NORTH DAKOTA STATE CLIMATE OFFICE ndsco

North Dakota Climate Bulletin

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In This Issue

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NCEI, NDSCO, NDAWN, USGS, SPC, CPC, USDM.

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North Dakota State Climate Office
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North Dakota State University

From the State Climatologist

The North Dakota Climate Bulletin is a digital quarterly publication of the North Dakota State Climate Office, College of Agriculture, Food Systems and Natural Resources, North Dakota State University in Fargo, North Dakota.

This summer was the 36th warmest (warmest summer since 2014) and the 19th driest (the driest summer since 2006) on record since 1895 statewide in ND. Overall there were 66 highest daily and 64 lowest daily temperature records either broken or tied. In addition, 57 highest daily precipitation records either broken or tied including two daily snowfall records in June. A total of 187 records were either tied or broken which include temperature and precipitation related occurrences across the state. There were 37 tornados, 179 hail events and 102 wind damage reports were filed. Drought conditions intensified compared to the previous spring. By then, the state was experiencing the worse drought since June 2006 based on an index that takes into account drought intensity (D-level) and coverage (%).

Detailed monthly climate summaries for June, July and August can be individually accessed via
https://www.ndsu.edu/ndsco/climatesummaries/monthlyclimatesummary/2017/

The bulletin will contain graphical displays of statewide seasonal temperature, precipitation, and other weather highlights.

This bulletin can be found at http://www.ndsu.edu/ndsco/, along with several other local resources for climate and weather information.

Bowman, ND: by Randall Gaebe through the *Drought Impact Reporter, NDMC.*

Adnan Akyüz, Ph.D.
North Dakota State Climatologist

Weather Highlights

Seasonal Weather Summary: By Adnan Akyüz

Precipitation

Using analysis from the National Centers for Environmental Information (NCEI), the average North Dakota precipitation for the summer season (June 1, through August 31, 2017) was 6.3 inches, which was 3.08” less than last year, 2” less than the 1981-2010 average summer precipitation and was the driest Summer since 2006. This would rank summer 2017 as the 19th driest summer since such records began in 1895. Figure 1 shows the percent of normal precipitation distribution geographically. Based on historical records, the state average summer precipitation showed a positive average long-term trend of 0.01” per decade since 1895. The highest and the lowest seasonal summer average precipitation for the state ranged from the highest amount of 15.54” in 1993 to the lowest amount of 3.32” in 1929. The “Historical Summer Precipitation For North Dakota” time series on page 5 shows a graphical depiction of these statistics.

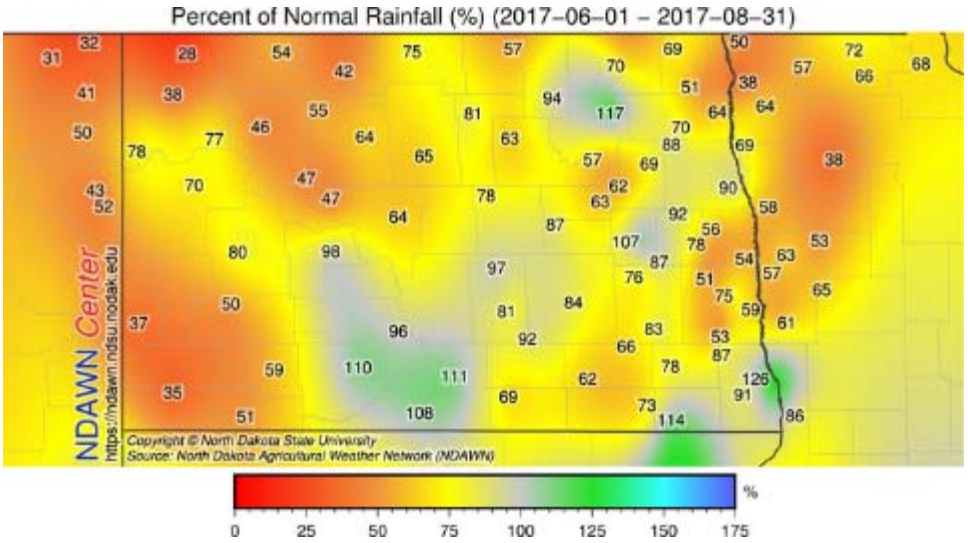


Figure 1. Precipitation % of Normal in Summer 2017 for North Dakota (NDAWN)

Flood: There were no major floods reported in North Dakota where the river stages reached above the NWS flood stage. Despite the progressive heavy rains Sioux, Grant and Morton counties in July and again in August, this time including Emmons County, dry soil soaked up the precipitation as fast as it fell leaving no room for a surface flow.

Temperature

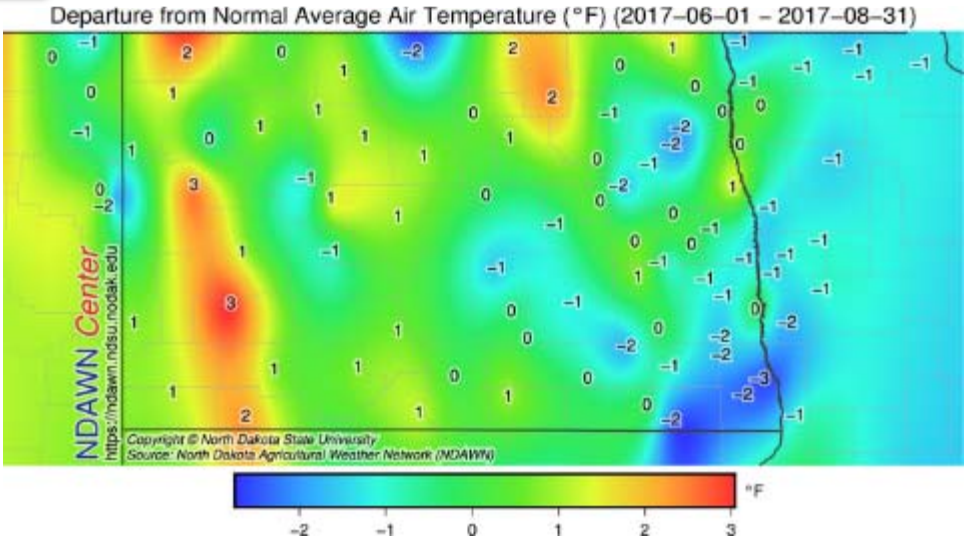


Figure 2. Temperature Departure from Normal in Summer 2017 for North Dakota (NDAWN)

