Upper Missouri River Basin
March 2012 Calendar Year Runoff Forecast
April 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.

March 2012 Runoff

March 2012 Missouri River runoff was 2,246 KAF (78% of normal) above Sioux City, and 1,927 KAF (75% of normal) above Gavins Point. In January and February very warm temperatures caused a premature ice breakup on rivers and tributaries, and soil frost thawed earlier than usual allowing more runoff to occur in January and February than would normally occur during a year with normal temperatures. As a result, March runoff did not benefit from the spring thaw.

In March, record high temperatures across the upper basin melted the very light plains snowpack early in March. Throughout the month precipitation was less than 50% of normal across the plains, resulting in lower than normal runoff volumes in all reaches except the Sioux City reach. The calendar year runoff summation above Sioux City as of April 1, 2012 was 4,871 KAF (4.9 MAF) which is 103% of normal.

2012 Calendar Year Forecast Synopsis

The April 1 forecast for 2012 runoff above Sioux City, IA is **23.4 MAF** (94% of normal). The April 1 forecast for runoff above Gavins Point Dam is **21.0 MAF** (92% of normal). This is a decrease from the March 1 forecast due to much lower than normal runoff from plains snowmelt, a slight decrease in the mountain snowpack, much warmer than normal temperatures and below normal precipitation. Due to the amount of variability in precipitation that can occur over the next 9 months, the range of expected inflow is quite large and ranges from the 30.6 MAF upper basic forecast to the 17.2 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 9 months are being forecasted for this April 1 forecast (3 months observed/9 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 9 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. According to the Climate Prediction Center (CPC) La Niña conditions in the equatorial Pacific Ocean still existed as of April 2; however, La Niña has been weakening.

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 2012 temperature pattern (warmer than normal) has not been typical of the expected temperature pattern during a La Niña episode. Plains snowfall was well-below normal; however, some tributary basins in the upper Missouri River basin experienced above normal precipitation.**

According to the NOAA Climate Prediction Center, La Niña is expected to transition to ENSO-neutral conditions by the end of April 2012. During ENSO-neutral conditions, there is not a strong climate signature associated with these conditions that would suggest if weather in the Missouri River basin will be wetter or drier and warmer or cooler; however, because the strength of impacts in the United States is not necessarily related to the exact strength of ENSO, CPC expects La Niña impacts to continue even as the episode weakens.

Precipitation

The March CPC precipitation outlook called for equal chances of precipitation in much of the northern plains with increased chances for precipitation in western Montana, the northwest tip of Wyoming, and eastern North Dakota, while there were reduced chances of precipitation in southwestern portions of the Missouri River basin. During March observed precipitation (see Figure 1) was dominated by areas of less than 50% of normal precipitation over vast portions of the basin including all of South Dakota, Nebraska, most of Wyoming, North Dakota, eastern Montana and northern Kansas. Areas that received above normal precipitation include tributary areas to the Missouri downstream of Nebraska City, NE,

the Rocky Mountains in western Montana, a small part of the Bighorn River basin, and portions of central and north central Montana. Very dry areas including parts of northeast Colorado, western Nebraska, southern and eastern Wyoming, western South and North Dakota and eastern Montana received less than 25% of normal March precipitation.

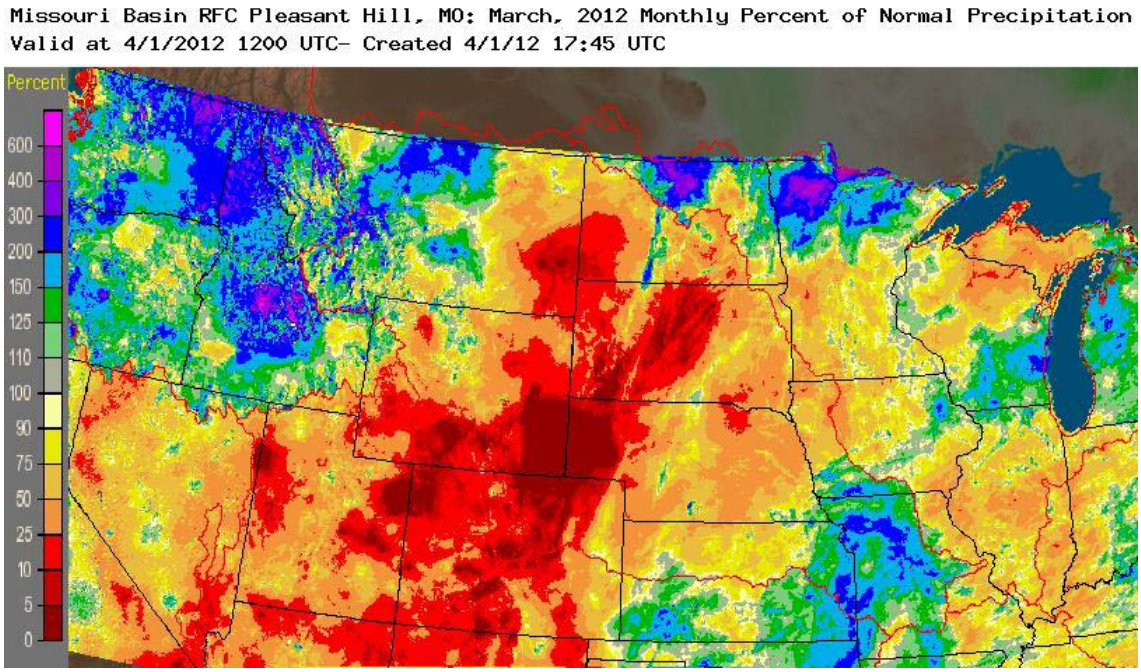

Figure 1. March 2012 Percent of Normal Precipitation. Source: National Weather Service.

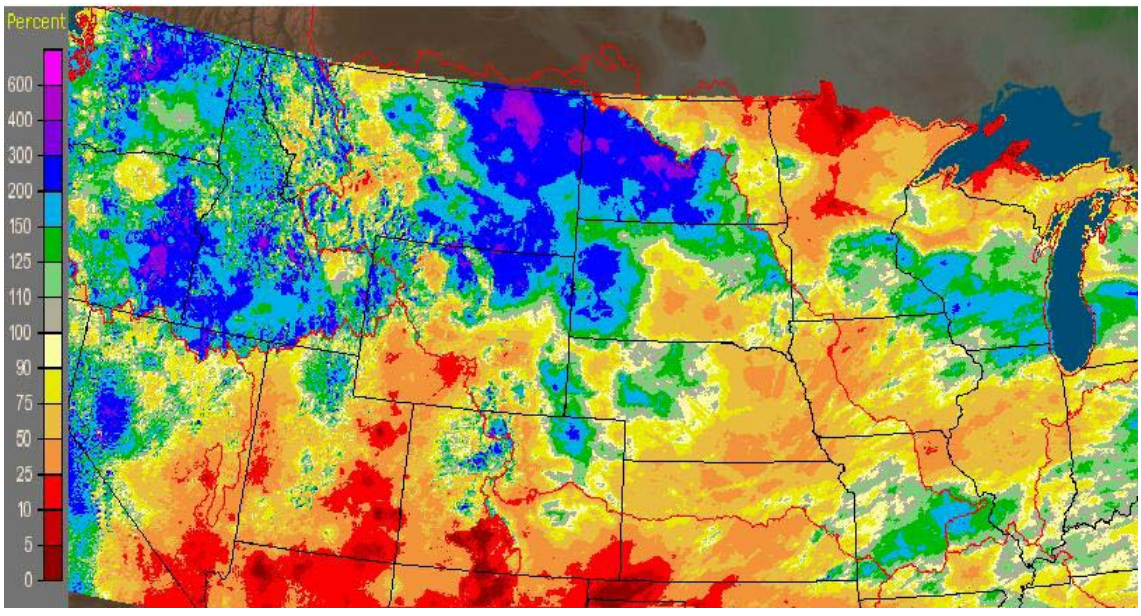

Figure 2. March 2011 Percent of Normal Precipitation. Source: National Weather Service.

In comparison, March 2011 precipitation (see Figure 2) was much wetter in the upper basin, particularly in northern Wyoming eastern Montana, western South Dakota, and much of North Dakota with departures of over 150% of normal and some areas receiving over 200% of normal.

Over the 90-day period (January-February-March) in Figure 3, the Missouri River basin has experienced both above and below normal precipitation. Most areas of Montana have received above normal precipitation while most other states are dominated by areas of below normal precipitation. An area of greater than 125% of normal precipitation covers a large portion of eastern South Dakota; however, this occurred as a result of one large winter storm. The Missouri River basin below Omaha, NE, has received nearly 125% of normal precipitation during the past three months.

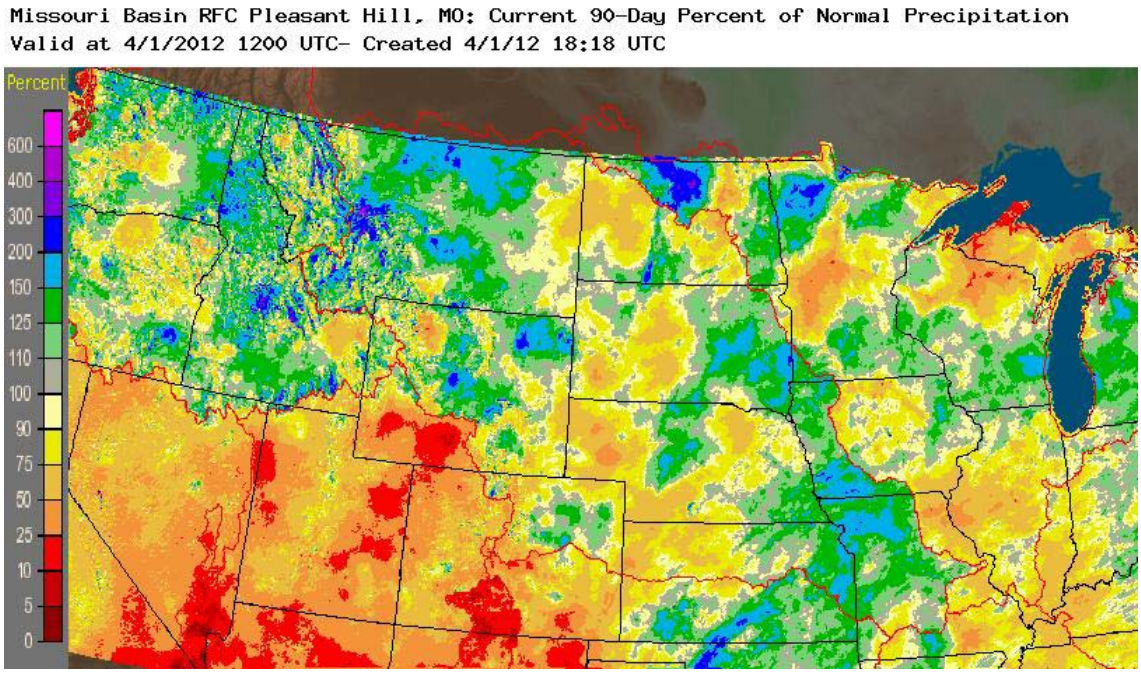

Figure 3. January-February-March 2012 Percent of Normal Precipitation. Source: National Weather Service.

