KANSAS CLIMATE and DROUGHT UPDATE
October 2018 Summary

Highlights

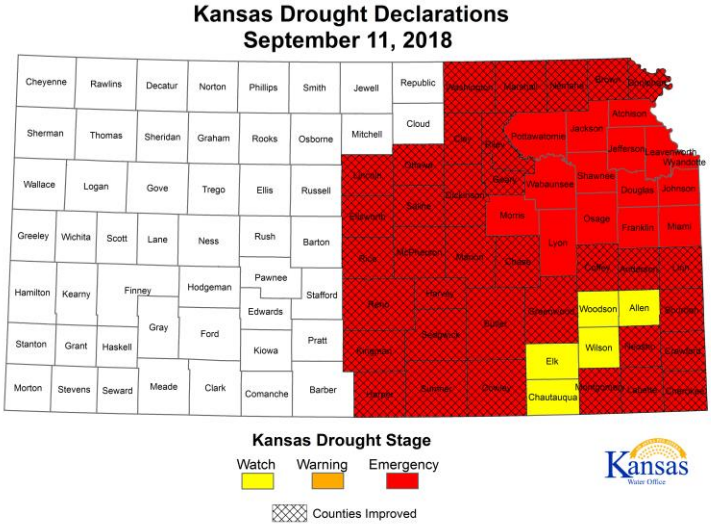
- Executive Orders 18-18 remains in effect for 50 counties in emergency status, and 5 in watch, primarily to allow continued assistance to mitigate drought impacts on livestock.

- U.S. Drought Monitor drought designations were removed for all but one percent of Kansas (parts of Wabaunsee, Jefferson, Leavenworth and Wyandotte counties) by October 16th. About 9 % of the state is still abnormally dry.

- Administration of MDS continued on Little Arkansas River at Alta Mills into October, but ceased October 18, 2018. Water rights junior to MDS above the gage had been under administration since August 10, 2017.

- Kansas Department of Health and Environment Public Health Advisories as Warnings (2) or Watches (1) were in place at the end of October for three Kansas water bodies due to the presence of harmful algae (HAB). This was an improvement from 21 lakes under advisories early in October. A public health watch indicates water may be unsafe for humans and animal – contact is discouraged. A public health warning indicates contact with water should not occur, it is unsafe.

Governor Jeff Colyer, MD issued Drought Declarations for Kansas counties with Executive Order (EO) 18-17 on September 11, 2018 placing 50 counties in emergency status and 5 into a watch status. A total of 55 counties were downgraded, 50 of these having drought declarations removed. EO 18-18 corrected the listing of counties. The September 11 map shows these counties. These Drought Declarations remain in place until revised or rescinded by a subsequent EO.



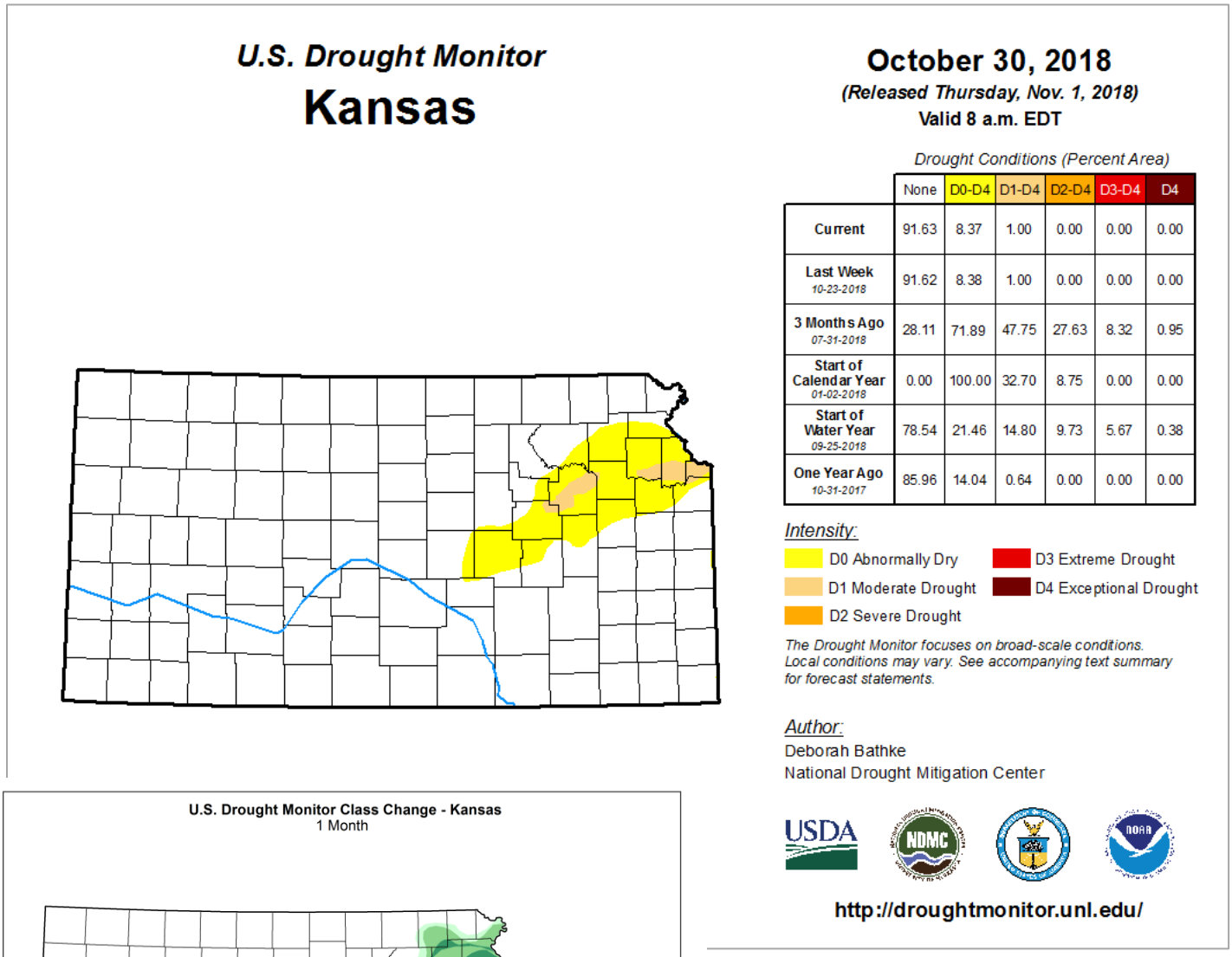
Drought Watch counties: Allen, Chautauqua, Elk, Wilson, Woodson

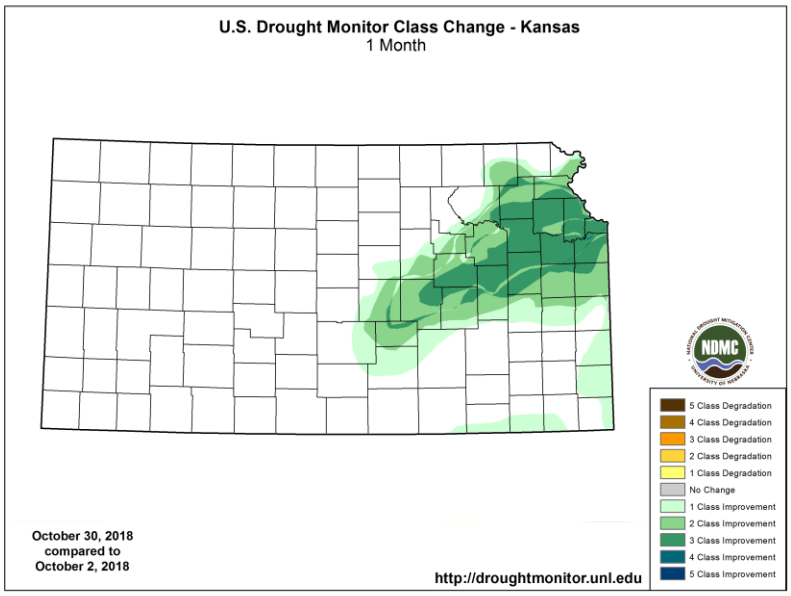
Drought Emergency counties: Anderson, Atchison, Bourbon, Brown, Butler, Chase, Cherokee, Clay, Coffey, Cowley, Crawford, Dickinson, Doniphan, Douglas, Ellsworth, Franklin, Geary, Greenwood, Harper, Harvey, Jackson, Jefferson, Johnson, Kingman, Labette, Leavenworth, Lincoln, Linn, Lyon, Marion, Marshall, McPherson, Miami, Montgomery, Morris, Nemaha, Neosho, Osage, Ottawa, Pottawatomie, Reno, Rice, Riley, Saline, Sedgwick, Shawnee, Sumner, Wabaunsee, Washington, Wyandotte

In counties under Emergency Drought Declaration, livestock water may be available from some state fishing lakes and federal reservoirs when properly permitted. To initiate the process, please contact the Kansas Water Office at 785-296-3185.