The average North Dakota temperature for the summer season (June 1 through August 31, 2017) was 67.5°F, which was 0.2°F colder than last year, but 0.8°F warmer than the 1981-2010 average summer temperature and was the coldest summer since 2014. This would rank summer 2017 as the 36th warmest summer since such records began in 1895. Figure 2 shows the departure from normal temperature distribution geographically. Based on historical records, the state average summer temperature showed a positive trend of 0.15°F per decade since 1895. The highest and the lowest seasonal summer average temperatures for the state ranged from the highest amount of 72° in 1936 to the lowest amount of 61.2° in 1915. The "Historical Summer Temperature For North Dakota" time series on page 6 shows a graphical depiction of these statistics.

Drought: Following the 9th driest spring, the end of the summer yielded the 8th driest 6 months in a row from March through August. Even though the precipitation pattern changed in August making it the first wetter than average month since March, the precipitation came too late for most agricultural purposes. Because of the drought intensity during most early stages of the growing season, some of the impacts were irreversible. Therefore, the majority of western North Dakota remained in Extreme and Exceptional drought categories. High nitrate concentrations in stock ponds and dugouts made any water in these locations useless. Air quality was low in counties adjacent to the Montana border because of the drought-related forest fires in MT. Figure 3 below shows the drought conditions in the beginning and the end of summer (USDM).

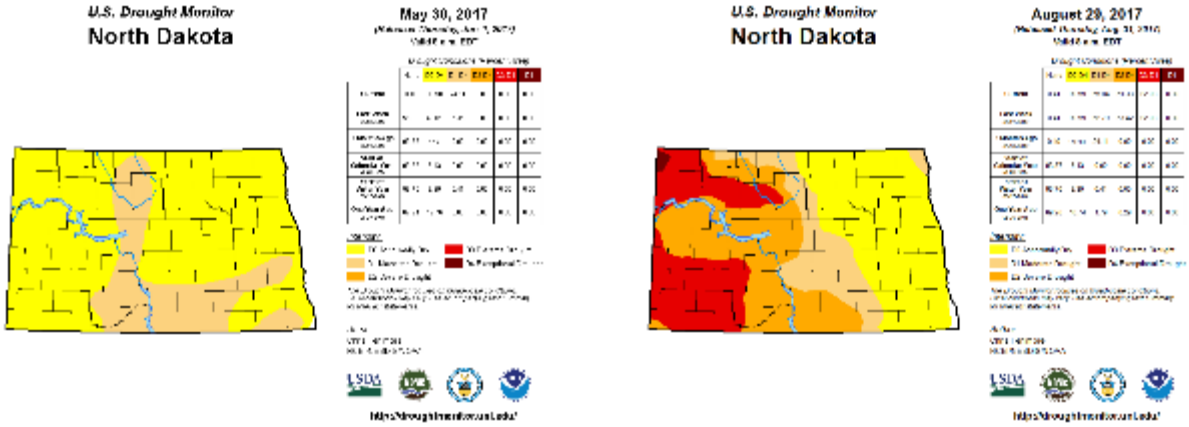


Figure 3. Drought Monitor map Comparison for North Dakota in the Beginning (on the left) and at the end (on the right) of Summer 2017.

Figure 4 below shows the statewide drought coverage in % and intensity (i.e. DO, D1, etc…) in time scale representing the state from the beginning to the end of the month with one-week resolution.

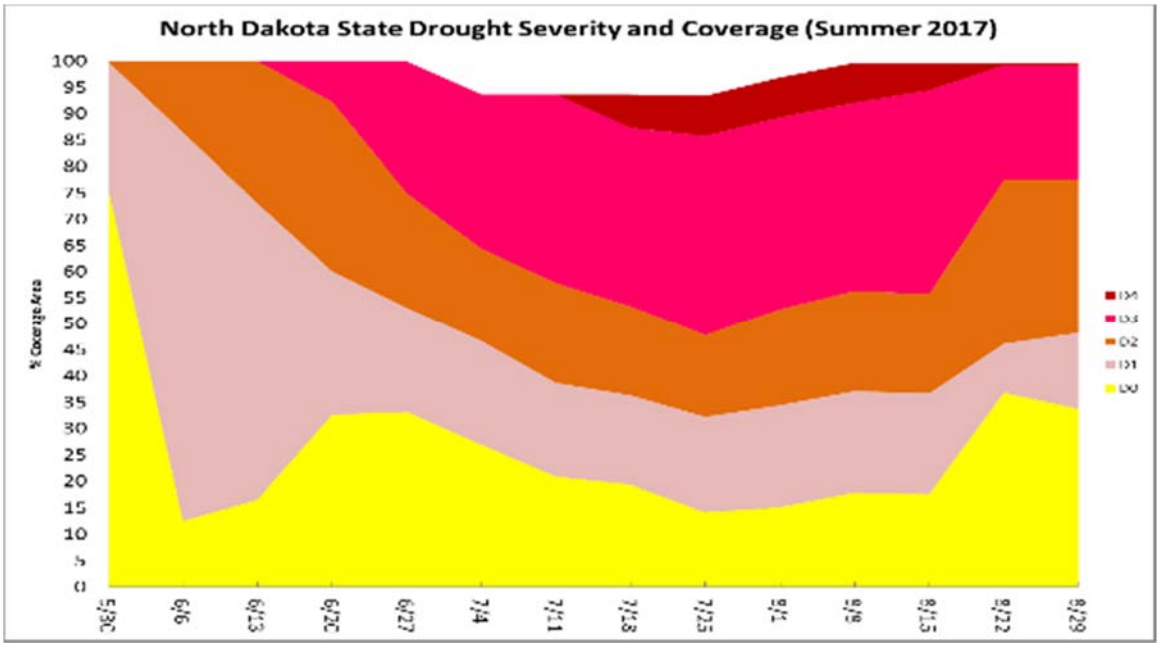


Figure 4. Statewide Drought Coverage (%) and Intensity (Dx) in Summer 2017.

