



# 2021 Annual Climate Summary

Sunset in Lincoln, NE. Photo courtesy Heleena Pettee, High Plains Regional Climate Center.  
<http://hprcc.unl.edu>

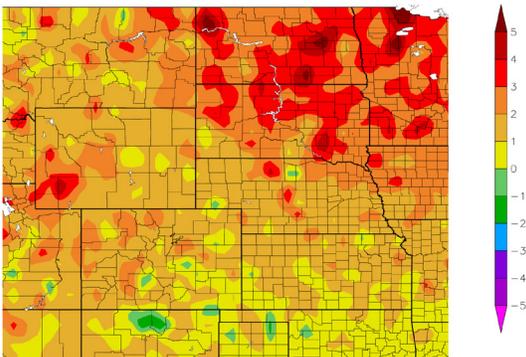
## A Year of Extremes

2021 was a year of extremes in the High Plains. January began the year with above normal temperatures across the region. Monthly temperature departures were as high as 15.0 degrees F (8.3 degrees C) above normal. This warmth led to drought expansion in the Dakotas which is abnormal to see in winter. Historic cold gripped the region in February as bitter cold persisted for 1-2 weeks, which made this event particularly impressive due to its longevity. Avalanche danger was extremely high in the Rockies throughout the winter as early season snowfall was weakened by dry conditions. The Southern portion of the region experienced an extremely wet early spring with above normal precipitation. The heavy precipitation recharged soil moisture and built snowpack in the mountains. Despite this heavy precipitation, flooding was limited in the region due to dry soil conditions.

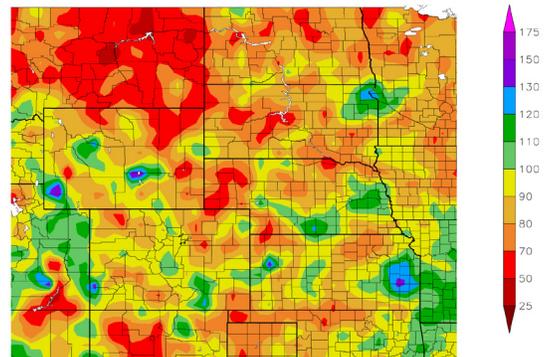
Drought conditions intensified and expanded throughout the spring and persisted through the remainder of the year. Drought conditions were most extreme in the Northern Plains where crops and rangelands were impacted by the lack of moisture and heat. Over 80 percent of pastures and rangeland in the Dakotas were in poor to very poor conditions by the end of the summer. Poor forage, low stock ponds, and pests led to increased cattle sales across the region. The dry conditions and heat impacted crops and led to early maturation and harvest. Pollinators and wildlife were also impacted as a result of drought conditions. Dwindling beehives led to a decrease in the Dakotas honey production this year. Fawn survival rates were lower than average with a lack of forage and some fish populations decreased from low river levels. As 2021 came to an end, 65 percent of the region in D1-D3 conditions, and 88 percent of the region remained in abnormally dry (D0) conditions.

## Temperature and Precipitation Overview

Departure from Normal Temperature (F)  
1/1/2021 - 12/31/2021



Percent of Normal Precipitation (%)  
1/1/2021 - 12/31/2021



Above: Departure from 1981-2010 normal temperature (left) and percent of normal precipitation (right) for 2021 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

2021 remained another dry year across the High Plains. The majority of the region experienced below normal precipitation for the year. While late winter and early spring started off wet in the region, that quickly changed as summer began and drought conditions started to expand and worsen throughout the remainder of the year. While only a couple of locations ranked in the top 10 wettest/driest for the year, many locations set new monthly records throughout 2021. Chadron, NE ranked the 5th driest year on record with 11.50 inches (292.1 mm) of precipitation recorded for the year. In contrast, Sisseton, SD had their 8th wettest year on record with a total of 28.98 inches (736.1 mm) of precipitation.

Snowpack for the 2020-21 season was below normal for the region resulting in portions of the upper Missouri River Basin runoff being much lower than average. Snow Water Equivalent (SWE) peaked above Fort Reservoir at the end of March with 86 percent of the normal peak, while the reach between Fort Peck and Garrison Reservoirs peaked at the end of April at 96 percent of the normal peak. Both areas ended the season below average with Snow Water Equivalent (SWE) 80 percent of average above Fort Peck Reservoir and 65 percent of average between Fort Peck and Garrison reservoirs. As a result, as summer began, Basin runoff was 69 percent of average. As this year's snow season (2021-2022) began, early-season snowpack across the region is below normal as a result of a warmer and drier start to the winter season. While it is still early in the 2021-2022 season, this can become a concern to farmers as they look to spring planting.