General Conditions

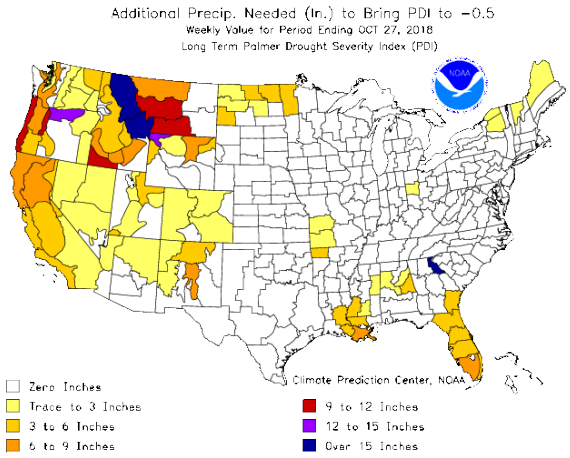
U.S. Drought Monitor drought conditions across the state continued to improve during October. The remaining exceptional and extreme drought in eastern Kansas was downgraded to moderate and severe drought October 9. One week later, October 16, only two pockets of moderate drought remained. Currently, over 91 percent of the state is drought free, while 1 percent is in moderate drought. The change in drought categories map shows where changes occurred.





Changes in drought classification are shown on the left.

More information can be found on the U.S. Drought Monitor web site.



Palmer Drought Severity Index (PDSI) - The Palmer Drought Severity Index is an indicator of relative dryness or wetness and is one factor used the U.S. Drought Monitor. The additional precipitation map indicates the inches of precipitation needed to be out of drought for the climate division.

More information on the PDSI can be found at http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

State Drought Mitigation

Livestock Water

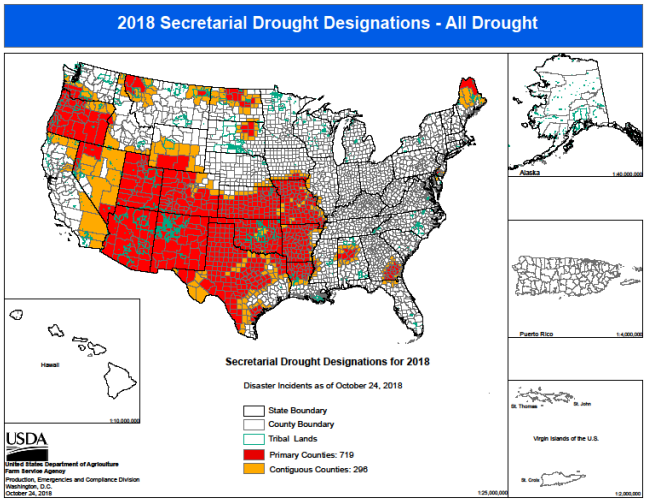
Emergency livestock water is available to producers in counties under Kansas Drought Emergency Declarations. The Kansas Water Office will verify eligibility for arrange for withdrawal permit processing. The producer must pump and haul water to livestock tanks and follow procedures to ensure aquatic nuisance species are not introduced to water bodies. If harmful algal blooms advisories are issued for a lake, withdrawals are not allowed.

Financial assistance for livestock water supply wells, pipeline and tanks may also be available through Environmental Quality Incentives Program (EQIP) Drought Initiative by NRCS or Kansas Department of Agriculture-Division of Conservation through the Livestock Water Supply Financial Assistance Initiative in Emergency counties. Applications can be made through local conservation districts.

Federal Disaster Drought Declarations 2018

U. S. Department of Agriculture Drought Disaster

USDA Secretary makes agricultural disaster designations based on crop losses in a designated county. Disaster designations make emergency (EM) loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county. In addition to EM loan eligibility, other emergency assistance programs, such as Farm Service Agency (FSA) disaster assistance programs, have historically used disaster designations as an eligibility trigger.



USDA drought disasters have been declared in 2018 for Kansas. Designations are for 85 primary counties and 11 contiguous counties. Primary counties include Allen, Anderson, Atchison, Barber, Barton, Brown, Butler, Chase, Chautauqua, Cherokee, Clark, Clay, Coffey, Comanche, Cowley, Dickinson, Doniphan, Douglas, Edwards, Elk, Ellis, Ellsworth, Finney, Ford, Franklin, Geary, Grant, Gray, Greeley, Greenwood, Hamilton, Harper, Harvey, Haskell, Hodgeman, Jackson, Jefferson, Johnson, Kearny, Kingman, Kiowa, Labette, Lane, Leavenworth, Lincoln, Linn, Lyon, Marion, Marshall, McPherson, Meade, Miami, Montgomery, Morris, Morton, Nemaha, Neosho, Ness, Osage, Ottawa, Pawnee, Pottawatomie, Pratt, Reno, Rice, Riley, Rush, Russell, Saline, Scott, Sedgewick, Seward, Shawnee, Stafford, Stanton, Stevens, Sumner, Trego, Wabaunsee, Wallace, Washington, Wichita, Wilson, Woodson and Wyandotte. Contiguous counties are Bourbon, Cloud, Crawford, Gove, Graham, Logan, Mitchell, Osborne, Republic, Rooks, and Sherman.

Climate Summary - Precipitation

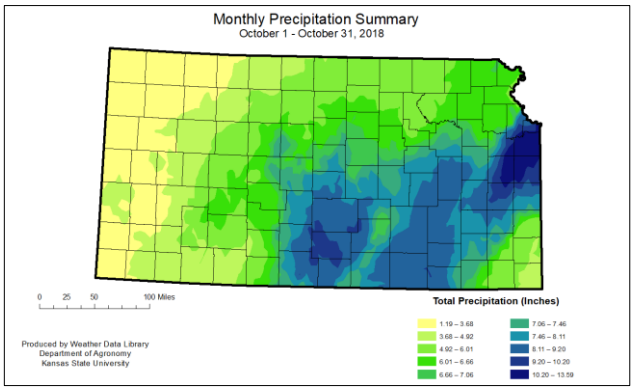
October was a very wet month across the state. It actually ranks as the second wettest October since 1895. The wettest October on record was in 1941 when the state-wide average was 5.99 inches. This year the state-wide average precipitation was 5.88 inches, 259 percent of normal. The Northwest Climate Division was the driest with an average of 2.62 inches. That is a surplus of 1.06 inches, 165 percent of normal. The South Central Division was the wettest, with an average of 7.97 inches. That is 5.33 inches above normal, 305 percent of normal. There were 165 new daily record rainfall totals, of which 3 were records for any day in October. The highest 24 hour rainfall total for a National Weather Service Cooperative station was 5.55 inches at Stilwell 1N, Johnson County, on the 8th. The greatest 24 hour rainfall total for a Community Collaborative Rain Hail and Snow network station was 6.44 inches recorded at Coats 3.3 NNE, Pratt County, on the 9th. The greatest monthly precipitation totals for October: 13.59 inches at Stilwell 1N, Johnson County (NWS) and 13.24 inches at Princeton 2.0 NE, Franklin County (CoCoRaHS). Not all precipitation was in the form of rainfall. A total of 257 stations reported snowfall in October, with monthly totals ranging from trace amounts in eastern Kansas to 9 inches at the CoCoRaHS station north of St. Francis, Cheyenne County.

