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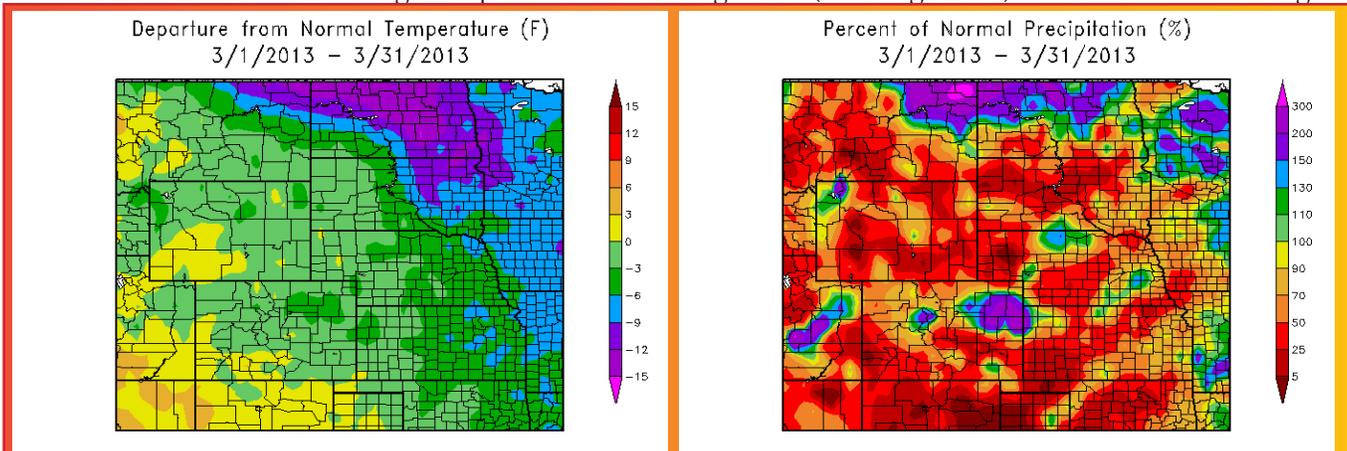
Robin in tree in Lincoln, Nebraska - Photo by Natalie Umphlett  
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# March 2013 Climate Summary

## Region Breakdown

What a difference a year makes! Just last year, the High Plains Region had its warmest March on record and this year, a persistent and strongly negative phase of the Arctic Oscillation kept temperatures well below normal - not just in the High Plains Region, but also for most of the country. Average temperatures ranged quite a bit from 3.0 degrees F (1.7 degrees C) above normal to 15.0 degrees F (8.3 degrees C) below normal. The southwest to northeast temperature gradient had most locations in Wyoming and Colorado around normal and the eastern half/northern parts of the Region well below normal. The Dakotas had the largest temperature departures in the entire country with 9.0-15.0 degrees F (5.0-8.3 degrees C) below normal.

March ranked in the top 15 coolest for many locations in the northern tier of the Region. For example, Grand Forks, North Dakota had its 6th coolest March on record with an average temperature of 14.2 degrees F (-9.9 degrees C). This was an impressive 11.0 degrees F (6.1 degrees C) below normal but still a far cry from the coldest March on record (period of record 1893-2013). Grand Forks' coldest March occurred in 1970 with an average temperature of only 9.6 degrees F (-12.4 degrees C). Another chilly location was Aberdeen, South Dakota which had its 7th coolest March with an average temperature of 19.8 degrees F (-6.8 degrees C). The record of 15.1 degrees F



Departure from 1981-2010 Normal Average Temperature (left) and Percent of Normal Precipitation (right) for March 2013 in the High Plains Region. Maps produced by High Plains Regional Climate Center. Available at: <http://hprcc.unl.edu/maps/current>