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

Temperature

The March Climate Prediction Center temperature outlook called for an increased probability for 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 March forecast discussion).

Average temperatures throughout the entire Missouri River basin were well above normal in March 2012 (Figure 4). Temperature anomalies ranged from 8 to 16 degrees F above normal in the plains, while in the mountains temperatures were anywhere from 2 to 9 degrees above normal. Record high monthly March temperatures occurred in Billings, MT; Miles City, MT; Lander, WY; Rapid City, SD; Sioux

Falls, SD; Sioux City, IA and Omaha, NE. This very warm weather pattern has occurred due to a number of factors including strong southerly winds, a jet stream pattern that has locked cold air far to the north of the central U.S., and a persistent positive North Atlantic Oscillation, which favors warmth in the eastern and central U.S. These warm temperatures have been a major driving factor that has dried surface soils and reduced runoff to below normal volumes in March.

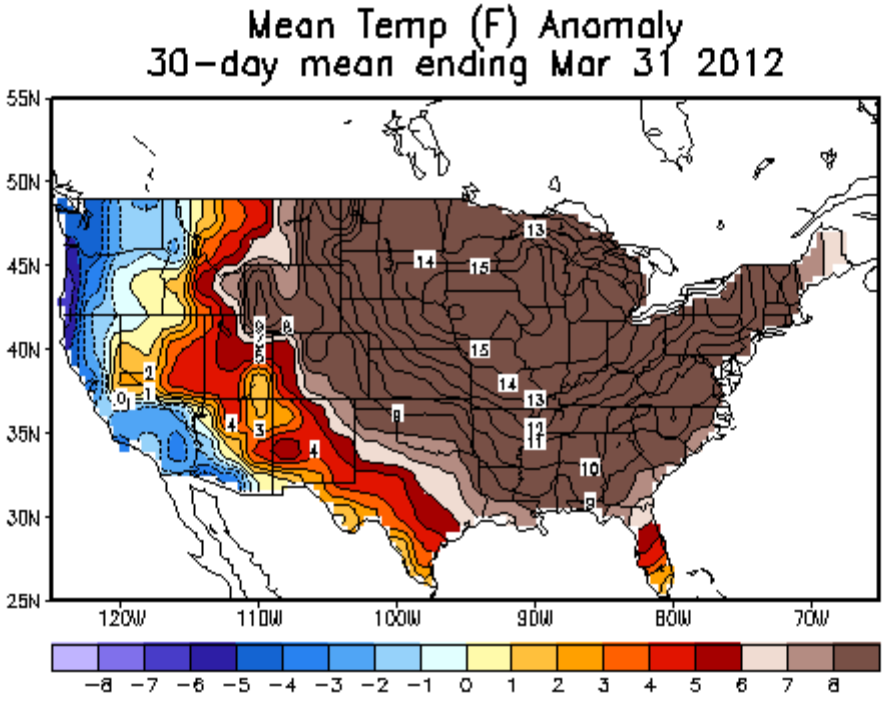

Figure 4. 30-day temperature anomaly (deg F) ending 31 Mar 2012.

Ninety-day (90-day) temperature departures ending on March 31, 2012 are shown in Figure 5. During the time period from January 1, 2012 to March 31, 2012, average daily temperatures have ranged from 3 to 6 degrees F above normal in the mountain regions of the upper Missouri River basin, and 4 to 10 degrees F above normal in the plains region of the upper Missouri River basin. In contrast, 90-day temperatures through March 1, 2011 (Figure 6) were 2 to 4 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.

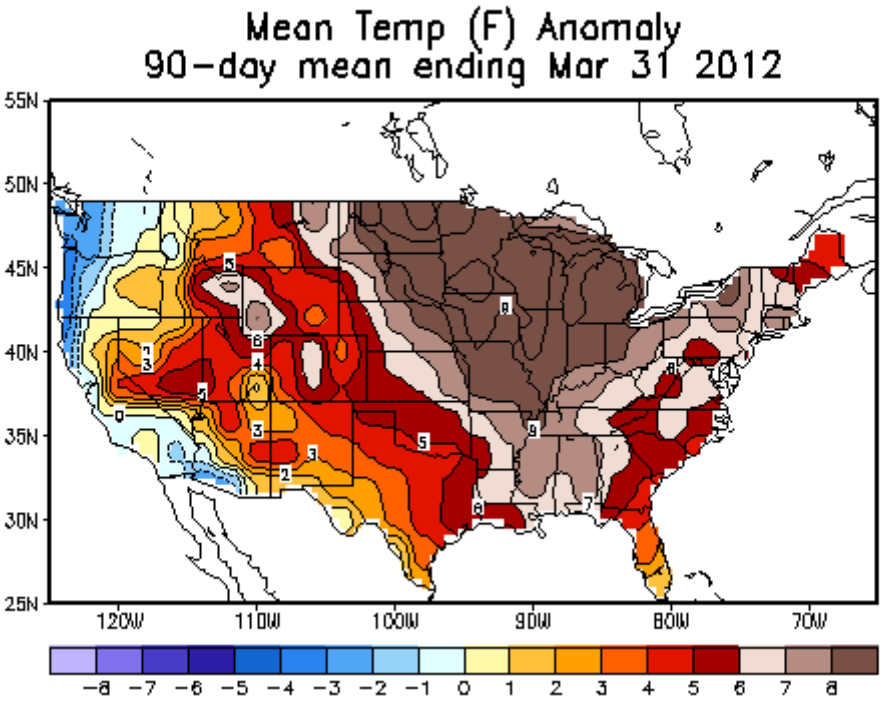

Figure 5. 90-day temperature anomaly (deg F) ending 31 Mar 2012.

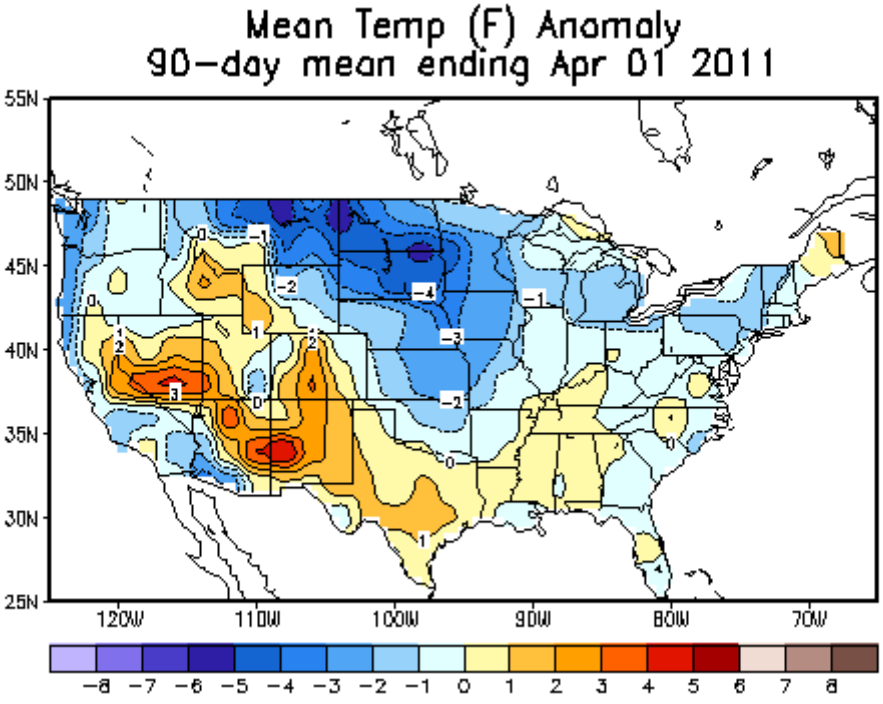

Figure 6. 90-day temperature anomaly (deg F) ending 1 Apr 2011.

Soil Moisture Conditions

Two independent assessments of soil moisture are provided below which include the CPC soil moisture percentile ranking (Figure 7) and the Variable Infiltration Capacity (VIC) soil moisture percentile ranking (Figure 8). The CPC soil moisture percentile ranking (Figure 7) shows very dry areas in northeast Nebraska, northwest Iowa and eastern South Dakota, with developing area of dry soils in the Dakotas. In the Rocky Mountains the CPC map shows areas of wet soil moisture conditions ranging from the 70 to 99th percentile ranking. These conditions have developed over the last two months due to some early low elevation mountain snowmelt according to local observations. The VIC model (Figure 8) shows the same dry in eastern South Dakota, northeast Nebraska and northwest Iowa as well as additional dry areas in the western Dakotas, western Nebraska, eastern Montana, and eastern Wyoming. In central and western Montana and western Wyoming, soil moisture conditions are slightly wetter than the median condition (30th-70th percentile) in some areas, but not nearly as wet as the CPC map would indicate.

In contrast to March 2012 conditions, March 2011 soil moisture conditions were much wetter in the plains. Soil moisture percentile rankings (Figure 9) 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.

Local observations of soil moisture are provided in the Field Verification of Conditions section.

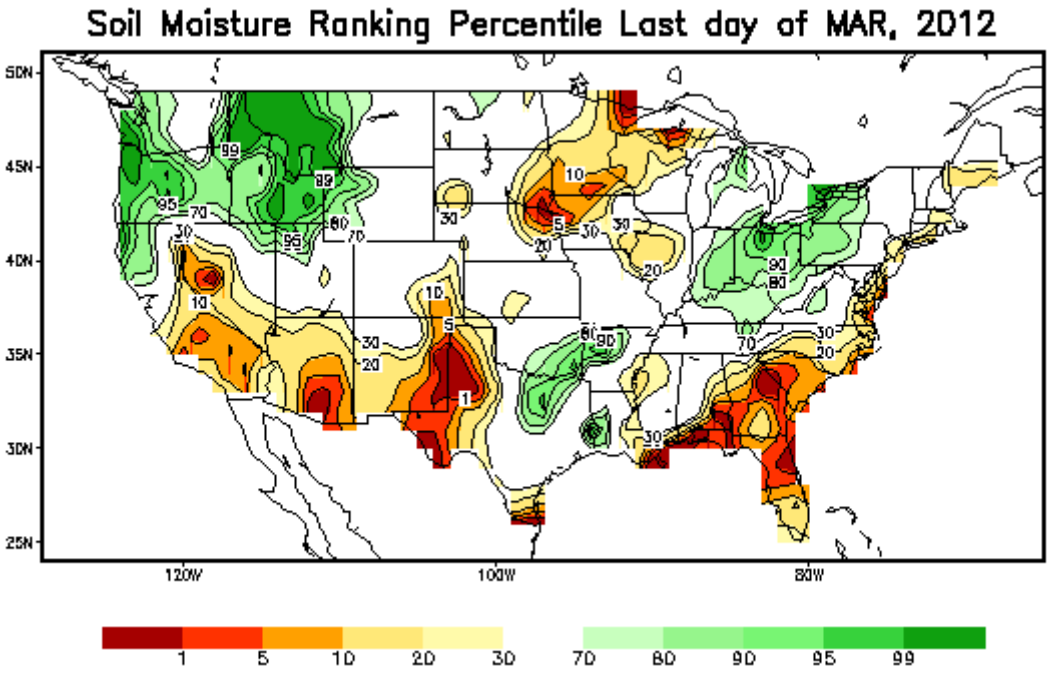

Figure 7. Calculated Soil Moisture Ranking Percentile on the last day of March 2012. Source: Climate Prediction Center. http://www.cpc.ncep.noaa.gov/cgi-bin/US_Soil-Moisture-Monthly.sh#

