected in the Sioux City reach due to the additional SWE accumulated in the mid-

February snow storm, expected colder temperatures, wet soil moisture conditions and high tributary flows experienced during the winter.

Mountain snow accumulations as a percent of long-term averages are 110% of normal in the Fort Peck subbasin and 108% of normal in the Fort Peck to Garrison subbasin. As a result, the May-July runoff above Fort Peck is expected to be 105% of normal, while the Fort Peck to Garrison reach is expected to receive 103% of normal runoff. Runoff in all reaches above the System are forecasted to return to normal by August 2011, while above average runoff is forecasted in the Gavins to Sioux City reach due to persistent moist soil conditions.

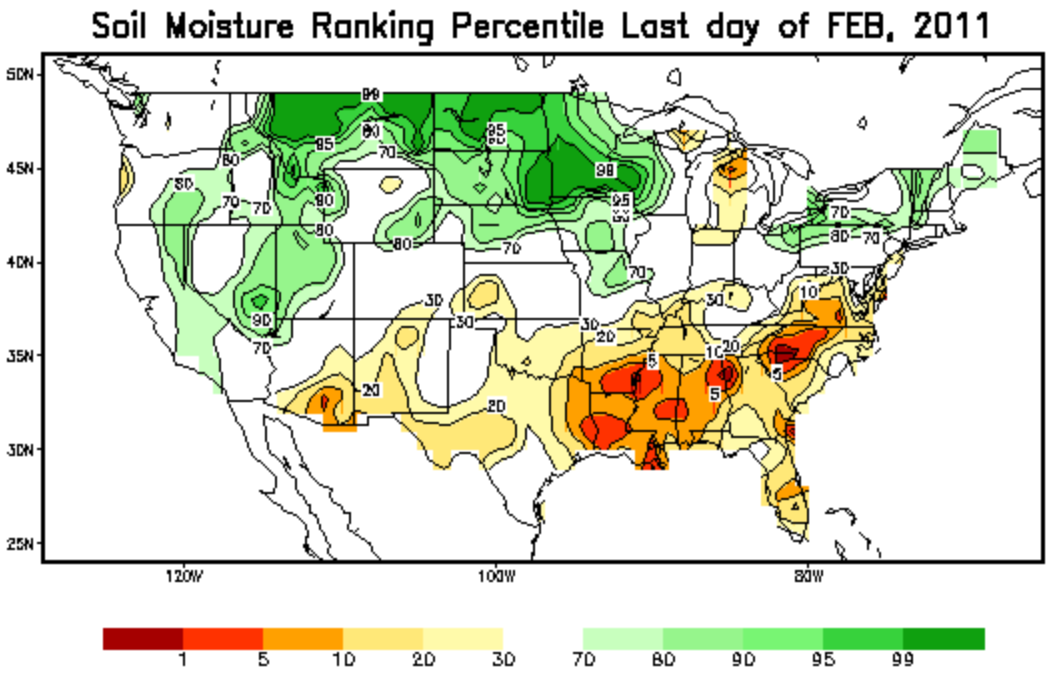


Figure 1 End of February 2011 Soil Moisture Ranking Percentile.

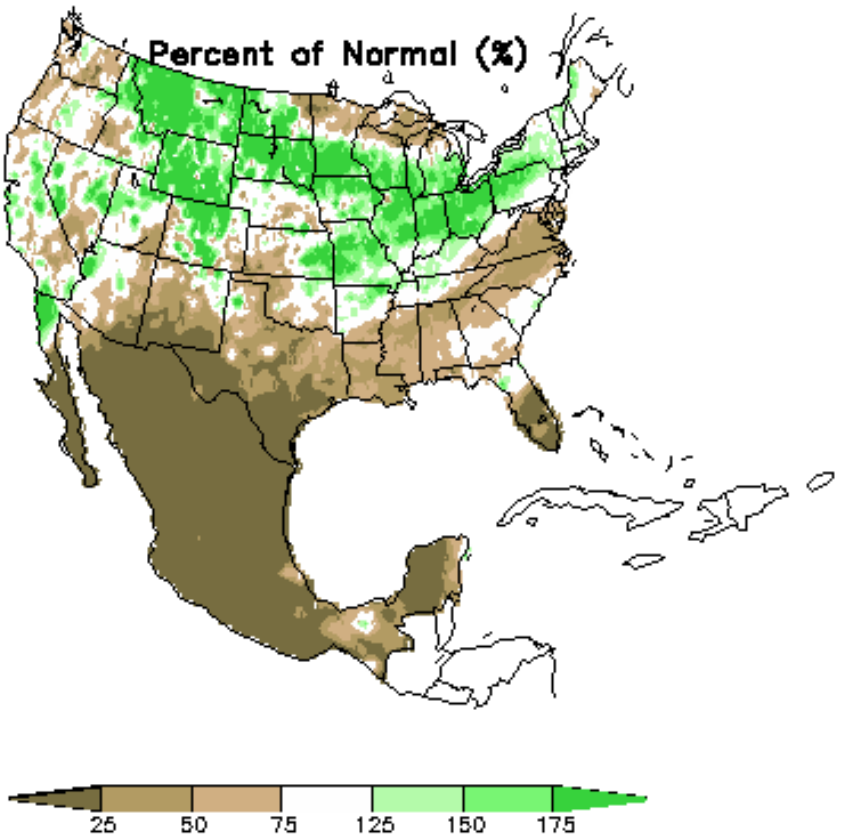


Figure 2 30-day precipitation as a percent of normal, ending February 28, 2011.

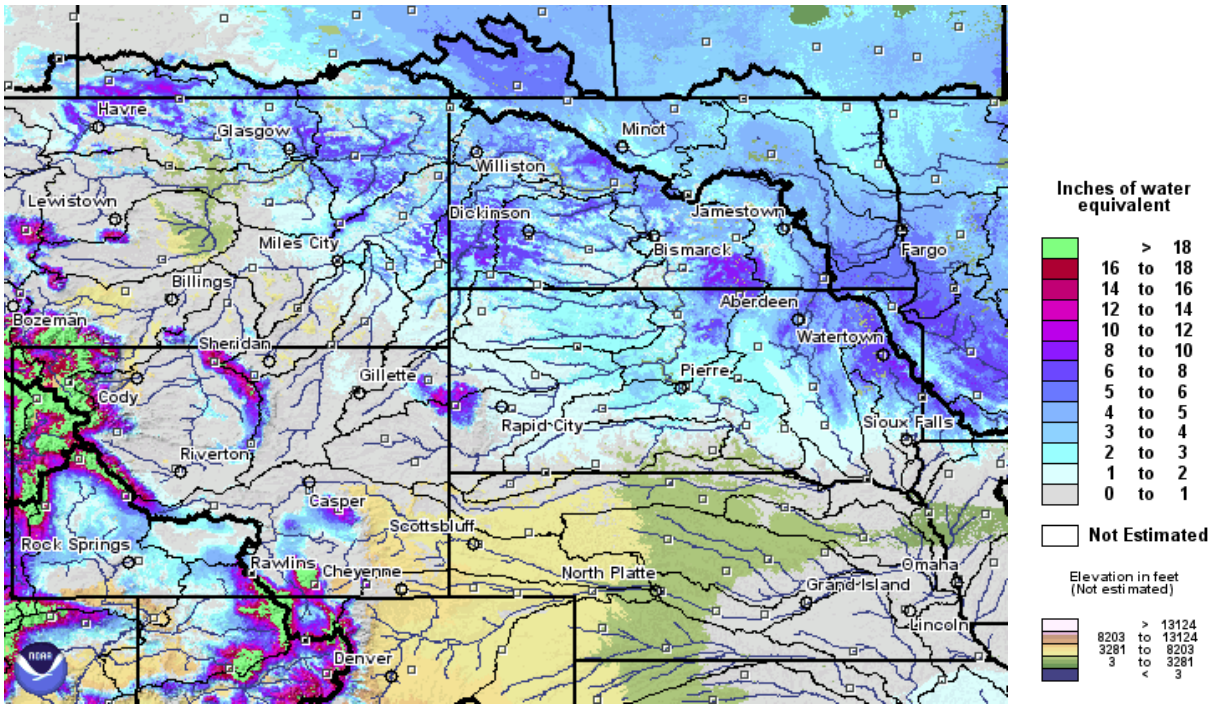


Figure 3 Plains Snow Water Equivalent (SWE) on March 1, 2011.

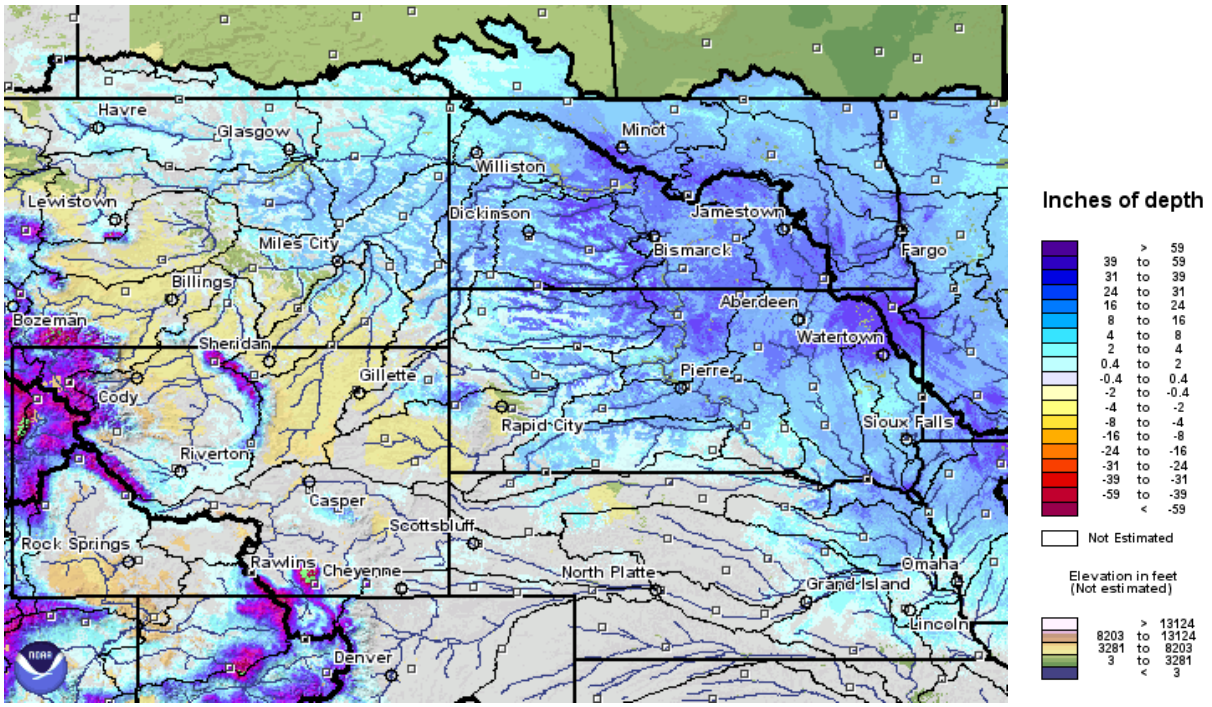


Figure 4 Plains Snow Water Equivalent on March 1, 2010.

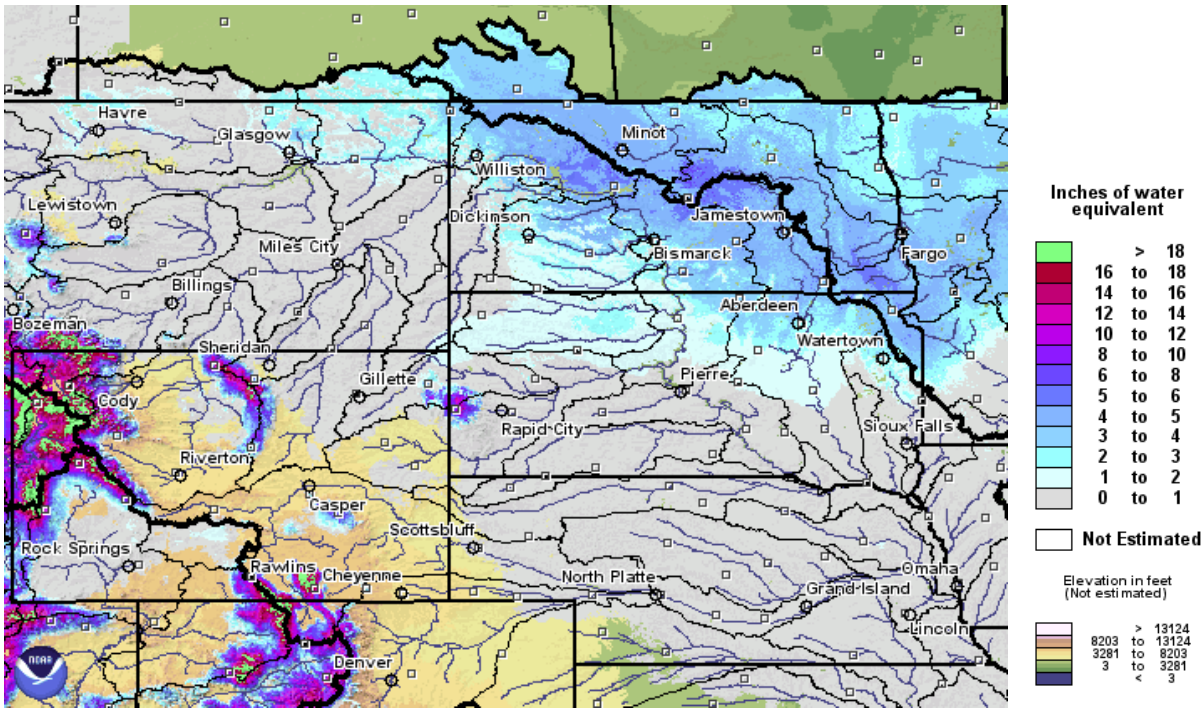
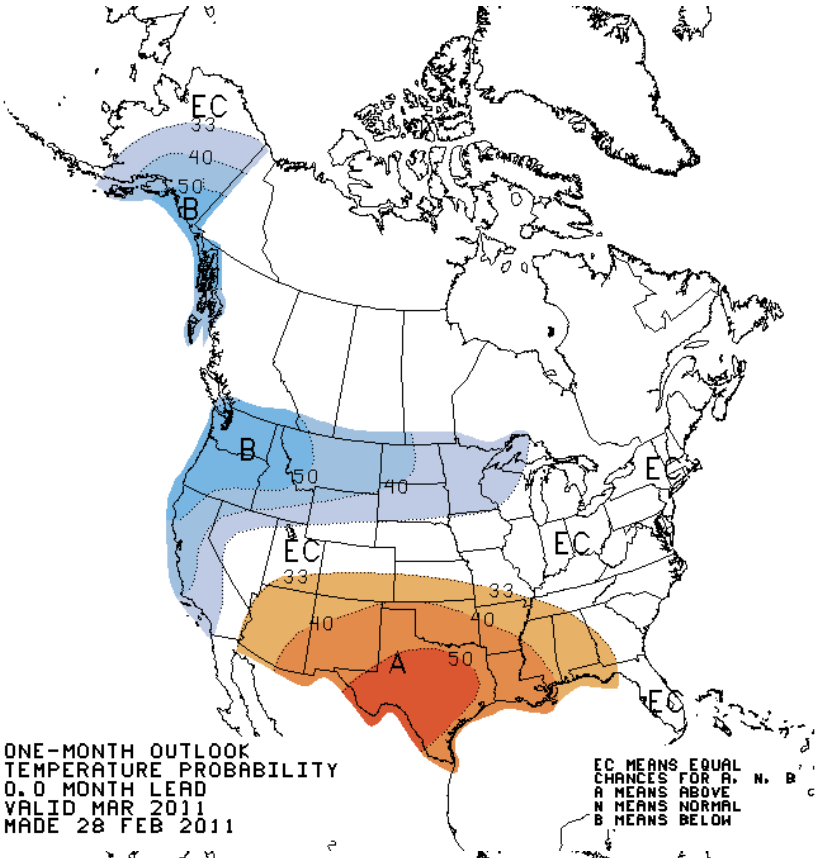


Figure 5 Plains Snow Water Equivalent on March 1, 2009.