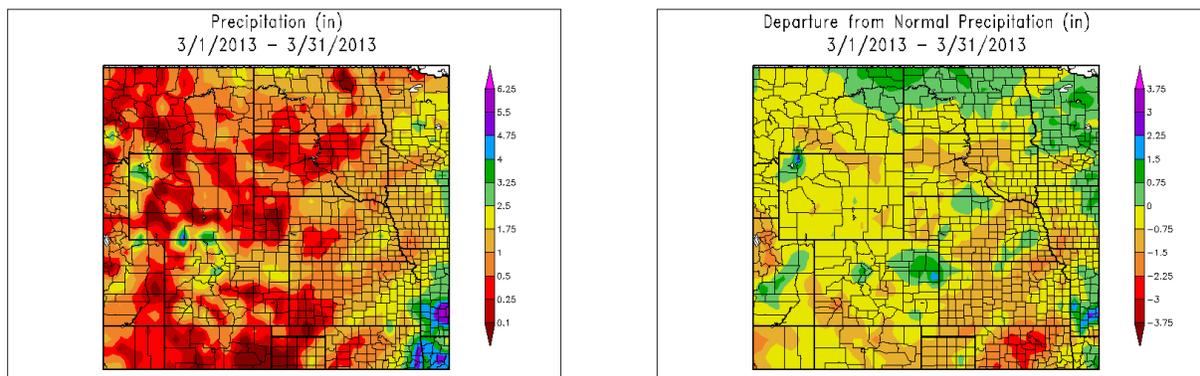
(-9.4 degrees C) was set back in 1897 (period of record 1893-2013).

### Precipitation Summary

Precipitation was varied across the Region this month. Generally, precipitation was below normal except for northern North Dakota, northeastern Colorado, and pockets of northwestern Wyoming and north-central and eastern Nebraska. Other areas were quite dry and received less than 50 percent of normal precipitation. These areas included central and northern South Dakota, the panhandle and central parts of Nebraska, southern and eastern Wyoming, southern Colorado, and a swath from western Kansas through southeast Nebraska. The varied precipitation allowed for top 10 rankings on both the dry and wet sides. For example, a strip of central South Dakota received less than 25 percent of normal precipitation this month. One of the locations in that area was Pierre, South Dakota which had its 10th driest March on record with 0.15 inches (4 mm) of liquid equivalent precipitation (period of record 1893-2013). The driest March occurred in both 1909 and 1918 with 0.02 inches (1 mm). Meanwhile, northern North Dakota had precipitation totals over 150 percent of normal. This month's snowy spot was Williston, North Dakota and with 16.1 inches (41 cm) of snow, Williston had its 6th snowiest March on record (period of record 1894-2013). The 1975 record firmly held with 30.9 inches (78 cm).

Even with the start of spring, snowpack continued to be of concern in the Rockies and also North Dakota. Unfortunately, snowpack in the Rockies continued to be lower than average. As of April 1st, the statewide Colorado snowpack was only 73 percent of average, down from 75 percent at the end of last month. Similarly, the statewide Wyoming snowpack was down 2 percent to 82 percent of average. On the opposite end of the spectrum, there is a chance for flooding later in the season in the northern areas of the Region. Even though most of the Region was still dealing with the ongoing drought, northern areas of North Dakota have received above normal precipitation which has led to a solid snowpack with high water content. The April outlook shows cool and wet conditions for this area, which would delay the spring snowmelt. Usually, a delayed snowmelt leads to a more rapid thawing. In addition, heavy rain events could occur at the same time as the flooding from the snowmelt, exacerbating the situation. Because of these reasons, outlooks from the National Weather Service indicate that there is a potential for moderate to major flooding along the Red River of the North and the Souris River.