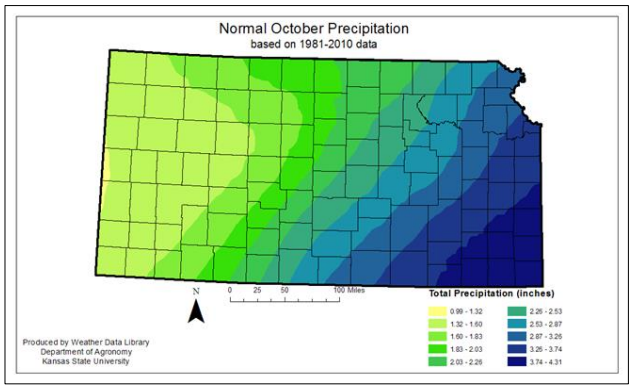
Information in this summary is taken from weekly information generated by Kansas State University Department of Agronomy along with data tables and maps. (Maps based on data from the Cooperative Observer and Kansas Mesonet, and provided by KSU Weather Data Library.) Weekly maps of precipitation information can be accessed at http://climate.k-state.edu/maps/weekly/.

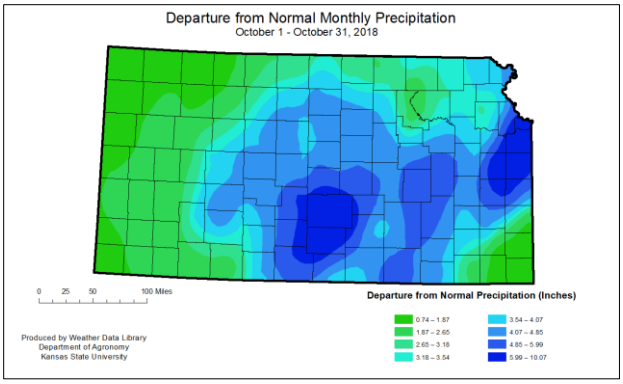
Kansas Climate Division Precipitation Summary (inches)

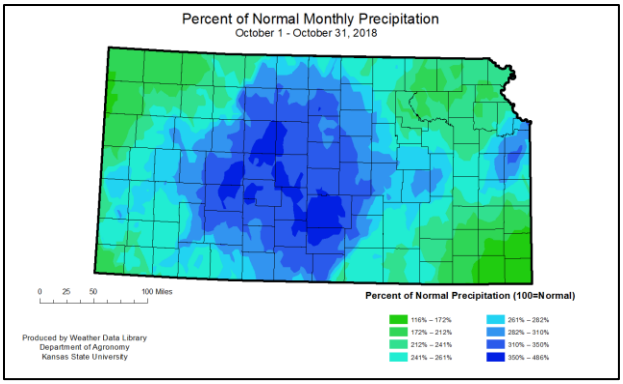
Climate Division	October 1-31, 2018			January 1-Oct 31, 2018			April 1, 2017- Oct 31 , 2018			Sept 1, 2018- Oct 31, 2018		
	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	2.62	1.06	165	21.62	1.66	107	20.23	2.57	113	4.07	0.99	129
West Central	3.90	2.44	265	23.18	3.83	118	22.08	5.23	129	6.22	3.16	203
Southwest	4.57	3.05	300	24.67	6.09	132	24.26	8.06	149	6.86	3.72	218
North Central	5.26	3.28	264	29.75	3.82	115	28.18	5.74	126	9.97	5.36	219
Central	6.90	4.77	332	29.88	2.75	111	28.32	5.15	123	10.84	6.19	236
South Central	7.97	5.33	309	34.03	5.32	119	32.01	7.93	133	11.98	6.74	233
Northeast	6.44	3.71	238	3074	-1.26	97	28.29	0.50	103	11.25	4.91	180
East Central	7.13	4.04	226	29.22	-5.13	84	26.33	-3.10	88	9.99	3.24	145
Southeast	7.33	3.66	204	36.94	-0.15	99	32.75	1.66	105	11.18	3.50	150
STATE	5.88	3.56	259	29.13	2.19	110	27.19	4.10	120	9.22	4.28	192

The maps below summarize precipitation. Climate maps are also available from the High Plains Regional Climate Center at https://hprcc.unl.edu/maps.php?map=ACISClimateMaps









Climate Summary-Temperature

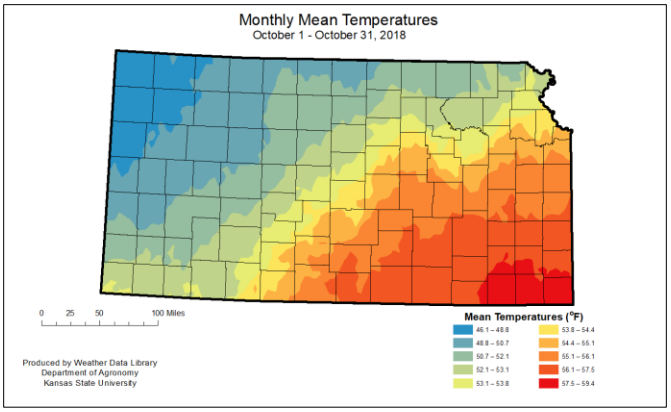
Despite a warm start to the month, October temperatures were cooler than normal. State-wide average temperature for the month was 53.0 ^{o}F, which is 2.3 degrees cooler than normal. All climate divisions were cooler than normal. The Northwest Division and the West Central division tied for the largest departure, with an average of 48.6 and 50.0 ^{o}F, or 3.6 degrees cooler than normal. The Southeast Division came closest to normal with an average of 57.1 ^{o}F or 0.8 degrees cooler than normal. The variability showed in the range of temperatures. The warmest maximum temperature was 101 ^{o}F at Tribune 13NNE, Greeley County, on the 4th. The coldest minimum temperature at a NWS station was 12 ^{o}F, recorded at Brewster 4W, Sherman County, on the 16th. The Kansas Mesonet station in Cheyenne County, south of St. Francis, reported a low of 9 ^{o}F. There were 11 record daily high maximum temperatures in the month, and 121 record daily low maximum temperatures. On the minimum temperature side, there was one record high minimum compared to only 60 record low minimums.

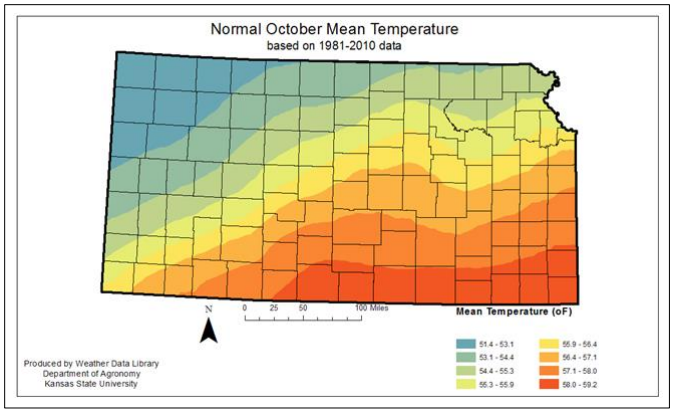
Information in this summary is taken from weekly information generated by Kansas State University Department of Agronomy along with data tables and maps. (Maps based data from the Cooperative Observer and Kansas Mesonet, provided by KSU Weather Data Library.) The weekly maps a glimpse at the temperature variation from normal. Weekly maps of information can be accessed at http://climate.k-state.edu/maps/weekly/.