EC
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40
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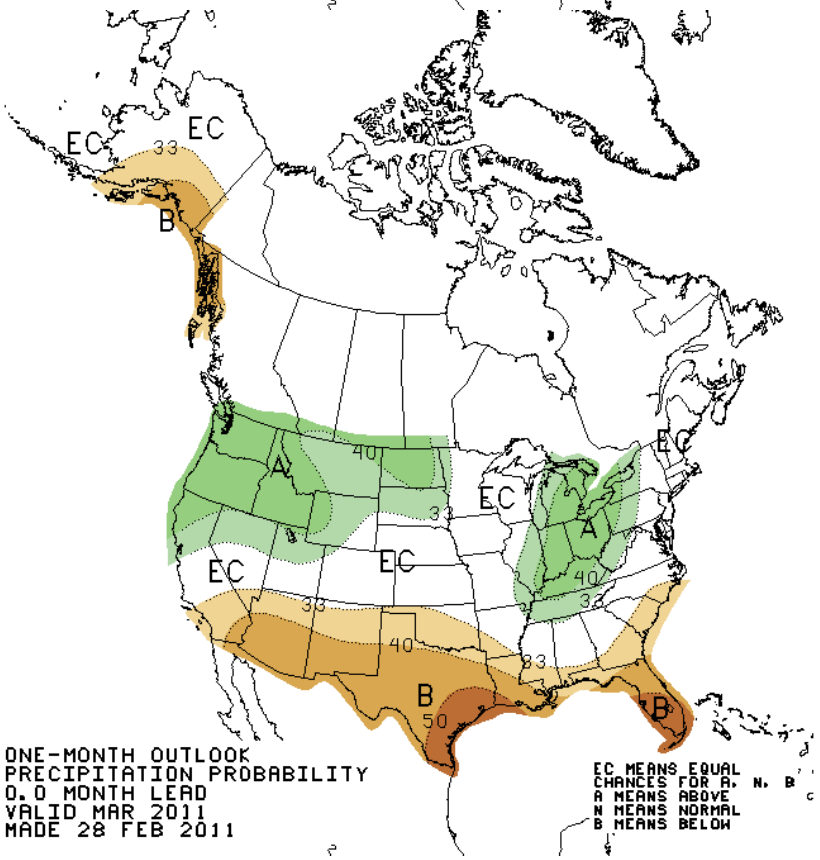
ONE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.0 MONTH LEAD
VALID MAR 2011
MADE 28 FEB 2011
EC MEANS EQUAL
CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW


EC
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B
ONE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
0.0 MONTH LEAD
VALID MAR 2011
MADE 28 FEB 2011
EC MEANS EQUAL
CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

April 2011 Calendar Year Runoff Forecast

2011 March Runoff

March 2011 runoff above Sioux City, IA, was 231% of normal at 6653 KAF, and above Gavins Point Dam runoff was 213% of normal at 5501 KAF. The actual March runoff into the system was 2451 KAF greater than forecasted March runoff above Gavins Point. Fort Peck received 1049 KAF (176%), Garrison received 1567 KAF (156%), Oahe received 1806 KAF (319%), Fort Randall received 686 KAF (328%), Gavins Point received 392 KAF (190%), and the Sioux City reach received 1152 KAF (385%).

Antecedent Moisture & Precipitation

Soil moisture conditions on March 31, 2011, continue to rank very high in the Northern Plains including eastern Montana and the Dakotas, and the Northern Rockies in Montana and northwest Wyoming (Figure 1). Soil moisture conditions rank in at least the 70th percentile, with particularly wet areas ranking 90 percent or higher. The Upper Missouri basin in the Northern Rockies, northern Montana, northern North Dakota, and eastern South Dakota all rank in the 95th percentile or higher. Wetter than normal soil conditions are also present northern Nebraska and northwest Iowa. Drier than normal soil conditions have developed in eastern Colorado, western Kansas and a small portion of central Missouri.

Thirty day precipitation departures as a percent of normal ending on March 31, 2011 is shown in Figure 2. A large area extending from eastern Montana through central North Dakota, also including northeast Wyoming, and western and northern South Dakota received greater than 150% of normal precipitation in March. A large area within this region including northeast Montana, and western and central North Dakota has been very wet, receiving over 200% of normal precipitation with some areas receiving over 300% of normal precipitation. In other areas such as central South Dakota, Nebraska, Iowa, and Kansas, precipitation was less than 75% or normal in March.

Mountain Snow Pack

Mountain snowpack as of March 31, 2011 was 116% of normal above Fort Peck and 112% of normal in the Fort Peck to Garrison reach. This is an increase from 110% of normal above Fort Peck and 108% of normal in the Fort Peck to Garrison reach on February 28, 2011. Missouri River Basin mountain snowpack normally peaks near on April 15. By April 1, normally 96% of the peak accumulation has occurred. The current SWE accumulations in each reach are greater than the normal annual peak accumulations.

Plains Snow Pack

The Plains snow pack on April 1, 2010, contains pockets of relatively heavy snow cover within a light to average cover extending from north central Montana through eastern Montana and across the Dakotas. Very little snow cover exists in Iowa or Nebraska. Snow water equivalent conditions are shown in Figures 3 and 4. Figure 3 shows the plains SWE in inches on March 31, 2011. Figure 4 shows the plains SWE on March 10, 2011, which is near the date of peak SWE accumulation prior to the snowmelt that melted a majority of the snow in South Dakota.

Above Fort Peck Lake, the snow cover has thinned significantly; however, 1-2 inch amounts of SWE remain in central Montana, and trace amounts of SWE remain south of the reservoir.

The Fort Peck to Garrison reach contains the greatest amounts of plains snow with very heavy pockets of SWE remain in the Milk River Basin and tributary basins primarily north of the Missouri River extending into north central North Dakota. Very limited snowmelt has occurred in the Fort Peck to Garrison reach north of the Missouri River; however, south of the River in the lower Yellowstone and Little Missouri River basins, some snowmelt and runoff has occurred. SWE amounts in the Milk River Basin range from 2.5 to 4.5 inches according to measurements, while in the Missouri River reach from Fort Peck to Williston, 2-4 inches of SWE remain. NOAA's NOHRSC office is estimating heavy pockets of 6-8 inches of SWE in the Milk River Basin in Canada and in an areas extending from east of Fort Peck, northwestward into Canada (Figure 3). In the lower Yellowstone and Little Missouri River Basins, snow cover is sparse, yet some remaining SWE and meltwater has not reached rivers and streams. Snow conditions at the end of March bare similarities to the mid-March SWE in the Garrison reach that was present in 1969.

In the Oahe reach, much of the snow in the tributaries west of the Missouri River has melted leaving only heavy pockets in tree rows and protected areas. Only a trace to 1-inch amounts covers the plains as a result of recent light snow. Areas within the Knife and Heart River Basins in North Dakota still contain small pockets of 2-3 inches of SWE (adjusted down from NOHRSC estimates). In the Oahe to Gavins Point reaches, trace to 0.5-inch amounts exist as a result of recent snows.

In the Gavins Point to Sioux City reach, a trace to 0.5-inch coverage exists in the James and Big Sioux River Basins south of U.S. Highway 212 that runs through Watertown, SD. In mid-March most of the plains snow melted as a result of warmer temperatures. In northern South Dakota and North Dakota, very limited snowmelt occurred in March, so with the approach of warmer temperatures at the end of March and beginning of April, snowmelt in the Big Sioux and the James River north of U.S. 212 will re-commence. SWE in the upper James River Basin ranges from 2.5-5 inches according to on the ground measurements, while in the Big Sioux north of Watertown, SWE ranges from 3-4 inches.

Climate Outlook

During the next five days temperatures in the Missouri Basin will be normal in southern portions of the basin; however colder temperatures will prevail in the Northern Plains with daily high temperatures expected to be 5-10 degrees Fahrenheit below normal. During the 6-10 day period, temperatures will continue to be below normal through the Northern Plains and Rockies, and normal in the lower basin. Through the remainder of April, temperatures will trend below normal (Figure 5).

In terms of precipitation, during the next five days, the Missouri Basin will receive light precipitation in the Central Plains; however, a powerful winter storm will produce heavy snow in the Northern Rockies and a mix of rain and snow in the Northern Plains. During the 6-10 day period, the Northern Plains could continue to receive precipitation while the southern half of the Missouri River Basin will likely be dry. Through the end of April, the wet conditions in the north and dry conditions in the south are expected to continue (Figure 6).

During the April-June period, temperatures are forecast to trend below normal from the Midwest to the Northern Rockies. Precipitation chances are forecast to be normal throughout the basin with the exception of above normal chances in North Dakota and northeast Montana. In relation to drought, normal (non-drought) hydrologic conditions are expected to prevail in the Dakotas, Wyoming, Montana and Iowa through June (Figure 7). Moderate to severe drought already affecting eastern Colorado and western Kansas are expected to persist, while abnormally dry conditions and moderate drought will continue to develop in southern Nebraska and central Kansas.

April 2011 Calendar Year Runoff Forecast

The overall calendar year 2011 runoff forecast is 28.7 MAF (126% of normal) above Gavins Point Dam, which is an increase of 3.35 MAF over the March 2011 forecast. This increase is due in part to actual March runoff being higher than forecasted March runoff, an increase in forecasted runoff into the Garrison reach, and an increase in the expected mountain snowmelt runoff due to increased mountain SWE. The summation above Sioux City is 33.8 MAF (136% of normal), an increase of 4.0 MAF.

The remaining plains snow pack (2.5-4.5 inches of SWE) in the Fort Peck to Garrison reach north of the Missouri River has not melted, and as a result Garrison is expected to receive up to 1.5 MAF of runoff in the month of April, which represents about 0.75 inch of snowmelt runoff from the contributing area covered with snow (35,000 square miles). The total March-April runoff forecast into Garrison is 2.9 MAF. Similar runoff volumes occurred in March and April of calendar years 1949 (2.9 MAF), 1960 (2.8 MAF), 1969 (3.4 MAF), and 1979 (4.5 MAF), which were all impacted by moderate to heavy plains snow in the Garrison reach.

Mountain snow accumulations as a percent of long-term averages are 116% of normal above Fort Peck and 112% of normal in the Fort Peck to Garrison reach. As a result, the May-July runoff above Fort Peck is expected to be 115% of normal, while the Fort Peck to Garrison reach is expected to receive 109% of normal runoff using snow to runoff regression equations. Runoff in all reaches above the System are forecasted to return to normal by August 2011, while above average runoff is forecasted in the Gavins to Sioux City reach due to persistently high streamflow conditions.

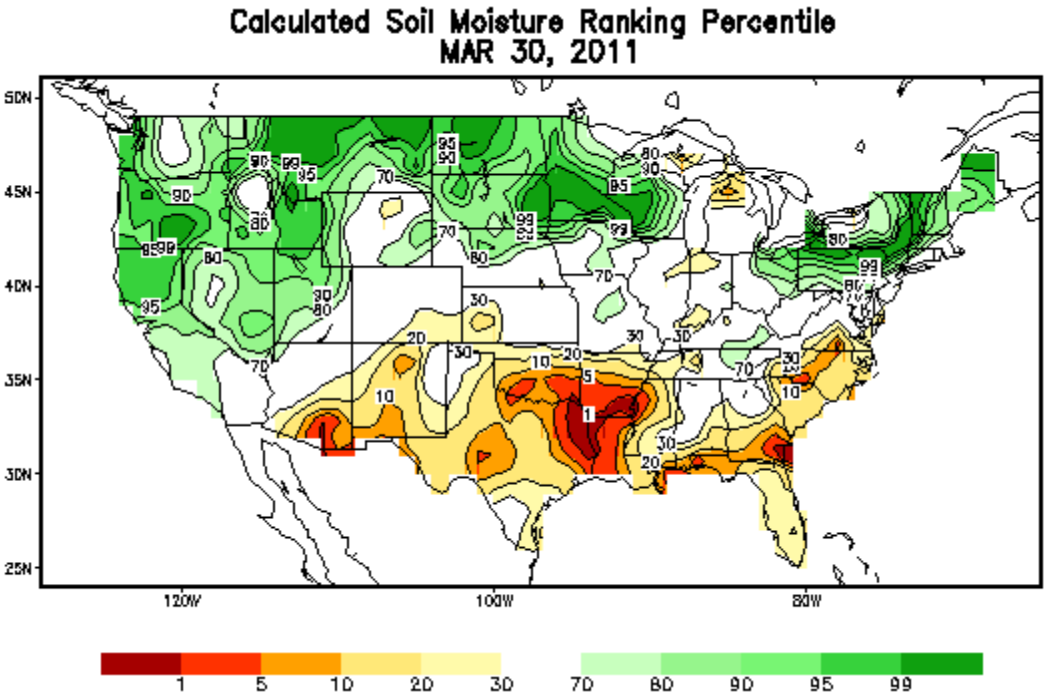

Figure 1 March 30, 2011 Soil Moisture Ranking Percentile.

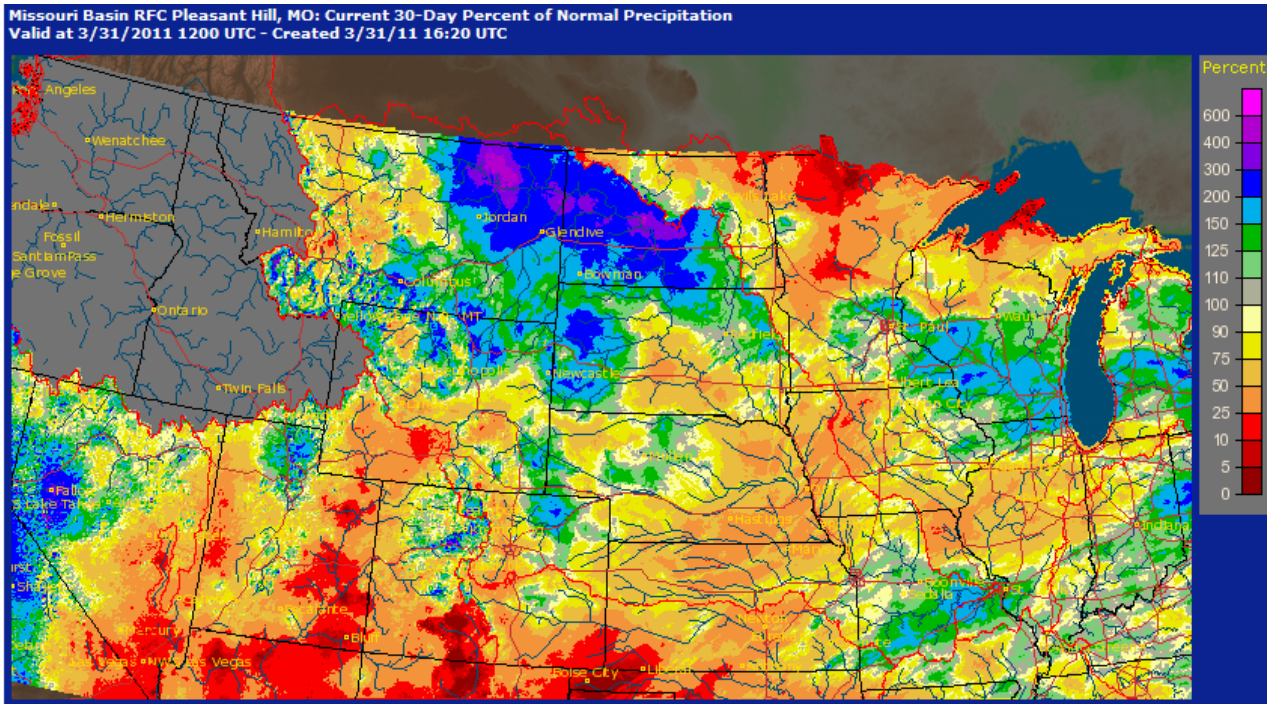

Figure 2 30-day precipitation as a percent of normal, ending March 31, 2011.