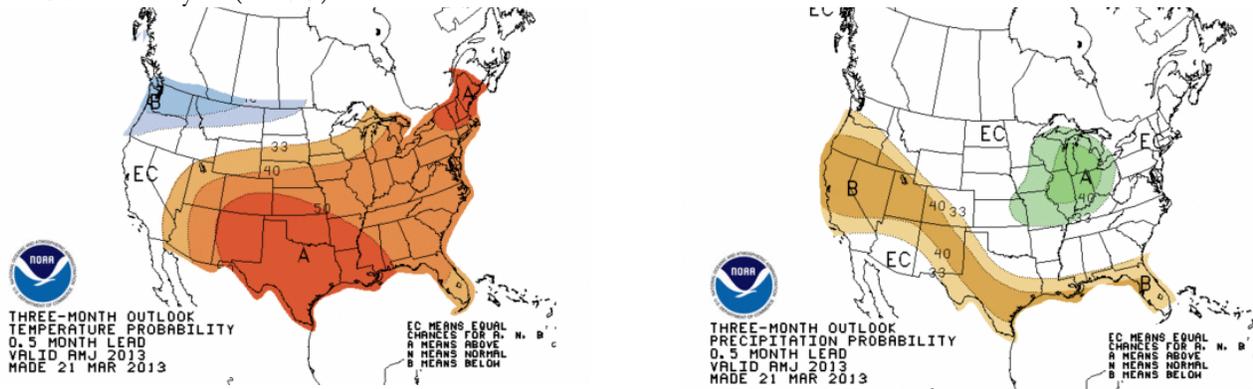
Although precipitation totals fell short in many areas, there were still several storm systems that crossed through the Region. Early in the month, a major winter storm produced snowfall totals up to 18.0 inches (46 cm) in northern and eastern North Dakota. Not even a week later, southern parts of the Region had a storm pass through on March 9-10 which brought rain, freezing rain, sleet, heavy snow, and even thunderstorms. Storm totals topped out at just under a foot (30 cm) and winds of 30-40 mph (48-64 km/hr) caused near white-out conditions which closed parts of I-80 west of Lincoln and cancelled local events. Later, on March 19th a system caused many problems across eastern portions of the Dakotas. Schools were closed and travel became so treacherous that people had to be rescued from stranded cars on I-29 between Fargo and Wahpeton in North Dakota.



Above: Total precipitation (inches) (left) and Departure from Normal Precipitation (inches) (right) for March 2013 in the High Plains Region. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: <http://hprcc.unl.edu/maps/current>.

# Climate Outlook

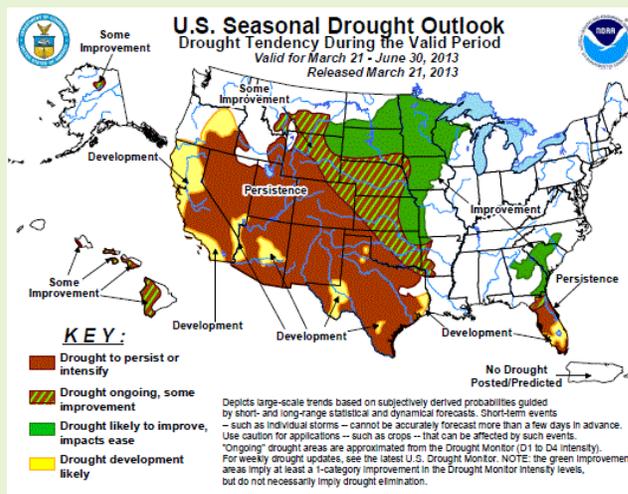
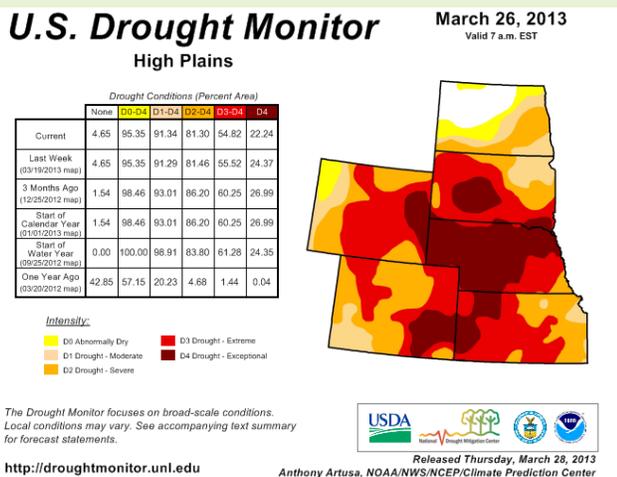
At the end of March, ENSO-neutral conditions were still present and likely to continue into summer. For the next three months, the temperature outlook indicates a higher probability of above normal temperatures for a large portion of the High Plains Region including Colorado, Kansas, Nebraska, the majority of Wyoming, and the southern half of South Dakota. Meanwhile, the precipitation outlook indicates a higher probability of below normal precipitation for western Colorado and southwestern Wyoming. A higher probability of above normal precipitation exists for the far southeastern corner of Nebraska and eastern Kansas. Equal chances of above, near, or below normal temperatures and precipitation exist for the rest of the High Plains Region. The seasonal outlooks combine the effects of long-term trends, soil moisture, and when applicable, the El Niño Southern Oscillation cycle (ENSO).



