2017 Annual Climate Summary

A corn field suffers from lack of rainfall in South Dakota. - Photo courtesy Tom Young via Twitter.

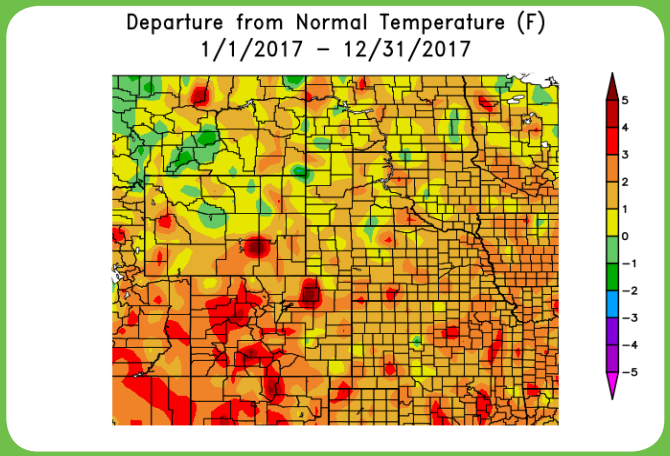
http://hprcc.unl.edu

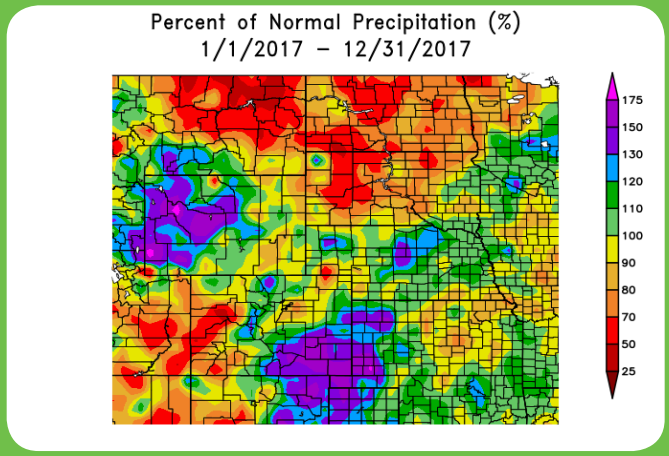
Record Warmth, High Snowpack, Drought Characterize 2017

It was another warm year throughout the High Plains, as 2017 was among the top 10 of warmest years for several locations across the region. Colorado experienced the greatest departures, and Alamosa and Akron had their warmest years on record. The transition seasons were most responsible for this record-breaking warmth, as spring and fall temperatures were approximately 2.0-4.0 degrees F (1.1-2.2 degrees C) above normal. As for precipitation, wet and dry conditions were both present throughout the region. Much of the High Plains experienced a wet winter, and the southern portion of the region had a wet spring as well. Meanwhile, the summer was dry for most, and the fall brought both wet and dry conditions. The major precipitation stories of the year included the high snowpack in the Rockies and the Northern Plains drought. Mountain snowpack was plentiful throughout Wyoming and Colorado, and spring runoff caused streams to flood. However, the Dakotas and Montana experienced drought, which developed during the late spring and peaked during the summer, impacting crops and livestock.

While corn and soybeans did well nationally in 2017, it was a rough year for crops and livestock in the High Plains. In Kansas and Nebraska, winter wheat suffered due to the wet spring, and diseases such as wheat stripe rust, leaf rust, and Wheat Streak Mosaic Virus were reported by producers. In particular, a late-season winter storm dropped a heavy band of snow across the two states that knocked down wheat stands, and it killed thousands of cattle in Colorado. In June, cold temperatures caused frozen corn in South Dakota. In the Northern Plains, spring wheat did not fare well due to summer drought conditions. The drought dried up pastureland and created a hay shortage, forcing ranchers to find alternative feed or sell off livestock. In Nebraska, thousands of acres of corn were damaged during the fall due to a combination of conditions. High temperatures during pollination, followed by cooler temperatures in August led to heavy ears on weakened shanks, which made it easy for high winds in October to snap stalks and knock corn to the ground.

Temperature and Precipitation Overview





Above: Departure from 1981-2010 normal temperature (left) and percent of normal precipitation (right) for 2017 in the High Plains region. Maps produced by the High Plains Regional Climate Center and are available at: http://hprcc.unl.edu/maps/current .

