3-2016

Umphlett QCI March 2016

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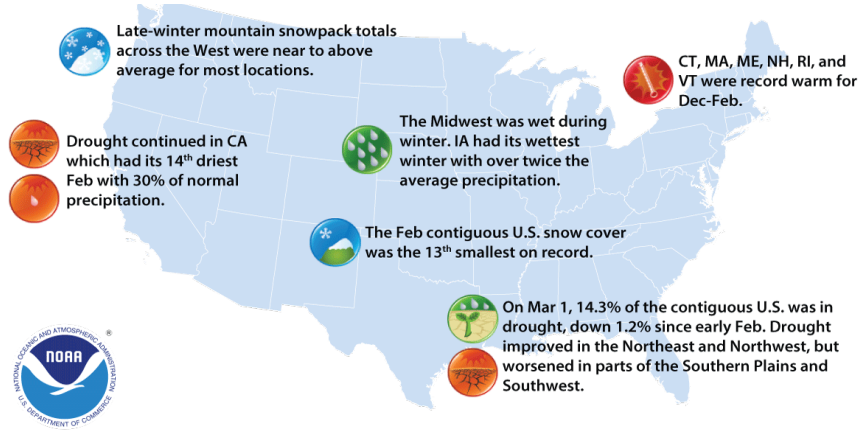
Quarterly Climate Impacts and Outlook

Missouri River Basin

March 2016

National - *Significant Events for December 2015 - February 2016*

U.S. Selected Significant Climate Anomalies and Events February and Winter 2016



The average U.S. temperature during February was 39.5°F, 5.7°F above average, the seventh warmest on record. The winter U.S. temperature was 36.8°F, 4.6°F above average, and the warmest on record. February U.S. precipitation was 1.93 inches, 0.20 inch below average. The winter U.S. precipitation was 8.05 inches, 1.26 inches 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

Highlights for the Basin

It was the warmest winter on record for the U.S. and many states in the region ranked in the top 10 warmest: Kansas and Montana (3rd), Missouri (4th), North Dakota (6th), and Nebraska (8th).

Minimum temperatures continued to be warm this winter, with all Missouri Basin states except Colorado ranking in the top 10 warmest.

Although it was a mild winter, several storms impacted the region, such as historic flooding in Missouri in December, the Groundhog Day blizzard, and several high wind events. On February 18th, the Monarch Pass AWOS site in Colorado reported a wind gust of 148 mph setting an unofficial state record for highest wind gust.

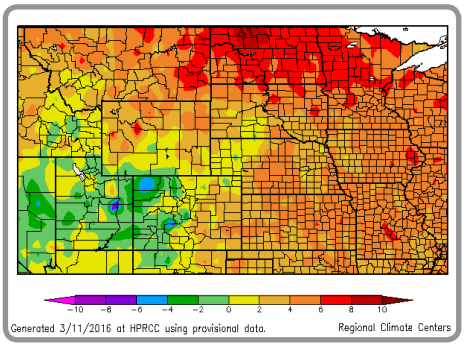
Several locations set new records for highest February temperature on record. A new record of 73°F in Bismarck, ND on the 27th smashed the previous record set in 1992 by 4°F.

Although temperatures stole the spotlight this winter, many locations ranked in the top ten wettest and/or snowiest winters on record. For instance, Lincoln, NE had its wettest winter on record with 6.01 inches.

Regional - *Climate Overview for December 2015 - February 2016*

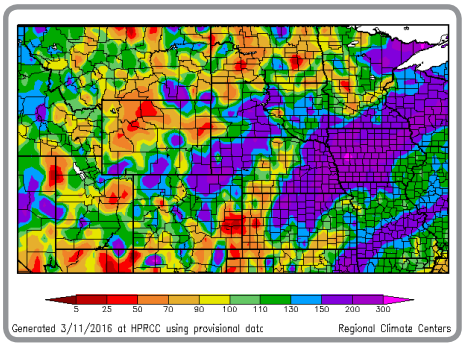
Temperature and Precipitation Anomalies

Departure from Normal Temperature (°F)
December 1, 2015 - February 29, 2016



Above-normal temperatures continued into winter for the majority of the Missouri River Basin region. The winter started and ended very warm, as many states in the region ranked in the top 10 warmest Decembers and Februarys. Meanwhile, January, with a mix of warm and cold conditions, was near-normal. Overall, the majority of the region had seasonal temperature departures that were more than 4°F above normal, with the largest departures occurring across northern portions of the Basin in Montana and North Dakota.

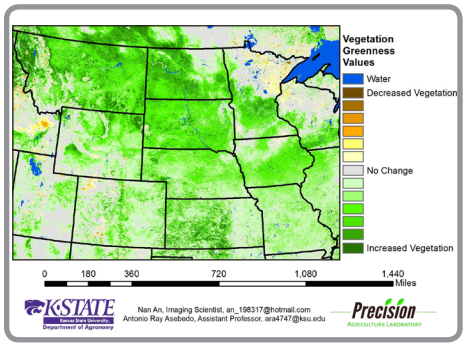
Percent of Normal Precipitation (%)
December 1, 2015 - February 29, 2016



It was a wet winter for much of the Basin, with three distinct swaths of above-normal precipitation running from Oklahoma through Illinois, Kansas through Wisconsin, and Colorado through South Dakota. Much of this precipitation occurred in December as heavy rain due to unseasonably warm conditions. Drier areas in the Basin included Wyoming and portions of Montana and North Dakota. Drought conditions developed in north-central Wyoming and southern Montana, which is somewhat unusual for this time of the year.