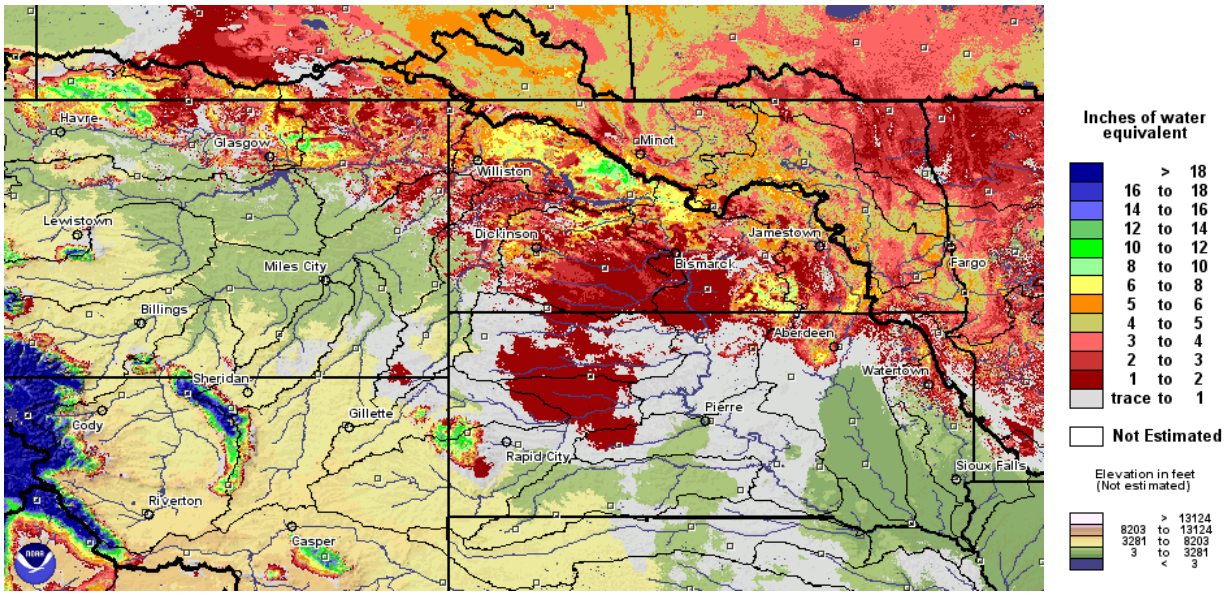

Figure 3 Plains Snow Water Equivalent on March 31, 2011.

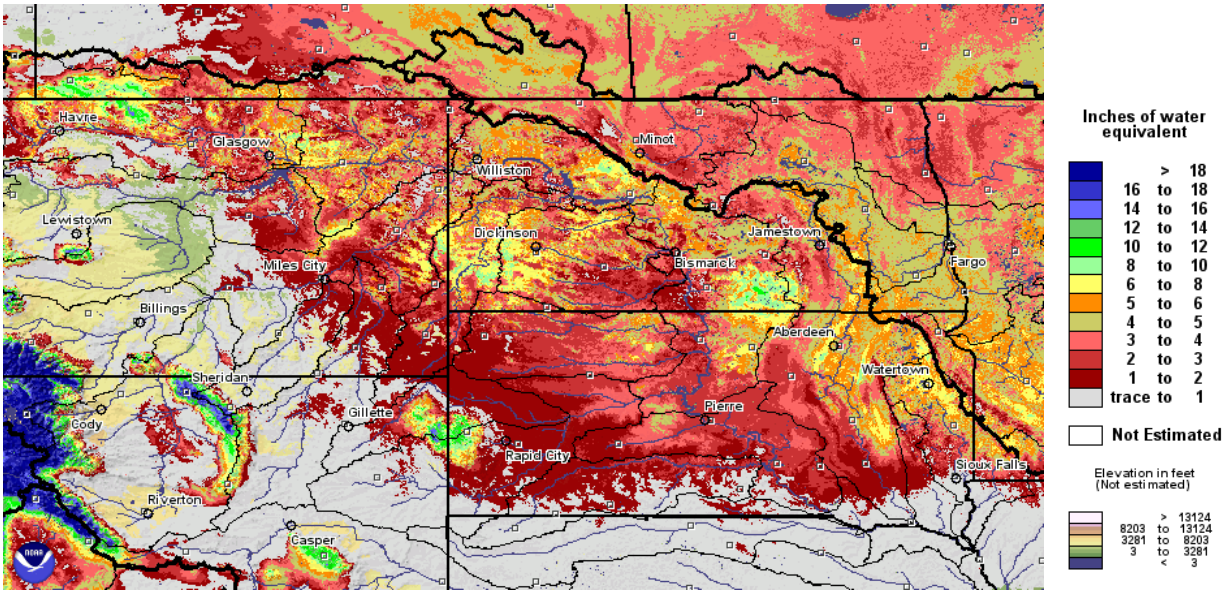

Figure 4 Plains Snow Water Equivalent on March 10, 2010.

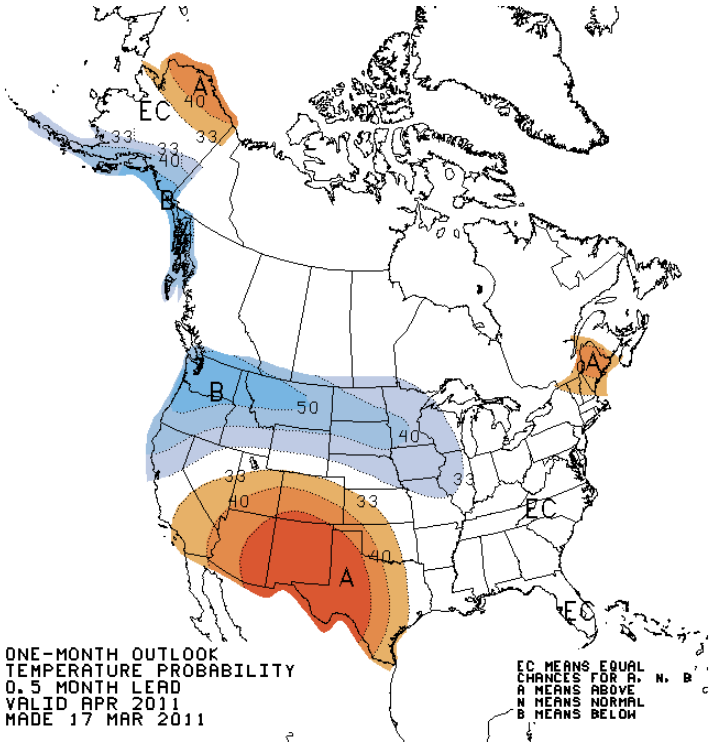

Figure 5 April 2011 temperature outlook.

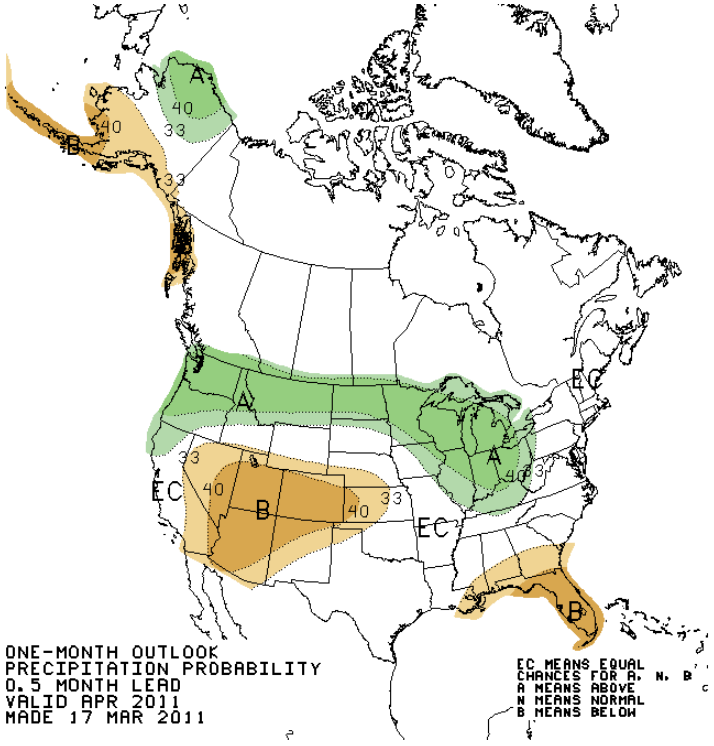

Figure 6 April 2011 precipitation outlook

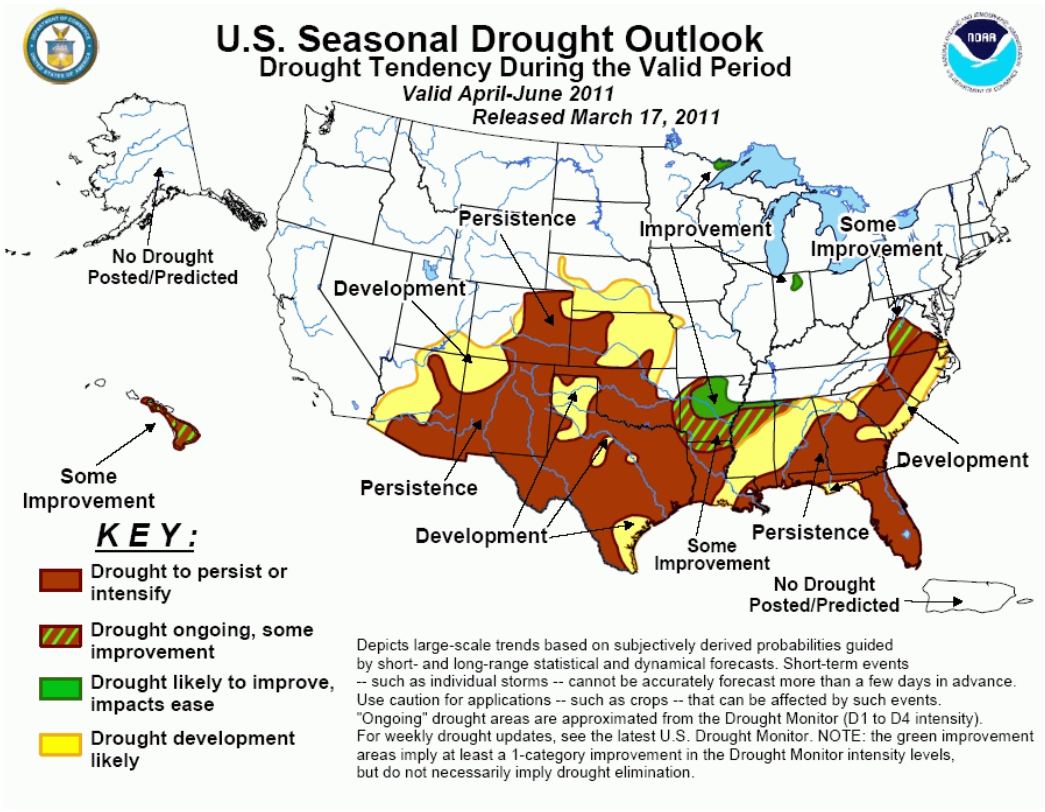

Figure 7 U.S. Drought Outlook through June 2011.

May 2011 Calendar Year Runoff Forecast

2011 April Runoff

April 2011 runoff above Sioux City, IA was 7713 kaf, 267% of normal. April 2011 runoff above Gavins Point Dam was 5632 kaf, 222% of normal.

April 2011 runoff:

Fort Peck - 895 kaf (138% of normal),
Garrison - 2748 kaf (254% of normal),
Oahe - 1617 kaf (336% of normal),
Fort Randall - 238 kaf (165% of normal),
Gavins Point - 134 kaf (74% of normal), and
Gavins to Sioux City - 2081 kaf (578% of normal).

While the bulk of the runoff in April occurred from plains snowmelt, precipitation in the basin during April was well-above normal above the upper three projects and slightly above normal between Oahe and Sioux City. As of May 1, 2011 the accumulated runoff above Sioux City, IA was 18.0 maf (236% of normal), while above Gavins Point Dam, the accumulated runoff was 15.9 maf (220% of normal).

Antecedent Moisture & Precipitation

Soil moisture conditions on April 30, 2011 continue to rank very high in the Northern Plains and Rocky Mountains (Figure 1); and, percentile rankings have increased slightly from the March 31, 2011 rankings. Soil moisture percentiles range from the 95th to the 99th percentile in much of Montana including the Missouri River basin in western and northern Montana. Soil moisture ranks in the 99th percentile in southwest Montana and northwest Wyoming in the headwaters of the Missouri and Yellowstone River basin. Across the Northern Plains region soil moisture ranks above normal, while in eastern Montana and most of the Dakotas percentiles rank above the 90th percentile. In contrast, drier conditions have prevailed in the upper South Plate and Kansas River basins, thus soil moisture conditions rank normal to below normal (30th percentile).

The thirty-day precipitation departure as a percent of normal ending on April 30, 2011 is shown in Figure 2. A precipitation pattern similar to March 2011 (Figure 3) occurred in April. The Northern Plains continued to receive abundant precipitation with over 200% of normal in the Fort Peck to Garrison reach, and areas of 150-200% of normal precipitation across Montana, northern Wyoming and North Dakota. Precipitation in the Fall of 2010 was 150% of normal in the Northern Plains; however, in the Rocky Mountains, precipitation accumulations were below normal.

Mountain Snow Pack

Mountain snowpack is the primary factor used to predict May-July natural runoff volumes in the Fort Peck and Fort Peck to Garrison mainstem reaches. Greater than average mountain snow accumulations are usually associated with greater than average May-July runoff volumes, especially when greater than average runoff and snow accumulations occur in successive years.

Mountain snowpack as of March 31, 2011 was 116% of normal above Fort Peck and 112% of normal in the Fort Peck to Garrison reach. By April 15, 2011, the average date of the mountain snow accumulation, snowpack above Fort Peck rose to 126% of normal while snowpack between Fort Peck and Garrison rose to 121% of normal. During the final 15 days of April, mountain snow continued to accumulate, and on May 1, 2011, the mountain snow accumulations above Fort Peck and from Fort Peck to Garrison were 153 and 141% of normal, respectively. As a percent of peak accumulation 140% of normal was present above Fort Peck, while 136% of normal was present between Fort Peck and Garrison. The Missouri River basin mountain snowpack normally peaks around April 15, and the current snowpack appeared to be peaking in early May.

Since 1987, the 2011 peak accumulation above Fort Peck is higher than the 135% that occurred in 1997, while the 2011 peak accumulation from Fort Peck to Garrison is second highest to the 139% that occurred in 1997.

Table 1. Mountain snowpack accumulation as a percent of normal.

Date	Above Fort Peck	Fort Peck to Garrison
February 28, 2011	110	107
March 31, 2011	116	112
April 15, 2011	126	121
May 1, 2011	153	141
May 1, 2011 % of Average Peak	140	136

Plains Snow Pack

The Plains snow pack melted in the Missouri River Basin from mid-March through early April resulting in high runoff volumes entering the mainstem reservoirs in March and April. As of May 1, 2011, only small pockets of snow remained in northern Montana where deep accumulations occurred in drifts and ditches. Additional snowmelt will not impact runoff into the mainstem reservoirs; however, existing recession flows will continue to keep streamflows higher than average.

Climate Outlook

During the two weeks temperatures in the Missouri River Basin above Sioux City will likely trend below normal daily temperatures with increased chances of precipitation in the Northern Plains and Northern Rocky Mountains. Through the end of May, precipitation chances are expected to be greater than normal in the Northern Plains and Rockies with a continuing cooler than normal pattern in the Northern Rockies and Plains (Figure 4). During the May-July period (Figure 5), temperatures are again expected to be below normal from the Northern Rockies into the Midwest, while the outlook for precipitation will be normal, with slightly above normal chances in the Northern Plains and lower Missouri River basin.

With regard to drought, most traces in the Missouri River basin above Sioux City are gone; however, moderate to severe drought conditions have developed in the South Platte River basin, while moderate

conditions have developed in the Kansas River basin. During the next three months, these drought conditions are expected to persist in these basins (Figure 6).

May 2011 Calendar Year Runoff Forecast

The overall calendar year 2011 runoff forecast is 36.0 MAF (158% of normal) above Gavins Point Dam, while the total system runoff above Sioux City is forecast to be 44.0 MAF (178% of normal). The increase from the April 1 forecasts (33.8 maf above Sioux City and 28.8 maf above Gavins Point) is due to greater than expected April runoff and significant increases in mountain snowpack totals during the month of April. During the critical runoff months of May, June and July, forecasted runoff into the mainstem reservoir system above Gavins Point are forecasted to total 4505 kaf (the equivalent of 73 kcfs/day) in May, 7655 kaf (124 kcfs/day) in June, and 4500 kaf (73 kcfs/day) in July.