Based on the index that takes into account intensity (D-level) and coverage (%) called Drought Intensity and Coverage Index (Figure 5), the index by the end of the season was 229. However, the index value reached its maximum value of 295, recorded in the first week of August. August 2006 was the last time this number was exceeded.

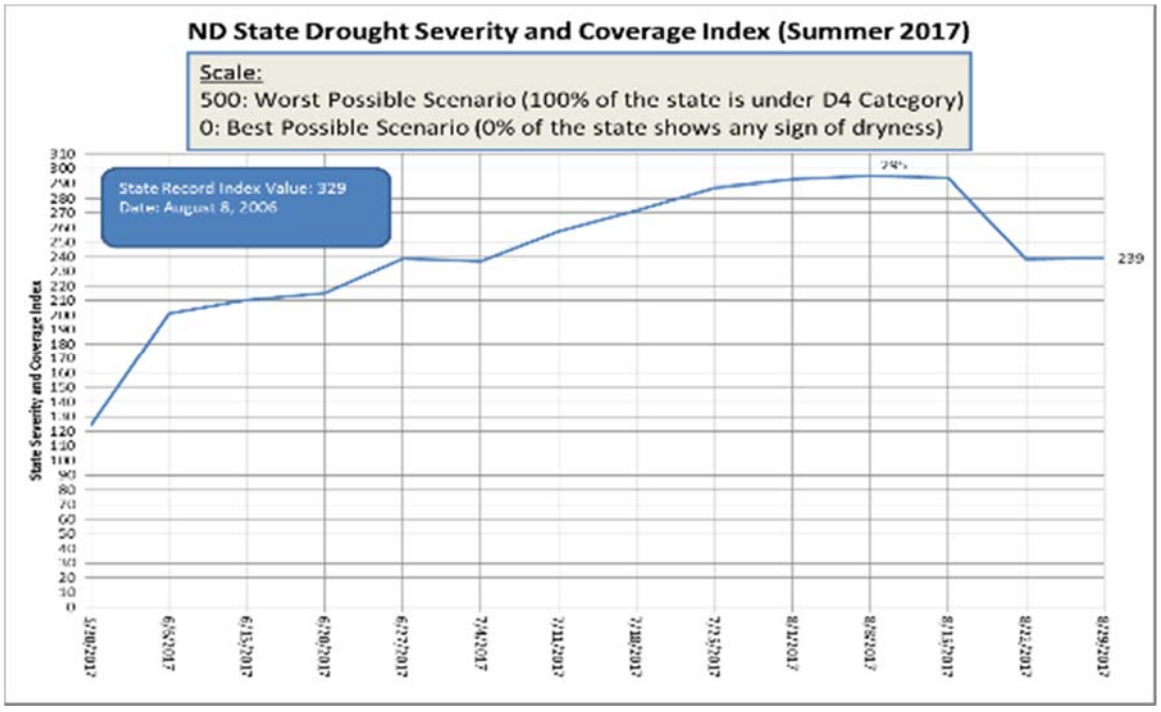
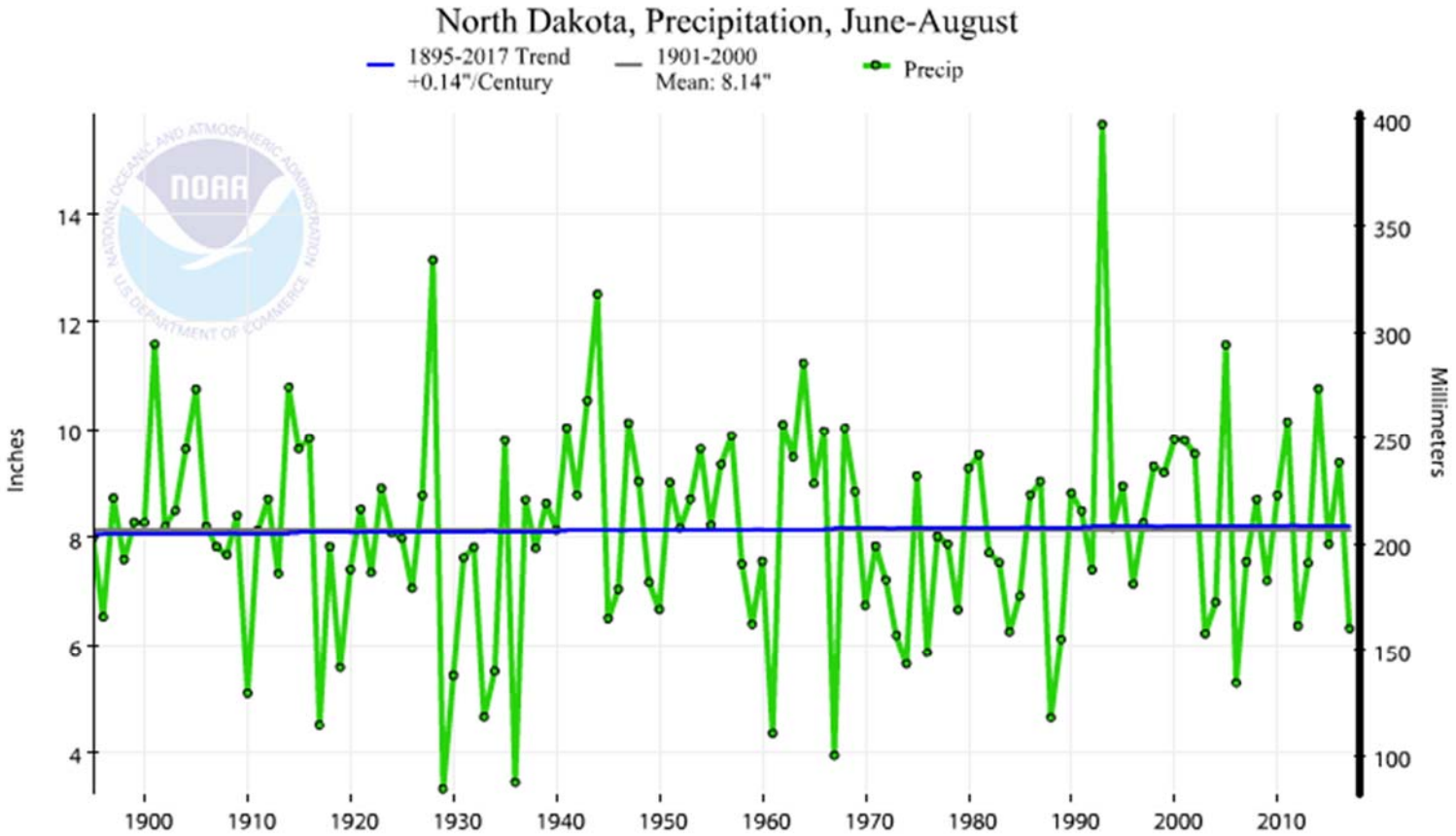