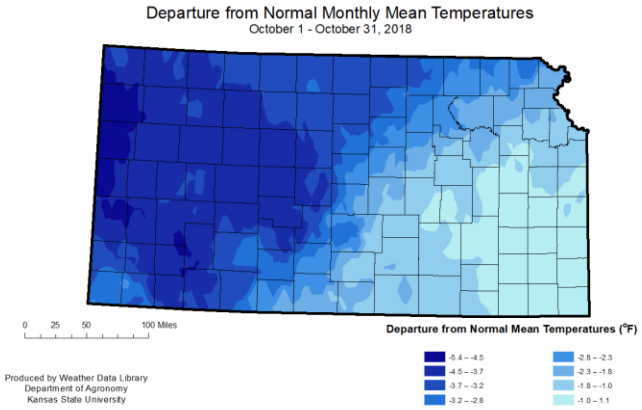
Climate Division	Kansas Climate Division Temperature Summary (^{o}F) October 2018							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	95	12	48.6	-3.6	95	4	12	16
West Central	101	12	50.0	-3.6	101	4	13	15
Southwest	99	21	53.1	-2.9	99	4	21	15
North Central	97	20	51.7	-3.3	97	4	20	16
Central	97	20	53.5	-2.8	97	4	20	15
South Central	97	26	55.4	-2.3	97	3	26	16
Northeast	91	26	52.7	-2.7	91	4	26	16
East Central	93	26	54.6	-1.7	93	3	26	16
Southeast	91	27	57.1	-0.8	91	4	27	16
STATE	101	12	53.0	-2.6	101	4th	12	16th
Data Source: KSU Weather Library								

For once hail wasn't featured in the severe weather reports. High winds and a tornado were major contributors to severe weather in Kansas during October. Flooding was again a feature, with much of the damage occurring in South Central, Kansas.

The maps below summarize temperature. Climate maps are also available from the High Plains Regional Climate Center at https://hprcc.unl.edu/maps.php?map=ACISClimateMaps .



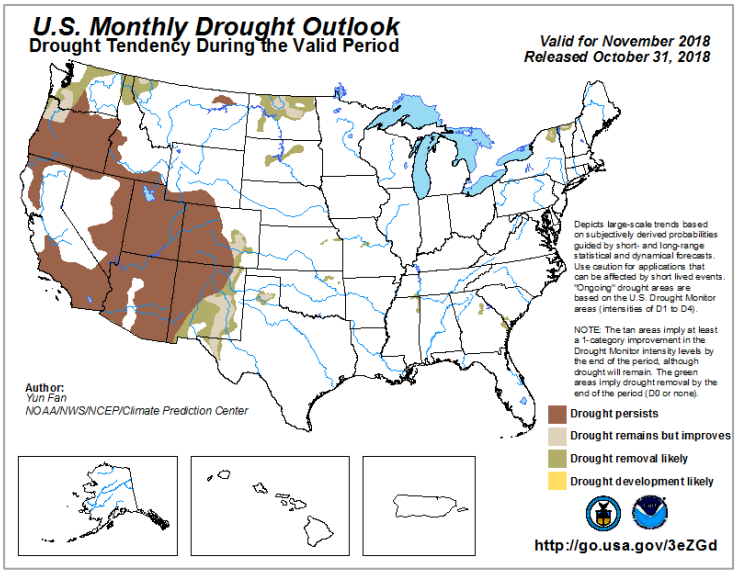


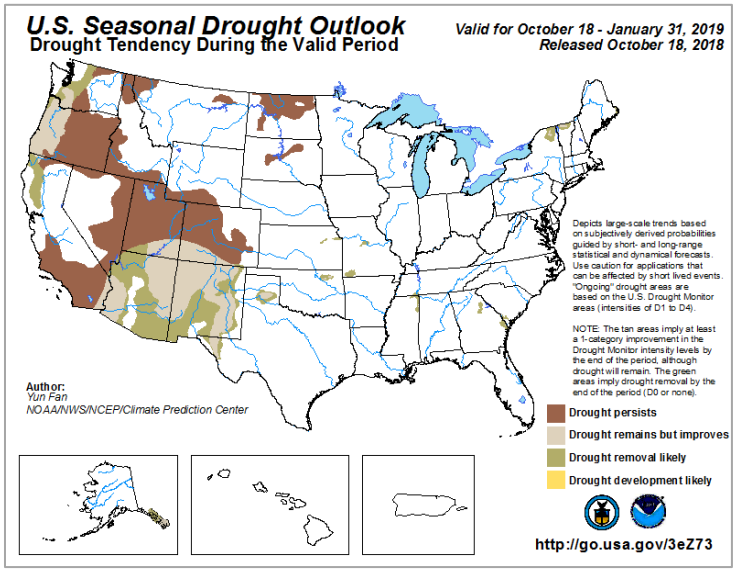


Future Outlook

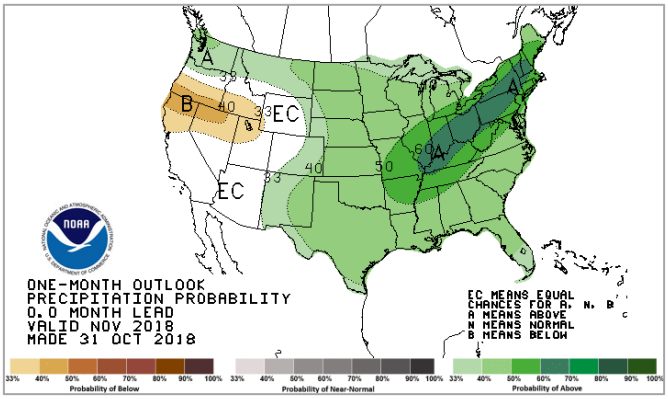
The Monthly Drought Outlook indicates drought conditions likely to improve in northeast Kansas in November.

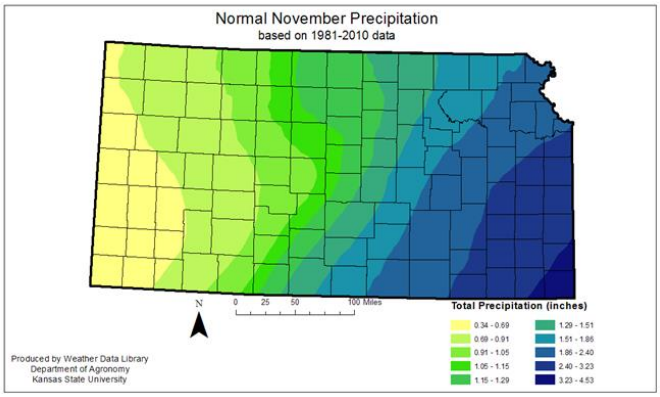
Seasonal Outlook (3-month) favors removal of the drought remaining in eastern Kansas. The individual temperature and precipitation outlooks that contribute to these outlooks are available below. Others time intervals are also available from the climate prediction center.

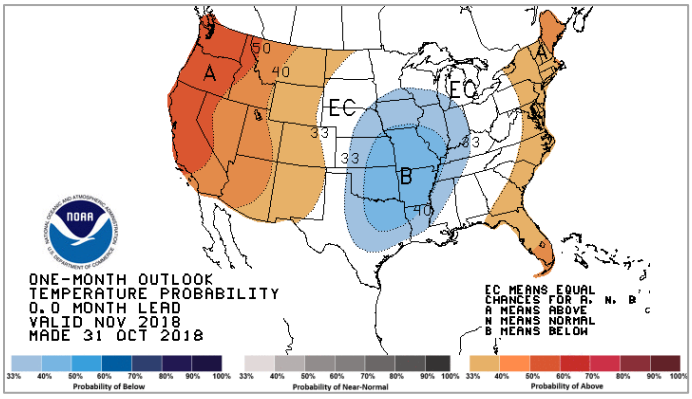


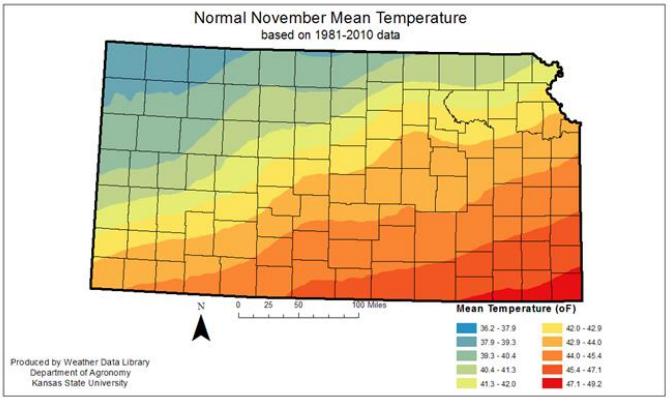


The November outlook has increased chances for above normal precipitation across most of the state. However, given the low normal precipitation at this time of the year, continued improvement is likely to be slow. The temperature outlook is for cooler than normal temperatures across all but the western edges of the state.