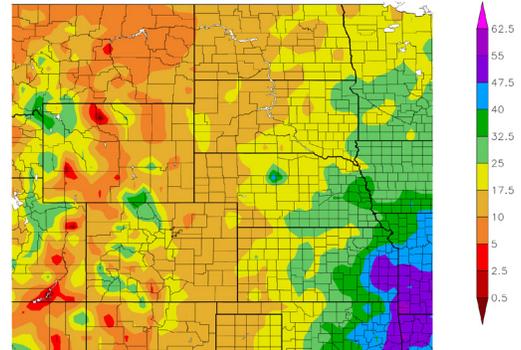
The severe weather season in the region was less active for the year. In June, only four tornado warnings were issued across Kansas, which is well below the June average of 29 (based on data going back to 1986). At the end of peak severe weather season in July for the High Plains, every state aside from Colorado was 50 percent below their yearly total for tornadoes, according to the Storm Prediction Center. South Dakota and Nebraska both had their lowest number of severe weather warnings since 1995. Aside from this, there were some extreme severe weather events including an unusual December Derecho that moved across the plains causing damaging winds and tornadoes (see page 4 for details).

The following locations had notable precipitation records during 2021:

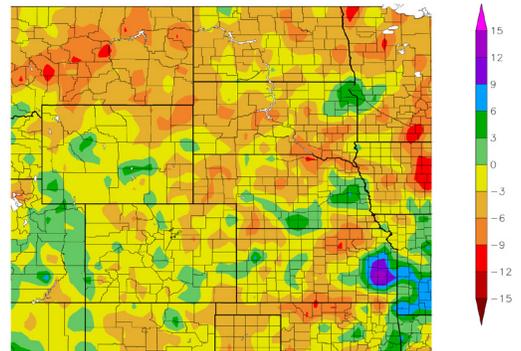
- Akron, Colorado had its wettest spring on record with 10.78 inches (274 mm) of precipitation (period of record 1937-2021).
- Tribune, Kansas reported 5.66 inches (144 mm) of rain on May 16th, which was the highest 1-day total precipitation ever recorded at this location (period of record 1893-2021)
- Denver, Colorado reported its first measurable snow of the season on December 10th surpassing the previous record of November 21st, 1934, by 19 days.
- Grand Forks, North Dakota had its driest July with 0.42 inches (11 mm) of precipitation (period of record 1893-present). This was 3.10 inches (79 mm) below normal.

### Regional Precipitation

Precipitation (in)  
1/1/2021 - 12/31/2021



Departure from Normal Precipitation (in)  
1/1/2021 - 12/31/2021



Above: Total precipitation in inches (top) and departure from normal precipitation in inches (bottom) for 2021. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: <http://hprcc.unl.edu/maps/current>.

## Temperatures

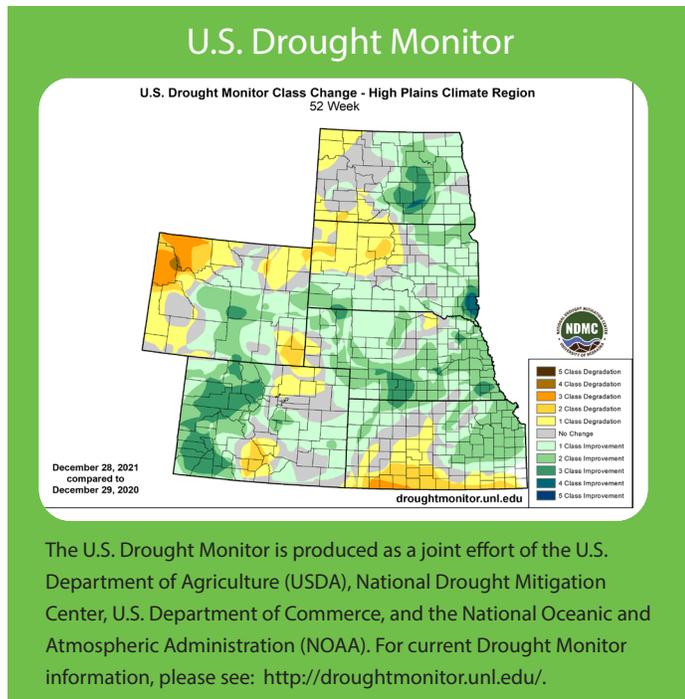
Temperatures across the region were above normal for the year, with the northern part of the region being well above normal. The majority of the region experienced departures of 2.0 degrees F (1.1 degrees C) with isolated parts of North Dakota observing departures of above 5.0 degrees F (2.8 degrees C). The year started with above normal temperatures but cooled off dramatically with a historic outbreak of Arctic air that affected the region during the middle of February. Multiple records were broken during the span of several weeks. Outside of cooler temperatures in March and May, the region experienced above normal temperatures throughout the year.