Fort Peck & Garrison

The May-July runoff forecast is based on regression equations that relate the peak mountain snow accumulations to May-July runoff volumes. As of May 1, 2011 the Fort Peck basin contained 140% of the normal April 15 peak mountain snowpack, while the Fort Peck to Garrison basin contained 136% of the normal April 15 peak mountain snowpack. Total forecasted runoff from May–July above Fort Peck is 6230 kaf (177% of normal). This forecast would rank the May-July runoff period above Fort Peck as the 5th highest of record since 1898. Likewise, total runoff forecast to occur during May–July in the Fort Peck to Garrison reach is 8527 kaf (150% of normal). This forecast would rank the May-July runoff period from Garrison to Fort Peck as the 10th highest of record since 1898.

Above Fort Peck, the distribution of the May-July forecasted runoff is 31% (May), 46% (June) and 23% (July). In the Fort Peck to Garrison reach, the distribution of the May-July forecasted runoff is 22% (May), 47% (June), and 31% (July). These distributions are based on historic runoff patterns. Runoff into both of these projects are forecasted to be above normal in August as the high streamflows recede from the snowmelt runoff, and subsequent months' runoff returns to more normal conditions.

Oahe , Fort Randall & Gavins Point

Since Oahe received much greater than normal runoff in March and April, and streamflows continue to be high in the Oahe reach, expect runoff volumes in May to be greater than normal, but slowly recede to normal by August. Runoff volumes into Fort Randall and Gavins Point are expected to be normal assuming normal conditions.

Sioux City

In the Gavins Point to Sioux City reach, we expect May runoff from the James, Vermillion and Big Sioux Rivers to contribute 1,370 kaf (20,600 cfs/day). This forecast was determined by receding the May 1, 2011 discharge in each river at their historic recession rates. We expect subsequent runoff volumes in this reach to be above normal through the remainder of the calendar year due to elevated contributions from the James and Big Sioux River basins from persistent wet soil conditions. The forecasted calendar

year runoff in the Gavins to Sioux City reach is expected to be 7980 kaf, almost 400% of normal, but less than the 520% of normal received in 2010.

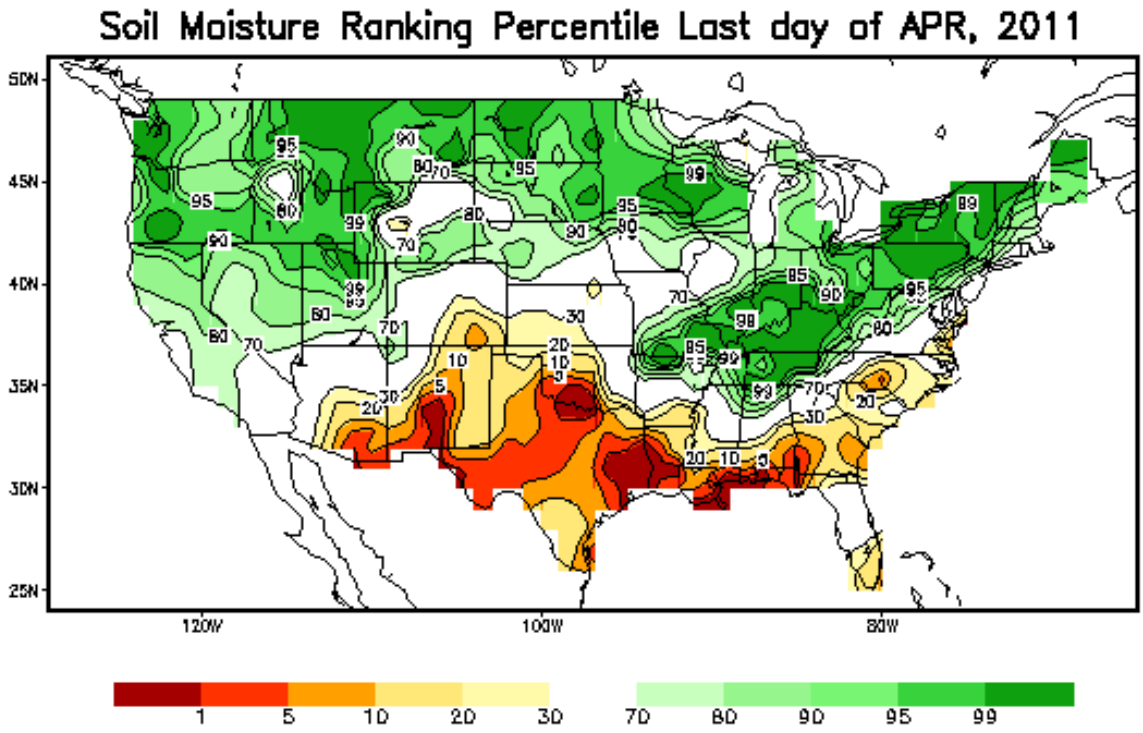

Figure 1. April 30, 2011 Soil Moisture Ranking Percentile.

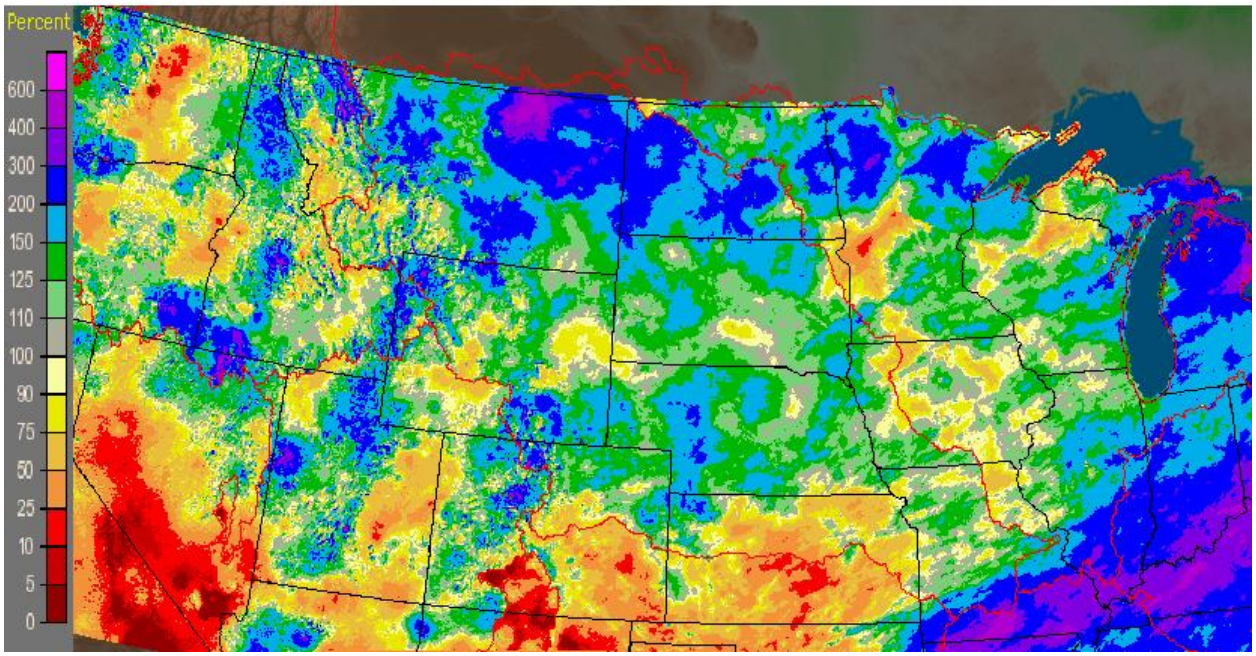

Figure 2. 30-day precipitation as a percent of normal, ending April 30, 2011.

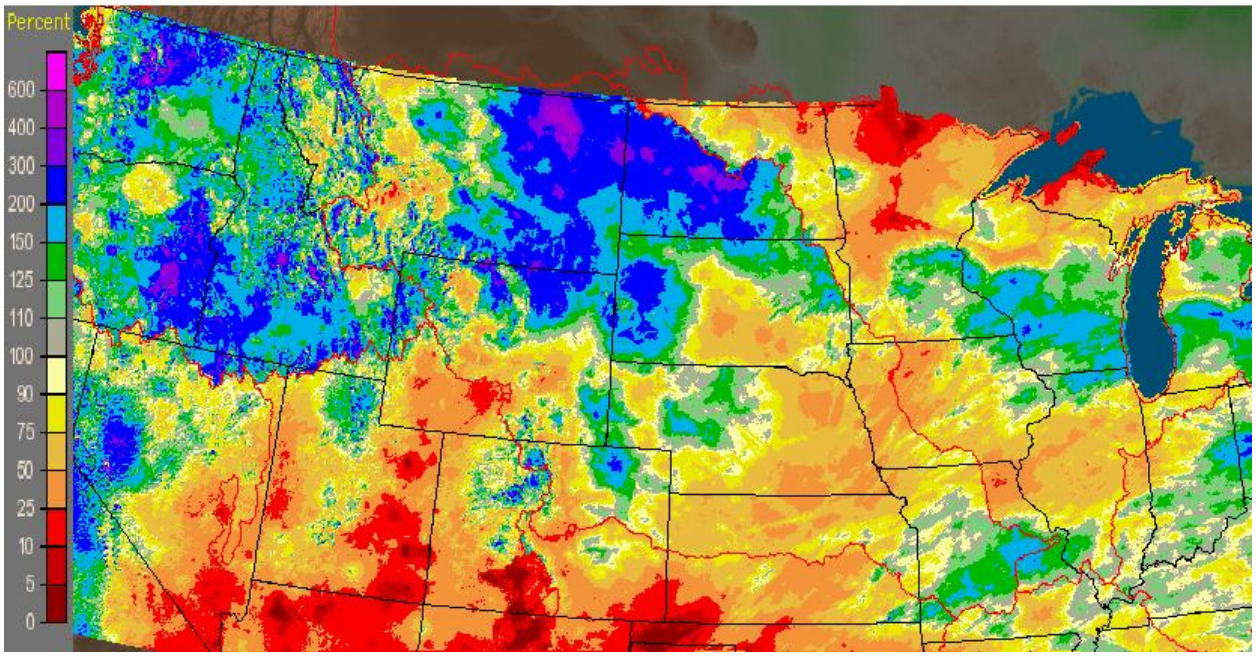

Figure 3. 30-day precipitation as a percent of normal, ending March 31, 2011.

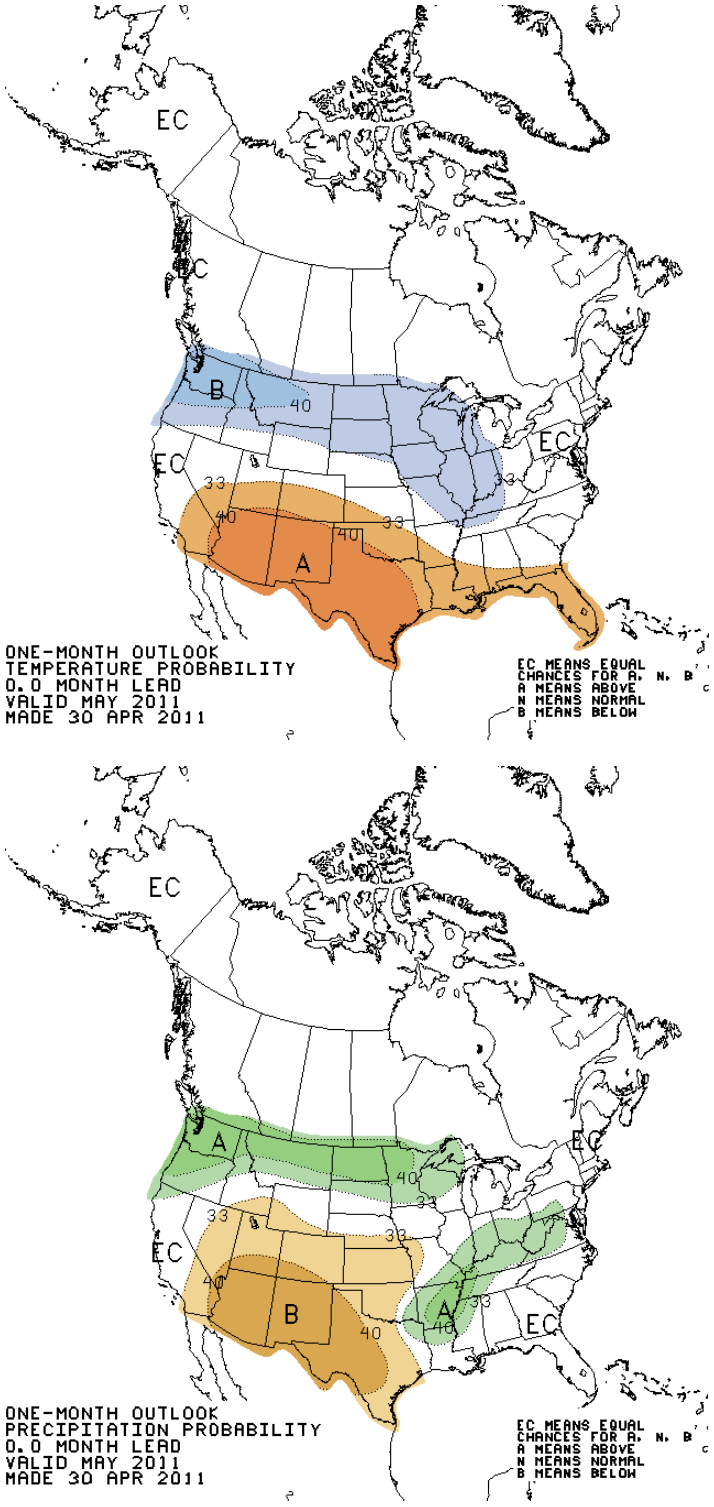

Figure 4. May 2011 temperature and precipitation outlook.

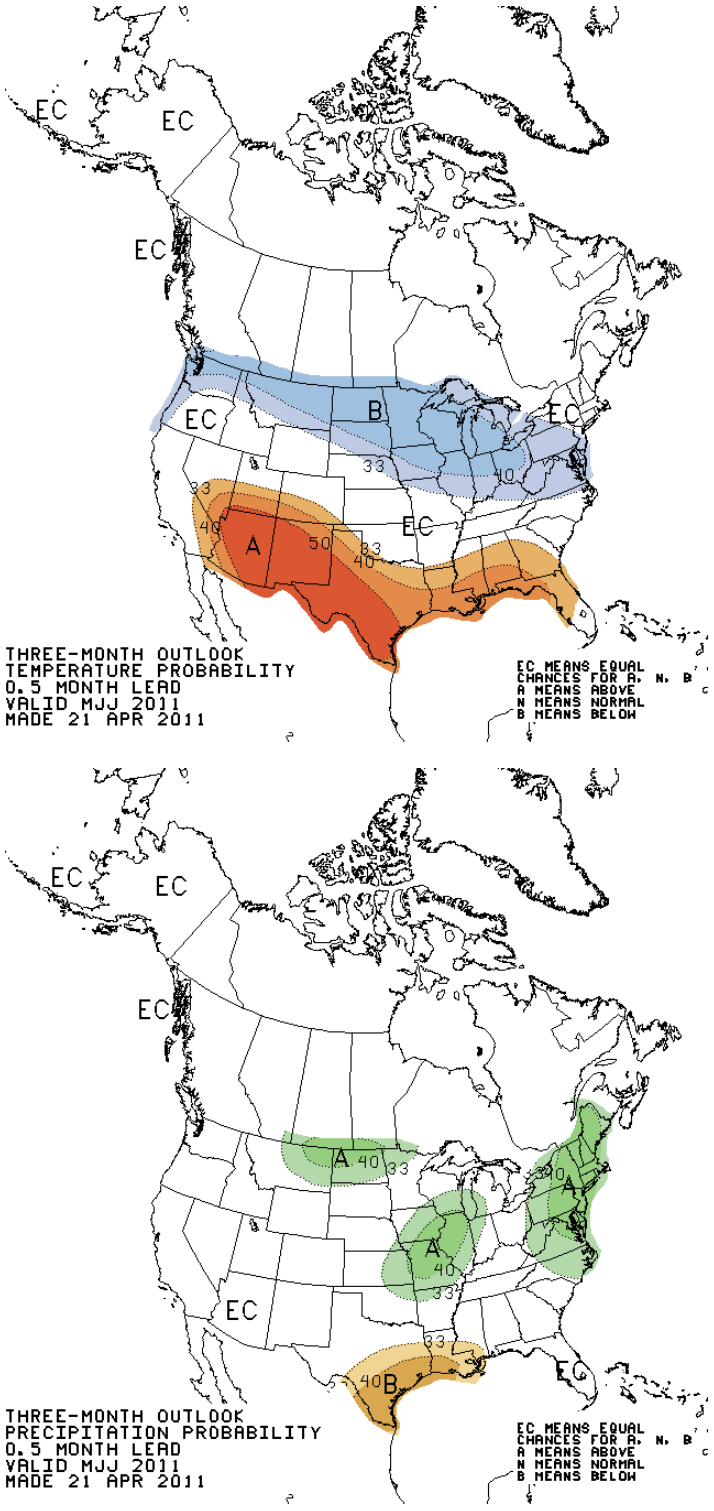

Figure 5. May-July 2011 temperature and precipitation outlook.