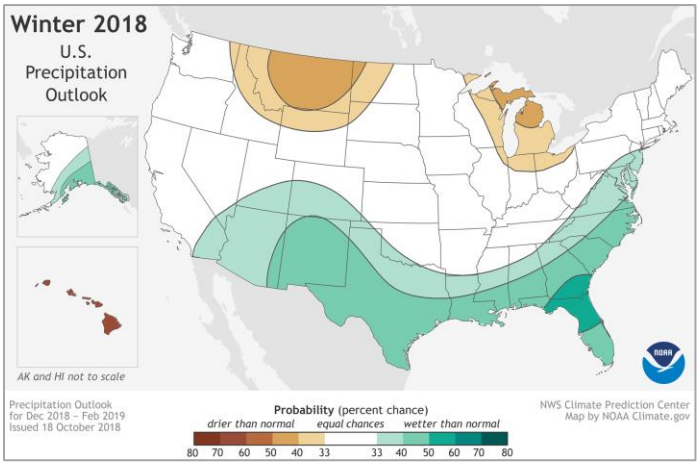


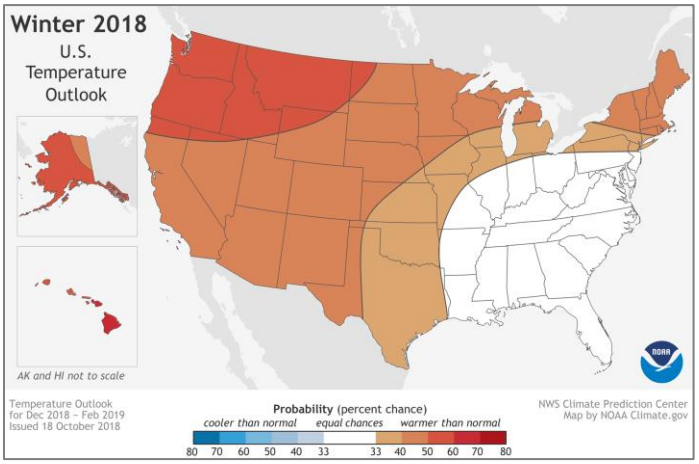






The A mild winter could be in store for much of the United States this winter according to NOAA's Climate Prediction Center. The U.S. Winter Outlook for December through February favors above-average temperatures for Kansas with equal chances of below, above or normal precipitation. Additionally, El Nino has a 70 to 75 percent chance of developing according to, NOAA's Climate Prediction Center. A weak El Nino is expected, which may influence the winter season by bringing wetter conditions across the southern United States, and warmer, drier conditions to parts of the North.





Additional outlooks for various timeframes are available from the national CPC for up to 13 months. (http://www.cpc.ncep.noaa.gov/products/predictions/90day/)

Water

Public Water Supply Conditions

Cities and rural water districts are encouraged to measure their current water supply as well as review and use their conservation and drought emergency plans as needed. Please note stage designation or name and corresponding conservation measures are defined by each water supplier, so requirements to conserve and conservation measures are not uniform among public water suppliers.

Numerous communities have conservation measures in place throughout the summer or year to restrict outdoor watering to times with less evaporative loss. The conservation measures in place that are in addition to these that we are aware of include the**: City of Oswego,** Labette County, issued a water watch August 16, 2018; and **City of Burlington** enacted a stage 3 water emergency initiating mandatory water conservation for all its consumers August 15, 2018, including Coffey County Rural Water Districts 2 and 3 and the cities of Gridley, LeRoy and New Strawn.

Surface Water Supply Conditions

Kansas River basin: Milford, Tuttle, and Perry reservoirs all experienced higher than normal inflows in October and all are retaining flood storage. Inflows to Clinton also increased over past months and storage gained was about 10 thousand acre-feet but it did not reach full normal pool. Flood storage evacuation from Milford, Tuttle Creek, and Perry was restricted the entire month due to near flood conditions in the Missouri River.

Marais des Cygnes basin: Melvern, Pomona, and Hillsdale reservoirs received significant inflow in October. All three reservoirs were in flood pool operations for the majority of the month, which resulted in higher than normal flows in the Marais des Cygnes River.

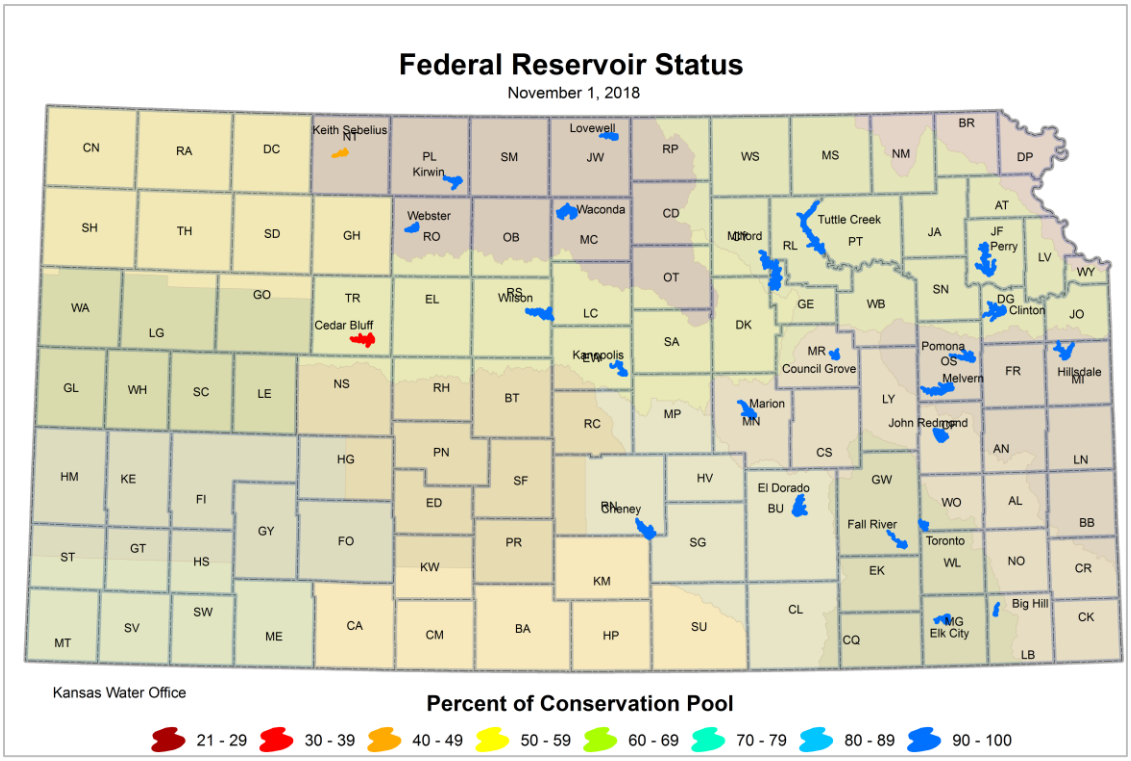
Cottonwood/Neosho basin: Inflows to Marion Reservoir remained lower than the rest of the system but it did make progress toward refilling conservation storage, gaining more than 2 feet and nearly 14 thousand acre-feet in October. Flood pool releases were necessary from Council Grove and John Redmond reservoirs.

Verdigris basin: Inflows to Toronto, Fall River, Elk City, and Big Hill reservoirs were moderate to above normal in October. Stream flow in the Verdigris and Fall Rivers were maintained well above normal due to flood pool releases throughout the month.