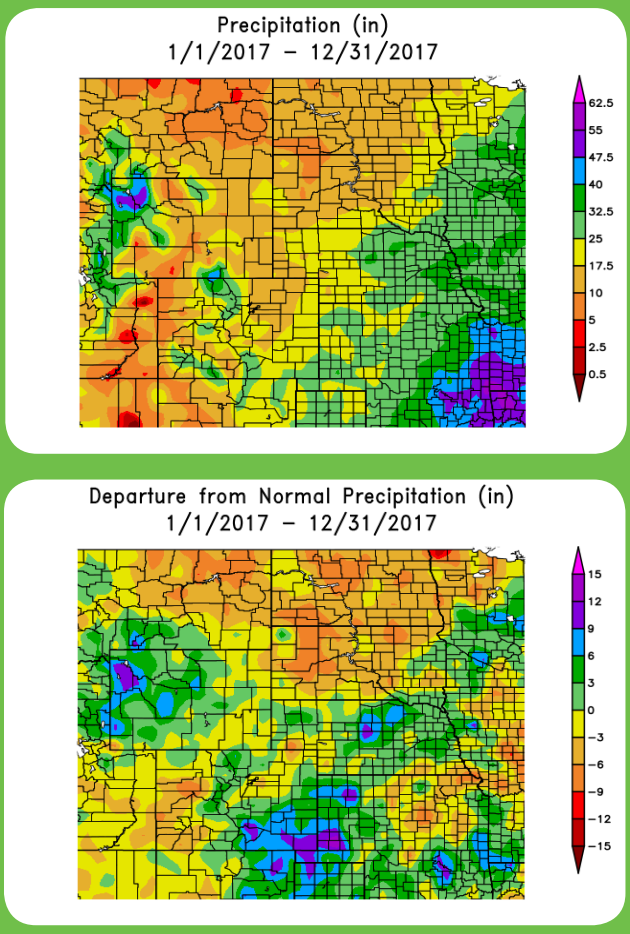
Precipitation

The High Plains had a mix of wet and dry conditions in 2017. Above-normal precipitation occurred throughout Wyoming, Nebraska, eastern Colorado, and western Kansas, while it was dry in the Dakotas and western Colorado. Precipitation records were set for both wetness and dryness. For instance, Alamosa, Colorado and Goodland, Kansas had their 6th wettest and 8th wettest years on record, respectively, while it was the 3rd driest year on record for Grand Junction, Colorado and Dickinson, North Dakota, and 8th driest for Rapid City, South Dakota.

Several months were particularly notable in terms of extreme precipitation, or lack thereof. For instance, January was very wet, setting several top 10 records for wettest and snowiest January. September was also quite wet, with heavy precipitation providing drought relief to the Northern Plains. Meanwhile, June, November, and December brought below-normal precipitation to much of the region, causing drought development and expansion. In May and October, the region was starkly divided by extremely wet and extremely dry conditions, setting records on both ends of the precipitation spectrum.

It was a good year for mountain snowpack in Colorado and Wyoming, as the season got off to a favorable start and timely, ample precipitation enabled the snowpack to build. According to the U.S. Army Corps of Engineers, the reach of the Missouri River above Fort Peck Reservoir peaked on April 29th at 99 percent of normal, while the reach between Fort Peck and Garrison Reservoirs peaked on May 2nd at 148 percent of normal. Both reaches peaked about two weeks later than normal. The high snowpack caused spring flooding from runoff in several places, including the Wind River Indian Reservation in Wyoming. As for the current season, mountain snowpack got off to a good start in the Upper Missouri Basin. In fact, an early October snowstorm in the northern and central Rockies set new snowfall records and caused the greatest impacts in Montana. Wyoming snowpack also started off strong and remained above normal in the northwestern part of the state through December. However, Colorado snowpack got off to a very slow start, as warm and dry fall and early winter conditions inhibited the snowpack from building.

Regional Precipitation



Above: Total precipitation in inches (top) and departure from normal precipitation in inches (bottom) for 2017. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: http://hprcc.unl.edu/maps/current.

While mountain snowpack was abundant last year, Plains snowpack was scarce in the southern and western portions of the region. This was mostly due to above-normal temperatures causing precipitation to fall as rain instead of snow. The following locations had a top 5 least snowiest season on record (defined as the period of July 2016-June 2017): Denver, Colorado (2nd least snowiest), Lincoln, Nebraska (2nd least snowiest), Wichita, Kansas (3rd least snowiest), Concordia, Kansas (3rd least snowiest), Omaha, Nebraska (3rd least snowiest), and Goodland, Kansas (5th least snowiest). However, the Northern Plains snowpack was excessive, causing flooding in North Dakota. This season's Plains snowpack started out below normal for many locations, although there is still plenty of time to catch up.