Figure 5. Statewide Drought Coverage and Intensity Index in Summer 2017.

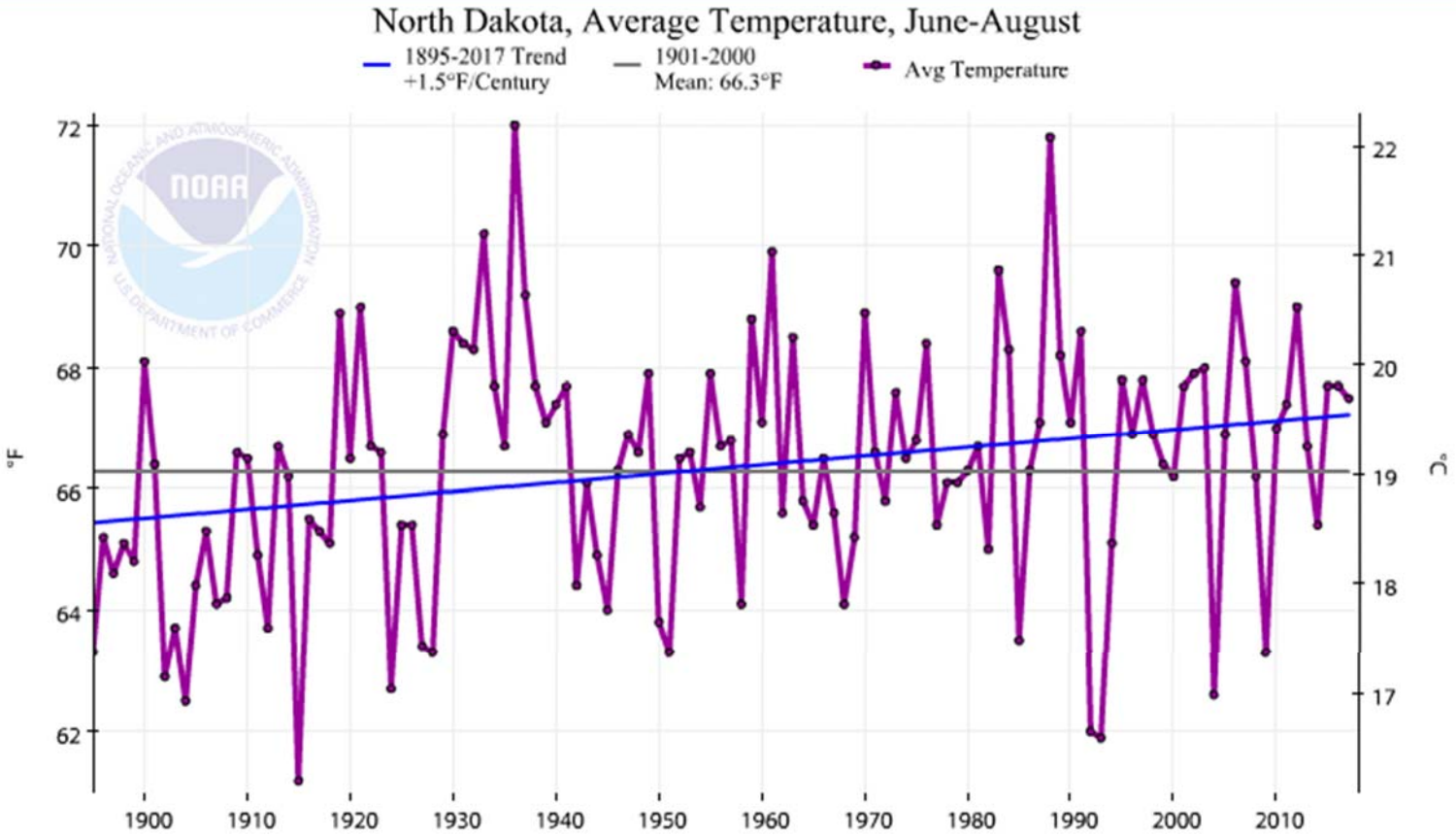
HISTORICAL SUMMER PRECIPITATION FOR NORTH DAKOTA



Record High Value: 15.54” in 1993
Record Low Value: 3.32” in 1929
Seasonal Trend: 0.01” per Decade