Above: 3-Month Outlook Maps Courtesy the NOAA Climate Prediction Center - <http://www.cpc.ncep.noaa.gov>  
 (left) The Three-Month Temperature Probability Outlook, (right) The Three-Month Precipitation Probability Outlook

## Drought Watch

Just like February, there were only slight changes to the U.S. Drought Monitor over the past month. Approximately 91 percent of the Region was still in moderate (D1) to exceptional (D4) drought - exactly the same percentage as the end of last month. Precipitation was spotty, which allowed for only slight improvements. Some D4 areas in southern South Dakota, northeastern Colorado, northwestern Kansas, and small portions of Nebraska had a one-category improvement which reduced the D4 coverage from 27 percent to 22 percent. Small one-category improvements were also made in eastern Kansas and southwestern Colorado. Unfortunately, conditions worsened in northwestern South Dakota where extreme drought conditions (D3) expanded. Even with some slight improvements, Nebraska remained the hardest hit state with 76 percent of the state in the D4 designation. According to the U.S. Seasonal Drought Outlook released March 21st, drought conditions were expected to improve in North Dakota, South Dakota, Nebraska, most of Kansas, northeastern Colorado, and all but the southwest corner of Wyoming. Drought was expected to persist elsewhere through June 2013.



The U.S. Drought Monitor is produced as a joint effort of the U.S. Department of Agriculture (USDA), National Drought Mitigation Center, U.S. Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA). Real-time data provided through ACIS from the Regional Climate Centers are often used by the agencies involved in the U.S. Drought Monitor when determining the area and intensity of drought conditions, although the product itself is not produced by HPRCC. For current Drought Monitor information, please see: <http://droughtmonitor.unl.edu/>  
 Portions of this Drought Watch are courtesy the Drought Monitor Text Discussion found on the Drought Monitor webpage.

## State Summaries

Colorado	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Akron Washington County Airport	49.9	22.8	36.3	-2.9	77	03/15	-1	03/25	1.49	0.62	171
Alamosa San Luis Airport	52.6	14.9	33.7	0.2	70	03/15	-4	03/24	0.34	-0.19	64
Colorado Springs Municipal Airport	52.3	24.7	38.5	-0.6	73	03/15	5	03/24	0.18	-0.82	18
Grand Junction Walker Field Airport	57.2	30.4	43.8	-0.1	71	03/31+	14	03/24	0.35	-0.57	38
Pueblo Memorial Airport	58.6	23.4	41.0	-1.3	80	03/15	4	03/05	0.21	-0.72	23

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	49.9	26.8	38.4	-4.6	81	03/15	11	03/11	0.89	-1.12	44
Dodge City Regional Airport	57.1	27.5	42.3	-2.1	83	03/15	13	03/26	0.26	-1.33	16
Goodland Renner Field	52.5	22.6	37.5	-3.0	80	03/15	1	03/25	1.45	0.38	136
Topeka Municipal Airport	50.4	30.0	40.2	-4.6	87	03/15	20	03/26+	2.01	-0.48	81
Wichita Mid-Continent Airport	54.2	32.4	43.3	-3.2	80	03/15	16	03/26	2.11	-0.58	78

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	52.1	21.0	36.6	0.8	75	03/15	2	03/25	0.64	-0.59	52
Grand Island Airport	48.0	24.2	36.1	-3.3	74	03/15	10	03/02	1.64	0.56	152
Lincoln Municipal Airport	46.3	23.4	34.8	-5.3	71	03/29	8	03/13	2.12	0.19	110
Norfolk Karl Stefan Airfield	43.5	21.8	32.7	-4.7	70	03/29	9	03/02	1.28	-0.49	72
North Platte Regional Airport	52.0	21.2	36.6	-1.4	79	03/15	7	03/26+	0.49	-0.56	47
Omaha Eppley Airport	43.3	25.2	34.2	-5.3	69	03/29	15	03/20+	1.98	-0.01	99
Valentine Miller Field	47.3	20.7	34.0	-2.2	71	03/29	3	03/11	1.57	0.50	147

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismark Municipal Airport	32.9	12.5	22.7	-7.2	62	03/14	-2	03/20	0.83	-0.04	95
Fargo International Airport	27.4	7.2	17.3	-10.5	42	03/29	-15	03/17	1.44	0.14	111
Grand Forks International Airport	24.9	3.5	14.2	-11.0	39	03/30	-23	03/17	0.98	0.02	102
Theodore Roosevelt Airport	36.7	14.9	25.8	-4.2	66	03/14	3	03/20+	0.35	-0.34	51
Williston International Airport	28.3	7.7	18.0	-11.3	47	03/13	-12	03/25	1.42	0.71	200

All Data are Preliminary and Subject to Change. + indicates multiple dates, latest date listed.