The following locations had notable precipitation records during 2017:

- Alliance 1WNW, Nebraska: Highest 1-day snowfall total of 17.3 inches (44 cm), February 24 and highest 2-day snowfall total of 22.1 inches (56 cm), February 23-24 (period of record 1894-2018)
- Lander, Wyoming: Highest March 1-day precipitation total of 2.71 inches (69 mm), March 31 and 6th highest 1-day precipitation total on record (period of record 1891-2018)

Temperatures

Overall, temperatures were above normal throughout the High Plains in 2017. Temperature departures ranged from approximately 1.0-3.0 degrees F (0.6-1.7 degrees C) above normal in most areas, with the highest departures occurring in Colorado, where several locations had impressive annual temperature records. For instance, Alamosa and Akron had their warmest year on record, while it was the 2nd warmest for Grand Junction and 3rd warmest for Colorado Springs. Breaking it down by month, the greatest above-normal temperature departures occurred in February, March, July, and November, with all four months yielding record-breaking warmth across parts of the region. As was the case in 2016, average temperatures were influenced more so by warmer minimum temperatures than maximum temperatures. On the other hand, much of the region experienced below-normal temperatures in August, with several locations experiencing a top 10 coolest August on record.

The following locations had notable temperature records during 2017:

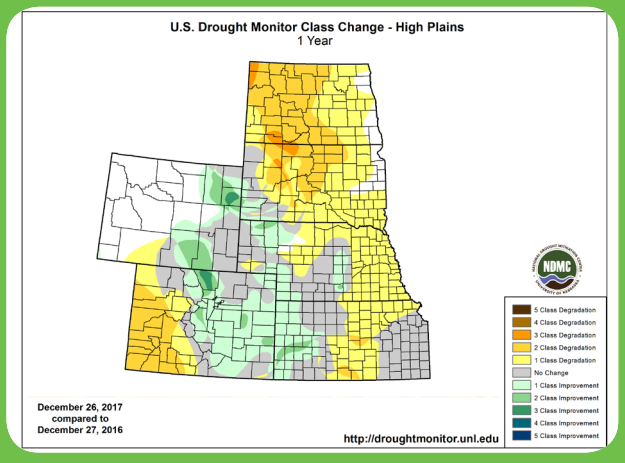
- Laramie, Wyoming: 5th lowest temperature on record at -40.0 degrees F (-40.0 degrees C), January 6 (period of record 1948-2018)
- Denver, Colorado: earliest and latest 80.0 degrees F (26.7 degrees C) temperature on record, February 10 and November 27, respectively (period of record 1872-2018)
- Liberal, Kansas: earliest 90.0 degrees F (32.2 degrees C) temperature on record, February 11 (period of record 1893-2018)
- Valentine, Nebraska: 3rd highest temperature on record at 112.0 degrees F (44.4 degrees C), July 19 (period of record 1889-2018)
- Chadron, Nebraska: earliest fall freeze on record, September 6 (period of record 1942-2018)
- Cheyenne, Wyoming: latest 70.0 degrees F+ (21.1 degrees C) temperature on record, November 26 (period of record 1872-2018)

Drought Conditions

Contrary to 2016, drought was an issue in the region in 2017, impacting several areas but particularly the Northern Plains. At the beginning of the year, abnormally dry or drought conditions (D0-D4 intensity categories on the U.S. Drought Monitor map) were impacting about half of the High Plains region, including eastern Wyoming, western South Dakota, eastern Colorado, southwestern and central Nebraska, and western Kansas. This depiction changed very little throughout the winter months, and then conditions began to gradually improve throughout the spring, thanks to heavy precipitation in drought-stricken areas. Then, extremely dry conditions caused drought to develop in May in the Dakotas and eastern Montana, expanding and intensifying rapidly in June and July. In August, cooler and wetter weather provided some relief, while heavy rains in September vastly improved conditions. However, dryness returned in October, and with frozen soils and the growing season over, conditions changed very little throughout the rest of the year. Impacts from the drought were mostly agricultural in nature. Read more about the Northern Plains drought in the Noteworthy Events section.

In the southern part of the region, a warm and dry fall caused drought to develop in western Colorado and southern and central Kansas. It was a slow start to the mountain snowpack season in Colorado, as statewide Snow Water Equivalent was only about 50 percent of median at the end of December. By the end of the year, 80 percent of the High Plains region was experiencing abnormally dry or drought conditions.