Summer 2017 Value: 6.3”
1981-2010 Average: 8.3”
Seasonal Ranking: 19th Driest Summer
Record Length: 123 years

HISTORICAL SUMMER TEMPERATURE FOR NORTH DAKOTA



Record High Value: 72.0°F in 1936
Record Low Value: 61.2°F in 1915
Seasonal Trend: 0.15°F per Decade

Summer 2017 Value: 67.5°F
1981-2010 Average: 66.7°F
Seasonal Ranking: 36th Warmest Summer
Record Length: 123 years

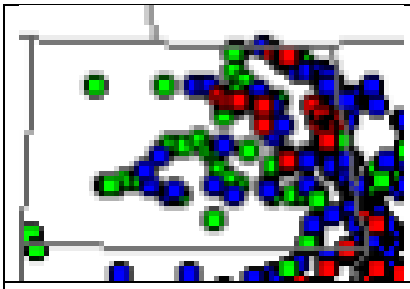
Storms & Record Events

State Tornado, Hail, and Wind Events for Summer 2016-17

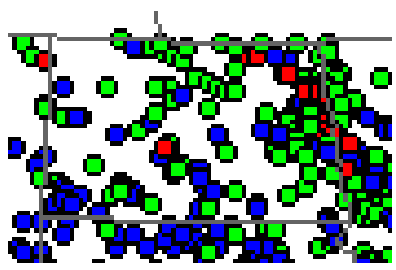
Table 1. Numbers in the table below represent the number of tornado, hail and wind events accumulated monthly and seasonally.

Month	Tornado	Hail	Wind	Total
June Total	22	58	57	**137**
July Total	15	108	44	**167**
August Total	0	13	1	**14**
Seasonal Total	**37**	**179**	**102**	**318**

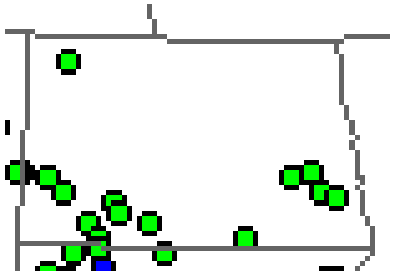
The graphics below show the geographical distribution of the storm events in the table above in each month. The dots are color coded for each event (Red: Tornado; Blue: Wind; Green: Hail).



June 2017 North Dakota Storm Events



July 2017 North Dakota Storm Events.



August 2017 North Dakota Storm Events.

State Record Events for Summer 2017

Table 2. Numbers in the table below represent the number of select state record events (records broken or tied) accumulated monthly and seasonally.

Category	June	July	August	Seasonal Total
Highest Daily Max Temp.	28	22	0	**50**
Highest Daily Min Temp.	8	8	0	**16**
Lowest Daily Max Temp.	17	3	13	**33**
Lowest Daily Min Temp.	25	2	4	**31**
Highest Daily Precipitation	25	7	23	**55**
Highest Daily Snowfall	2	0	0	**2**
Total	**105**	**42**	**40**	**187**

Seasonal Outlook

Fall 2017 Outlook

By R. Kupec[1]

Abnormally dry-to-drought conditions prevail across North Dakota as we begin September. Precipitation was below average in much of the state in June and July with welcome rains in August bringing many locations to above average precipitation for that month. Temperatures were the opposite, being well above average in June and July then below average in August. My summer outlook called for warmer and drier conditions across the state, which is how summer 2017 turned out overall despite some late-season reversal in August.

The beginning of September has brought some large fluctuations in temperature, while overall moisture has remained low. The neutral phase of the La Niña/El Niño sea surface temperature regime in the southern Pacific remains firmly in place. Most computer models suggest that this will remain through the winter. These conditions tend toward average autumn precipitation and temperatures across North Dakota.

Since a large rain event in the middle of August, our weather has been on the dry side with a large thermal ridge in the western United States and high pressure blocking the path of storms in the mid-Atlantic. This pattern will likely hold for much of the beginning of fall before breaking down. Despite historical trends, I believe precipitation will be slightly below average for the season. Temperatures will likely be near average for the fall, but I believe they will come with large fluctuations, that in the end will work out to be near seasonal normals.

The current Climate Prediction Center (CPC) Fall Outlook has a slightly different view with a 40% chance of above average temperatures for the season (see figure 1). The CPC is forecasting an equal chance of above or below average precipitation for the state (see figure 2). The next 90-day outlook from the CPC should be available after September 21st at http://www.cpc.ncep.noaa.gov/products/predictions/90day

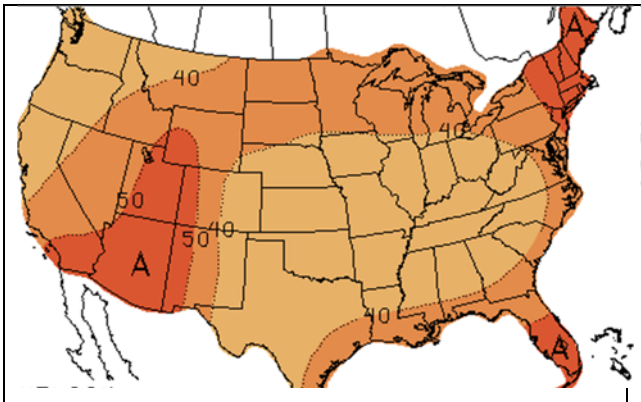


Figure 6a. September through November Temperature Outlook (Climate Prediction Center, NOAA.)