Vegetation Conditions

Late-February 2016 Compared to 27-year Average for Late-February



February warmth across the Basin led to an early start to green-up. The map above shows above-average photosynthetic activity across the Basin, particularly in eastern Montana and the Dakotas. The combination of below-average snowpack and above-normal temperatures across the northern tier of the Basin has spurred this early plant development. The map above was produced by K-State's Precision Agriculture Laboratory using remotely sensed data provided by the EROS Data Center.

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Regional - *Impacts for December 2015 - February 2016*

Early Signs of Spring

It was a short winter for the Basin as not only was there a late end to the growing season in the fall, but early signs of spring were evident in February. Examples include Billings, MT where crocuses were blooming and Yellowstone, WY where bears were coming out of hibernation. But, an early start to the spring may not be welcomed by all. Vegetation is at risk for damage as frosts are still highly likely to occur and allergy sufferers may not enjoy an early start to the pollen season.

Winter Wheat Breaks Dormancy

Winter wheat broke dormancy early this year, as above-normal temperatures prevailed in Kansas and Nebraska, according to the National Agriculture Statistics Service. Although freezes may pose a risk to the crop, the degree to which the crop may or may not be damaged will depend on its growth stage and the duration of any potential freeze. Luckily, this year's winter wheat growing season has been much more successful than the last.

Above: (Left) Forsythia in full bloom in Lincoln, Nebraska, courtesy Natalie Umphlett; (Center) winter wheat wind blast damage near Ellsworth, Kansas in February, courtesy Romulo Lollato; and (Right), flooding in Pacific, Missouri in December, courtesy Associated Press.

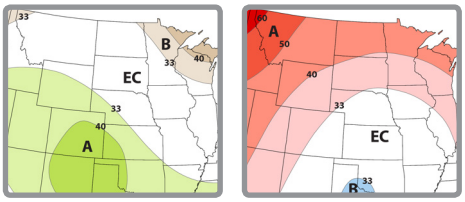
Monitoring Water Resources Across the Basin

As anticipated, current snowpack is below-average for the headwaters and tributaries of the Missouri River in Montana and Wyoming and near-average in southern portions of the Rockies. This, in combination with warm conditions already melting lower elevation snowpack, may lead to decreased streamflows later on in the spring and summer. To the south, minor to moderate flooding is possible for many rivers in the lower portion of the Basin due to increased soil moisture and convective activity, according to the National Weather Service's latest flood outlook. This risk, however, is not atypical for this time of the year. It is important to note that the U.S. Army Corps of Engineers is prepared for a variety of conditions this spring and early summer, whether conditions turn wet or dry.

Regional - *Outlook for April - June 2016*

3-Month Precipitation and Temperature Outlooks

Valid for April - June 2016



Precipitation Temperature

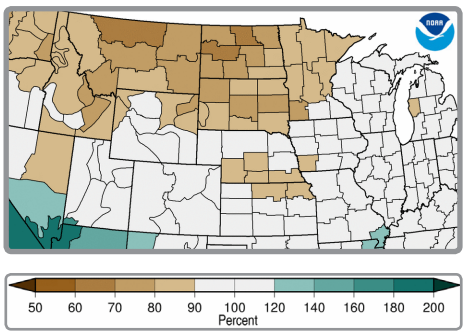
EC: Equal chances of above, near or below normal
A: Above normal, **B:** Below normal

According to the Climate Prediction Center, El Niño conditions continued this winter, but are expected to weaken through the spring with a transition to ENSO-neutral conditions likely by late spring or early summer. La Niña conditions could develop in the fall, however later outlooks will be important as forecast skill increases in the summer months.

Over the next three months, the outlooks favor increased chances for above-normal temperatures for the majority of the Basin, especially across the north. The precipitation outlook shows increased chances for above-normal precipitation for southern and western areas and below-normal precipitation for small portions of Montana and North Dakota.

Percent of Average Precipitation: Strong El Niños

Composite: March-May
1958, 1966, 1973, 1983, 1992, 1998



The map above shows spring (March, April, and May) percent of average precipitation using a composite of years with strong El Niño conditions. Notice how the northern tier of the basin and portions of southern Nebraska and northern Kansas have tended to be drier during these years. Conversely, the bootheel of Missouri has been wetter. Although not a forecast for the spring, this does give some insight into the overall spring precipitation pattern during previous strong El Niño events.

For a more detailed update on El Niño in the Missouri River Basin, please see: http://www.hprcc.unl.edu/pdf/ENSO-MOBasin-Feb2016-Final.pdf

MO River Basin Partners

High Plains Regional Climate Center
www.hprcc.unl.edu
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://revampclimate.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

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