U.S. Drought Monitor



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). For current Drought Monitor information, please see: http://droughtmonitor.unl.edu/.

Noteworthy Events

Ice Storm in Kansas and Nebraska: An ice storm wreaked havoc on southeastern Nebraska and a large part of Kansas from January 14th-16th. A warm and moist air mass settled over frozen ground, creating a widespread freezing rain event. Ice up to 1.0 inches (3 cm) thick accumulated onto trees and power lines, causing them to snap. While ice storms are not uncommon in the region, this event was rather unusual for January in southeastern Nebraska because snow is the predominant form of precipitation in winter.

Early-Spring Wildfires: A warm, dry end to winter and beginning to spring sparked wildfires across the High Plains in March that spread rapidly due to high winds. The most notable was the Northwest Oklahoma Complex fires, which burned parts of Kansas in early March. Several people and thousands of cattle were killed, and thousands of miles of fencing had to be replaced. It became the largest wildfire in Kansas' history, a record that was just set in 2016 by the Anderson Creek Fire. Fires also occurred in Colorado, South Dakota, and Nebraska.

Late-Season Winter Storm: A powerful storm system impacted Colorado, Wyoming, Kansas, Nebraska, and southeastern South Dakota from April 28th-May 1st. One to two feet (30-61 cm) of snow fell across central Nebraska and western Kansas and damaged crops, particularly winter wheat, corn, and alfalfa. In Colorado, the heavy snow and cold temperatures killed cattle and put calves at risk.

Denver Area Hail Storm: On May 8th, severe thunderstorms produced damaging hail in Denver, Colorado and the surrounding area. Hail of at least 2.0 inches (5 cm) in diameter was reported, damaging homes, businesses, and over 100,000 vehicles. While this event was localized in nature, insured losses exceeded $1.5 billion, and it was officially declared a Billion-Dollar Weather Disaster. It also became the most expensive hail storm in Colorado's history.

Northern Plains Drought: Drought developed across North Dakota, South Dakota, and Montana during the late spring and rapidly intensified throughout the summer. Impacts were primarily agricultural in nature, as field crops were damaged and the lack of feed forced ranchers to sell off their livestock. The drought also contributed to an active wildfire season, particularly in Montana where over 1 million acres were burned.

Legion Lake Fire in South Dakota: Warm, dry, and windy conditions contributed to the spread of the Legion Lake Fire, which ignited in December and burned more than 54,000 acres in the Black Hills, becoming the third largest fire in South Dakota's history. The fire burned in Custer State Park, which was forced to close temporarily due to damaged trails, roads, and fences. Wildlife was also impacted, as deer, elk, and buffalo perished in the fire.

Top photo: Ice forms on trees and power lines in Dodge City, KS during the January ice storm. Photo courtesy Stan Rose via Twitter.

Second photo: A calf dies in the late-season winter storm that impacted southeastern Colorado. Photo courtesy Colorado Farm Bureau.

Third photo: The Northern Plains drought dries up pastures, such as this one in Mercer County, ND. Photo courtesy Craig Askim.

Bottom photo: The Legion Lake Fire burns thousands of acres in the Black Hills of South Dakota. Photo courtesy Darren Clabo.

Station Summaries: By the Numbers

Colorado	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Akron Washington County Airport	65.6	37.7	51.7	2.1	103	07/19	-11	01/06	13.69	-3.05	82
Alamosa San Luis Airport	62.5	26.9	44.7	3.2	90	06/21+	-36	01/07	10.69	3.38	146
Colorado Springs Municipal Airport	65.7	38.6	52.1	3.2	95	09/03+	-7	01/06	18.44	1.90	111
Denver International Airport	67.4	38.3	52.8	2.4	100	07/19+	-7	01/06	11.69	-2.61	82
Grand Junction Walker Field Airport	69.4	41.6	55.5	2.9	102	07/09+	-4	01/06	5.08	-4.34	54
Pueblo Memorial Airport	71.0	38.3	54.6	2.7	103	07/19	-15	01/07	15.99	3.42	127

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	66.9	44.0	55.5	1.7	105	07/21	-7	12/31+	36.47	8.58	131
Dodge City Regional Airport	70.8	43.2	57.0	1.7	104	07/21	-5	12/31	25.57	3.97	118
Goodland Renner Field	67.1	38.6	52.8	1.5	100	06/21	-8	01/07+	26.37	6.71	134
Topeka Municipal Airport	68.6	46.0	57.3	2.3	103	07/22	-4	12/31	38.60	2.14	106
Wichita Mid-Continent Airport	70.9	47.8	59.3	2.4	107	07/22	4	12/31+	33.84	1.20	104