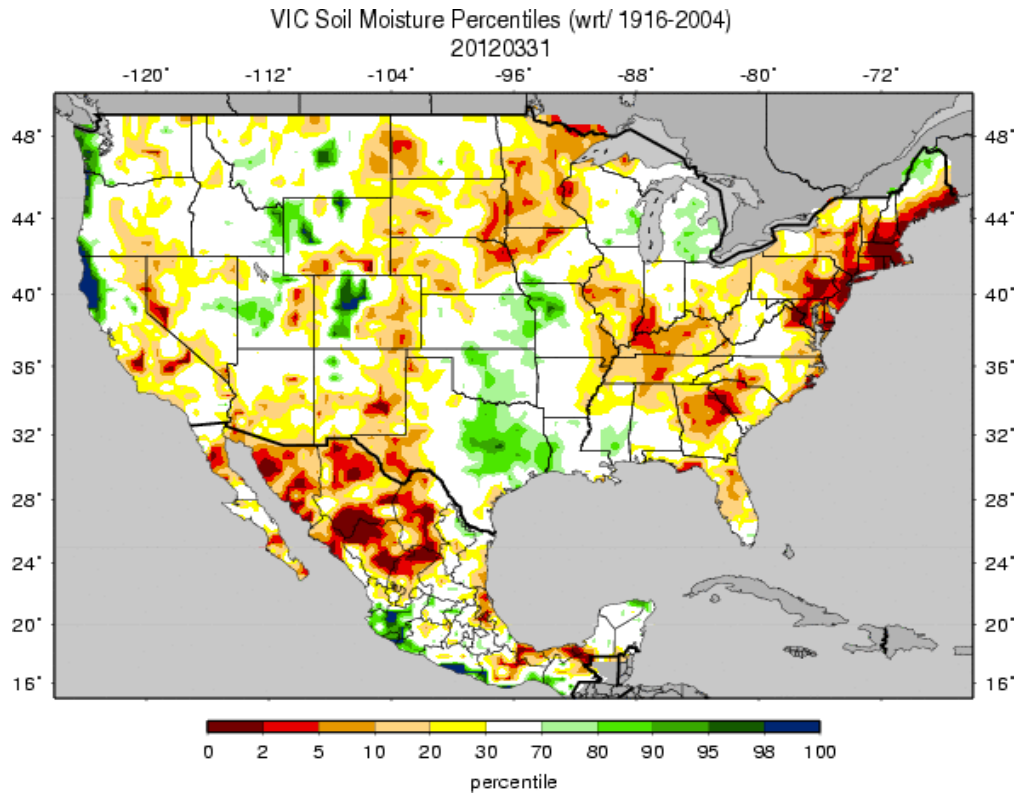

Figure 8. VIC modeled soil moisture percentiles as of March 31, 2012. Source: University of Washington. http://www.hydro.washington.edu/forecast/monitor/curr/conus.mexico/main_sm.multimodel.shtml

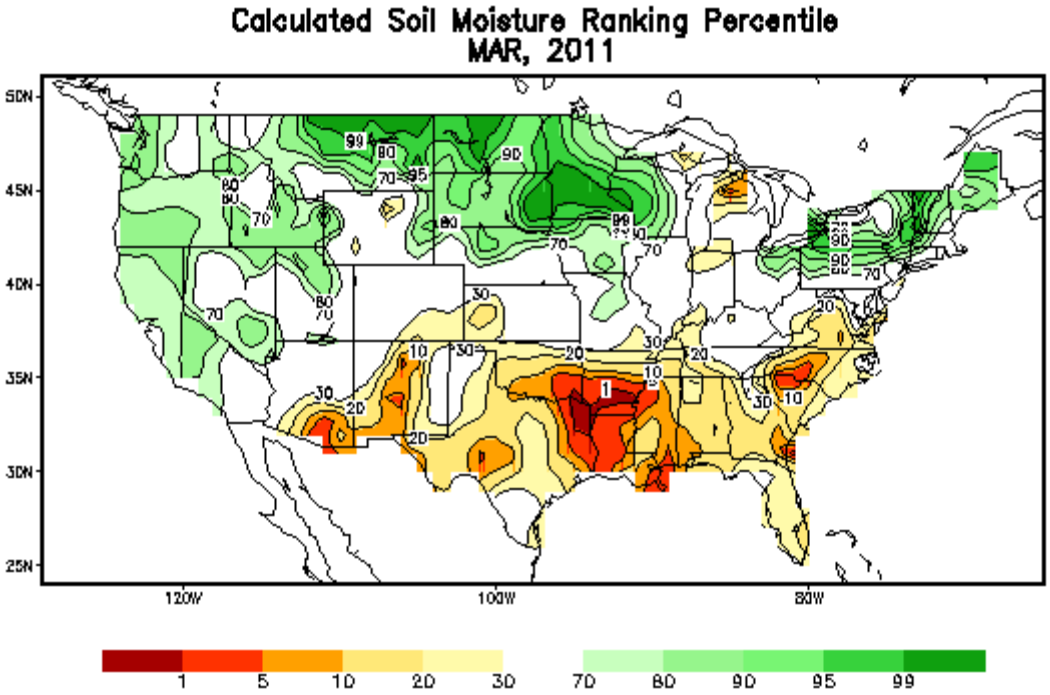

Figure 9. Calculated Soil Moisture Ranking Percentile in March 2011. Source: Climate Prediction Center. http://www.cpc.ncep.noaa.gov/cgi-bin/US_Soil-Moisture-Monthly.sh#

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. Historically, about 25% of annual runoff occurs in March and April due to both melting snowpack and rainfall runoff; however, runoff occurs in March and April whether or not there is any plains snow to melt. Thus, the March-April runoff forecast is formulated based on existing plains snowpack and existing basin conditions and hydrologic forecasts.

Temperatures in March were well above normal in the Northern Plains, limiting additional snow accumulation. On March 1 the NOHRSC snow model estimated areas of SWE ranging from 1.0 to 2.0 inches in portions of central and eastern North and South Dakota. Other areas contained trace to 1.0 inch amounts. By March 12, 2012 (Figure 10) all plains snowpack in the Missouri River basin had melted.

In contrast, plains snowpack on March 12, 2011 (Figure 11) was very extensive in aerial coverage and heavy to very heavy in all locations. 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 possible heavier amounts in concentrated areas.

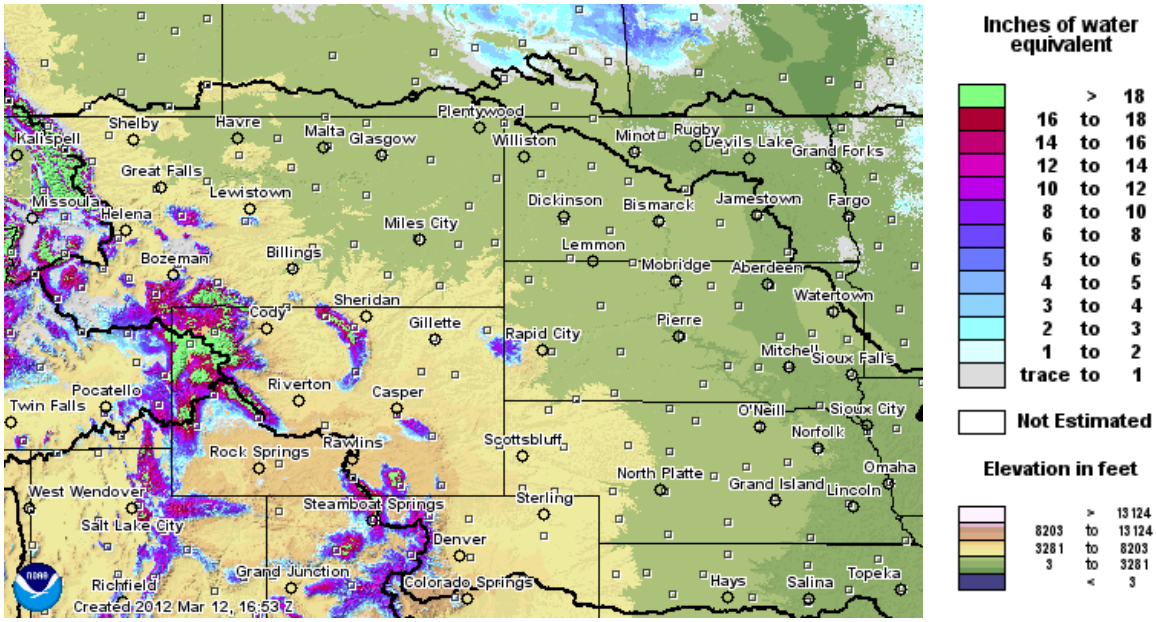

Figure 10. March 12, 2012 NOHRSC modeled plains snow water equivalent. Source: NOAA National Operational Hydrologic Remote Sensing Center. http://www.nohrsc.nws.gov/interactive/html/map.html

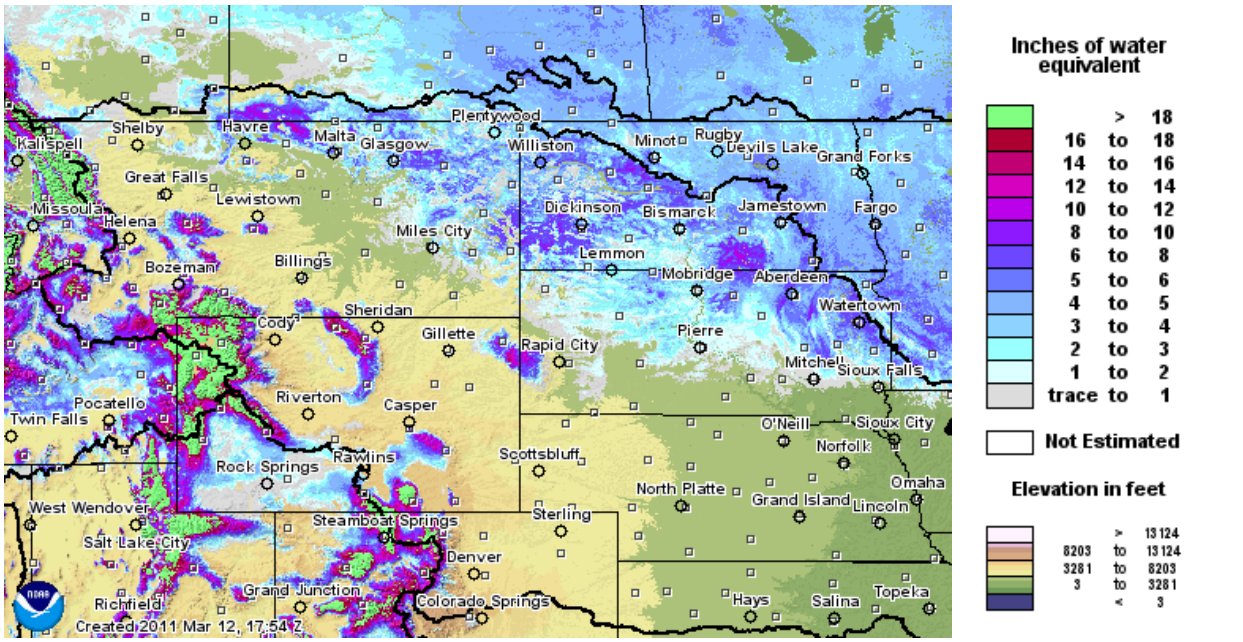

Figure 11. March 12, 2011 NOHRSC modeled plains snow water equivalent. Source: NOAA National Operational Hydrologic Remote Sensing Center. http://www.nohrsc.nws.gov/interactive/html/map.html

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.