Source: National Weather Service Cooperative Observation Network Data

Data are retrieved through the Applied Climate Information System (ACIS).

These data are available for the entire period of record through the CLIMOD system. For more information please see <http://hprcc.unl.edu/services>.

## March 2013 Climate Summary

South Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Aberdeen Regional Airport	30.5	9.0	19.8	-10.1	47	03/14	-8	03/13	0.24	-0.92	21
Huron Regional Airport	34.4	15.3	24.8	-8.3	66	03/29	3	03/13+	0.78	-0.68	53
Pierre Regional Airport	41.5	17.1	29.3	-5.1	72	03/29	3	03/20	0.15	-1.08	12
Rapid City Regional Airport	36.7	18.4	27.5	-7.9	66	03/29	6	03/19+	0.88	-0.05	95
Sioux Falls Joe Foss Field Airport	47.8	19.2	33.5	0.6	73	03/14	0	03/25	0.82	-0.94	47

Wyoming	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Casper Natrona County International AP	48.1	19.5	33.8	-1.4	68	03/15+	3	03/25	0.85	0.03	104
Cheyenne Municipal Airport	47.0	22.3	34.6	-1.3	67	03/15	4	03/25	0.61	-0.44	58
Lander Hunt Field Airport	48.7	23.4	36.1	0.6	68	03/15	8	03/24	0.42	-0.74	36
Laramie Regional Airport	43.6	17.4	30.5	-0.4	60	03/31	-1	03/24	0.20	-0.38	34
Rawlins Municipal Airport	45.4	20.2	32.8	0.5	63	03/15	0	03/25	0.07	-0.61	10
Sheridan County Airport	47.2	20.6	33.9	-1.3	65	03/14+	5	03/05	0.27	-0.71	28

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These data are available for the entire period of record through the CLIMOD system. For more information please see <http://hprcc.unl.edu/services>.

## March 2013 Top 10 Precipitation Rankings - Highlights

Precipitation Rankings			
Precipitation and Snowfall in inches			
<b>Driest March</b>			
Location	Precipitation / Rank	Record or Previous Record / Year	Period of Record
Garden City Rgnl AP, KS	0.08 / 2nd driest	0.01 / 1966	1947-2013
Scottsbluff, NE	0.21 / 10th driest	0.00 / 2012	1893-2013
Aberdeen, SD	0.24 / 10th driest	0.04 / 1971	1893-2013
Rawlins Muni AP, WY	0.10 / Driest	0.14 / 2012	1951-2013
Rock Springs AP, WY	Trace / Driest	0.05 / 1956	1948-2013
Sheridan, WY	0.27 / 3rd driest	0.14 / 1978	1907-2013
<b>Wettest March</b>			
Location	Precipitation / Rank	Record or Previous Record / Year	Period of Record
Burlington, CO	2.86 / 3rd wettest	4.90 / 1981	1903-2013
Osage City, KS	4.22 / 10th wettest	8.49 / 1973	1896-2013
Minot Exp Stn, ND	1.82 / 5th wettest	2.45 / 1987	1905-2013
<b>Snowiest March</b>			
Location	Snowfall / Rank	Record or Previous Record / Year	Period of Record
Goodland, KS	19.8 / 9th snowiest	32.0 / 1912	1895-2013
Williston, ND	16.1 / 6th snowiest	30.9 / 1975	1894-2013

All Data are Preliminary and Subject to Change.