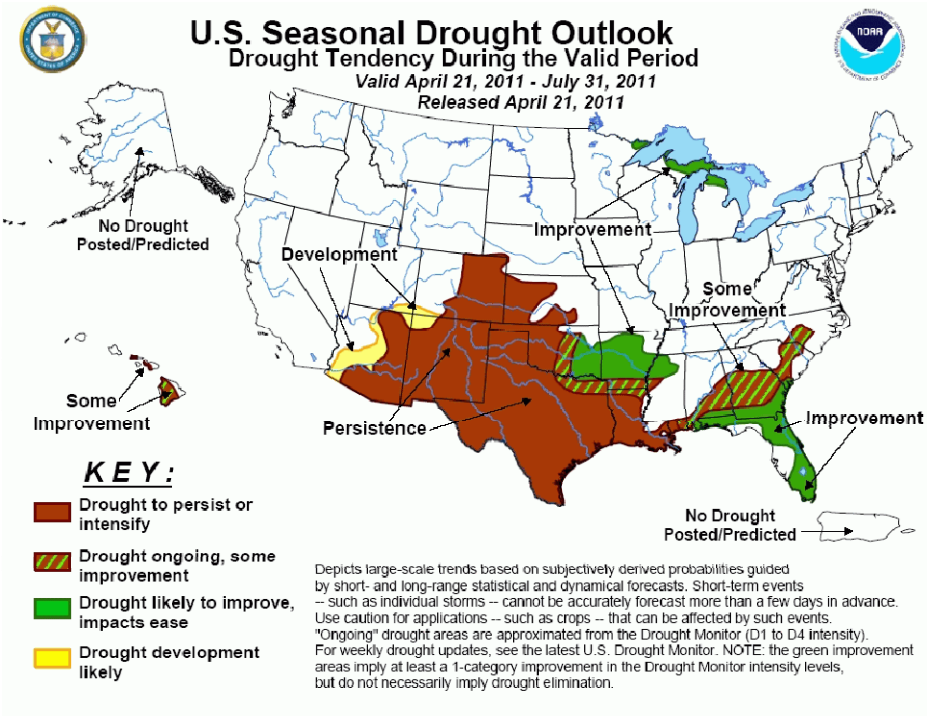

Figure 6 U.S. Drought Outlook through July 2011.

June 2011 Calendar Year Runoff Forecast

2011 May Runoff

May 2011 runoff above Sioux City, IA was 10,468 kaf, 321% of normal. May inflow was the 2nd highest monthly total of all months from 1898-2011, exceeded only in April 1952 (13,200 kaf), and the highest May runoff (previous record May was 7200 kaf in 1995). May 2011 runoff above Gavins Point Dam was 8,866 kaf, 298% of normal.

May 2011 runoff:

Fort Peck – 2,871 kaf (266% of normal), and highest May of record,
Garrison – 4,414 kaf (355% of normal), and highest May of record,
Oahe – 1,259 kaf (403% of normal),
Fort Randall - 305 kaf (207% of normal),
Gavins Point - 17 kaf (9% of normal), and
Gavins to Sioux City - 1603 kaf (549% of normal).

A large majority of the inflow occurred as a result of extremely high amounts of rainfall that covered all of Montana, northern Wyoming, and western South and North Dakota. These areas received at a minimum 3.0 inches more rainfall than normal May rainfall amounts. Many areas in Montana received between 4 and 8 inches greater than normal precipitation. Rainfall is discussed further in the next section. Additionally, some snowmelt occurred in the Northern Rockies, but continued accumulation slowed the decline in existing snowpack. As of June 1, 2011 the accumulated runoff above Sioux City, IA was 28.44 maf (262% of normal), while above Gavins Point Dam, the accumulated runoff was 22.81 maf (233% of normal).

Antecedent Moisture & Precipitation

Soil moisture conditions on May 31, 2011 increased in the Northern Plains and Rocky Mountains (Figure 1); and, percentile rankings increased to 99th percentile rankings throughout Montana, Wyoming, and parts of the Dakotas.

A monumental amount of precipitation occurred throughout the upper Missouri River Basin in May (Figure 1). In Montana and northern Wyoming, a large area received greater than 10 inches of rainfall. Billings, MT received 9.54 inches (7.06 inches above normal), Glasgow, MT received 6.97 inches (5.25 inches above normal), Lander, WY received 6.77 inches (4.35 inches above normal), and Zortman, MT received 16.44 inches (more than 14 inches above normal). Also areas near Bighorn Reservoir (Yellowtail Dam) received greater than 15 inches during the month. Departures from normal are shown in Figure 2.

This weather pattern was influenced by a mean trough of low pressure over the Pacific Northwest, which although normal in May, it was particularly strong. The trough guided a number of areas of low pressure through the area causing repeated precipitation in the Northern Rockies and Plains.

Missouri Basin RFC Pleasant Hill, MO: May, 2011 Monthly Observed Precipitation
Valid at 6/1/2011 1200 UTC- Created 6/2/11 17:40 UTC

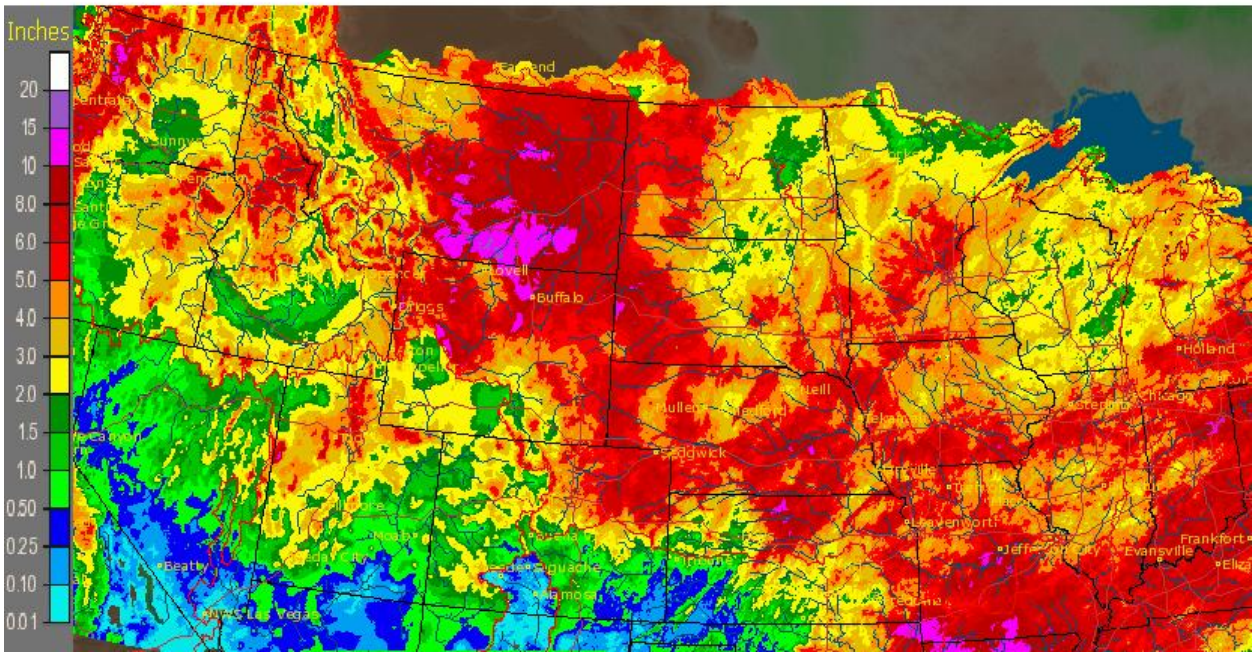

Figure 1. May 2011 precipitation in the Missouri River Basin. Source: NOAA.

Missouri Basin RFC Pleasant Hill, MO: May, 2011 Monthly Departure from Normal Precipitation
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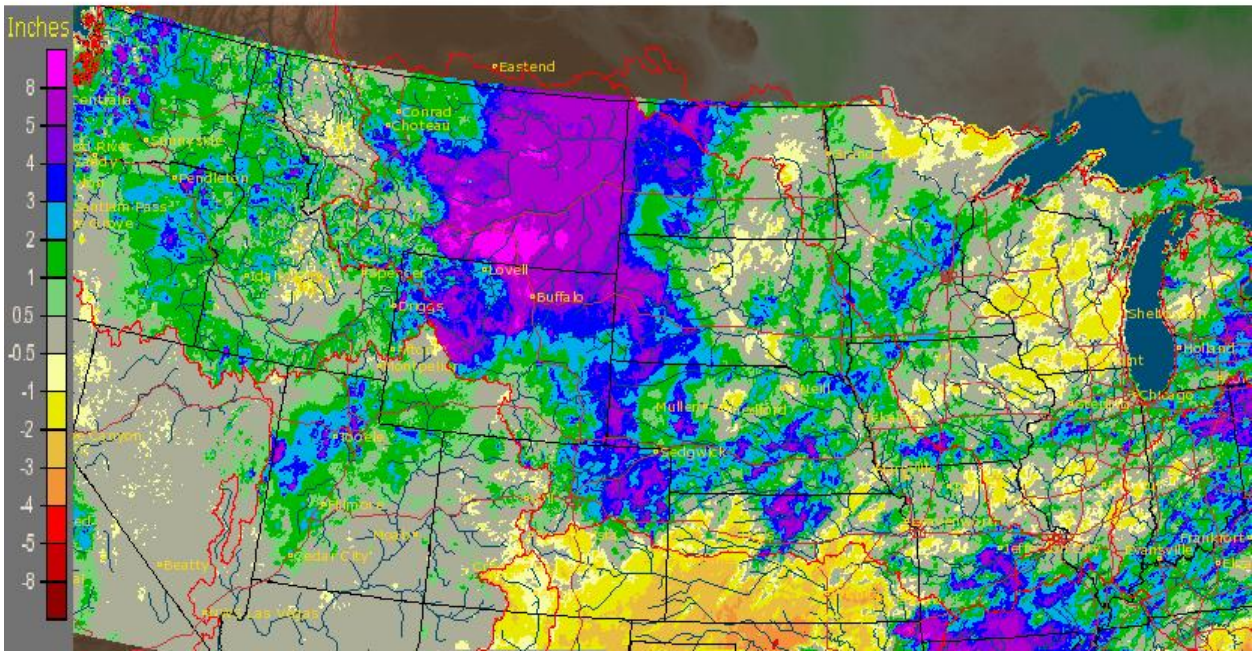

Figure 2. May 2011 precipitation departures in the Missouri River Basin. Source: NOAA.

Mountain Snow Pack

Mountain snowpack is the primary factor used to predict May-July natural runoff volumes in the Fort Peck and Fort Peck to Garrison mainstem reaches. Greater than average mountain snow accumulations are usually associated with greater than average May-July runoff volumes, especially when greater than average runoff and snow accumulations occur in successive years.

Mountain snowpack as of March 31, 2011 was 116% of normal above Fort Peck and 112% of normal in the Fort Peck to Garrison reach. By April 15, 2011, the average date of the mountain snow accumulation, snowpack above Fort Peck rose to 126% of normal while snowpack between Fort Peck and Garrison rose to 121% of normal. During the final 15 days of April, mountain snow continued to accumulate, and on May 1, 2011, the mountain snow accumulations above Fort Peck and from Fort Peck to Garrison were 153 and 141% of normal, respectively. As a percent of peak accumulation, snow peaked at 141% of normal above Fort Peck and 136% of normal between Fort Peck and Garrison on May 2, 1011. The Missouri River basin mountain snowpack normally peaks around April 15, and the current snowpack appeared to be peaking in early May. Although the mountain snowpack has declined since May 2, continued accumulations due to persistent snowfall and cooler than normal temperatures have slowed mountain snowmelt.

As of June 1, 2011, 104% of the normal peak accumulation existed above Fort Peck, and 127% of the normal peak accumulation existed in the Fort Peck to Garrison reach. As a percent of normal for June 1, above Fort Peck the snow accumulation was 243% of normal, and between Fort Peck and Garrison Dams it was 281% of normal. For forecasting purposes, it was determined that 75% of the Fort Peck peak accumulation existed on June 1 and 95% of the Fort Peck to Garrison peak accumulation existed.

Table 1. Mountain snowpack accumulation as a percent of normal.

Date	Above Fort Peck	Fort Peck to Garrison
February 28, 2011	110	107
March 31, 2011	116	112
April 15, 2011	126	121
May 1, 2011	153	141
May 2, 2011 % of Average Peak	141	136
June 1, 2011 % of Average Peak	104	127

Climate Outlook

During the first two weeks of June, probabilities for precipitation will be greater than normal in the upper Missouri River Basin. Temperatures are expected to be cooler than normal, slowing the mountain snowmelt after a brief period of warm weather end June 4. During the month of June the Climate Prediction Center is forecasting higher probabilities that temperatures will be below normal in the Upper Basin, as a result of continued cloudiness and precipitation expected to move through the area. This trend will likely delay or slow the rate of mountain snowmelt initially; however, by late June, a majority of the mountain snow is expected to be melted with the exception of the high elevation snow.

Precipitation is expected to be influenced by continued troughing over the Pacific Northwest, which will create greater than average precipitation chances for much of the Missouri River basin, especially the Northern Plains.

~~Two week temperatures in the Missouri River Basin above Sioux City will likely trend below normal daily temperatures with increased chances of precipitation in the Northern Plains and Northern Rocky Mountains. Through the end of May, precipitation chances are expected to be greater than normal in the Northern Plains and Rockies with a continuing cooler than normal pattern in the Northern Rockies and Plains (Figure 4). During the May-July period (Figure 5), temperatures are again expected to be below normal from the Northern Rockies into the Midwest, while the outlook for precipitation will be normal, with slightly above normal chances in the Northern Plains and lower Missouri River basin.~~

With regard to drought, most traces in the Missouri River basin above Sioux City are gone; however, moderate to severe drought conditions have developed in the South Platte River basin, while moderate conditions have developed in the Kansas River basin. During the next three months, these drought conditions are expected to persist in these basins (Figure 6).

~~May~~ June 2011 Calendar Year Runoff Forecast

The overall calendar year 2011 runoff forecast is 54.6 MAF (220% of normal) above Gavins Point Dam, while the total system runoff above Sioux City is forecast to be 46.2 MAF (203% of normal). The increase from the April 1 forecasts (44.0 maf above Sioux City and 36.0 maf above Gavins Point) is due to the much greater than expected May runoff from Fort Peck to Oahe and significant increases in the Fort Peck and Garrison June-July forecast runoff.

Fort Peck & Garrison

Methodology

The methodology used to forecast runoff into Fort Peck and Garrison Reservoirs in June and July relied on mountain snowpack, temperature and precipitation. Three sets of equations described in the D-96 report were used including: 1) the June 1 % of normal equation, 2) Peak SWE equation, and 3) the Peak SWE, P & T

The June 1 Percent of Normal equation (1) uses the percent of normal snowpack on June 1 in the two reaches to compute a May-July natural runoff volume. On June 1, snow pack was 243% and 281% of normal in the Fort Peck and Garrison reaches, respectively. This equation yielded the lowest three-month runoff volumes.

The Peak SWE equation (2) uses the percent of peak snowpack accumulation to compute the May-July runoff volume. Mountain snowpack peaked at 141 and 136% of normal on May 2, 2011 above Fort Peck and from Fort Peck to Garrison, respectively. This equation yields a higher three-month runoff volume than the June 1 percent of normal.