Saline basin: The elevation at Wilson Lake was maintained above normal pool in October. Inflow remained above normal and releases in excess of low flow settings were necessary to manage lake level.

Smoky Hill basin: The middle Smoky Hill River continued to benefit from sustained runoff in October. Kanopolis Lake experienced high inflows and flood releases occurred through the main service gates was necessary for much of the month. Cedar Bluff Reservoir also received some inflow and gained about 3 thousand acre-feet over the month.

Surface Water Supply Conditions
Reservoir Storage



Kansas Federal Reservoir Conservation Pool Levels

Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**Project Data Date/Time: 10/31/2018 06:00 AM**		
Norton[1]	2304.3	2293.28	-11.02	45.1
Harlan County, NE	1945.73	1939.05	-6.68	73.7
Lovewell[1]	1582.6	1582.12	-0.48	96.1
Milford[1]	1144.4	1153.89	9.49	100.0
Cedar Bluff	2144	2122.00	-22.00	37.3
Kanopolis[1]	1463	1473.82	10.82	100.0
Wilson[1]	1516	1516.77	0.77	100.0
Webster[1]	1892.5	1892.48	0.03	100.0
Kirwin[1]	1729.3	1729.98	0.73	100.0
Waconda[1]	1455.6	1457.54	1.94	100.0
Tuttle Creek[1]	1075	1103.71	28.71	100.0
Perry[1]	891.5	895.34	3.84	100.0
Clinton[1]	875.5	874.68	-0.82	95.1
Melvern[1]	1036	1038.63	2.63	100.0
Pomona[1]	974	973.40	-0.60	95.8
Hillsdale[1]	917	918.02	1.02	100.0
Arkansas River Basin		**11/01/2018 08:00 AM**		
Cheney	1421.6	1424.29	2.69	100.0
El Dorado	1339	1339.40	0.40	100.0
Toronto[1]	901.5	902.27	0.77	100.0
Fall River[1]	948.5	949.06	0.56	100.0
Elk City[1]	796	796.64	0.64	100.0
Big Hill	858	858.07	0.07	100.0
Council Grove[1]	1274	1274.50	0.50	100.0
Marion[1]	1350.5	1349.02	-1.48	89.0
John Redmond[1]	1039	1051.05	10.05	100.0

[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

Note: The conservation pool is the water storage for non-flood purposes of the reservoir, set by the elevation of the top of the pool.

Harmful Blue-Green Algal Blooms (lake water safety)

KDHE issues two levels of public health protection notifications for blue-green algae (BGA) Blooms: a Public Health Watch and Public Health Warning. Public Health Watch–Notifies public that a hazardous condition may exist, that the water may be unsafe for humans and animals and contact with the water is discouraged. Public Health Warning–Notifies public that conditions are unsafe, that contact with the water should not occur, and all conditions of Public Health Watch remain in effect. Warning that conditions are unsafe and water contact should not occur include that no swimming, wading, skiing or consumption of the water should occur. More information can be found at http://www.kdheks.gov/algae-illness/index.htm.

Lake Public Health Advisories

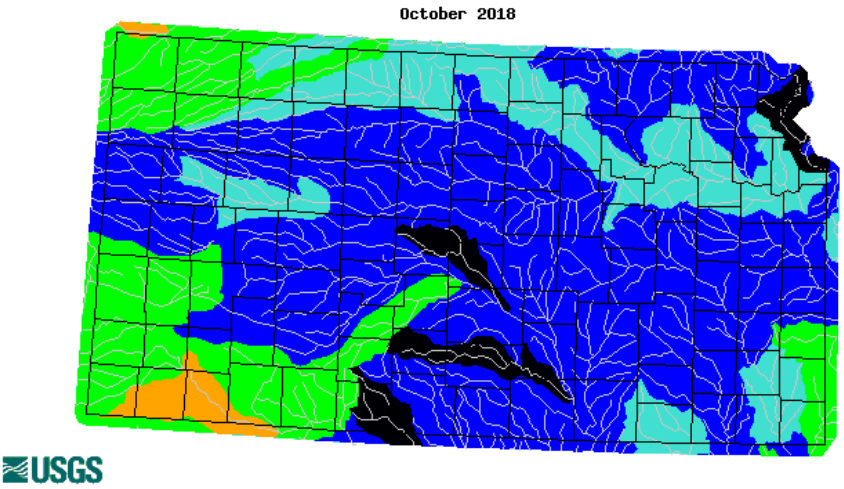
Water Body	County	10/5/2018	10/11/2018	10/19/2018	10/26/2018
Atchison County Park Lake	Atchison	Warning			
Atchison County State Fishing Lake	Atchison	Watch			
Carbondale West Lake	Osage	Warning	Warning	Warning	
Central Park Lake	Shawnee	Warning			
Frazier Lake	Grant	Warning	Warning	Warning	Warning
Hodgeman Co. State Fishing Lake	Hodgeman	Warning	Warning	Watch	
Jerry Ivey Pond	Saline	Warning	Warning	Warning	Warning
Lake Afton	Sedgewick	Warning	Warning		
Lake Scott State Park	Scott	Warning			
Lakewood Park Lake	Saline	Warning	Watch	Watch	
Marais des Cygnes Wildlife Area Lake	Linn	Warning	Warning	Warning	
Mary's Lake	Douglas	Watch	Watch		
Melvern Outlet Pond	Osage	Warning	Warning	Warning	
Melvern Outlet Swim Pond	Osage	Warning	Warning		
Overbrook City Lake	Osage	Watch	Watch		
Overbrook City Kids Pond	Osage	Watch	Watch		
Pomona Lake	Osage	Watch	Watch		
Rock Garden Pond	Shawnee	Warning	Warning	Warning	
South Park Lake	Johnson	Warning	Warning	Warning	Watch
Tomahawk Park Lake	Johnson	Watch	Watch		
Webster Lake	Rooks	Warning	Watch	Watch	

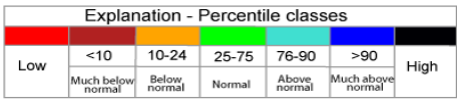
Please note lakes are only tested if a suspected bloom is reported to Kansas Department of Health and Environment (KDHE). Then testing is added to the next round of testing. So if in doubt stay out of the water and avoid contact with the water. Report new algae-blooms to KDHE: www.kdheks.gov/algae-illness or call 785-296-1664.

Streamflow Conditions

WaterWatch summarizes streamflow conditions in a region (state or hydrologic unit) in terms of the long-term typical condition at stream gages in the region. In general, a streamflow which is greater than the 75 percentile is considered *above normal*, a streamflow which is between 25 and 75 percentiles is considered *normal* and a streamflow which is less than the 25 percentile is considered *below normal*. Color codes are for basins with streamflow averages less than 25 percent of historic values. This comparison aids in evaluating water resources conditions for a time period.

October Streamflow compared to historical streamflow is reflected in the map below.





Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is not being administered in Kansas. MDS administration requires water rights junior to MDS, usually with priority dates after April 12, 1984, to stop diverting water. Administration is ordered when streamflow drops below MDS for more than seven days. To rescind orders at most gages, daily average flow must be above MDS for 14 days.

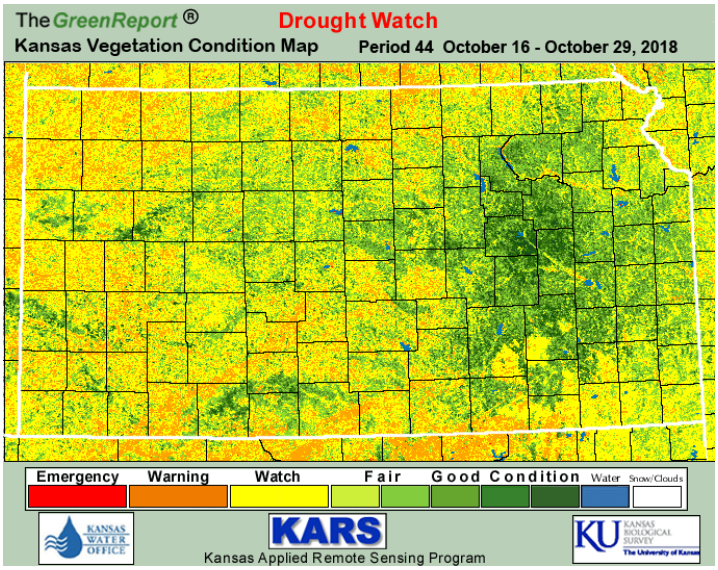
The table below provides a snapshot of conditions for streams of interest to the Kansas Department of Agriculture, Division of Water Resources. Flows at the gages on Rattlesnake Creek at Macksville and Zenith increased to exceed MDS during October.