\* indicates multiple records, latest date is listed

Source: National Weather Service Cooperative Observation Network Data

## State Spotlight - Kansas

Mary Knapp - State Climatologist  
 Kansas State Climate Office, Kansas State University



### Cold Contrast

March 2013 was a very cold contrast to March 2012. Average temperatures ranged from 1.2 degrees cooler than normal in the Southwestern Division to 6.0 degrees cooler than average in the East Central Division. State-wide average temperatures were 5.0 degrees below normal. In contrast, during 2012 the Southwestern Division averaged 8.0 degrees above normal, while the East Central Division averaged 13.1 degrees above normal. The state-wide average temperature was 10.9 degrees above normal. Unfortunately this year, as with temperatures, the precipitation was also below normal. State-wide, the average precipitation was 1.11 inches, which was just 48% of normal. As percent of normal, the Northwest Division ranked the highest at 68 percent. That was only 0.88 inches, much of which came in the form of snow from the 23rd through the 24th. Goodland Renner Field had the highest daily snowfall from a National Weather Service (NWS) site with 11 inches on the 23rd. Herndon 6.9 WNW, in Rawlins County, had the greatest 24 snowfall total from a Community Collaborative Rain Hail and Snow (CoCoRaHS) site with 13 inches on the 24th. One hundred daily snowfall records were set in March, with 20 records tied. Heaviest precipitation totals fell in the eastern portion of the state where more came as rain. The highest 24 hour precipitation total from a NWS site was 3.00 inches at Chautauqua, in Chautauqua County on the 30th. On that same date, Garland 2.7 SW in Bourbon County set the record for the CoCoRaHS network with 2.56 inches. March ended as the 34th driest March of 119 years.

State-wide temperatures averaged 40.8F, which is 5.0 degrees below normal. The Northeastern Division had the coldest average at 36.9F, or 5.6 degrees below normal. The Southwestern Division had the smallest departure from normal, with an average of 42.8F. This was 1.2 degrees below normal. Tribune 14NW (Greeley County) reported the warmest temperature for the month with 88 oF on the 16th. The coldest reading for the month was reported as 0 oF at Brewster 4W (Thomas County) on the 25th.

Despite the below normal moisture, the latest Drought Monitor shows some improvement. Extreme drought now covers 64.28 percent of the state, with just over 17 percent of the state in exceptional drought. With below normal precipitation, March precipitation was lacking but the cooler than normal temperatures allowed for minimal improvement. Only a small portion of the state is in moderate drought, with the majority of the state in extreme drought or worse. The latest Drought Outlook indicated some drought conditions are expected to improve. Much of that may have already been seen, and improvement from exceptional drought to extreme drought will have little effect on the impacts. The El Niño/Southern Oscillation (ENSO) is expected to remain neutral, which reduces the skill in the forecast. The jet stream is expected to shift northward. For April chances are equally likely for precipitation to be above or below state-wide. The temperature outlook calls for warmer than normal temperatures for much of the state. This does not indicate how much warmer conditions might be, and does not exclude the possibility of significant cold weather in the period.

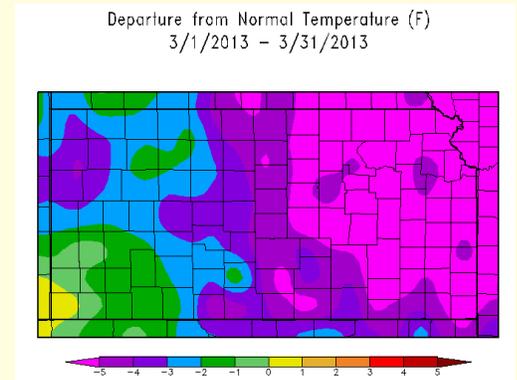


Figure 1. March 2013 departure from average temperatures across Kansas (High Plains Regional Climate Center)

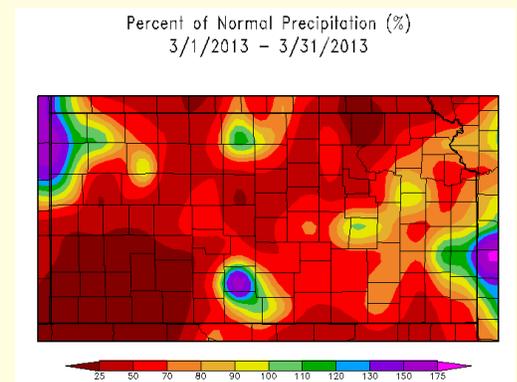


Figure 2. March 2013 percent of normal precipitation across Kansas (High Plains Regional Climate Center)