The third estimate used the Peak SWE, Temperature and Precipitation equation (3). The temperature component is an April-June ratio of monthly maximum daily temperature compared to normal maximum daily temperatures at a total of six long-term monitoring stations in Montana and Wyoming.

Forecast Parameters

Maximum daily temperatures compared to normal were computed as 88% and 92% of normal in April and May above Fort Peck, and 94% and 87% of normal in April and May between Fort Peck and Garrison. June temperatures were assumed to be 94% of normal based the current trend and outlook, for overall three-month values of 91% above Fort Peck and 92% between Fort Peck and Garrison. The affect of lower than average maximum daily temperatures is two-fold: it delays the melting of mountain snowpack and allows the accumulation of precipitation in the form of snow, both increasing the volume of May-July runoff.

The precipitation component is a ratio of total May-July precipitation to average May-July precipitation at a total of 13 monitoring stations. Precipitation as compared to normal was computed as 168% of normal above Fort Peck and 321% of normal from Fort Peck to Garrison in May. Precipitation in June and July were estimated to be 130% and 150% in June above Fort Peck and from Fort Peck to Garrison, respectively; and, 100% of normal in July. The overall three-month values were 133% and 190%. The affect of above normal precipitation is to increase May-July runoff volumes by both increasing runoff and building additional snowpack.

Since the computed May runoff volumes far exceeded the May 1 forecast, the June-July forecasted runoff volumes were divided between the remaining months by both dividing it according to historic monthly ratios, and apportioning it according to the remaining mountain snow pack. Above Fort Peck, 25% of the peak snow pack amount had melted, so 50% and 25% were assigned to June and July. From Fort Peck to Garrison, about 5% of the peak snow pack had melted (95% of peak remaining) so 57% and 38% was assigned to June and July, respectively. These estimates assume 75% of the three month computed runoff will occur in June and July above Fort Peck, and 95% of the computed runoff will occur in June and July from Fort Peck to Garrison.

Forecast Results

A summary of computations using the three equations is presented in Attachment 1. The forecast results are compared in Table 2. The forecast provide a range of inflow volumes based on various basin conditions. When existing and future precipitation and temperature are taken into consideration in Method 3, a very conservative estimate is computed. Late-May preliminary forecasts used to compute reservoir releases at the onset of the May rainfall runoff event are provided in Table 3. These estimates included three methods including: 4) preliminary runoff volumes patterned to the 1997 inflow hydrographs, 5) runoff volumes patterned to the 1997 hydrographs with an early May storm, and 6) an additional 10% increase to Method 5. These runoff forecasts are provided in Table 3.

Table 2. June 1 June-July Forecast Results.

	Above Fort Peck, kaf	Fort Peck to Garrison, kaf

	June-July (75%)	June (50%)	July (25%)	June-July (95%)	June (57%)	July (38%)
(1) June 1 Percent of Normal	3,551	2,368	1,184	7,471	4,482	2,988
(2) Peak SWE + 10%	**5,158**	**3,422**	**1,736**	**8,910**	**5,346**	**3,564**
(3) Peak SWE, P & T	**5,859**	**3,906**	**1,953**	**10,353**	**6,212**	**4,141**

Table 3. Preliminary June-July Forecast Results.

	Above Fort Peck, kaf	Fort Peck to Garrison, kaf
	June-July	June-July
(4) 1997 Pattern	4,632	7,440
(5) 1997 Pattern + storm	5,037	8,237
(6) 1997 Pattern + storm + 10%	5,541	9,061

The June 1 forecasts in Table 2 are very comparable to the late-May preliminary forecasts in Table 3, thus they verify that the preliminary estimates provided good initial operating plans for the mainstem system of reservoirs. The June 1 operating plan was determined by both the Peak SWE + 10% (2) runoff forecast and the Peak SWE, P & T (3) runoff forecasts.

The June 1 June-July forecast for Fort Peck is 5,158 kaf (212% of normal) above Fort Peck and 8,910 kaf (200% of normal) from Fort Peck to Garrison. After further discussion of the reservoir operation plan, the June-July forecast was revised to 5,859 kaf (240% of normal) above Fort Peck and 10,353 kaf (233% of normal) from Fort Peck to Garrison, which is the Peak SWE, P & T (3) method. This forecast was used because it was based on actual mountain SWE, April-May temperatures, and May precipitation. Furthermore, it puts more stress on the already sensitive high pools in the upper three reservoirs; therefore, maximizing the reservoir release plan in order to attain greater flexibility later in the summer.

Oahe , Fort Randall & Gavins Point

Since Oahe received much greater than normal runoff in March, April and May, the June and July forecast runoff is expected to remain above normal. Fort Randall and Gavins Point runoff is expected to be normal through the remainder of the year.

Sioux City

James, Vermillion, and Big Sioux River flows continued to be higher than normal in the Gavins Point to Sioux City reach. Since May inflows were 1,603 kaf (549% of normal), inflows through the end of the year are forecast to be high. June inflows are forecast to be 1,100 kaf (385% of normal) while July inflows are forecast to be 600 kaf (275% of normal).

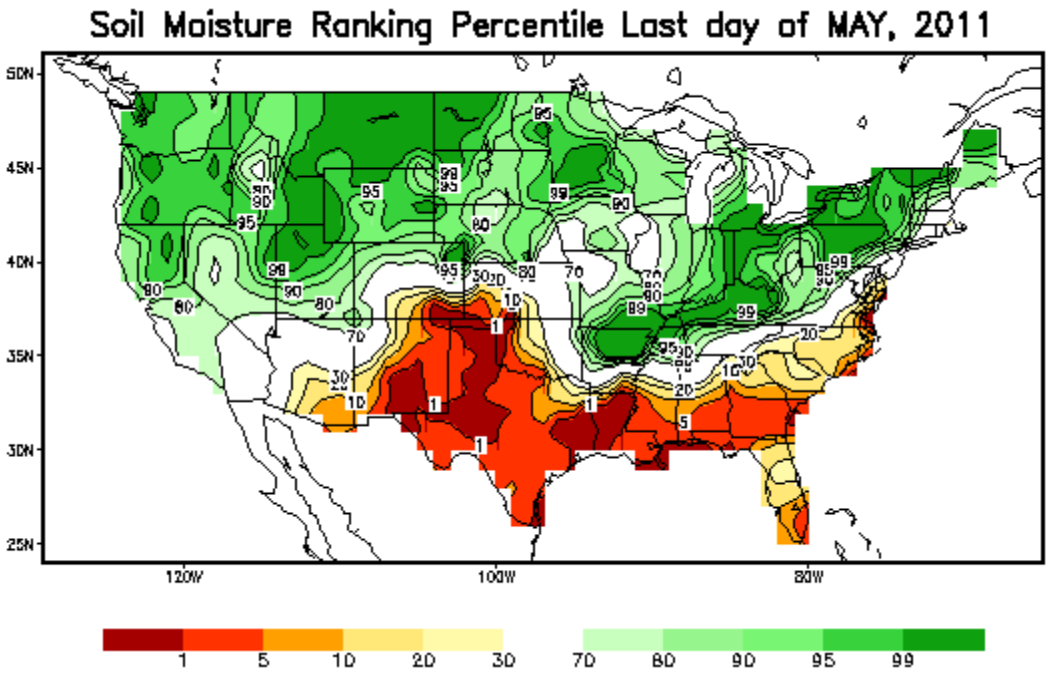

Figure 3. MAY 31, 2011 Soil Moisture Ranking Percentile.

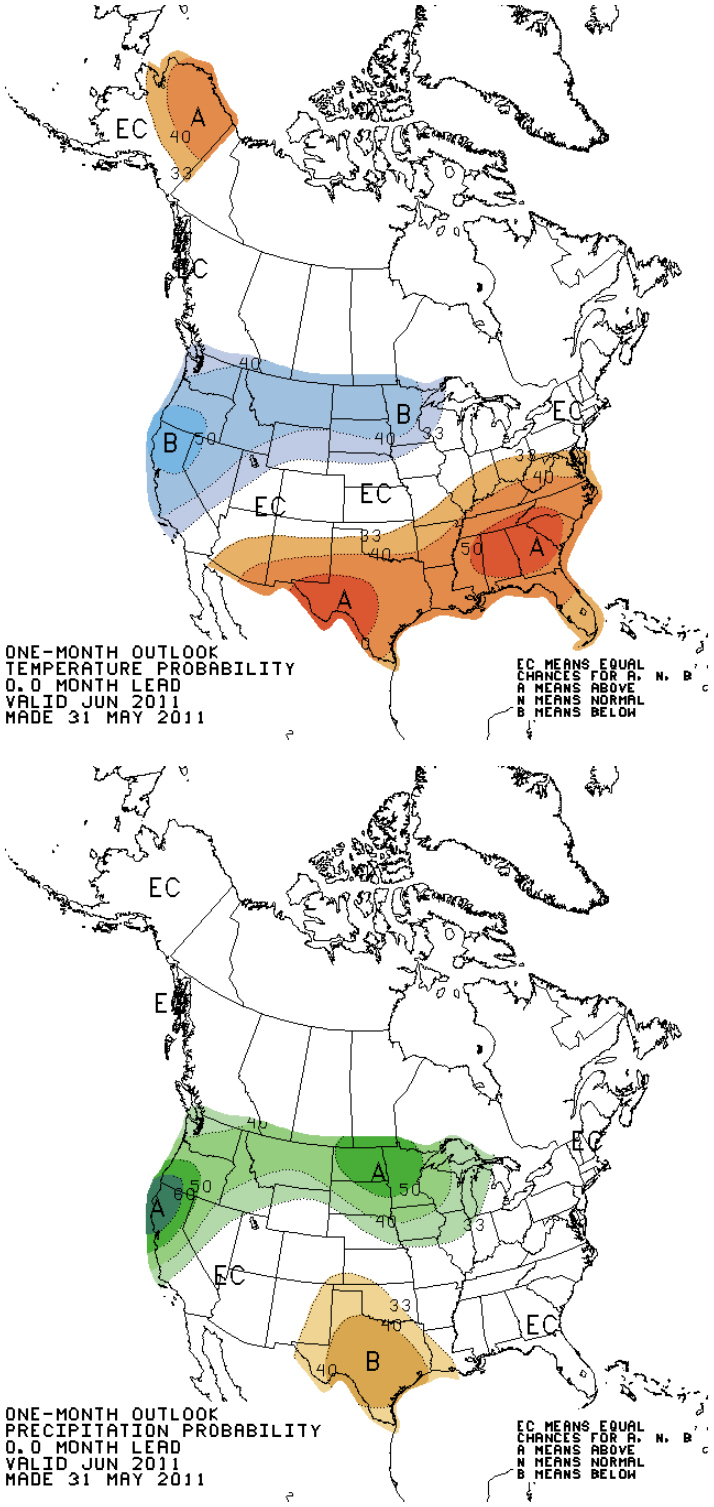

Figure 4. ~~May~~ June 2011 temperature and precipitation outlook.

July 2011 Calendar Year Runoff Forecast

2011 June Runoff

June 2011 runoff above Sioux City, IA was 13,836 KAF, 260% of normal. June inflow was the highest monthly total of all months from 1898-2011, while May 2011 (10,468 KAF) was third of all time. Prior to 2011, the highest June runoff was 9,800 KAF in 1927. June 2011 runoff above Gavins Point Dam was 12,744 KAF, 253% of normal.

June 2011 runoff:

Fort Peck – 4,035 KAF (250% of normal), and 2nd highest June of record,
Garrison – 6,467 KAF (242% of normal), and highest June/month of record,
Oahe – 1,009 KAF (239% of normal),
Fort Randall – 932 KAF (613% of normal), and highest June of record,
Gavins Point - 301 KAF (169% of normal), and
Gavins Point to Sioux City – 1,092 KAF (382% of normal), and 4th highest May of record.

Much of the inflow occurred as a result of mountain snowmelt runoff, heavy precipitation in Montana, and heavy precipitation in the Dakotas. Mountain snowmelt coupled with abundant precipitation in Montana produced high runoff volumes into Fort Peck and Garrison Reservoirs. Snowmelt runoff was overshadowed by rainfall, therefore a number of runoff peaks occurred into Fort Peck and Garrison. In the Dakotas a series of intense thunderstorms occurred from mid- to late June in the Oahe, Fort Randall, Gavins Point, and Sioux City reaches.

As of July 1, 2011 the accumulated runoff above Sioux City, IA was 42.3 MAF (261% of normal), while above Gavins Point Dam, the accumulated runoff was 35.6 MAF (240% of normal).

Hydrologic Factors

Soil Moisture Conditions

Soil moisture conditions across the upper Missouri River basin continue to be extremely wet (Figure 1). Soil moisture conditions on June 30, 2011, were in the 99th ranking percentile across a majority of Montana except for western Montana which was in the 80th to 95th ranking percentile. Western North and South Dakota were also ranked in the 99th percentile for moisture with 80th to 95th rankings in the much of the Missouri River basin from the mouth of the Platte River upstream.

Figure 2 shows changes to soil moisture anomalies from May 31 to June 27. During June, soil moisture anomalies increased by 50 to 70 mm (soil became wetter) across much of western Montana, while central and southeastern Montana and Wyoming soil moisture decreased in moisture anomaly, indicating some drying. Soil moisture anomalies increased by 50 to 80 mm from eastern North Dakota through central South Dakota into western Nebraska as a result of very heavy rains during June. Increases in soil moisture also occurred in Iowa and northern Missouri.

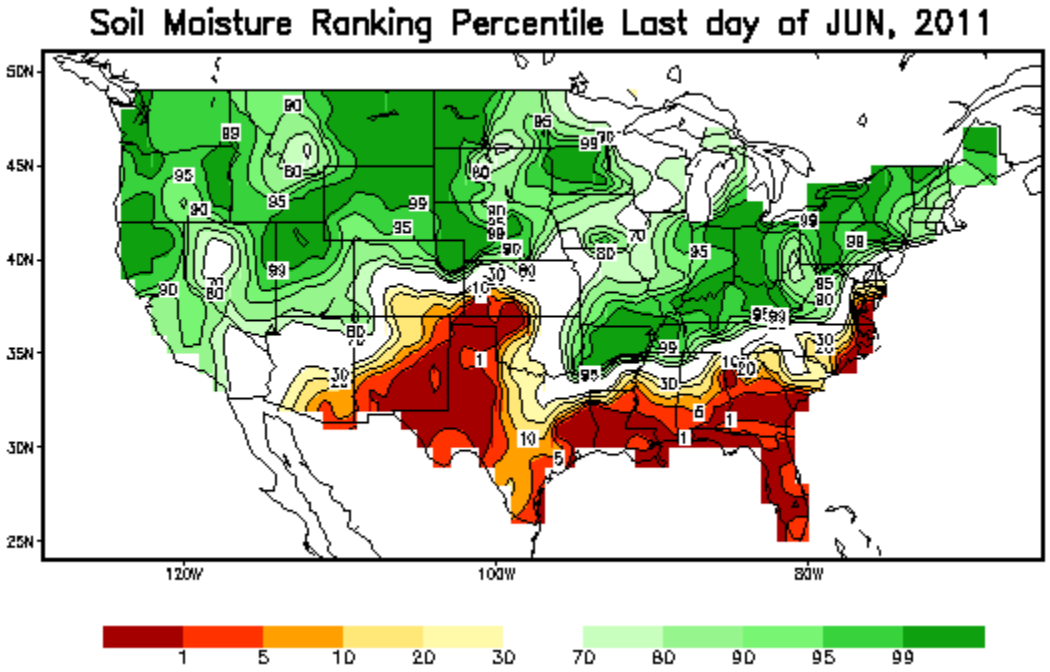

Figure 1. Soil Moisture Ranking Percentile as of June 27, 2011.