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	63.6	33.7	48.6	1.4	108	07/19	-20	12/27	16.35	-1.70	91
Grand Island Airport	64.1	40.5	52.4	1.7	102	07/06	-17	12/26	30.39	3.73	114
Lincoln Municipal Airport	65.7	41.9	53.8	2.3	100	07/21	-17	12/27	37.03	8.08	128
Norfolk Karl Stefan Airfield	62.0	38.7	50.3	1.1	98	07/25	-21	12/31	27.79	0.38	101
North Platte Regional Airport	65.9	36.3	51.1	2.4	107	06/21	-21	01/06	26.24	6.01	130
Omaha Eppley Airport	64.8	43.3	54.0	3.0	103	07/21	-14	12/31	26.40	-4.22	86
Valentine Miller Field	64.5	36.4	50.4	2.5	112	07/19	-20	12/31	18.00	-2.02	90

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismarck Municipal Airport	57.2	32.1	44.7	1.9	103	07/05	-30	01/07	13.79	-4.06	77
Fargo International Airport	54.7	33.6	44.1	1.9	96	06/02	-24	12/31	15.23	-7.35	67
Grand Forks International Airport	52.9	31.4	42.2	2.4	96	06/02	-27	01/13	17.25	-3.56	83
Theodore Roosevelt Airport	55.5	30.2	42.9	0.4	104	07/14+	-31	12/31	10.35	-5.42	66
Williston International Airport	56.0	30.8	43.4	1.9	103	07/16+	-31	12/31	12.34	-2.03	86

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South Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Aberdeen Regional Airport	57.3	32.1	44.7	1.8	104	07/17	-32	12/31	15.22	-6.50	70
Huron Regional Airport	59.1	35.2	47.1	1.2	101	07/17	-31	12/31	20.64	-2.26	90
Pierre Regional Airport	60.5	35.9	48.2	0.9	106	07/09	-25	12/31	13.90*	-6.11	69
Rapid City Regional Airport	61.9	33.8	47.8	0.8	106	07/09	-21	12/31+	11.29	-5.00	69
Sioux Falls Joe Foss Field Airport	59.0	37.8	48.4	2.8	96	07/25+	-20	12/31	25.20	-1.18	96

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	60.0	32.3	46.2	0.9	98	07/14+	-28	01/05	14.10	1.58	113
Cheyenne Municipal Airport	61.1	35.5	48.3	2.0	97	07/19	-17	01/06	15.07	-0.87	95
Lander Hunt Field Airport	*	*	*	*	*	*	*	*	*	*	*
Laramie Regional Airport	57.2	28.8	43.0	2.1	92	07/19	-40	01/06	10.34	-0.58	95
Rawlins Municipal Airport	58.1*	31.8*	44.9*	2.5	94	07/19	-32	01/06	9.52*	0.27	103
Sheridan County Airport	60.3	31.3	45.8	0.7	102	07/20	-22	02/03	18.77	4.61	133

2017 Highlights

Annual Rankings

Temperature in degrees F / Precipitation in inches

Warmest	**Temperature / Ranking**	**Record / Year**	**Period of Record**
Akron, CO	51.7 / WARMEST	51.4 / 1994	1939-2018
Alamosa, CO	44.7 / WARMEST	44.6 / 2015	1933-2018
Grand Junction, CO	55.5 / 2nd warmest	57.4 / 1934	1893-2018
Colorado Springs, CO	52.1 / 3rd warmest	52.9 / 2012	1895-2018
Cheyenne, WY	48.3 / 3rd warmest (tie, 1981)	49.0 / 2012	1873-2018
Valentine, NE	50.4 / 4th warmest (tie, 2016)	52.0 / 2012	1890-2018
Laramie, WY	43.0 / 4th warmest	44.2 / 2012	1948-2018
Omaha, NE	54.0 / 6th warmest (tie, 1938+)	55.9 / 1931	1871-2018
Denver, CO	52.8 / 8th warmest	54.8 / 1934	1872-2018
Pueblo, CO	54.6 / 8th warmest	56.5 / 1981+	1889-2018
Fargo, ND	44.1 / 8th warmest (tie, 1990)	46.7 / 2016	1881-2018
Grand Forks, ND	42.2 / 8th warmest	44.4 / 2016	1894-2018
Wichita, KS	59.3 / 9th warmest (tie, 1938+)	61.4 / 2012	1889-2018
Wettest / Driest	**Precipitation / Ranking**	**Record / Year**	**Period of Record**
Alamosa, CO	10.69 / 6th wettest	11.55 / 1969	1906-2018
Goodland, KS	26.37 / 8th wettest	30.89 / 1915	1895-2018
Grand Junction, CO	5.08 / 3rd driest	4.41 / 1956	1893-2018
Dickinson, ND	10.35 / 3rd driest	9.17 / 1988	1949-2018
Rapid City, SD	11.29 / 8th driest	9.12 / 1974	1943-2018