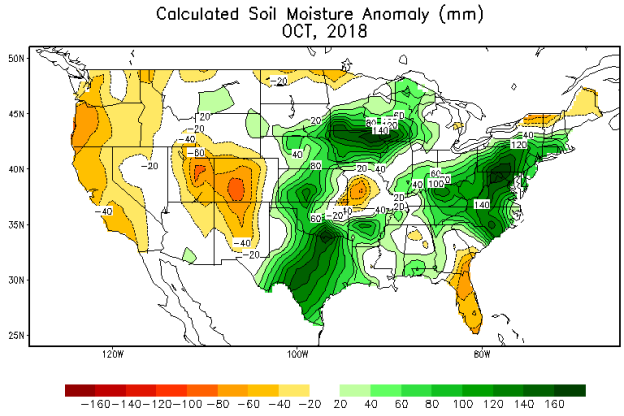
Streamflows					
USGS Gaging Station	**Oct. 1 Flow**	**Oct. 29 Flow**	**Oct. MDS**	**Nov. MDS**	**Comment**
Rattlesnake Creek near Macksville	Dry	4.7	1	5	No surface water diversions junior to MDS above gage
Rattlesnake Creek near Zenith	5	19	3	10	No surface water diversions junior to MDS above gage
Little Arkansas River at Alta Mills	2	84	8	8	MDS admin began Aug 10, 2017, ceased Oct 18, 2018

Crop , Vegetation and Soil

Vegetative Conditions

The Vegetative Condition map provides current conditions related to drought effects on vegetation. It is produced using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. The green areas are considered to be in good or excellent condition.

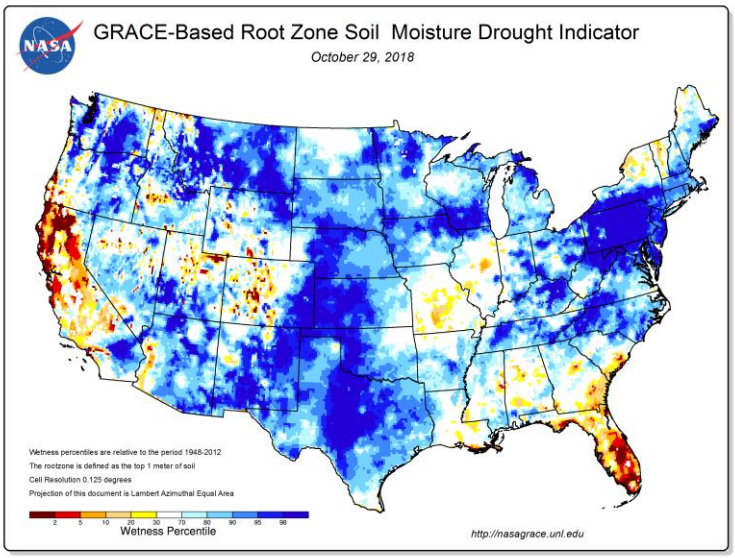




Soil Moisture

The Climate Prediction Center (CPC), also monitors soil moisture and predicts future soil moisture. Anomalies are defined as deviations from the 1971-2000 monthly climatology. The soil anomaly is provided below indicates deficit soil moisture for most of Kansas. (.http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml)

Root zone soil moisture is another tool to look at drought. NASA generates soil moisture drought indicators each week using GRACE satellite data integrated with other observations. Indicators describe wet or dry conditions as a percentile of probability of occurrence within the period of record (1948-present). Surface soil moisture and shallow groundwater maps are also available. https://nasagrace.unl.edu/Default.aspx



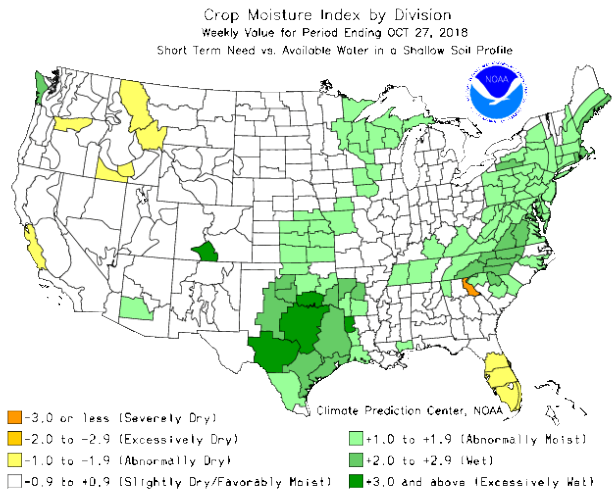
Crops and Rangeland

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report by USDA's National Agricultural Statistics Service for the state as a whole for the week ending October 29, 2018 indicates topsoil moisture supplies rated 0 percent very short, 3 short, 75 adequate, and 22 surplus. Subsoil moisture supplies rated 1 percent very short, 7 short, 81 adequate, and 11 surplus.

Field Crops Report:

Winter wheat condition rated 3 percent very poor, 15 poor, 40 fair, 36 good, and 6 excellent. Soybean condition rated 4 percent very poor, 11 poor, 32 fair, 43 good, and 10 excellent. Sorghum condition rated 2 percent very poor, 5 poor, 23 fair, 56 good, and 14 excellent. Cotton condition rated 1 percent very poor, 4 poor, 36 fair, 54 good, and 5 excellent.

Pasture and Range Report**:** Pasture and range conditions rated 4 percent very poor, 103 poor, 33 fair, 46 good, and 7 excellent.

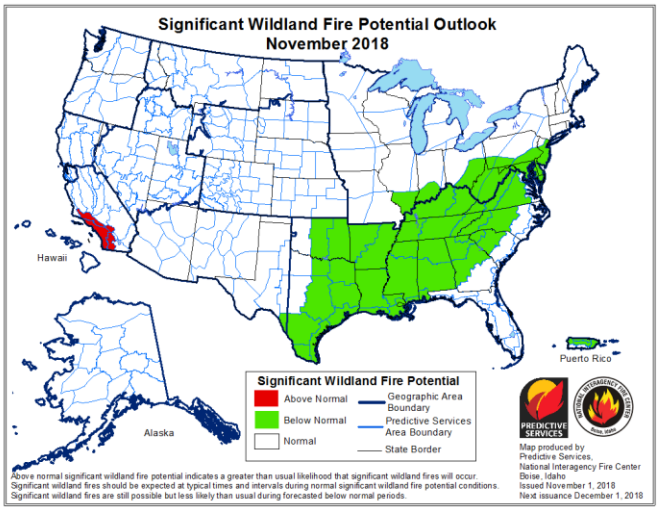


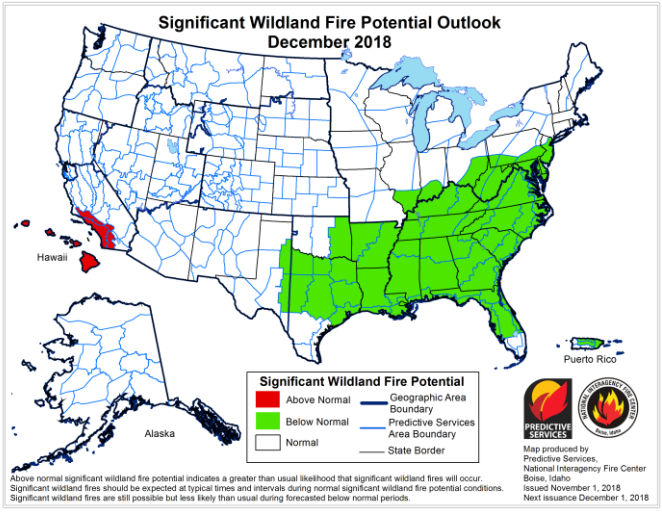
Based on the Palmer Drought Index, the Crop Moisture Index (CMI) uses a meteorological approach to monitor week-to-week crop conditions. It was developed by Palmer (1968) from procedures within the calculation of the PDSI. The CMI was designed to evaluate short-term moisture conditions across major crop-producing regions. It is based on the mean temperature and total precipitation for each week within a climate division, as well as the CMI value from the previous week. The CMI responds rapidly to changing conditions, and it is weighted by location and time so that maps, which commonly display the weekly CMI across the United States, can be used to compare moisture conditions at different locations. Weekly maps of the CMI are available as part of the USDA Weekly Weather and Crop Bulletin.