The following locations had notable temperature records during 2021:

- Sisseton, South Dakota: Warmest year on record. The average temperature was 48.0 degrees F (8.9 degrees C), which broke the previous record of 47.1 degrees F (8.4 degrees C), set in 2016 (period of record 1931-2021)
- Bismarck, North Dakota: Also observed the warmest year on record. Average temperatures were 47.2 degrees F (8.4 degrees C), which broke the previous record of 46.5 degrees F (8.1 degrees C) from 2016 (period of record 1886-2021)
- Omaha, Nebraska: Warmest December temperature on record at 74.0 degrees F (23.3 degrees C), December 15 (period of record 1871-2021)
- Bottineau, North Dakota: Lowest temperature on record at -51.0 degrees F (-46.1 degrees C), February 13 (period of record 1893-2021)
- Grand Junction, Colorado: Warmest temperature on record at 107 degrees F (41.7 degrees C), July 9 (period of record 1893-2021)
- Bismarck, North Dakota: Most number of 100.0 degree F (37.8 degrees C) in a single year, 15 days

## Drought Conditions

According to the U.S. Drought Monitor, significant improvements to drought conditions were observed throughout the High Plains this past year. At the beginning of 2021, 81 percent of the region was in moderate to exceptional (D1-D4) conditions. The drought was particularly devastating in Colorado, where 28 percent of the state was in D4 conditions and 76 percent of the state experienced extreme drought (D3) at the start of the year.



During the course of the year, conditions deteriorated drastically then rebounded in North Dakota. At the peak of the drought on May 18th, 85 percent of the state experienced D3 conditions and 17 percent of the state was within D4 conditions. The drought caused serious issues for agriculture during the late spring and summer months. At the year's end, conditions have improved substantially with only 8 percent of the state in D3 conditions. Colorado began the year in bad shape but gradually improved throughout the year. Despite the improvements to drought conditions, the state observed destructive wildfires in late December which destroyed hundreds of homes north of Denver.

At the end of the year, 65 percent of the region was experiencing D1 to D3 conditions. Although the majority of the region was in drought conditions, the entire region has been without D4 conditions to end the year. Even with the improvements this past year, 88 percent of the region remained in abnormally dry (D0) conditions.

## Noteworthy Events

**Historic February Cold:** Historic cold impacted the region in February. Many areas in the region observed record-breaking temperatures and temperature departures exceeding 40 degrees F (22.2 degrees C) below normal occurred in Nebraska. The extreme cold was most notable due to its duration which lasted for 1-2 weeks. The Southwest Power Pool, which serves the Dakotas, Nebraska, and Kansas, was most impacted with rolling blackouts and requests to residents to conserve energy until temperatures increased.

**March Precipitation :** A slow-moving storm system brought heavy rain and snow over the southern High Plains. Many areas received over 200 percent of their normal precipitation for the month of March. Numerous daily and monthly records were set, and some locations received more precipitation from this storm than what they would expect for the entire month. While this system caused areas of flooding, road closures, and canceled flights, it did help to replenish soil moisture and improve drought conditions.

**Colorado Mudslides:** Localized heavy rains in burn-scarred areas led to multiple mudslides along I-70 in Colorado. Starting in late June, multiple mudslides resulted in the closure of the major interstate and traffic delays. July 29th, more than 100 motorists were trapped on the interstate overnight with some taking shelter in a nearby tunnel. This July event closed I-70 for a record 15 days before debris could be removed to make way for motorists.