## State Spotlight - North Dakota

F. Adnan Akyüz - State Climatologist, Barb Mullins - Assistant to the State Climatologist  
 North Dakota State Climate Office, North Dakota State University



### Precipitation:

Below normal precipitation totals of ~50% to ~70% of normal fell in the southern and the east-central part of the state. Above normal amounts of ~130% to ~200% of normal fell in the north, northwest, and a small corner of the southeast based on the High Plains Regional Climate Center (HPRCC) analysis (Figure 1). HPRCC total precipitation amounts were between ~0.5 inches in the below normal regions and greater than an inch in the areas with above normal precipitation. The National Weather Service Grand Forks office reported a major storm on the 4th with significant snowfall in the northeastern part of the state of over a foot including Cavalier at 18", Park River at 16.5", and Gilby 2E at 15.0". A second storm on the 18th also brought the highest totals of 4 to 6 inches to the northeastern part of the state. The U.S. Drought Monitor March 26th report listed 66.51% of the state as having anywhere from Abnormally Dry (D0) through Severe Drought (D2). The Severe Drought (D2) was reported for 24.73% of the state with 33.49% of the state having no drought conditions.

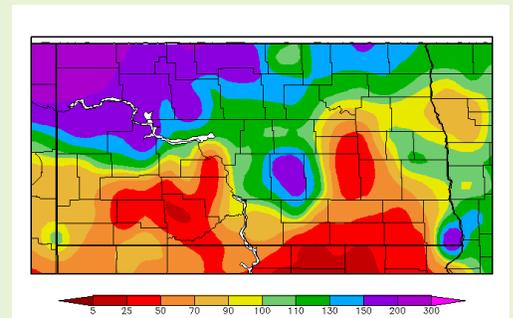


Figure 1. Percent of Normal Precipitation in March 2013 for North Dakota (High Plains Regional Climate Center)

### Temperature:

NDAWN March average air temperatures ranged from ~11 °F in the northeast to ~27 °F in the southwest. Departure from normal average air temperatures ranged from -15 °F to -3 °F (Figure 2). The daily average temperatures were primarily below normal throughout the state. March average monthly temperature for Grand Forks Univ. NWS was the 10th coolest for 2013 and 1956. Fargo March 2013 was 14th coolest along with 1996 and 1923. Minot REC average temperature for March 2013 was 4th coolest.

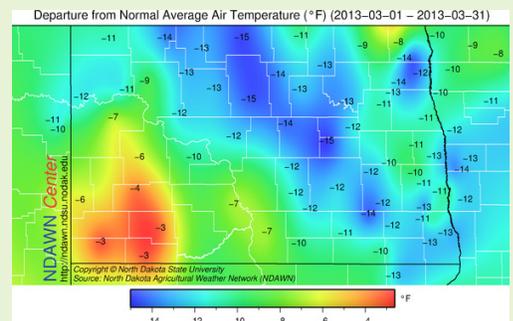


Figure 2. Temperature Departure from Normal in March 2013 for North Dakota (North Dakota State Climate Office)

# About the High Plains Regional Climate Center

The High Plains Regional Climate Center (HPRCC) operates out of the University of Nebraska - Lincoln (UNL) in Lincoln, Nebraska. As one of 6 regional climate centers throughout the nation, HPRCC works closely with other organizations such as the National Climatic Data Center (NCDC), Local and Regional National Weather Service (NWS) Offices, and other climate services organizations such as the National Drought Mitigation Center (also located at UNL) to provide climate data services and specialized climate products.

## For More Information Online

High Plains Regional Climate Center: <http://hprcc.unl.edu>

High Plains Regional Climate Services: <http://hprcc.unl.edu/services>

CLIMOD: <http://climod.unl.edu>

Regional Climate Centers and ACIS: <http://www.rcc-acis.org>

National Weather Service: <http://www.weather.gov>

National Climatic Data Center: <http://ncdc.noaa.gov>

University of Nebraska - Lincoln: <http://www.unl.edu>

National Drought Mitigation Center: <http://drought.unl.edu>

Climate Prediction Center: <http://www.cpc.noaa.gov>

NOAA Storm Prediction Center: <http://www.spc.noaa.gov>



Photo of the Nebraska Sandhills by Bill Sorensen - Senior Programmer - HPRCC

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