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National - Significant Events for June - August 2016

Highlights for the Basin

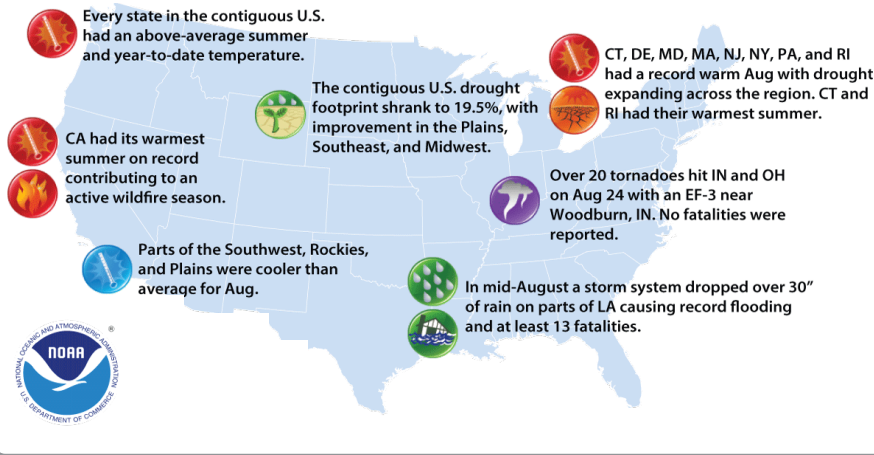
The summer started off warm and dry for the Missouri River Basin region as every state except for North Dakota ranked in the top ten warmest Junes on record. Wyoming, South Dakota, and Nebraska had their 10th, 11th, and 12th driest Junes, respectively.

Large differences in summertime precipitation led to rankings in both the top 10 wettest and top 10 driest summers on record. For instance, Wichita, KS had its 3rd wettest summer, while Rawlins, WY had its driest summer on record.

June 21st was a record-setting day for parts of the region. Colorado Springs, CO and Casper, WY both set new records for earliest 100°F day. Interestingly, Colorado Springs has hit 100°F only 7 other times in the station's 123-year history.

Heavy rainfall events were common across lower portions of the Basin this summer. Storms brought flash flooding to the Kansas City metro area on August 26th where some parts of the city received up to 6.00 inches of rain in only 2 hours. A flash flood emergency was issued by the National Weather Service for downtown Kansas City for the first time.

U.S. Selected Significant Climate Anomalies and Events August and Summer 2016



The average U.S. temperature during August was 73.6°F, 1.5°F above average. The summer U.S. temperature was 73.5°F, 2.1°F above average, and the fifth highest on record. August U.S. precipitation was 3.74 inches, 0.85 inch above average, and the second wettest on record. The summer precipitation was 8.92 inches, 0.60 inch above average.

Please Note: Material provided in this map was compiled from NOAA's State of the Climate Reports. For more information please visit: <http://www.ncdc.noaa.gov/sotc>

Regional - Climate Overview for June - August 2016

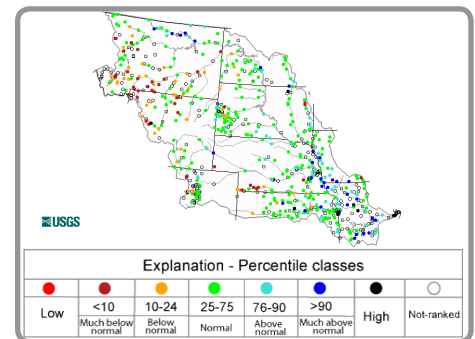
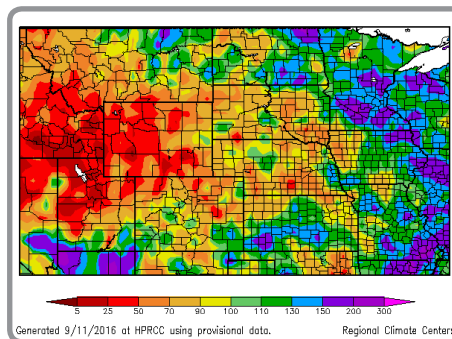
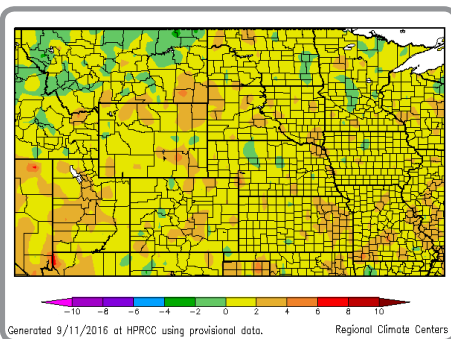
Temperature and Precipitation Anomalies