As of April 1, 2012, the Corps of Engineers' assessment of the mountain snowpack was 97% of normal in the drainage area above Fort Peck (Figure 12), an increase from 94% of normal on March 1, 2012. Mountain snowpack was 86% of normal in the incremental drainage area between Fort Peck and Garrison (Figure 12), a decrease from 105% of normal on March 1, 2012. In terms of peak snow accumulation, normally 96% has accumulated in the mountains by April 1. According to the NRCS, snowpack at many SNOTEL stations up to 9,000 feet of elevation are isothermal, meaning the snow is ready to melt, which is several weeks earlier than it would normally occur. In southern Montana and northern Wyoming, many SNOTEL stations have melted significant amounts of snow; whereas in northern Montana the snowpack is steady to slightly increasing due to colder temperatures. The NRCS depictions of the mountain SWE as a percent of normal SWE by mountain river basin in Montana and Wyoming (provided in the Additional Figures section at the end of this report) show this contrast in mountain SWE by basin. In comparison to 2012, 2011 snowpack on (bold black line in Figure 12) still increasing at 116% of normal above Fort Peck and 112% of normal between Fort Peck and Garrison.

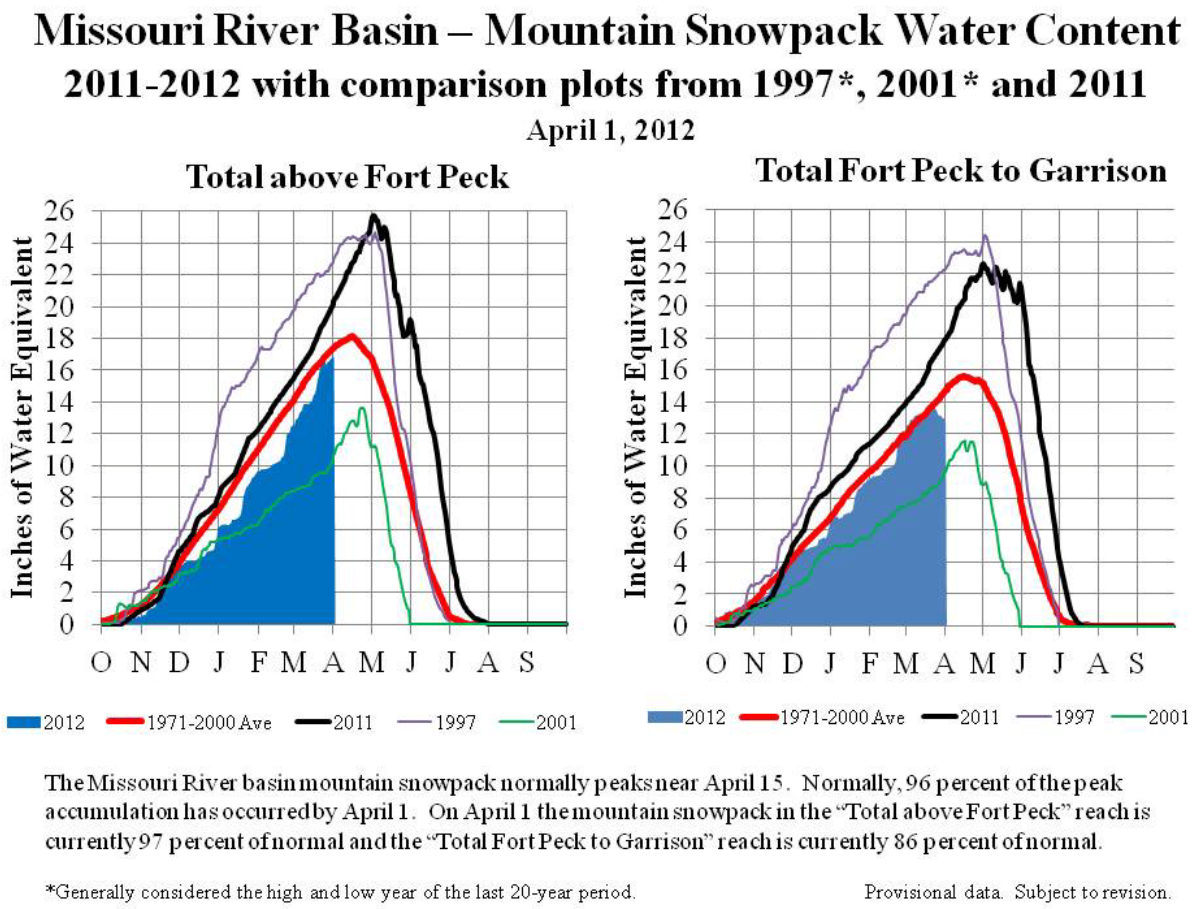

Figure 12. Mountain snowpack water content compared to normal and historic conditions. Corps of Engineers - Missouri River Basin Water Management. The shaded blue area indicates 2012 mountain SWE amounts. The bold black line indicates 2011 mountain SWE amounts.

Drought Analysis

According to the National Drought Mitigation Center (NDMC), Abnormally Dry (D0) conditions have expanded into eastern Montana, eastern Wyoming, western Nebraska and northeast Colorado; while areas of Moderate Drought (D1) developed in western South Dakota and western North Dakota (see Figure 13). Severe Drought (D2) continues to impact a narrow band in eastern South Dakota, southern Minnesota, and northwest Iowa. Through the end of June, the NDMC is predicting no change throughout much of the upper Missouri River basin; however, some improvement is possible in North and South Dakota, Minnesota, and northwest Iowa. (Figure 14).

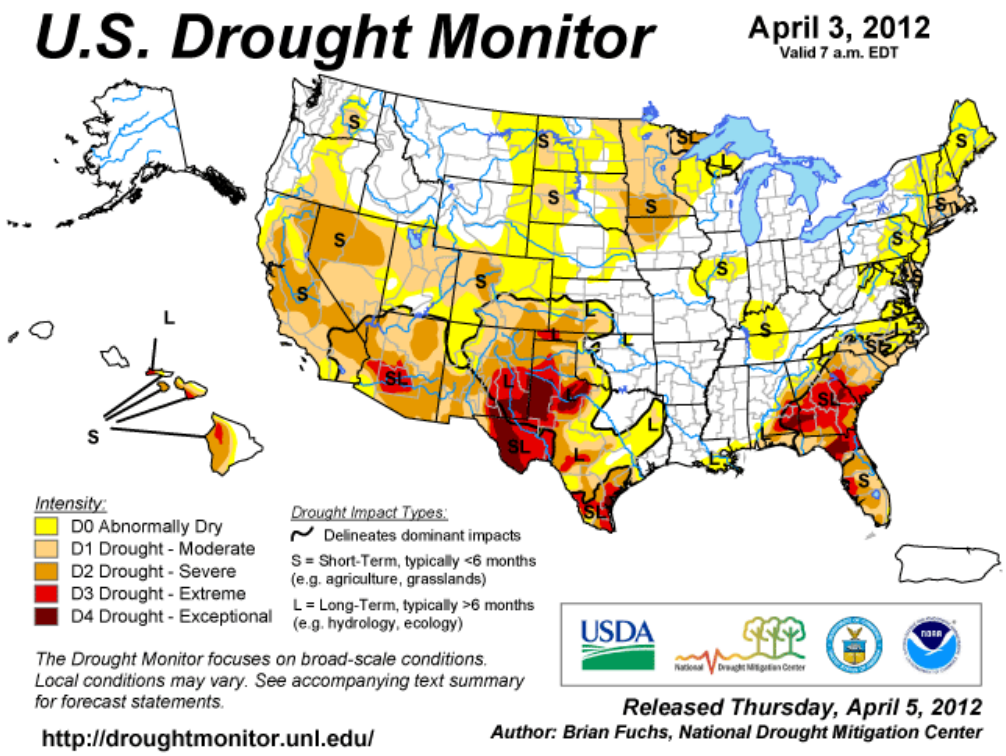

Figure 13. National Drought Mitigation Center U.S. Drought Monitors for April 3, 2012.

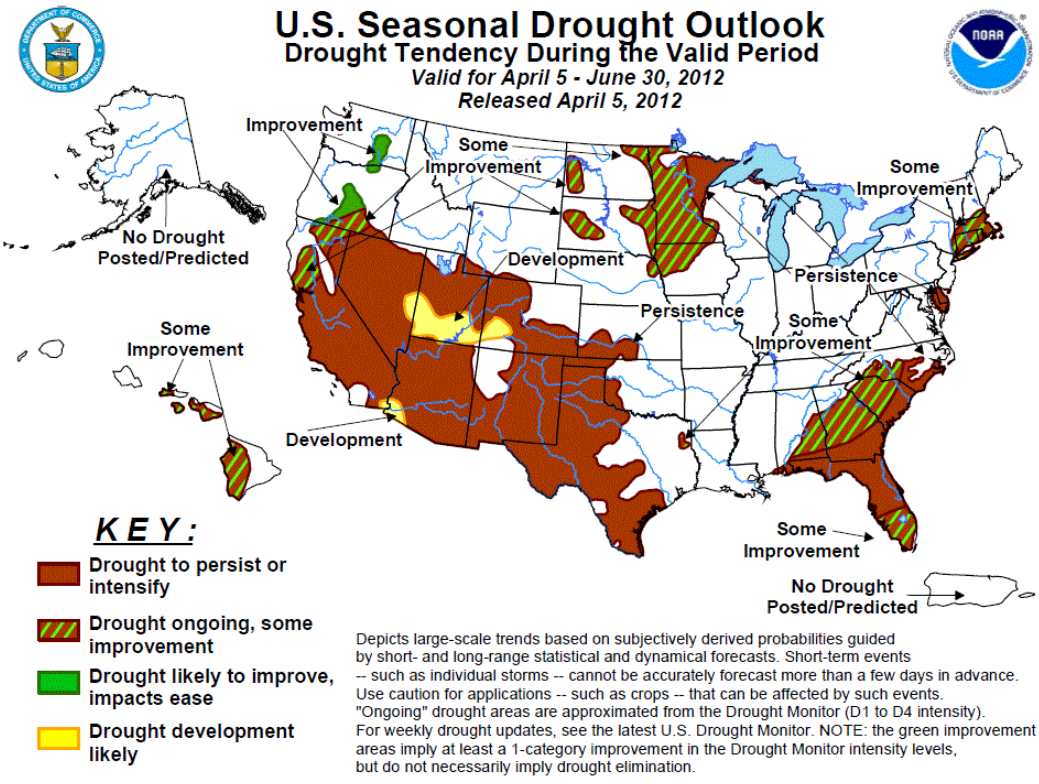

Figure 14. National Drought Mitigation Center U.S. Drought Seasonal Drought Outlook for 5 April to June 30, 2012.