**December Derecho:** On December 15th, a powerful derecho moved across the High Plains and traveled more than 650 miles across the country. Impacts in our region were observed across Colorado, Nebraska, and Kansas. Preceding the storm, daily temperature records were being set all across the region. High winds from the derecho set new daily wind records, created dust storms, and damaged structures and powerlines. Tornadoes also occurred in areas, Nebraska exceeded their previous December tornado record of 5 after 27 tornadoes were confirmed across the state.

**Drought Across the Region:** Drought conditions persisted throughout the year with impacts seen across the region. Pastures and rangeland were in poor to very poor conditions, with poor water quality and forage, resulting in increased cattle sales. Extreme heat resulted in earlier than average maturation and harvest for crops as well as pest issues as a result of grasshoppers thriving in warm conditions. Wildlife and pollinators were also impacted with lower than average pronghorn fawn survival rates and dwindling beehive sizes.

**Wildfires:** Warm and dry conditions resulted in multiple wildfires across the region this year, the most severe in Wyoming and Montana. Smoke from the wildfires could be seen across the High Plains with hazy skies.



**Top photo:** Snow in Lincoln, NE. Photo courtesy Heleena Pettee, High Plains Regional Climate Center.

**Second photo:** Flooding at Holmes Lake in Lincoln, NE. Photo courtesy Rezaul Mahmood, High Plains Regional Climate Center.

**Third photo:** Drought stressed crops in KS. Photo courtesy Chip Redmond

**Bottom photo:** Burn scarred area along Pourde River in CO. Photo courtesy Dannele Peck

## 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	65.1*	37.9*	51.5*	1.3	101	07/08	-22	02/15	14.09	-1.30	92
Alamosa San Luis Airport	63.5	25.0	44.2	1.9	94	07/10+	-14	01/27	5.66	-1.73	77
Colorado Springs Municipal Airport	65.7	38.3	52.0	1.6	100	06/16	-16	02/15	14.46	-1.91	91
Denver International Airport	66.7	38.6	52.7	1.5	102	07/08	-16	02/15	12.53	-1.95	87
Grand Junction Walker Field Airport	68.0	41.1	54.5	1.3	107	07/09	4	01/02+	9.79	0.73	108
Pueblo Memorial Airport	70.8	37.7	54.2	1.0	103	07/09+	-20	02/15	15.39	3.37	128

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	67.7	45.0	56.4	2.3	105	06/17	-22	02/16	23.06*	-5.32	81
Dodge City Regional Airport	70.6	43.2	56.9	1.0	105	09/11+	-14	02/15	19.82	-2.18	90
Goodland Renner Field	67.9	37.9	52.9	1.2	104	06/17	-24	02/15	13.21	-5.88	69
Topeka Municipal Airport	68.2	45.9	57.0	1.2	101	06/17	-21	02/16	36.64	0.11	100
Wichita Mid-Continent Airport	70.0	46.6	58.3	0.6	103	08/12	-17	02/16	30.56	-3.75	89

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	64.7	34.5	49.6	1.3	107	07/28	-25	02/15	11.58	-3.64	76
Grand Island Airport	65.0	41.7	53.3	1.5	106	06/17	-27	02/16	28.59	1.98	107
Lincoln Municipal Airport	65.8	41.6	53.7	1.4	103	06/17	-31	02/16	26.86	-2.34	92
Norfolk Karl Stefan Airfield	63.4	40.1	51.7	2.5	100	06/17+	-31	02/16	25.66	-1.35	95
North Platte Regional Airport	66.4	36.9	51.6	1.7	103	06/16	-29	02/15	23.12	2.04	110
Omaha Eppley Airport	64.7	43.5	54.1	1.7	105	06/17	-23	02/16	33.21	1.35	104
Valentine Miller Field	65.9	38.0	51.9	2.8	108	06/23	-33	02/15	22.69	1.79	109

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismarck Municipal Airport	60.4	34.0	47.2	4.1	107	07/03	-28	02/13	12.42	-6.63	65
Fargo International Airport	56.2	34.2	45.2	3.0	102	06/04	-26	12/29	19.11*	-4.84	80
Grand Forks International Airport	55.2	30.9	43.1	3.3	103	06/04	-33	12/31	19.13	-2.61	88
Theodore Roosevelt Airport	59.2	32.0	45.6	2.8	103	08/16	-30	02/14	12.90*	-2.73	83
Williston International Airport	56.2	32.8	44.5	2.8	104	07/19	-28	02/13	10.03	-5.08	66

All data are preliminary and subject to change. + indicates multiple dates, latest date listed. \* indicates some missing data for the period. Data are retrieved through the Applied Climate Information System (ACIS) and are available online through the CLIMOD system. For more information please contact us: <http://www.hprcc.unl.edu/contact.php>.