Departure from Normal Temperature (°F)
June 1 - August 31, 2016

Percent of Normal Precipitation (%)
June 1 - August 31, 2016

Streamflow Conditions

Missouri Basin Streamflow
August 2016



Summer temperatures were largely near normal for the Missouri River Basin region with most locations ending the season within 2°F degrees of normal. Scattered pockets were in the 2-4°F above-normal range, however. The season started off very warm with June temperature departures in excess of 4°F above normal across a majority of the region. Consequently, most states ranked in the top 10 warmest Junes on record. July and August were more moderate, with most of the region experiencing departures within 2°F of normal.

After a wet spring, the summer started dry with large areas of the region receiving 50% of normal precipitation, at most, in June. July and August, however, were characterized by extremes in both wet and dry conditions. For some areas, like northern Wyoming, southern Montana, and western South Dakota, ongoing dryness caused drought conditions to develop and/or worsen this summer. Meanwhile, other areas of the region, including portions of Kansas, North Dakota, and Missouri, experienced flooding from heavy rainfall.

The disparity in precipitation across the Missouri River Basin region this summer resulted in much below-normal streamflows in upper parts of the Basin, such as Montana and Wyoming, and above-normal streamflows in lower portions of the Basin including Iowa, Missouri, and Nebraska.

The sporadic heavy rain events in the lower part of the Basin resulted in the U.S. Army Corps of Engineers maintaining lower-than-normal mainstem releases throughout the late summer and fall.

Regional - Impacts for June - August 2016

Challenging Season for Bird Breeding

Dry conditions in northern areas of the region were a challenge for birds this summer. According to the American Bird Conservancy, grassland songbirds ended their breeding season about two weeks early. A scarce supply of insects forced birds to travel farther to find food for their young, which resulted in smaller than usual nestlings and, in some cases, failed nests.

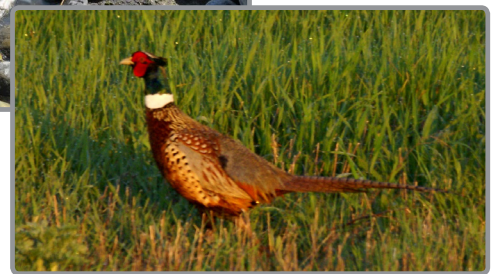
Mixed Impacts to Agriculture this Summer

Overall, it has been a successful growing season for many crops, with the potential for record yields of corn and soybeans in the U.S. However, for a third year in a row, farm incomes are expected to be down, according to the USDA Economic Research Service. The decline is due to higher yields combined with lower commodity prices.

Frequent rainfall events in northeastern North Dakota caused issues for potato and sugar beet producers. These wet conditions led to concerns for disease, particularly for hail and wind damaged crops. On the other end of the spectrum, dry conditions impacted producers in Montana where dryland hay harvest was down 30-50% in some areas, according to the National Agricultural Statistics Service.

Unprecedented Fish Kill on Yellowstone River

A parasitic disease caused the deaths of thousands of whitefish in the Yellowstone River in Montana. The disease can be exacerbated by high water temperatures and low flows, which has been an ongoing issue this summer. Nearly 200 miles of the river were closed in response to the parasite, impacting tourism and recreation along the river. As of this writing, some portions of the river have been reopened, but others remain closed.