Climate Outlook

According to the NOAA Climate Prediction Center, La Niña is expected to transition to ENSO-neutral conditions by the end of April 2012. During ENSO-neutral conditions, there is not a strong climate signature that indicates whether or not conditions in the Missouri Basin will be wetter or drier and warmer or cooler; however, because the strength of impacts in the United States is not necessarily related to the exact strength of ENSO, CPC expects La Niña impacts to continue even as the episode weakens.

The 6-10 Day (Figure 15) and 8-14 Day (Figure 16) Outlooks indicate temperatures are very likely to be above normal through April 15 in all of the upper Missouri River basin. If actual air temperatures are much warmer than, snow accumulation in the Fort Peck and Garrison reaches will likely be limited and possibly occur earlier than normal. The precipitation outlooks indicate there is an increased probability for precipitation in the northern Rocky Mountains and northern plains of North Dakota, while the central Rocky Mountains have increased probabilities for below normal precipitation.

The temperature outlook for April (Figure 17) indicates increased chances for above normal temperatures throughout much of the Missouri River Basin with the exception of an area of equal chances in Montana and northwest Wyoming, and increased chances for below normal temperatures in northwest Montana. Equal chances for above normal, normal and below normal precipitation exist across nearly the entire Missouri River basin with the exception of below normal chances for precipitation in Colorado and above normal chances in northwest Montana.

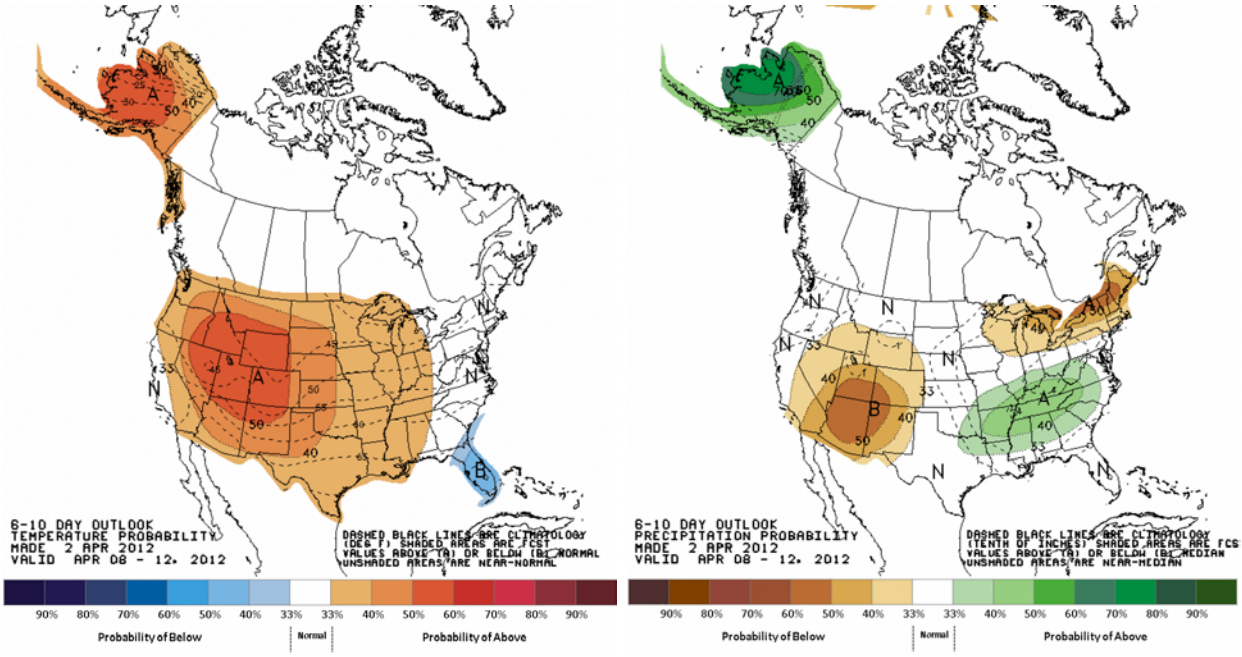

Figure 15. CPC 6-10 day temperature and precipitation outlooks.

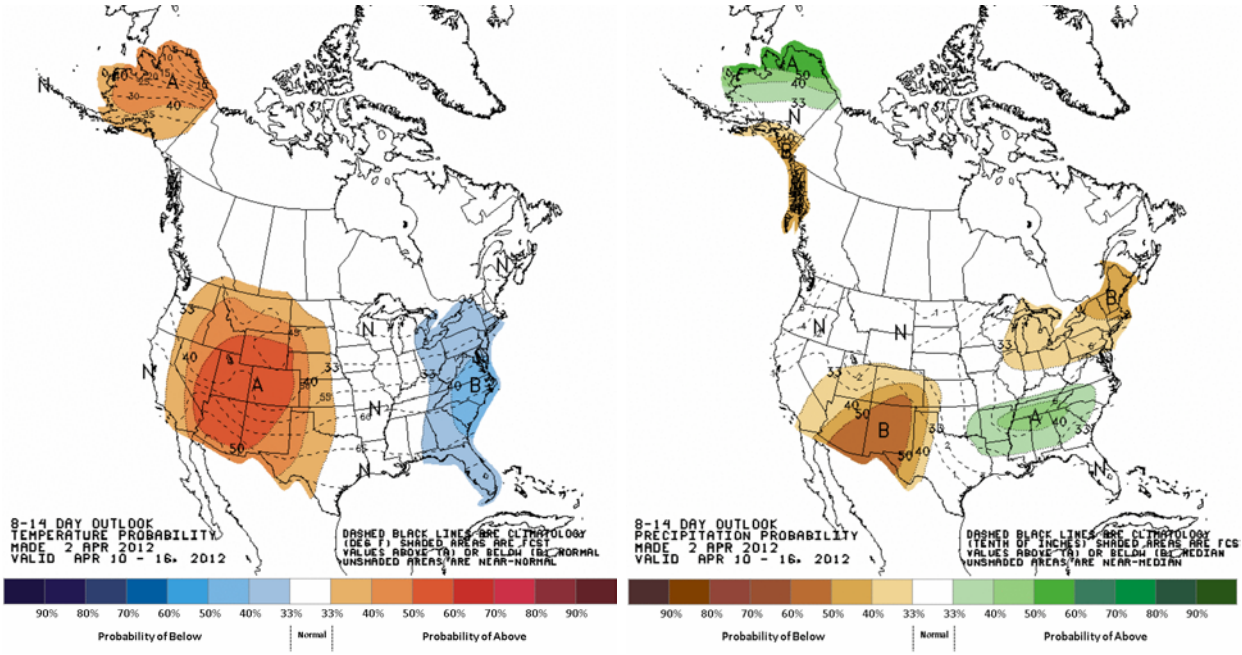

Figure 16. CPC 8-14 day temperature and precipitation outlooks.

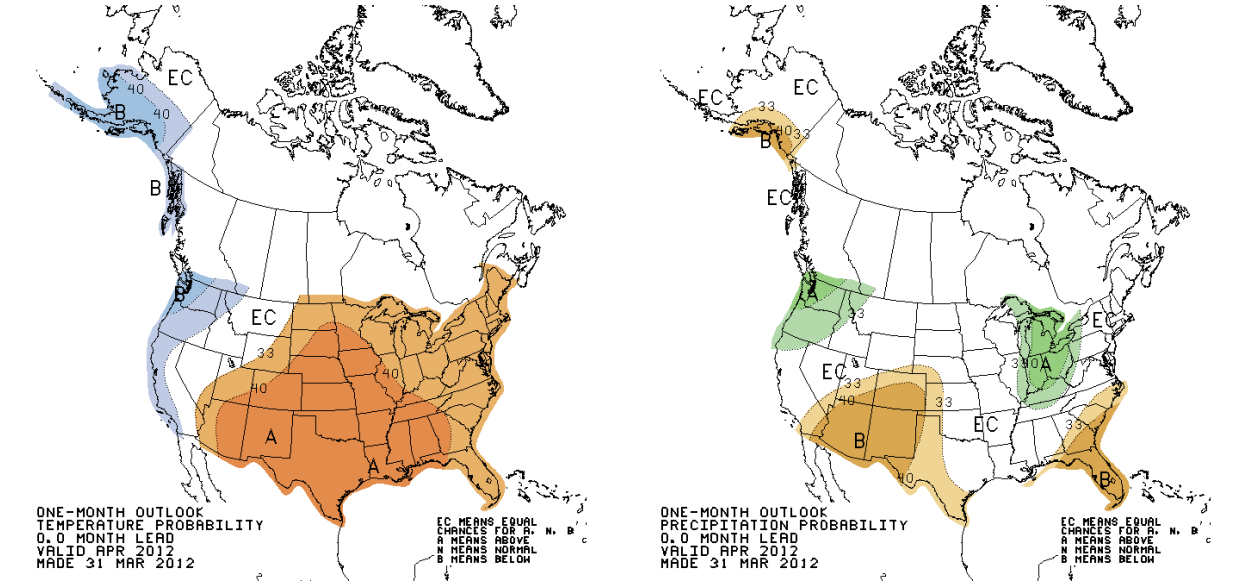

Figure 17. CPC April 2012 temperature and precipitation outlooks.

The three-month April-May-June outlook 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 (Figure 18). With regard to precipitation, there is an indication that there will be an increased probability for below normal precipitation in the central Rocky Mountains and the adjacent plains, effecting Wyoming, western Nebraska, Colorado, and Kansas.

Longer term CPC outlooks indicate there is an increased probability for above normal temperatures in the western U.S. affecting the Rocky Mountains and bordering high plains regions, while there are equal chances for above normal, normal, and below normal temperatures throughout the midwest and northern plains during July-August-September 2012 (Figure 19). There are equal chances for

precipitation throughout most of the basin with the exception of central and western Montana, which has increased chances for below normal temperatures. The October-November-December temperature outlook (Figure 20) indicates increased probabilities for above normal temperatures throughout most of the basin, while there are equal chances for precipitation.