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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	60.4	35.0	47.7	3.6	104	06/05	-25	02/15	19.26	-2.56	88
Huron Regional Airport	60.8	36.8	48.8	2.9	106	07/28	-23	02/14	20.28	-3.04	87
Pierre Regional Airport	62.7	36.9	49.8	2.8	108	07/27	-24	02/14	14.13*	-6.07	70
Rapid City Regional Airport	62.1	34.3	48.2	1.5	107	07/27	-24	02/13	16.37	-1.07	94
Sioux Falls Joe Foss Field Airport	60.8	39.1	49.9	3.3	101	07/28+	-26	02/15	27.73	-0.57	98

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	60.6	32.0	46.3	0.7	101	06/12	-24	02/14	14.52	2.3	119
Cheyenne Municipal Airport	60.8	35.3	48.1	1.2	96	9/10+	-15	02/14	14.21	-1.20	92
Lander Hunt Field Airport	61.3	33.7	47.4	2.3	100	07/19	-13	02/14	15.01	1.78	114
Laramie Regional Airport	57.0	29.0	43.0	1.6	94	06/15	-17	02/14	9.23	-1.29	88
Rawlins Municipal Airport	58.3	31.7	45.0	1.9	96	07/19+	-14	02/14	9.63	0.59	107
Sheridan County Airport	62.4	32.4	47.4	2.5	107	07/27+	-27	02/14+	12.95	-0.93	93

## 2021 Highlights

### Annual Rankings

Temperature in degrees F / Precipitation in inches

Warmest / Coolest	Temperature / Ranking	Record / Year	Period of Record
Sisseton, SD	48.0 / WARMEST	47.1 / 2016	1931-2021
Bismarck, ND	47.2 / WARMEST	46.5 / 2016	1886-2021
Aberdeen, SD	47.7 / 2nd warmest	48.1 / 1987	1893-2021
Valentine, NE	51.9 / 2nd warmest	52.0 / 2012	1889-2021
Alamosa, CO	44.2 / 3rd warmest (tied with 1954)	44.7 / 2017	1906-2021
Rawlins, WY	45.0 / 3rd warmest	46.2 / 2012	1951-2021
Colorado Springs, CO	52.0 / 4th warmest	59.0 / 2012	1894-2021
Norfolk, NE	51.7 / 4th warmest (tied with 2005)	53.2 / 2012	1893-2021
Grand Island, NE	53.3 / 4th warmest	56.0 / 1934	1895-2021
Grand Forks, ND	43.1 / 4th warmest	44.4 / 2016	1893-2021
Laramie, WY	43.0 / 4th warmest (ties with 2017)	44.2 / 2012	1948-2021
Chadron, NE	49.6 / 4th warmest (tied with 2020)	50.7 / 1981	1941-2021
Scottsbluff, NE	51.4 / 4th warmest	53.0 / 2012	1893-2021
Dickinson, ND	45.6 / 4th warmest (tied with 1999)	46.6 / 1987	1938-2021
Williston, ND	44.5 / 5th warmest (tied with 1934)	46.8 / 1981	1894-2021
Cheyenne, WY	48.1 / 5th warmest (tied with 2015)	49.0 / 2012	1871-2021
Wettest / Driest	Precipitation / Ranking	Record / Year	Period of Record
Sisseton, SD	28.98 / 8th wettest	34.92 / 2019	1931-2021
Chadron, NE	11.58 / 5th driest	7.61 / 2020	1941-2021

All data are preliminary and subject to change. + indicates multiple dates, latest date listed. \* indicates some missing data for the period. Data are retrieved through the Applied Climate Information System (ACIS) and are available online through the CLIMOD system. For more information please contact us: <http://www.hprcc.unl.edu/contact.php>.

# 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>.



## 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

To sign up for future webinars:  
<https://www.drought.gov/drought/calendar/webinars>

For an archive:  
[www.hprcc.unl.edu/webinars.php](http://www.hprcc.unl.edu/webinars.php)

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