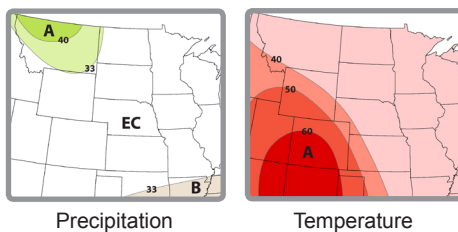


Above: (Top) UNL's Steve Spomer searches for butterflies, which have been sparse across the Great Plains this summer, photo courtesy Troy Feddersen; (Middle) fish kill in Montana, photo courtesy Montana Fish, Wildlife & Parks; and (Bottom), according to the South Dakota Game, Fish and Parks, South Dakota pheasant populations were down 20% from last year and 41% from the 10-year average, photo courtesy USGS Nebraska Cooperative Fish and Wildlife Research Unit.

Regional - Outlook for October - December 2016

3-Month Precipitation and Temperature Outlooks

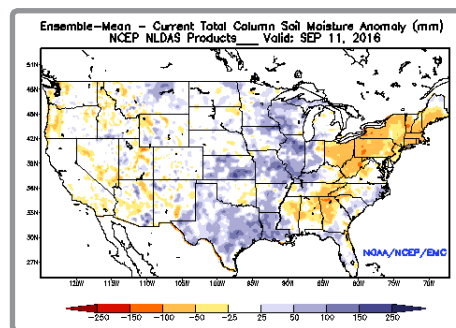
Valid for October - December 2016



EC: Equal chances of above, near or below normal
A: Above normal, B: Below normal

Soil Moisture Conditions

09/11/2016



According to the Climate Prediction Center, ENSO-neutral conditions are present and are slightly favored to continue this fall and winter. Because conditions no longer favor the development of a La Niña event within the next six months, the La Niña Watch has been cancelled by NOAA.

Over the next three months, outlooks favor increased chances for above-normal temperatures for the entire basin. Above-normal temperatures may aid in crop drydown and could also help dry out fields. The precipitation outlook shows increased chances for above-normal precipitation for much of Montana, which could help alleviate drought conditions there.

Modeled soil moisture conditions at the start of the fall indicated wet soils in southern parts of the region across Kansas and Missouri, as well as areas of north-central Montana and northeastern North Dakota. Wet soils this time of the year can be challenging to producers as harvest activities begin. Edible bean farmers in North Dakota have already reported significant losses due to wet conditions and soggy soils. Additionally, with above-normal precipitation favored for lower parts of the Basin during October, an increased chance for flooding across Kansas and Missouri could exist. This map shows the total column soil moisture anomaly in millimeters, from a NOAA model called NLDAS.

MO River Basin Partners

High Plains Regional Climate Center

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National Drought Mitigation Center

www.drought.unl.edu

National Integrated Drought Information System

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National Oceanic and Atmospheric Administration

National Weather Service - Central Region

www.crh.noaa.gov/crh

National Centers for Environmental Information

www.ncdc.noaa.gov

Missouri River Basin Forecast Center

www.crh.noaa.gov/mbrfc

Climate Prediction Center

www.cpc.ncep.noaa.gov

National Operational Hydrologic Remote Sensing Center

www.nohrsc.noaa.gov

North Central Climate Science Center

<http://nccsc.colostate.edu>

South Dakota State University Extension

<http://igrow.org>

State Climatologists

www.stateclimate.org

U.S. Army Corps of Engineers - Missouri River Basin

Water Management Division

www.usace.army.mil

U.S. Bureau of Reclamation

www.usbr.gov

U.S. Department of Agriculture

Natural Resources Conservation Service

www.nrcs.usda.gov

NRCS National Water & Climate Center

www.wcc.nrcs.usda.gov

Regional Climate Hubs

www.usda.gov/oce/climate_change/regional_hubs.htm

U.S. Geological Survey, Water Mission Area

www.usgs.gov/water

Western Governors' Association

www.westgov.org