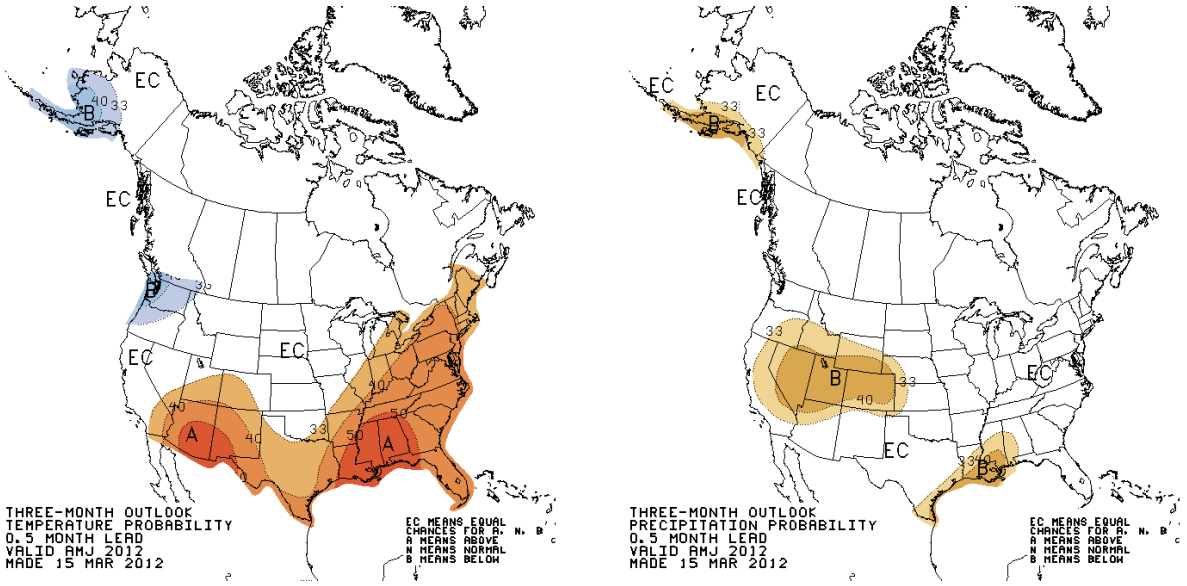

Figure 18. CPC April-May-June 2012 temperature and precipitation outlook.

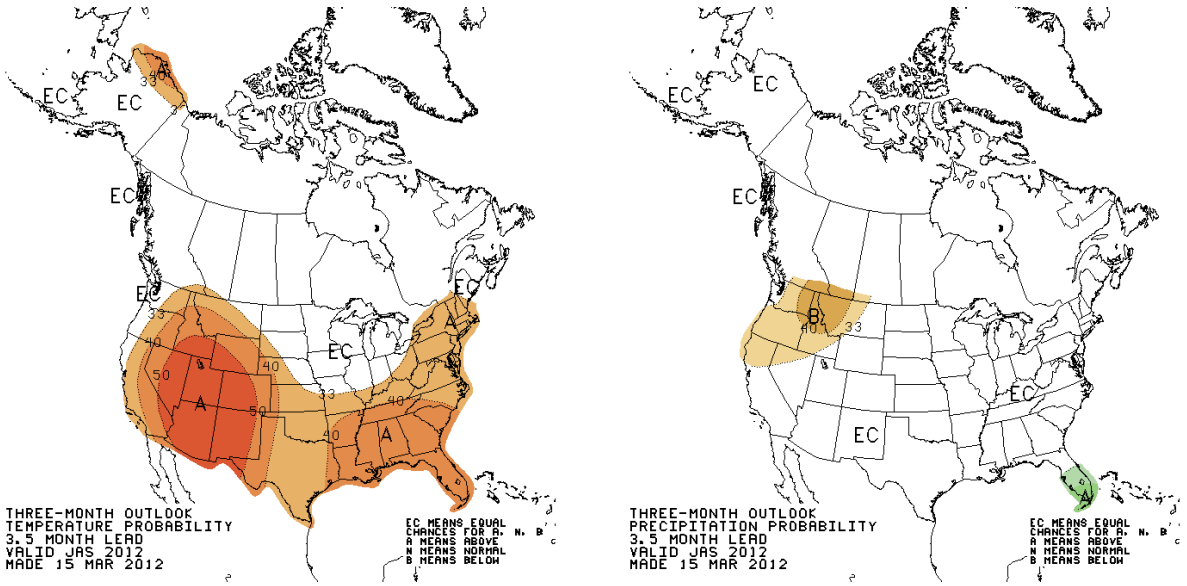

Figure 19. CPC July-August-September 2012 temperature and precipitation outlook.

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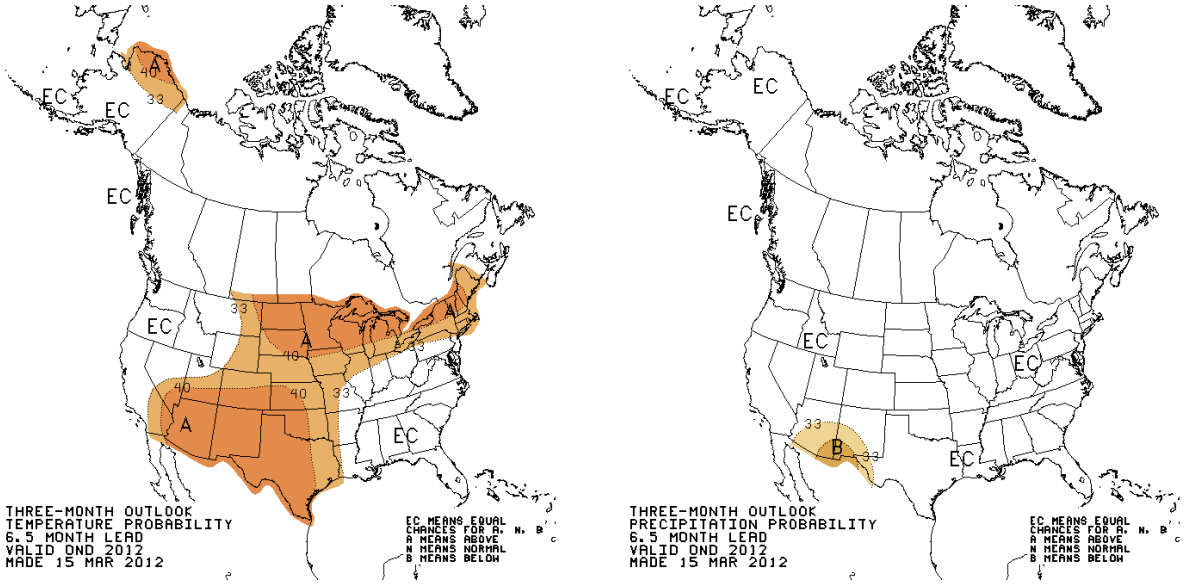


Figure 20. October-November-December 2012 temperature and precipitation outlook.

March 2012 Calendar Year Runoff Forecast

As stated earlier in this report the April 1 forecast for 2012 runoff above Sioux City, IA is 23.4 MAF (94% of normal). The April 1 forecast for runoff above Gavins Point Dam is 21.0 MAF (92% of normal).

Factors taken into consideration while preparing the 2012 forecast include: the previous months' runoff volumes and streamflow, soil moisture content, precipitation and temperature anomalies, mountain snowpack, and the CPC's monthly and seasonal temperature and precipitation outlooks.

April

Plains snow is a significant factor influencing the volume of runoff in March and April and often sets the stage for how much runoff will occur after the snow has melted; however, precipitation, air temperatures and soil moisture during this time period are also very important factors that need consideration. Factors taken into consideration in updating the April runoff forecast were: 1) low March runoff, 2) dry soil moisture conditions, 3) low runoff due to plains snowmelt, 4) a higher probability for warmer than normal temperatures, and 5) an equal chance probability for above, normal, and below normal precipitation.

Runoff during the months of January and February were 131% and 153% of normal, respectively, as a result of much warmer than normal temperatures causing some snowmelt runoff and allowing tributaries to flow freely. March runoff was below normal due to a number of factors described at the beginning of this report. Below normal runoff is expected to continue in April as a result of lower than normal antecedent precipitation, dry soil conditions, and low plains snowmelt runoff contribution. Furthermore, the April climate outlook is predicting greater chances for above normal temperatures and

equal chances for above normal, normal, and below normal precipitation. All reaches with the exception of the Sioux City reach are forecast to receive below normal April runoff. The overall runoff volume above Sioux City is 85% of normal.

May-June-July

During the May-June-July period, the mainstem system normally 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 average annual runoff into the system.