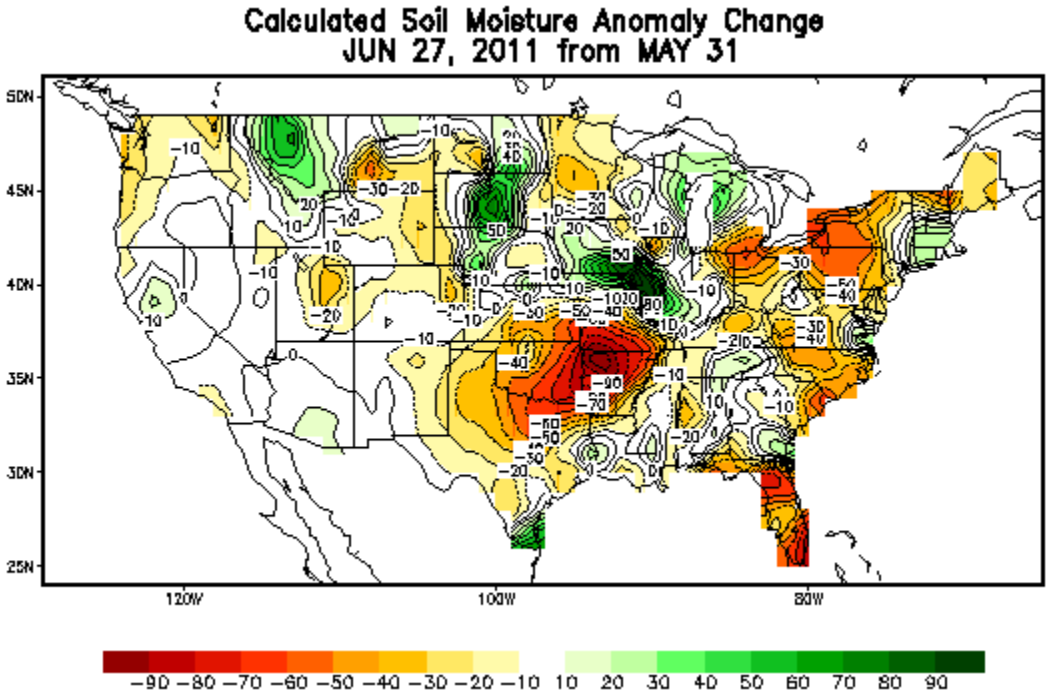

Figure 2. Soil moisture anomaly change since May 31, 2011.

June Precipitation

June rainfall continued to be well-above normal in many locations across the Missouri River Basin including northern and central Montana which received 3.0 to 6.0-plus inches, and the Dakotas, Nebraska, Iowa, northeast Kansas and the northern half of Missouri, which generally received amounts ranging from 2.5 to 6.0-plus inches. The June 2011 precipitation accumulation is shown in Figure 3. Precipitation departures are shown in Figure 4. Departures across Montana were generally greater than 1.0 inch in many locations while areas in excess of 3.0 inches occurred in the vicinity of Great Falls, MT, and in much of northeast Montana. Departures greater than 3.0 inches occurred in an area extending from central North Dakota through northern Nebraska. In addition some areas in Iowa and northern Missouri received more than 3.0 inches above normal. Point rainfall amounts in June include: 3.13 inches in Miles City, MT; 5.13 inches in Glasgow, MT; 2.55 inches in Great Falls, MT, 4.22 inches in Lewistown, MT; 3.94 inches in Helena, MT; 5.98 inches in Wolf Point, MT; 1.67 inches in Sheridan, WY; 0.55 inches in Lander, WY; 3.19 inches in Bismarck, ND; 5.67 inches in Jamestown, ND; 4.69 inches in Aberdeen, SD; 5.07 inches in Mobridge, SD; 7.73 inches in Pierre, SD; 4.26 inches in Sioux Falls, SD; and 5.03 inches in Sioux City, IA.

May Precipitation

A monumental amount of precipitation occurred throughout the upper Missouri River Basin in May (Figure 5). In Montana and northern Wyoming, a large area received greater than 10 inches of rainfall. Billings, MT received 9.54 inches (7.06 inches above normal), Glasgow, MT received 6.97 inches (5.25 inches above normal), Lander, WY received 6.77 inches (4.35 inches above normal), and Zortman, MT received 16.44 inches (more than 14 inches above normal). Also areas near Bighorn Reservoir (Yellowtail Dam) received greater than 15 inches during the month. Departures from normal are shown in Figure 6.

This weather pattern was influenced by a mean trough of low pressure over the Pacific Northwest, which although a normal occurrence during spring, it was particularly strong in May 2011. The trough guided a number of low pressure systems through the area causing repeated precipitation in the Northern Rockies and Plains.

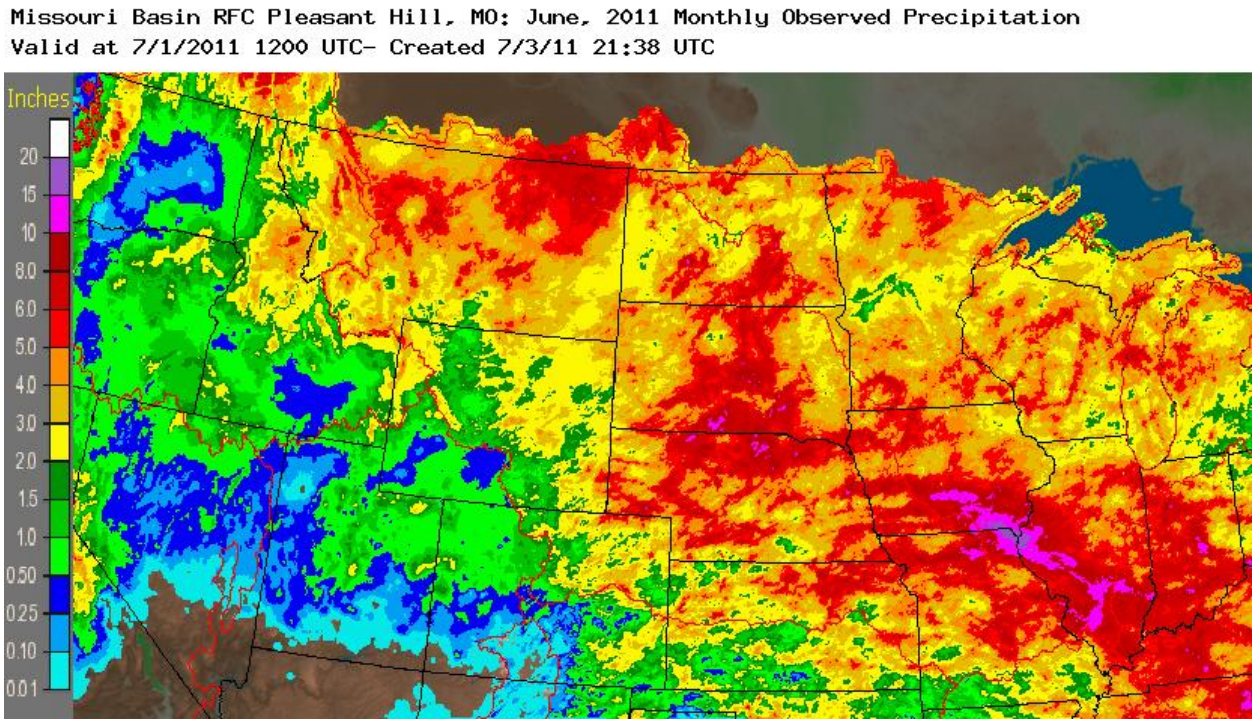

Figure 3. June 2011 precipitation in the Missouri River Basin. Source: NOAA.

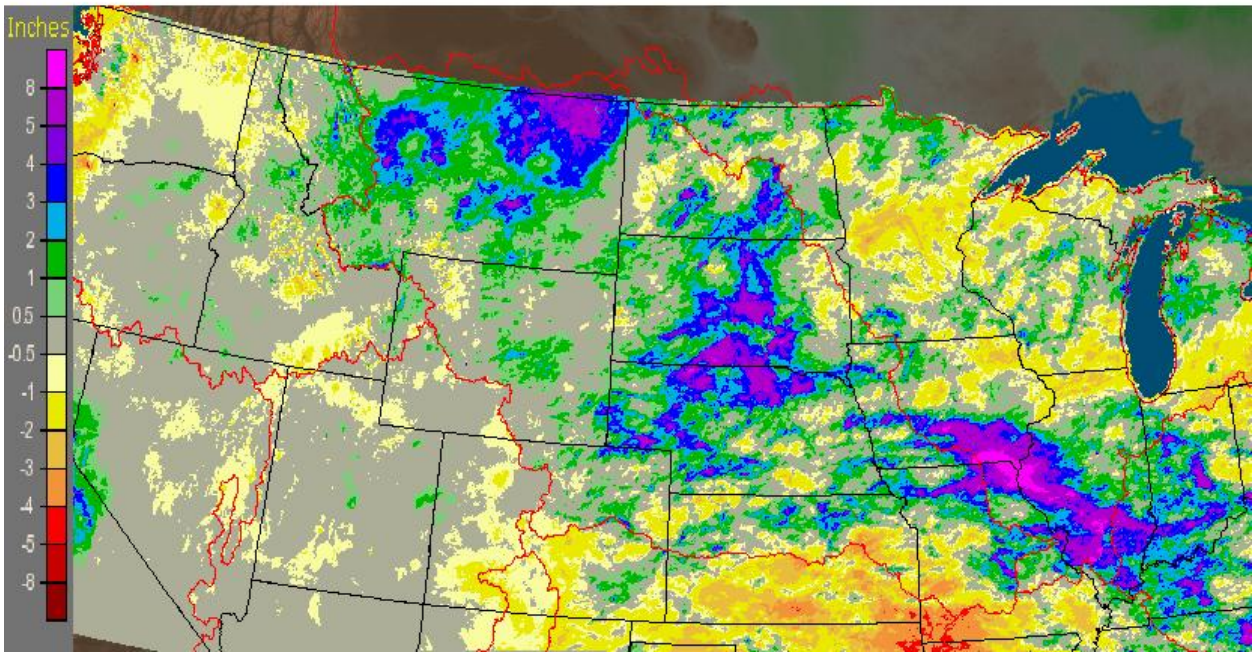

Figure 4. June 2011 precipitation departures in the Missouri River Basin. Source: NOAA.

Missouri Basin RFC Pleasant Hill, MO: May, 2011 Monthly Observed Precipitation
Valid at 6/1/2011 1200 UTC- Created 6/2/11 17:40 UTC

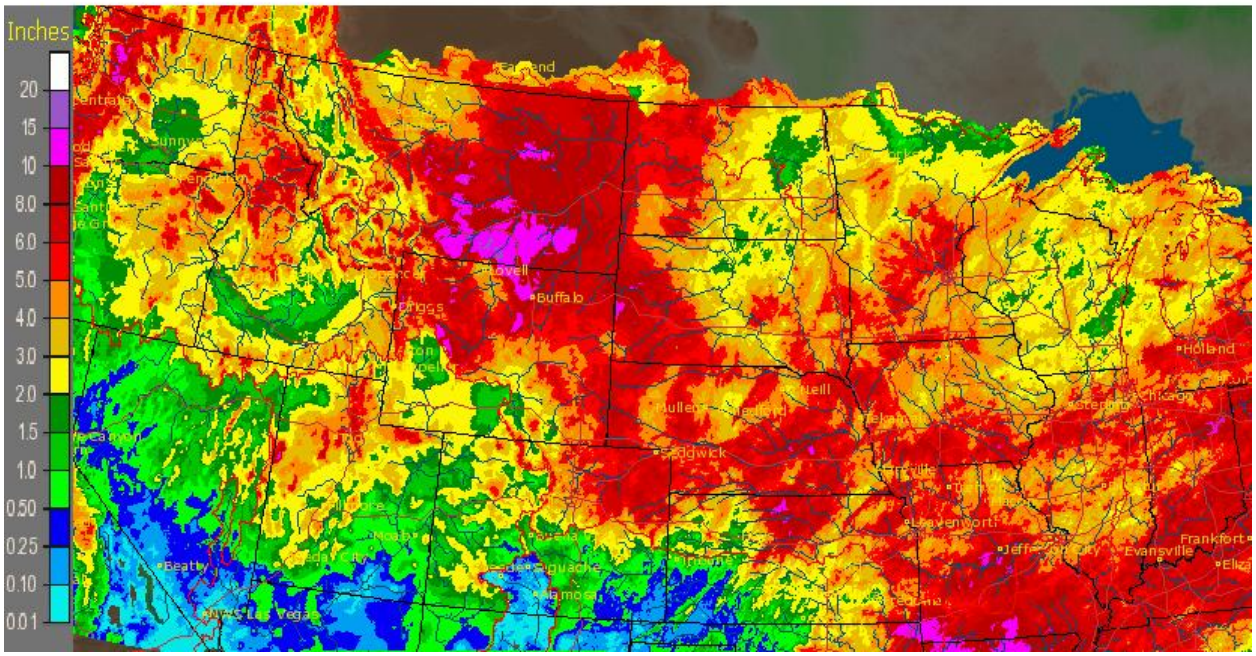

Figure 5. May 2011 precipitation in the Missouri River Basin. Source: NOAA.

Missouri Basin RFC Pleasant Hill, MO: May, 2011 Monthly Departure from Normal Precipitation
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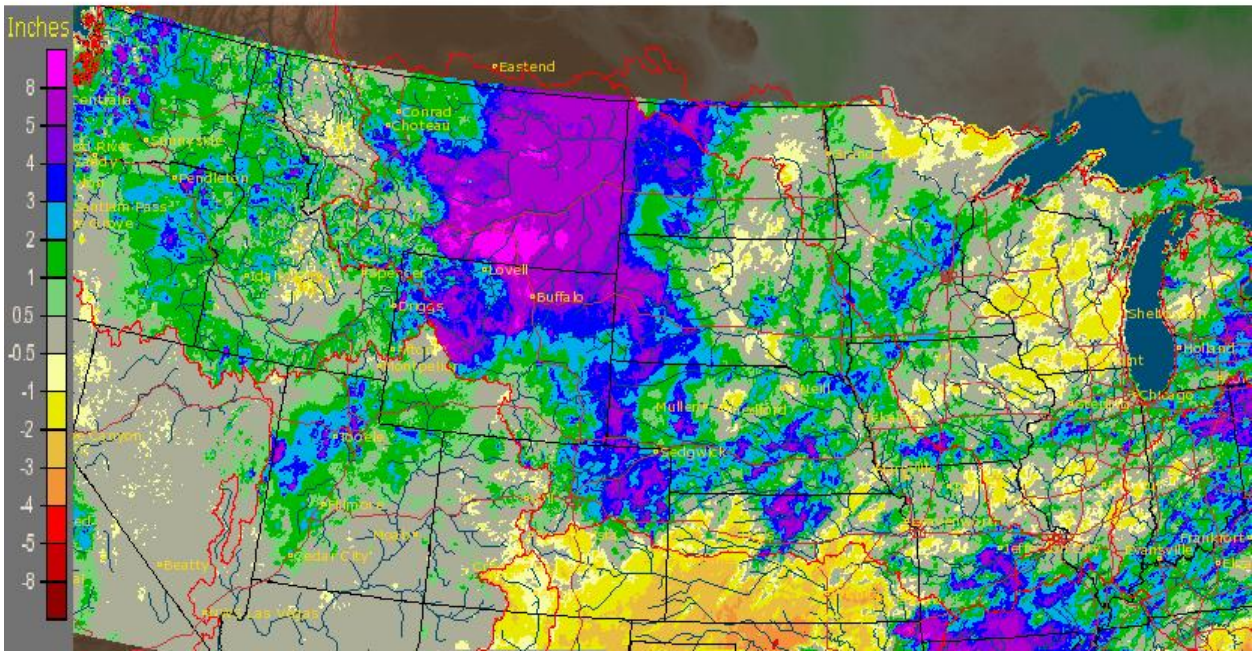

Figure 6. May 2011 precipitation departures in the Missouri River Basin. Source: NOAA.

Mountain Snow Pack

Mountain snowpack is the primary factor used to predict May-July natural runoff volumes in the Fort Peck and Fort Peck to Garrison reaches. Greater than average mountain snow accumulations are usually associated with greater than average May-July runoff volumes, especially when greater than average runoff and snow accumulations occur in successive years.

Mountain snowpack as of March 31, 2011 was 116% of normal above Fort Peck and 112% of normal in the Fort Peck to Garrison reach. By April 15, 2011, the average date of the mountain snow accumulation, snowpack above Fort Peck rose to 126% of normal while snowpack between Fort Peck and Garrison rose to 121% of normal. During the final 15 days of April, mountain snow continued to accumulate, and on May 1, 2011, the mountain snow accumulations above Fort Peck and from Fort Peck to Garrison were 153 and 141% of the May 1 normal, respectively. As a percent of peak accumulation, which usually occurs on April 15, snow peaked at 141% of normal peak above Fort Peck and 136% of normal peak between Fort Peck and Garrison on May 2, 1011. Although the mountain snowpack has declined May 2, continued accumulations due to persistent snowfall and cooler than normal temperatures slowed mountain snowmelt.