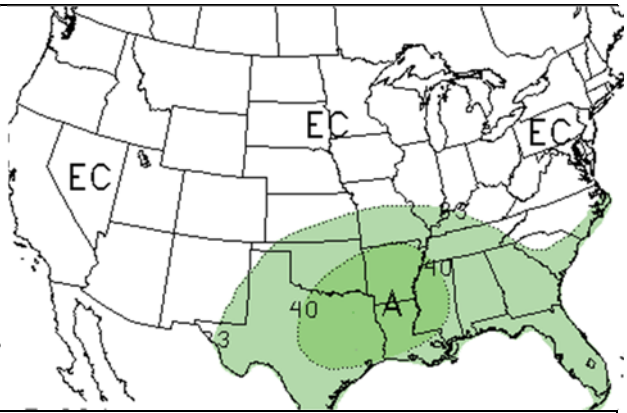


Figure 6b. September through November Precipitation Outlook (Climate Prediction Center, NOAA.)

[1] The corresponding author: Rob Kupec is Chief Meteorologist - KVRR TV in Fargo, ND. <rkupec@kvrr.com>

Hydro-Talk

Evolution of the 2017 Drought in ND

By A. Schlag[2]

In the last edition, I discussed how the 2017 drought crept up on the area. In this article, I plan on covering how the drought has evolved since June 1st, 2017.

When considering long-term precipitation totals, the vast majority of the state remains below normal for the year. It is fair to say that not even the areas that are near to above normal over the past couple of month are clear of problems. The impacts due to an exceptionally dry March through June have affected most of the growing season in North Dakota. The hangover from a dry summer will be felt well into the winter and quite possibly into next spring.

Thankfully, as the below table shows, there has been some improvement even though the recent wet period hasn't been widely felt.

Just a quick glance at the below table shows that the state still has long ways to go before there is no long-term deficit, but is it really necessary to erase a precipitation deficit to come out of drought? Some may think the obvious answer to that is, "yes, the deficit must be near zero". However, that is impractical for many reasons, the strongest being a wet August cannot reverse the damage done to crops by a dry May and June. Nor is it common for rains in July and August to refill wetlands, stock dams, or dugouts that usually receive the vast majority of their water from runoff during the spring melt of winter's snowpack.

Table 3. Departure from Normal Precipitation (in) in select location with various periods in western ND (red and blue colors indicate deficit (-) and surplus (+) respectively.

Location	Aug 1–Sept 1	Jul 1-Sept 1	Jun 1-Sept 1	Mar 1-Sept 1
BISMARCK 5NNW	+1.30	+0.29	-1.37	-4.43
FLASHER	+3.50	+3.04	+0.81	-2.08
GARRISON 1 NNW	+0.59	-1.23	-4.17	-5.89
GRAND FORKS UNIV (NWS)	-2.21	-4.02	-2.12	-3.40
HEART BUTTE DAM	+1.62	+0.34	-2.12	-4.42
HETTINGER EXP STN	-0.03	-0.59	-3.33	-7.34
LISBON	+1.77	-0.58	-1.62	-2.92
MINOT EXP STN	-0.38	-2.48	-3.93	-6.96
MAYVILLE	-1.70	-3.90	-3.06	-4.17
NEW SALEM 5NW	+3.14	+1.68	-0.61	-3.08
SHERWOOD	-0.93	-3.03	-2.96	-3.93
STREETER 7 NW	+1.12	-1.29	+0.36	-2.12
UNDERWOOD	+1.41	+0.01	-1.29	-4.81
WILLISTON	+2.24	+0.49	-0.74	-2.04
WILLOW CITY	-0.12	-2.01	-3.62	-5.11

[2] The corresponding author: Allen Schlag is the Service Hydrologist at the NOAA's National Weather Service, Weather Forecast Office in Bismarck, ND. E-Mail: Allen.Schlag@noaa.gov

Short-term deficits may no longer be present, but the drought impacts can remain and must be considered for the duration and severity of the drought designations.

As the native countryside vegetative health, streamflow, and soil moisture return to seasonally normal conditions drought designations may decrease even as the long-term deficit remains. The current USGS daily streamflow statistics indicate (Fig. 7) that hydrologically, the state has seen considerable improvement. There is close to an equal split between locations considered much above normal and those which are much below normal.

The collage of USDM graphics in Figure 8 shows how the drought has evolved throughout this growing season.

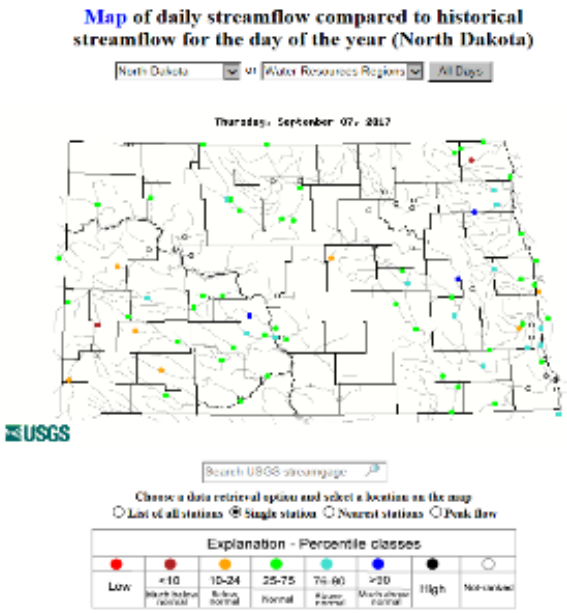


Figure 7. USGS Streamflow Conditions in ND (September 7, 2017)