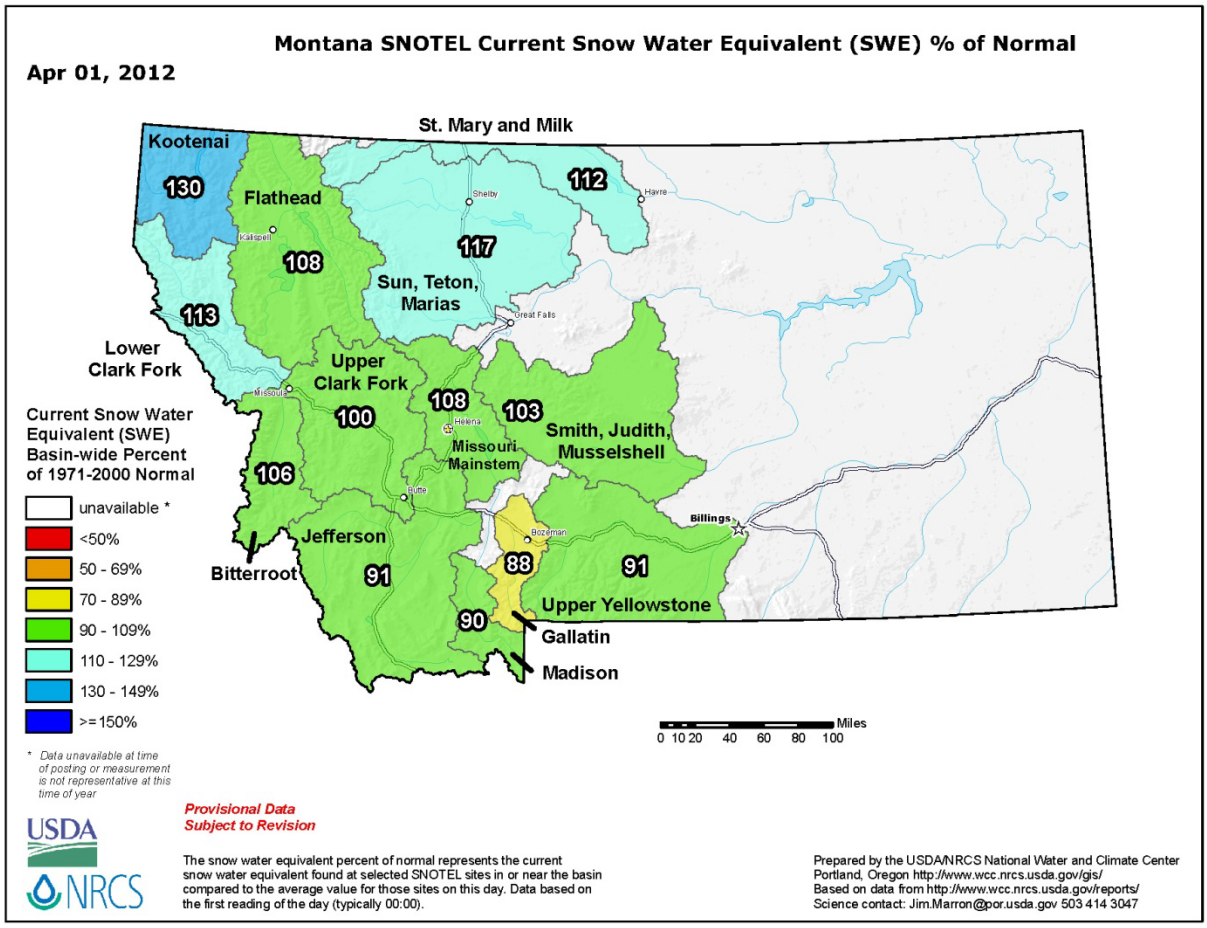
For this 3-month period, the most reliable method for predicting runoff into Fort Peck and Garrison reservoirs is through regression equations that relate mountain snowpack, precipitation, and temperature to runoff. Existing mountain snowpack was 97% of normal in the reach above Fort Peck and 86% of normal in the reach between Fort Peck and Garrison on April 1. Soil conditions are about normal to slightly wet, and the CPC is forecasting equal chances for precipitation with a slightly higher probability for above normal temperatures in Wyoming through June. According to NRCS reports, mountain snowpack in southern Montana and northern Wyoming has begun to melt in many locations, and it has melted significant amounts of snow at lower elevations. Snow is still accumulating in northern Montana. Due to the lower than normal amounts of mountain snowpack and the earlier than normal snowmelt in some regions, overall runoff during May-June-July is forecast to be below normal and occur several weeks earlier than normal.

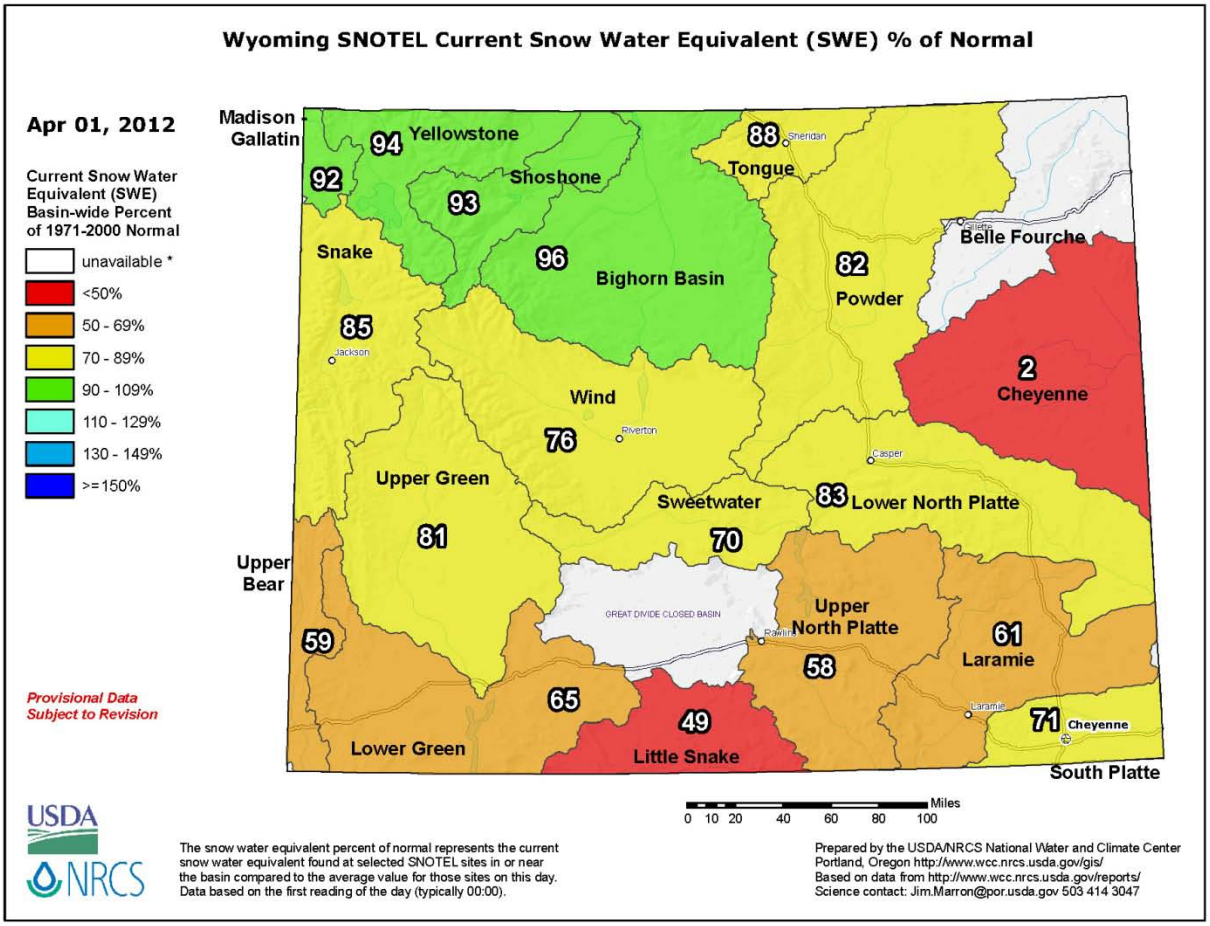
Runoff in the Oahe, Fort Randall and Gavins Point reaches is forecast to be below normal based on below normal soil moisture conditions, developing drought conditions in the Dakotas, and the fact that there is no strong climate signal influencing weather in the basin. Runoff in the Sioux City reach is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

August through December

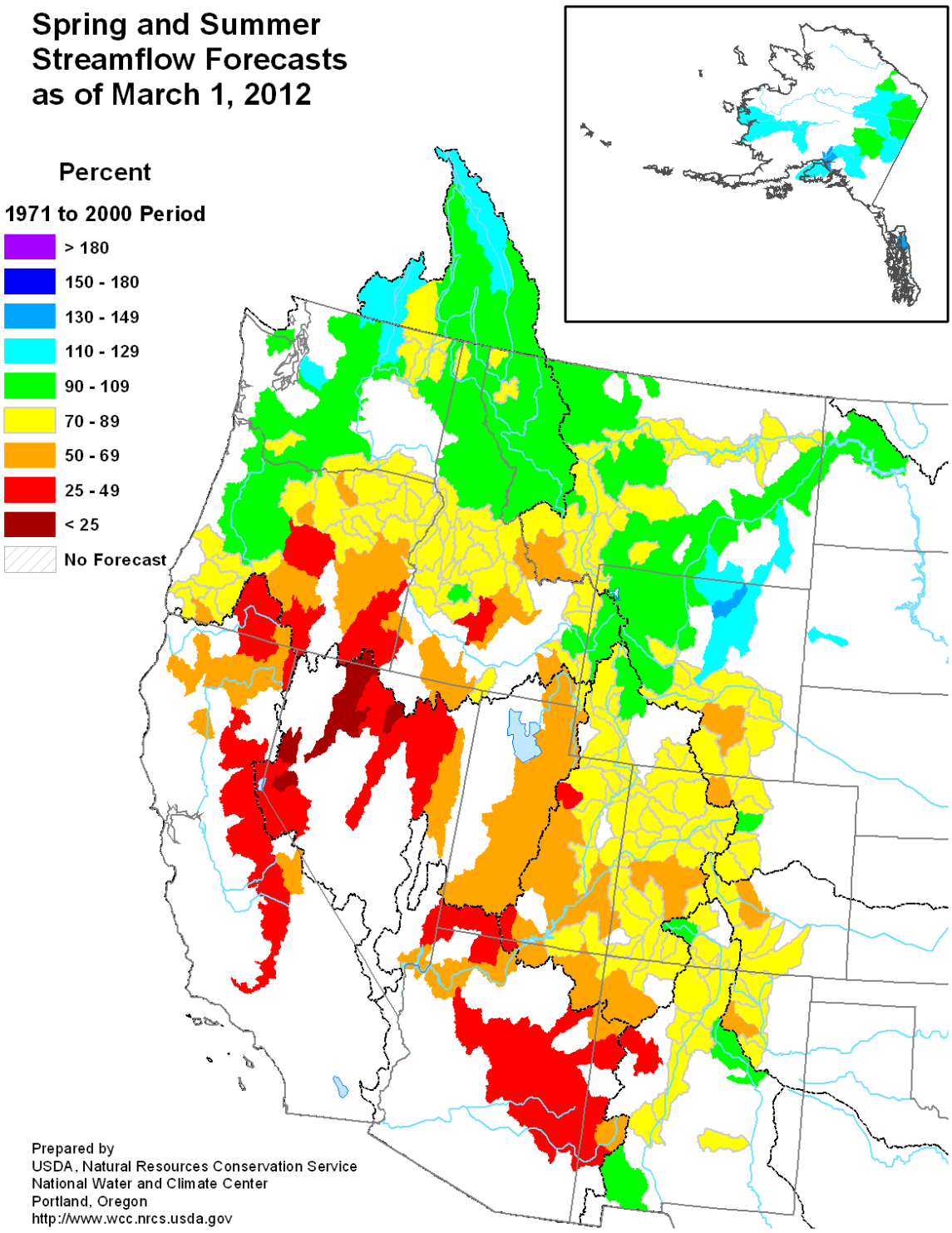
During the August through December period, runoff is forecast to be slightly below normal in all reaches from above Fort Peck to Gavins Point, primarily due to the increased chances for above normal temperatures during the fall. As the year progresses and the August through December precipitation and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

Additional Figures




Wyoming SNOTEL Current Snow Water Equivalent (SWE) % of Normal
Apr 01, 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
Madison Gallatin
94
Yellowstone
92
93
Shoshone
88
Sheridan
Tongue
Snake
96
Bighorn Basin
82
Powder
Belle Fourche
85
Jackson
Wind
76
Riverton
2
Cheyenne
Casper
Upper Green
Sweetwater
83
Lower North Platte
81
70
Upper Bear
GREAT DIVIDE CLOSED BASIN
Upper North Platte
Rawlins
59
58
61
Laramie
65
49
Laramie
71
Cheyenne
Lower Green
Little Snake
South Platte
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

NRCS Water Supply Outlook



NOAA Water Supply Forecast

Table 1. 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)*	Mar 1 2012**	Apr-Sep	3510	81%
Seasonal Ensemble Outlook*	Mar 20 2012	Apr-Sep	5435	130%
Monthly Ensemble Outlook*	Mar 20 2012			
April		Apr	817	N/A
May		May	1577	N/A
June		June	1616	N/A

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

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

Table 2. 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)*	Mar 1 2012**	Apr-Sep	10200	83%

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

** The Seasonal Water Supply Forecast was not available on April 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 March. Their observations are summarized below.