Fire

Periods of concern will be wind events coupled with low humidity that impact fire activity. Kansas Forest Service provides a grassland fire danger index at**:** http://www.kansasforests.org/fire_management/grasslandfireindex.html .

Significant Wildland Fire Potential Outlook is issued monthly for the United States, https://www.predictiveservices.nifc.gov/outlooks/monthly_seasonal_outlook.pdf .





Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report are compiled at least monthly, more frequently when conditions warrant, by the KWO. Information from various federal, state, local and academic sources is used. Some of the data is preliminary and subject to change once final data is available. The KWO web site, http://www.kwo.ks.gov/reports2/climate-and-drought-monitoring-response , contains additional drought information including links to other agencies with drought information and past issues of the Kansas Climate Summary and Drought Report. Kansas State Climatologist, Mary Knapp, is the primary source of the narrative on weather. She works closely with meteorologists throughout the state and region. Details of current conditions at Evapotranspiration (ET) and Mesonet sites across Kansas are available at http://www.ksre.k-state.edu/wdl/.

RESOURCES and ACTIVITIES

Kansas climate data is provided by Kansas State University, Weather Data Library. (http://www.ksre.k-state.edu/wdl/)

The U.S. Drought Monitor, from the National Drought Mitigation Center at the University of Nebraska-Lincoln, provides a "big picture" perspective of conditions across the nation. In the Kansas county drought stage scheme, a Drought Watch equates roughly to moderate drought in the U.S. Drought Monitor, while a Drought Warning is the equivalent of severe drought. A Drought Emergency is reserved for extreme or exceptional drought. Palmer Drought Severity Index - The Palmer Index (PDSI) is one indicator used in the U.S. Drought Monitor.

The High Plains Regional Climate Center (https://hprcc.unl.edu/)provides precipitation and temperature summary maps.

The U.S. Geological Survey (USGS) Drought Watch provides information average streamflow measured at long-term gaging stations and compares them to normal flows.

The Kansas Department of Agriculture-Division of Water Resources monitors stream flow using the USGS gages for determination of administrative needs. Administration may be needed due to Minimum Desirable Streamflow (MDS) requirements, impairments and reservoir release protection. (https://agriculture.ks.gov/divisions-programs/dwr/water-appropriation/minimum-desirable-streamflow.)

The water levels of the federal lakes fluctuate during a year according to the management plan. Lake level Management plans are posted on the Kansas Water Office web site www.kwo.ks.gov .

The Kansas Applied Remote Sensing Program (KARS) at the University of Kansas produces a Kansas Green Report each week during the growing season. For a full set of national and regional ***GreenReport***® maps, go to: http://www.kars.ku.edu/products/greenreport/greenreport.shtml. This Kansas Vegetation Drought Response Index map is developed weekly by the Kansas Biological Survey using state drought triggers as its key. In addition the

Vegetation Drought Response Index, by the National Drought Mitigation Center provides another a national perspective on vegetation conditions. VegDRI maps may be found at http://vegdri.unl.edu/

The National Weather Service (NWS) provides fire weather products and services for Kansas that include the Rangeland Fire Danger Index, Fire Weather Forecasts, Red Flag Watches/Warnings and Spot Forecasts. The five NWS offices that serve Kansas websites may be accessed from the NWS Offices' page.

The Monthly and Seasonal Drought Outlooks, developed by the NOAA Climate Prediction Center, assess the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. (http://www.cpc.ncep.noaa.gov/) Also see: http://www.noaa.gov/.

Responding to Drought: A Guide for City, County and Water System Officials provides an overview of Kansas county drought stage declarations, local planning and coordination, disaster declarations and available state and federal assistance. The 2007 Municipal Water Conservation Plan Guidelines and the Drought Vulnerability Assessment Report, both by KWO, provide guidance regarding drought preparedness and response. These are available at http://www.kwo.ks.gov/reports2/climate-and-drought-monitoring-response.

USDA Drought Programs and Assistance website (https://www.usda.gov/topics/disaster/drought/usda-drought-programs-and-assistance) listing the various USDA programs and agencies to assist with drought issues.

The National Interagency Coordination Center in Boise, Idaho, produces wildfire potential outlook maps monthly. (https://www.predictiveservices.nifc.gov/outlooks/outlooks.htm)

Please contact Diane Knowles at the Kansas Water Office (785) 296-3185 or diane.knowles@kwo.ks.gov should you have any questions or suggestions.

APPENDIX A

October 2018 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	2.44	1.29	212%	48.6	-2.1	92 (3)	14 (15)
Dodge City	6.45	4.71	371%	53.6	-3.0	96 (3)	25 (15)
Garden City	3.15	1.87	246%	51.8	-3.6	95 (3)	22 (16)
Goodland	2.36	0.99	172%	49.0	-2.9	94 (3)	16 (15)
Guymon, OK	5.29	3.72	337%	56.1	-1.2	97 (3)	30 (16,14)
Hill City	3.72	2.20	245%	51.5	-2.5	95 (3)	20 (15)
Lamar, CO	2.93	2.13	366%	51.4	-1.5	98 (3)	18 (15)
McCook, NE	2.53	0.74	141%	49.5	-1.8	96 (3)	19 (15)
Springfield, CO	2.91	1.52	209%	51.3	-2.6	94 (3)	24 (16)
Central							
Concordia	5.28	3.36	275%	53.0	-2.4	95 (3)	26 (15)
Hebron, NE				52.0	-1.3	93 (3)	25 (15)
Medicine Lodge	8.88	6.04	313%	56.9	-1.7	93 (3)	29 (16)
Ponca City, OK	8.23	4.85	243%	59.5	-0.6	92 (3)	32 (16)
Salina	5.70	3.43	251%	54.3	-3.2	94 (3)	28 (16)
Wichita (ICT)	6.28	3.50	226%	57.6	-0.6	93 (3)	30 (16)
East							
Bartlesville, OK	6.39	2.92	184%	58.6	-0.9	92 (3)	32 (21)
Chanute	7.52	3.86	205%	58.5	0.2	89 (3)	31 (16)
Falls City, NE	6.22	3.58	236%	52.5	-2.2	90 (3)	27 (21,16)
Johnson Co. Exec. Apt	9.98	6.54	290%	55.5	-1.5	88 (3)	28 (16)
Joplin, MO	2.57	-1.46	64%	58.7	-1.1	89 (5,3)	32 (21)
Kansas City (MCI), MO	10.76	7.60	341%	55.5	-0.9	91 (3)	26 (16)
St. Joseph, MO	6.43	3.62	229%	54.2	-0.5	92 (3)	29 (21)
Topeka (TOP)	7.01	3.98	231%	55.5	-1.1	93 (3)	27 (16)

1. Airport Automated Observation Stations (NWS/FAA)

2. Departure from 1981-2010 normal value

T - Trace; M - Missing; --- no normal value from which to calculate departure or percent of normal

Source: National Weather Service F-6 Climate Summaries