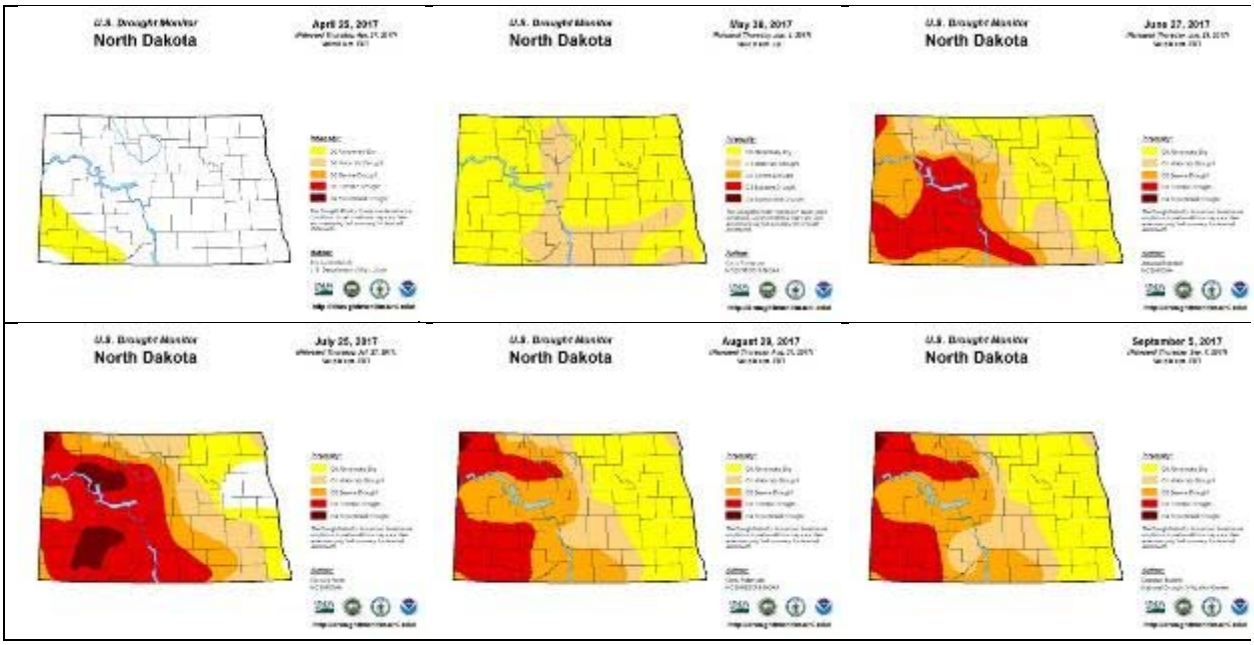


Figure 8. Evolution of the Drought of 2017 in ND based on the Us Drought Monitor.

The state of North Dakota is not nearly as bad off as it was back in July. It was the first summer I ever witnessed a cutting of hay in May, and there was a period where native vegetative and alfalfa fields went dormant in June and July. Now again I see farmers out cutting hay in September, some for the second time this year!

It has certainly been an odd year around these parts, but I guess North Dakotans have a reputation to uphold for being unique. Let's hope we can see another wet period this fall.

Science Bits

Livestock Forage Disaster Program Payment Calculator

By A. Swenson[3]

The drought monitor and the Livestock Forage Disaster Program (LFP) provides an example of how science and public policy intersect. LFP is a disaster assistance program created by 2008 Farm Bill legislation. It was designed to provide financial assistance to livestock producers who suffer grazing losses during periods of drought. The program, which is administered by the United States Department of Agriculture – Farm Service Agency (FSA), was modified in the 2014 Farm Bill legislation.

There are several rules to determine the eligibility for, and size of, cash payments under the LFP program. A key component in these calculations is the Drought Monitor (DM). See figure 1 below as an example of a DM applicable for September 12, 2017.

LFP, which also provides assistance for grazing losses because of fire on federally managed land, is designed to provide financial aid which varies by the level of grazing losses. The program relies on the DM to measure the duration and intensity of drought which are used as proxies to estimate the loss of forage production on grazing lands.

Producers with eligible livestock which graze on land in counties having any of the following levels of drought intensity and duration, as shown by the weekly drought monitor, are eligible for payments. The maximum payment amount is based on five months of forage value. Other possible payment amounts are based on one, three, and four months of forage value.

One monthly payment – D2 intensity in any area of the county for eight or more consecutive weeks during the normal grazing period

Three monthly payments – D3 intensity in any area of the county for at least one week of the normal grazing period.

Four monthly payments – Either of two situations must occur during the normal grazing period in any area of the county: a D4 intensity for at least one week, or a D3 intensity for at least four weeks. The weeks do not have to be consecutive.

Five monthly payments – D4 intensity in any area of the county for at least four weeks during the normal grazing period. The weeks do not have to be consecutive.

The monthly forage requirement, and therefore the monthly payment rate, varies by type and size of livestock. For example, an adult beef animal has a monthly payment rate of $30, a non-adult beef animal weighting more than 500 pounds has a monthly payment rate of $22.50, while any sheep, goat or deer is assigned a monthly payment rate of $7.50.

The drought of 2017 has significantly reduced the production of forage on grazing lands in large areas of the Dakotas and Montana.

[3] Mr. Andrew Swenson is Extension Farm and Farm Resource Management Specialist at the NDSU Agribusiness and Applied Economics Department.