North Dakota

Statewide Conditions (State Report): We don't have good information on soil moisture conditions; however ground water levels remain high around the state. Before today's rainstorm soil surface conditions were dry. Sloughs/and lakes around the state are fuller than normal, but I think this is residual from last year's moisture. Stream flow is on the low side. Vegetation is starting to green up.

Garrison Project: Soil dry/moist with no standing water and normal ground cover around Garrison Project, Riverdale ND. The surface conditions are very dry. Most of Western ND is in a fed flag warning for fire danger. However there is still moisture in the soil. I'm still seeing some areas seeping due high ground water tables, but some of the sloughs and areas that had standing water last year are drying out. If we stay in the 70's, with wind, like we've seen this will be exacerbated. Farmers are starting to plant their fields now and are planting through areas that they farmed around last year.

Jamestown: Pipestem Project Office area recorded 0.13" of rain since last Friday to this morning. Surface soil is generally dry in the Pipestem Lake watershed area. Subsurface soil is very wet/saturated in watershed area. All the wetlands/lakes in the watershed area froze FULL last fall and many of them continued to flow during the mild winter - Pipestem Dam released about 15-30 cfs most of Jan.-Feb. which is record amount for winter releases - Jamestown Res. water elevation increased about 24 vertical inches from Jan.- mid March and was releasing 13 cfs during that time period. Lakes/large wetlands in the watershed continue to surface drain into the system. Veg. ground cover - Thousands of acres of land is being taken out of CRP (grass cover) & converted into croplands in the watershed area which will probably contribute to increased runoff...especially if planted to soybeans!

South Dakota

Statewide (USGS): Most streams are below average across the state with the exception of the Belle Fourche which is still a little above normal and the James River where the lower James remains a little above normal. All of western SD is also dry enough that if we begin to get some spring rainfall, depending on intensity, most rainfall would soak in and not run off. Eastern SD also has many areas that could use moisture as well and we would not see a great deal of runoff.

Gavins Point: Surface and subsurface soil conditions are dry. Rain is coming today to eastern SD, but it is not enough to change conditions. Stream flow seems about normal.

Fort Randall: Very little if any soil moisture. Also from one of our engineers: Upper level soil moisture is slightly below average. With soil temperatures being higher than normal for this time of year, however, any precipitation that we see - rain or snow - should be almost entirely infiltration unless duration or intensity are extreme.

Fort Randall (Pickstown): Surface and subsurface soil conditions - Soil is very dry. Really haven't had much for precipitation for quite a while, other than a few light events. There is no standing water

anywhere that I have seen. Stream flow does appear to be low. Vegetative ground cover is greening up in the area. Vegetation is ahead of schedule for this time of year, due to the warmer than average temperatures. Grass is kind of struggling though due to the lack of moisture in the soil.

Oahe: We are dry around Oahe. Not much moisture so far this spring in the western half. Eastern SD has gotten more than us. BLUF: Soil moisture conditions around Oahe are in the Very Dry Category. Warm (hot) and dry. Yesterday we got up to 91. Extended temperatures are expected to be more seasonable over the next 10 days. Soil is dry on the surface and the subsoil is OK right now, but unless we get some moisture soon that will be declining also.

Oahe (NWS): NWS Says March was a Record Breaking Month for Temps. The start of a new month brings a look back at March and weather statistics by the National Weather Service. Weather observers at the NWS office in Aberdeen say that March in central and northeast parts of the state brought numerous daily and monthly records. The average high temperatures last month were said to be from 16 to almost 20 degrees above normal. The temperature reached 80 degrees or higher at several locations in northeast and central South Dakota in March; with Pierre reaching 80 or more at least five times last month. The warmest temperature in March was 88 at Pierre on March 18, which broke the all-time March high temp record for the community. Kennebec's warmest day in March was on the 18th, when it reached 87, Mobridge's warmest high was 83 on the 16th and Timber Lake got up to 82 on the 16th. The NWS also says that March was a dry month with precipitation amounts below normal. March is usually one of the snowiest months with 6-8 inches of snowfall, but for last month, snow amounts ranged from only trace amounts to up to three inches. Monthly precipitation levels in Pierre, Kennebec, Mobridge and Timber Lake are all said to be from a half an inch to just over an inch below normal for March.

Ashton: Very little rain since last reported snow fall. Ground is very dry as is the vegetation. Streams are flowing but a bit under the usual pattern. Most standing water is now gone.

Brookings: The soil condition here is dry. There isn't any standing water and the creek is well within its banks (very low compared to most springs). There is moderate growth to the grass. Everything is greening up, but we could use a good shot of rain.

Chamberlain: Here at Chamberlain, like so many places, has been unusually dry. We got that big snow/rain at the end of February, then had about .75" total for March until today. We fortunately had storms/rain all morning. I looked at lunch-about .85" and still drizzling. I don't think it's widespread, especially to the west.

We do have standing water in some low areas & ditches, but it was disappearing quickly. Farmers are working fields all the way to Pickstown. I see some stock dams are full; some are on the low side. I tilled the garden last weekend and there was some moisture down low, but not a great deal. My guess is there sufficient topsoil moisture with a dry layer below.

Last time across White River, I thought it was below normal flow for March. Streams were ok earlier, but were rapidly declining. I'll take a look today, but things will be skewed due to this morning's event. Vegetation is greening much ahead of normal, appears sufficient with good carryover from 2011.

Eureka: There was no snow to melt for runoff. The ground moisture is low but not dry. We would be able to handle quite a bit before runoff would become an issue. There are potholes but they have gotten less with the lack of moisture and all the wind we have had.

Huron: At Huron Airport the soil condition is moist, with little to no standing water. The area I was using for sampling is next to Broadland creek which is barely flowing at this time.

Pierre and statewide conditions (State Report): Here in the Pierre area n the past two weeks we have been experiencing above normal temps, 70's and 80's, and several days of windy conditions in the 20 - 30 mph range. We have not experienced any measurable precipitation since the last week of February.

Soils and sub-soils are in the dry to moist range but are drying out quickly.

The local dams and sloughs are still holding water but many are about half full. There really isn't any standing water in the small pot holes and the smaller prairie streams mostly have quit running about two weeks ago. The larger streams may still be flowing but not by much.

The prairies started greening up last week but really haven't started putting on new growth yet. Most of the farm land is black and farmers started working in the fields this past weekend drilling in spring wheat and if it stays warm, row crops will likely be put in two to three weeks earlier than normal. The winter wheat has come out of dormancy.

Spearfish: Surface and subsurface soil conditions are dry. There is no standing water. Spearfish Creek seems to flow at its normal rate.

Buffalo, Brule & Jerauld Counties: Soil conditions are quite dry. The soil moisture is low (I have seen farmers cultivating through depression areas that have been too wet the past couple years) and stream flow is low.

Day County: Webster SD, did not have any runoff, no major snow melt, land surfaces are on the dry side, farmers are planting now but appears dry over most of the county. Surface moisture is dry as prairie fire has been a problem.

Hamlin County: Hamlin County soil is dry with very little to no standing water. Many potholes and sloughs have dried up completely and water moving through the chain of lakes is slow. Even though temps have been abnormally high vegetation is just barely starting at this point. The county is receiving rain today but not significant amounts. My coop station for the NWS shows 0.18 for Jan, 1.39 for Feb and 0.30 so far in March total precipitation at Hayti.

Tripp County: In the Tripp County area we are very dry. Tripp County is receiving small amounts of rain today. In The past three weeks has been cloudy, but not much in rain from the clouds. In the last three weeks we have had less the .25 inch of moisture.

Montana/Wyoming

Fort Peck: It is dry around the project. Further west it is wetter.

Southern Montana/Northern Wyoming (NRCS report): Surface soil moisture - wet to less than slightly wet. Rain last night helped wet things up. Subsurface soil moisture - becoming moister as is typically the case this time of year. No standing water. Green-up is beginning to occur in the greater valley. Streamflow is up a bit from last night's rain/gropple storm in the valley.

SNOTEL sites at low elevations are showing the beginning signs of melting while mid elevations are approaching isothermal snowpack conditions. Upper elevations are holding relatively steady but some high elevations sites in the Big Horn mountains are going towards isothermal conditions as well. I

was talking to the Avalanche Center here this morning who gather mountain snowpack observations all around here, they concur that snowpack is isothermal up to 9000 feet which is the significant majority of the surface area driving streamflow. We made an attempt of measuring one of our mountain monthly manual snow courses (New World here outside of Bozeman) today but scrapped it because of tough access conditions due to low snow. Only extremely low elevation sites are in full melt mode but they do not seems to be affecting streamflow very much.

It certainly is setting up as an interesting year with very warm temps and high winds to further sublimation. Seems like we are 3 weeks early but all it takes is one storm to change everything. The fact that the Big Horn mountain snowpack is becoming isothermal this early is something to watch. Southern Montana is dryer than average and much closer to melting or already melting. In the field I saw snowmelt near at 6,900 feet. Northern Montana is above average snowpack with conditions further from isothermal meaning snow melt is not as far along as southern Montana.

Northeast Montana (NWS report): Northeast Montana has been very, very dry this winter, and much of the time we had no snow on the ground at all. The Drought Monitor updated today extends the abnormally dry conditions even further into eastern MT now.
http://droughtmonitor.unl.edu/DM_state.htm?MT,W

The soils were very wet across this entire region going into the winter season, with reports of combines getting stuck in the mud and sinking in on hilltops (not just the valleys) during the harvest last Sept/Oct.

We still have some soil moisture (sorry, we don't have any measurements I can think of in NE Montana), but each windy day is gradually taking more and more of that away. In the past month, I've been south of Glasgow to Gillette, WY, and there had been some ice on the Yellowstone left on the banks, but nothing major. It came through in late Feb with no impact this year to NE Montana. I've also been from Glasgow up to Plentywood and over to Williston (Poplar and Big Muddy basins), and again, no snow, some mild runoff with streams after our record high days, but nothing that caused any concerns.

There was a small dam breach NW of Glendive, MT about 10 days ago. The stock dam was damaged from last years runoff, and the owner was suppose to finish breaching it this summer. The little bit of snow runoff of the Big Sheeps wiped out the remainder of the dam. Caused some high water on Seven Mile Creek for about 12 hours, but by the time anyone noticed, and got around to investigating the cause, it was receded. That does flow into the Yellowstone.

We are actually more concerned about fires at this time, and have had a lot of them carry quickly with the winds, and the 1 and 10 hour fuels having been so thick last summer/fall. We are seeing some green up starting to occur, about 2-4 weeks earlier than normal.