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About the High Plains Regional Climate Center

The High Plains Regional Climate Center (HPRCC) is one of six NOAA Regional Climate Centers (RCCs) that has been providing timely climate data and information to the public for cost effective decision-making since 1987. The HPRCC primarily serves the six-state region of Colorado, Kansas, Nebraska, North Dakota, South Dakota, and Wyoming, but has also served people from all across the country and even throughout the world. HPRCC operates under a three-tiered structure of climate services and works closely with other organizations on the local, regional, and national levels. HPRCC staff engage with a wide range of stakeholders including K-20 education, the public, media, private industry, research, and state/tribal/federal entities, among others.

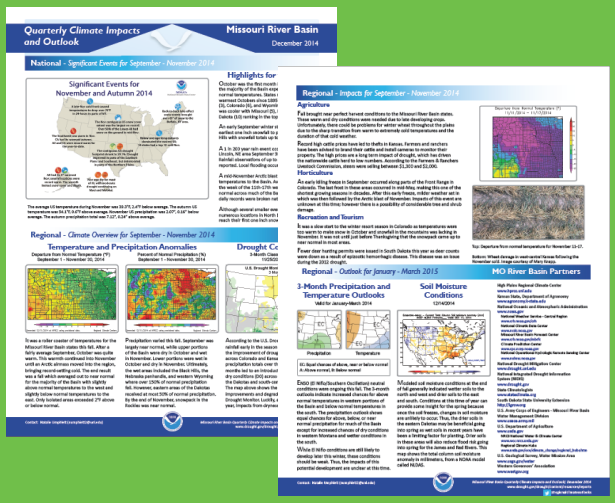
Much of the data and products found throughout this publication were built on the Applied Climate Information System (ACIS) framework. ACIS was designed to manage the complex flow of information from climate data collectors to the end users of climate data information. The main purpose of ACIS is to alleviate the burden of climate information management for people who use climate information to make management decisions.

HPRCC is involved in the ongoing development and management of ACIS. In the spring of 2014, the RCCs released a new website for ACIS. This new and improved website not only contains descriptions of ACIS and the sources of data found within, but also features real-world examples of how RCCs and external groups are using ACIS for their particular climate data needs. In addition to these examples, there is extensive documentation and tutorials on how ACIS can be used and accessed by external clients using Web Services. For more information see: http://rcc-acis.org.

ACIS Applied Climate Information System

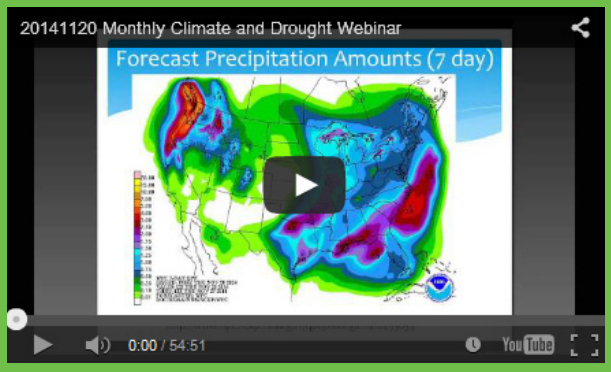
Additional Summary Information for the High Plains

Missouri River Basin Quarterly Climate Impacts and Outlook



For more information:
https://www.drought.gov/drought/dews/missouri-river-basin/reports-assessments-and-outlooks

Midwest and Great Plains Monthly Climate and Drought Webinar



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Author Information

For questions, comments, or suggestions, please contact:
Crystal Stiles, Applied Climatologist
(402) 202-3320 - cstiles3@unl.edu
713 Hardin Hall, 3310 Holdrege Street
Lincoln, NE 68583-0997
http://hprcc.unl.edu

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