As of 1 July 2011, 26% of the normal peak accumulation existed above Fort Peck, and 26% of the normal peak accumulation existed in the Fort Peck to Garrison reach. Normally less than 3% of peak accumulation remains on July 1 above Fort Peck, and less than 6% of peak accumulation remains between Fort Peck and Garrison. As a percent of the 2 May 2011 peak accumulation, 18% remained above Fort Peck on 1 July 2011, and 19% remained between Fort Peck and Garrison on 1 July 2011.

Table 1. Mountain snowpack accumulation as a percent of normal.

Date	Above Fort Peck	Fort Peck to Garrison
February 28, 2011	110	107
March 31, 2011	116	112
April 15, 2011	126	121
May 1, 2011	153	141
May 2, 2011 % of Average Peak	141	136
June 1, 2011 % of Average Peak	104	127
June 24, 2011 % of Average Peak	47	51
July 1 (Jun 30), 2011 % of Average Peak	26	26

In order to forecast remaining runoff in July based on snow accumulation, the percent of peak SWE accumulation as of June 24 was used to account for water that had not reached the reservoirs. From the Northern Rocky Mountains the travel time of melted snow is approximately 6 to 7 days through the Missouri and Yellowstone Rivers until it reaches Fort Peck and Garrison. Thus on 24 June 2011 47% of the normal peak accumulation existed in snowpack above Fort Peck and 51% of the normal peak accumulation existed in snowpack on 24 June 2011 between Fort Peck and Garrison.

Climate Outlook

During the first week of July a ridge of high pressure in the West will continue to keep conditions dry and warm in the Missouri River Basin with some occasional afternoon and evening thunderstorms with the passage of any frontal systems along the ridge. Following this first week, the ridge may break down slightly, and increase chances of convective precipitation across most of the basin. This type of precipitation pattern is not driven by large low pressure systems, therefore precipitation will be locally heavy and could cause rises in tributaries, but not the basinwide impacts that occurred in May and early June. During the second week of July the probability of precipitation is above normal for most of the basin with the exception of western Montana where probabilities are normal to below normal (Figures 7). This precipitation pattern will continue into at least mid month based on the CPC extended precipitation outlook. Furthermore according to the CPC July outlook (Figure 8) and the July-August-September three-month outlook (Figure 9), precipitation probabilities will continue to be above normal in the Northern Plains.

Temperatures during the first week of July in the West are expected to be above normal extending into western Montana and western Wyoming, with higher probabilities of colder than normal temperatures in the eastern Dakotas, northeast Nebraska and Iowa. During the second week of July (Figure 7) expect cooler than normal temperatures regressing westward into Wyoming and Montana, but above normal temperatures in northwest Montana. During the remainder of July (Figure 8) cooler than normal temperatures are likely to prevail in the Northern Plains and Northern Rocky Mountains. A similar trend is also expected in August and September (Figure 9).

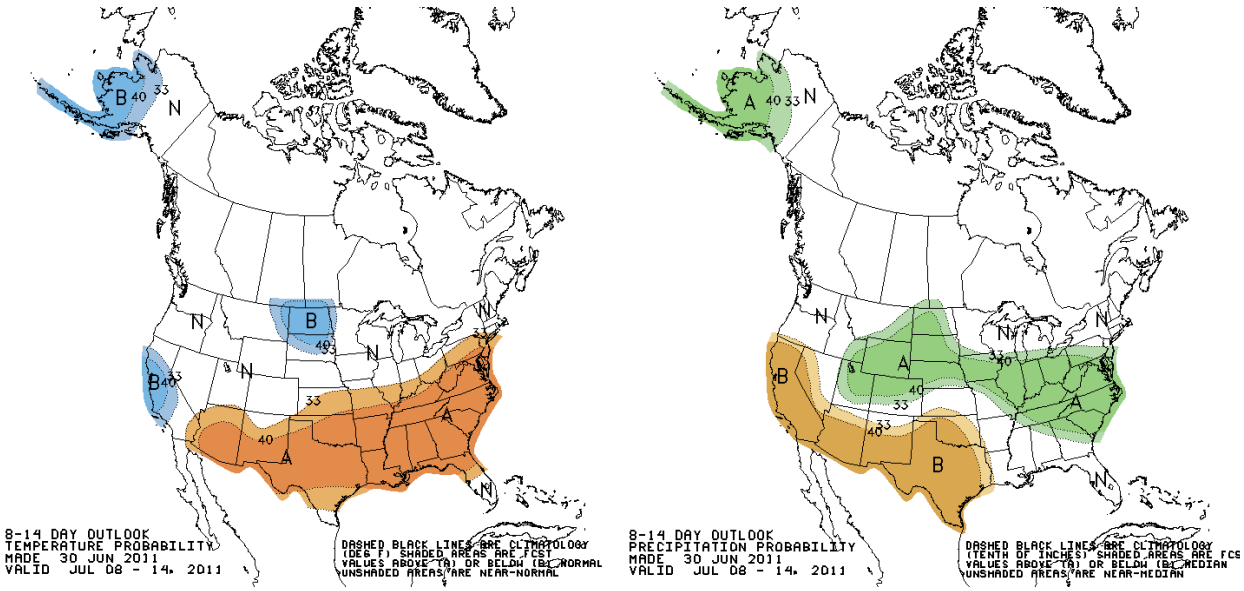

Figure 7. CPC 8-14 day temperature and precipitation outlooks.

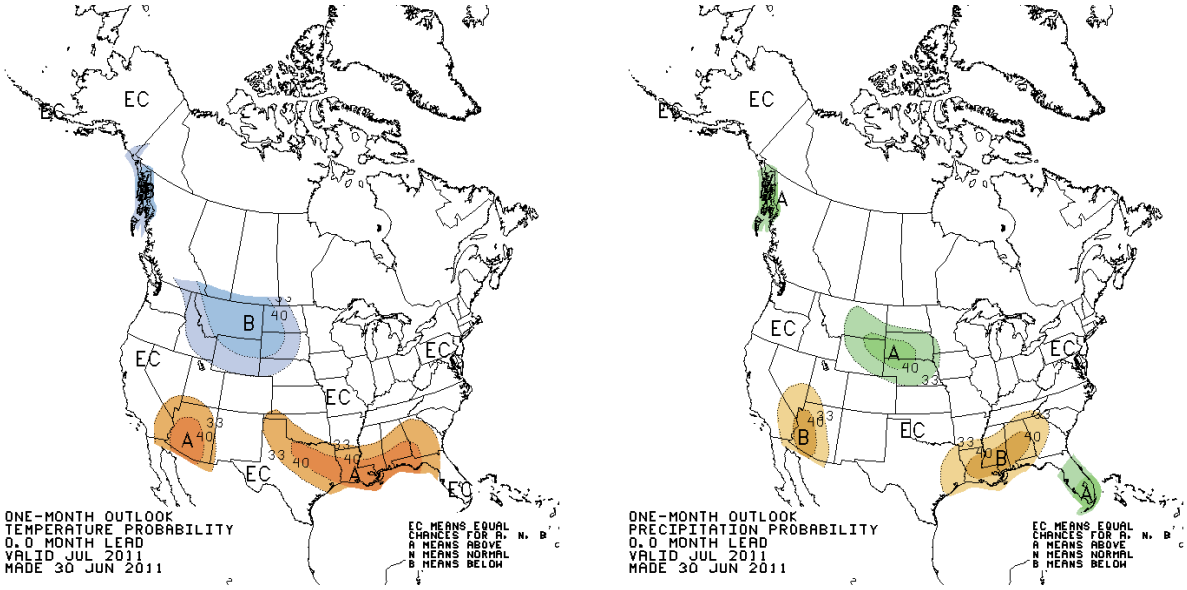

Figure 8. CPC July 2011 temperature and precipitation outlooks.

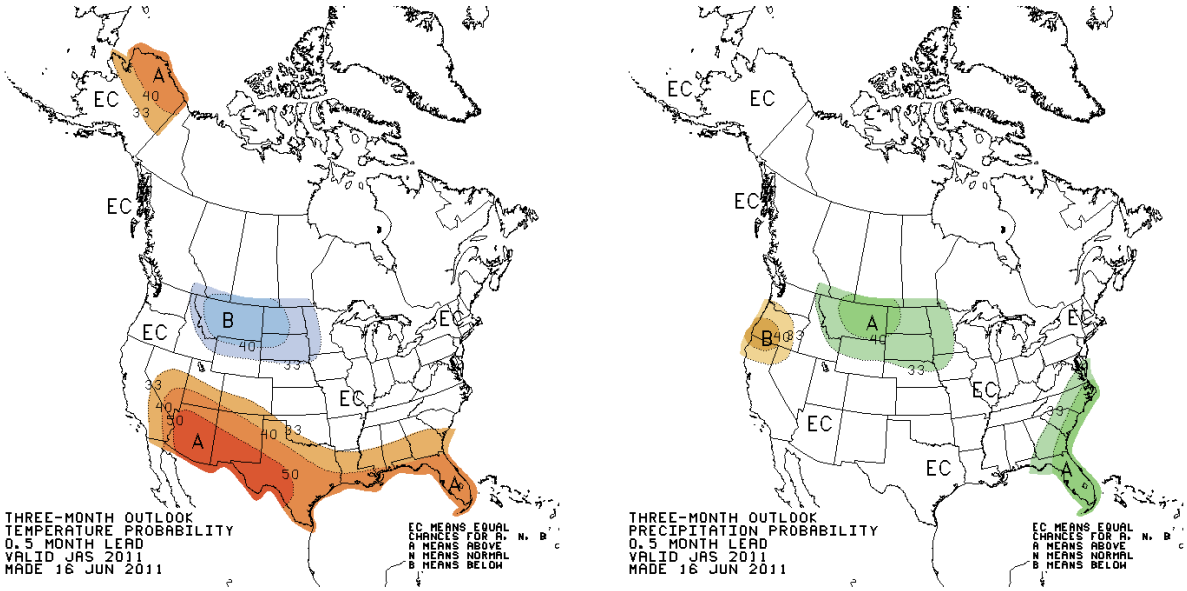

Figure 9. July 2011 temperature and precipitation outlook.

Summary of Factors

Soil moisture conditions continue to rank in the 90th to 99th percentile over much of the upper Missouri River Basin. Existing high streamflows caused by abundant antecedent precipitation in May and June and a high volume of snowmelt runoff will continue to maintain streamflows at higher levels during the month of July.

Although end of June conditions have give the basin a respite from the above normal precipitation and below normal temperatures, CPC predictions indicate that wetter than normal precipitation patterns will continue in July, August and September in concert with below normal temperatures. The

combination of all streamflow, soil moisture, and weather/climate factors indicate that above normal runoff will continue at least into July for many areas even with normal precipitation. The Upper Missouri River basin is very likely to receive above normal runoff in August and September.

July 2011 Calendar Year Runoff Forecast

The overall calendar year 2011 runoff forecast is 57.7 MAF (233% of normal) above Sioux City, IA, and 48.7 MAF (214% of normal) above Gavins Point. The increase above the June 1 forecast (54.6 MAF above Sioux City and 46.2 MAF above Gavins Point) is due in part to the additional 1.7 MAF that occurred in excess of the forecasted runoff in June. Furthermore very high tributary streamflows, which will remain high throughout the next two months as a result of very wet hydrologic conditions, contribute to the forecast increase.

Soil moisture conditions continue to rank in the 90th to 99th percentile over much of the upper Missouri River Basin. Although end-of-June conditions have give the basin a respite from the above normal precipitation and below normal temperatures, CPC predictions indicate that wetter than normal precipitation patterns will continue in July, and possibly August and September in concert with below normal temperatures. The combination of these factors indicates that above normal runoff will continue at least into July for many areas even with normal precipitation.

Fort Peck

On June 1, the forecast was made for Fort Peck using the Peak SWE, Precipitation & Temperature equation developed in RCC Technical Report D-96: Long Term Runoff Forecasting. This forecast predicts May-June-July runoff by a regression equation based on the peak SWE accumulation, May-June-July precipitation as a percent of average at seven observation sites, and April-May-June maximum daily temperature as a percent of average at three observation sites. The June-July volume was determined by assuming 75% of the three-month volume would occur in June and July based on the fact that 75% of the peak mountain SWE accumulation had not melted. This forecast proved to be relatively accurate as 4,035 KAF of runoff occurred above Fort Peck compared to the 3,906 KAF forecast.

As of July 1, 26% of the normal peak SWE accumulation remained above Fort Peck, or 18% of the 2 May 2011 peak accumulation remained. Historically, 23.3% of the May-July runoff occurs above Fort Peck in July. Accumulated precipitation in June was slightly greater than forecast, July precipitation is forecast to be above normal, and June temperatures were slightly lower than normal, resulting in about a 224 KAF increase in the May-July Fort Peck runoff forecast according to the Peak SWE-P-T equation. Part of this increased was realized in June. **Since the runoff distribution through May and June coincided with the historic runoff disbribution, the forecast runoff for July was calculated to be 1,872 KAF which is 23.3% of the newly calculated Peak SWE-P-T three-month runoff volume.** This forecast runoff volume accounts for continued increased chances of precipitation and existing wet conditions manifested in much higher than normal streamflows. The new (July 1) forecast July volume is 229% of the July normal runoff, but 81 KAF less than the June 1 forecast.

Garrison

On June 1, the forecast was made for Garrison using the Peak SWE-P-T equation. The June-July volume was determined by assuming 95% of the three-month volume would occur in June and July based on the fact that 95% of the peak mountain SWE accumulation had not melted. This forecast also proved to be relatively accurate as 6,467 KAF of runoff occurred between Fort Peck and Garrison compared to the 6,212 KAF forecast, giving us reason to believe the July forecast will be a good estimate. Since the observed runoff in June was 255 KAF more than forecast, plus tributary streamflows are expected to recede in July, the new July forecast will be reduced slightly.

As of July 1, 26% of the normal peak SWE accumulation remained above Fort Peck, or 19% of the 2 May 2011 peak accumulation remained. Historically, 31% of the May-July runoff occurs in the Garrison reach in July. Remaining mountain SWE on June 24 as a percent of the 2 May 2011 peak SWE accumulation was 38%. The June 24 date was examined because the travel time for melting mountain snow to Garrison Reservoir is about 6 days.

Accumulated precipitation in June was slightly less than forecast yet 122% of normal, July precipitation is forecast to be above normal, and June temperatures were slightly lower than normal. Using the Peak SWE-P-T equation, the resulting May-July Garrison runoff forecast was slightly less than the June 1 forecast, which is a reflection of less than expected June precipitation. **Using the percent of runoff remaining (38%) as indicated by the June 24 mountain SWE, a new July runoff volume of 3,928 KAF was computed for Garrison.** The forecast runoff (3,928 KAF) is less than the previous forecast runoff (4,141 KAF) because more runoff occurred in June than anticipated; however the total anticipated May-July runoff volume for Garrison is more than the previous June 1 forecast. The new forecast July volume is 221% of the July normal runoff.

The Fort Peck and Garrison combined June-July runoff forecast is 16.3 MAF, 0.1 MAF greater than the former 16.2 MAF. Expected wetter than normal conditions will keep August and September inflow volumes above normal into both reservoirs.

Oahe , Fort Randall & Gavins Point

Oahe and Fort Randall received much greater than forecast and normal runoff volumes in June as a result of intense rain that occurred over these basins in mid-June. These higher streamflows combined with a continuation of the expected wet conditions will produce higher than normal runoff volumes from July through September. The Gavins Point inflow volume in July will be slightly greater than normal, but is expected to return to normal in September.

Sioux City

Since James, Vermillion, and Big Sioux River flows continued to be much higher than normal in the Gavins Point to Sioux City reach, it is expected that the inflow volume for the remainder of the calendar year will be well above normal under normal rainfall conditions. The July incremental inflow volume is expected to be 980 kaf (450% of normal). It was determined by receding the end of month daily flow

values for the James, Vermillion, and Big Sioux Rivers through 31 July 2011, then summing the volumes. The inflow volume in August is expected to be about 550 kaf (420% of normal), while September through December will also be above normal.

Detailed narratives for Aug – Dec 2011 were not developed.