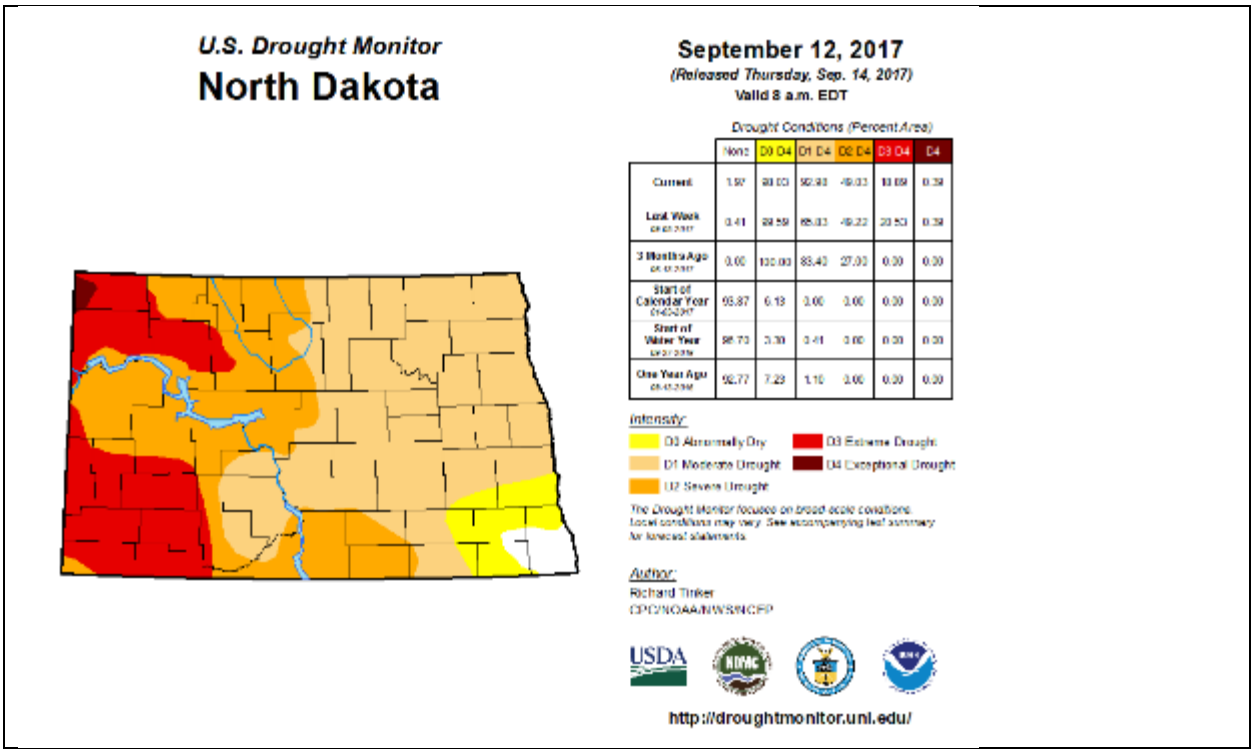


Figure 1. Drought Monitor (DM) Map on September 12, 2017 showing the drought categories in North Dakota (D0: Abnormally Dry, D1: Moderate Drought; D2: Severe Drought; D3: Extreme Drought; D4: Exceptional Drought)

The four weekly drought monitor maps from August 22 to September 12 have shown that the drought has alleviated in North Dakota but has become more severe in Montana.

During this period only one more North Dakota county became eligible for disaster forage payments and there was no change in the number of months of forage losses for which the counties are eligible. Thirty-two North Dakota counties are eligible for LRP and 16 counties are eligible for the maximum allowed five months of forage losses.

However, drought conditions in Montana have continued to deteriorate during these four weeks. Twenty more counties became eligible for LFP payments, bringing the total number of eligible counties to 37. Also, the intensity of drought increased as several counties became eligible for payments on more months of forage losses. As of September 12, producers in 13 counties may be eligible for the maximum five months of forage losses.

Below is an Excel spreadsheet that is available to a help producers estimate LFP payments. These payments are determined by the number, type, and size of grazing livestock; the typical forage production, or "carrying capacity," of native and improved grazing lands by county; and the duration and intensity of the drought as measured by the drought monitor.

Farm Bill legislation to assist producers during periods of reduced income due to low prices and/or production are not designed to cover total losses but only the portion of the loss that is considered unusually severe. The payment factor of LFP is 60 percent of the calculated total value of grazing loss. Payment limitations are often included in a public policy which provides support for domestic food production. Under the current Farm Bill, no entity with three-year average adjusted gross income greater

than $900,000 is eligible for any payments and total disaster payments, including LFP, are limited to $125,000 per entity.

Identification

Operator		
State	North Dakota	<--*required*
County eligible	Kidder ND	<--*required*

Livestock Current Year Inventory[4]

Livestock Type & Weight Range		Number of Head	Share (%)	One Mo. Pmt Rate per Hd	Total Monthly Feed Cost
Beef & Buffalo	Adult	175	100%	30.00	5,250.00
	500 lbs or more	31	100%	22.50	697.50
Dairy	Adult		100%	78.00	0.00
	500 lbs or more		100%	22.50	0.00
All Sheep, Goats & Deer			100%	7.50	0.00
All Equine			100%	22.20	0.00
Elk	Less than 400 lbs		100%	6.60	0.00
	400 to 799 lbs		100%	12.30	0.00
	800 lbs or more		100%	16.20	0.00
All Reindeer			100%	6.60	0.00
All Alpacas			100%	24.71	0.00
All Emus			100%	15.36	0.00
All Llamas			100%	10.95	0.00
A) Total monthly feed cost, with payment rate, for all livestock					**5,947.50**

Forage Information - Owned or Cash Leased Land in Kidder ND County

Pasture Type	Acres	Acres per Animal Unit (AU)	Maximum AU Capacity	Monthly Value of Forage	Mo. Feed Cost at Capacity
Native	1,120	8.0	140.0	30.00	4,200.00
Improved[5]	140	4.0	35.0	30.00	1,050.00
B) Total monthly feed cost at maximum carrying capacity					**5,250.00**

LFP Payment Estimate

Lesser of A) and B)	5,250.00
National Payment Factor	60%
Payment (based on one mo. cost of feed or value of carrying capacity)	3,150.00
No. of monthly payments based on drought monitor (9/12/2017)	4
Payment before sequestration	12,600.00
Estimated percent reduction for sequestration	6.9%
Estimated LFP payment[6]	**11,730.60**

[4] Inventory during the 60 days prior to date of qualifying drought

[5] Improved pastureland with permanent vegetative cover.

[6] This estimate does not apply all scenarios and actual payment may vary due to operators' grazing practices.

Contacting the North Dakota State Climate Office

Please contact us if you have any inquiries, comments, or would like to know how to contribute to this quarterly bulletin.

North Dakota State Climate Office

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