KANSAS CLIMATE and DROUGHT UPDATE – January 2016 Summary

Climate, Drought Conditions and Responses for Kansas

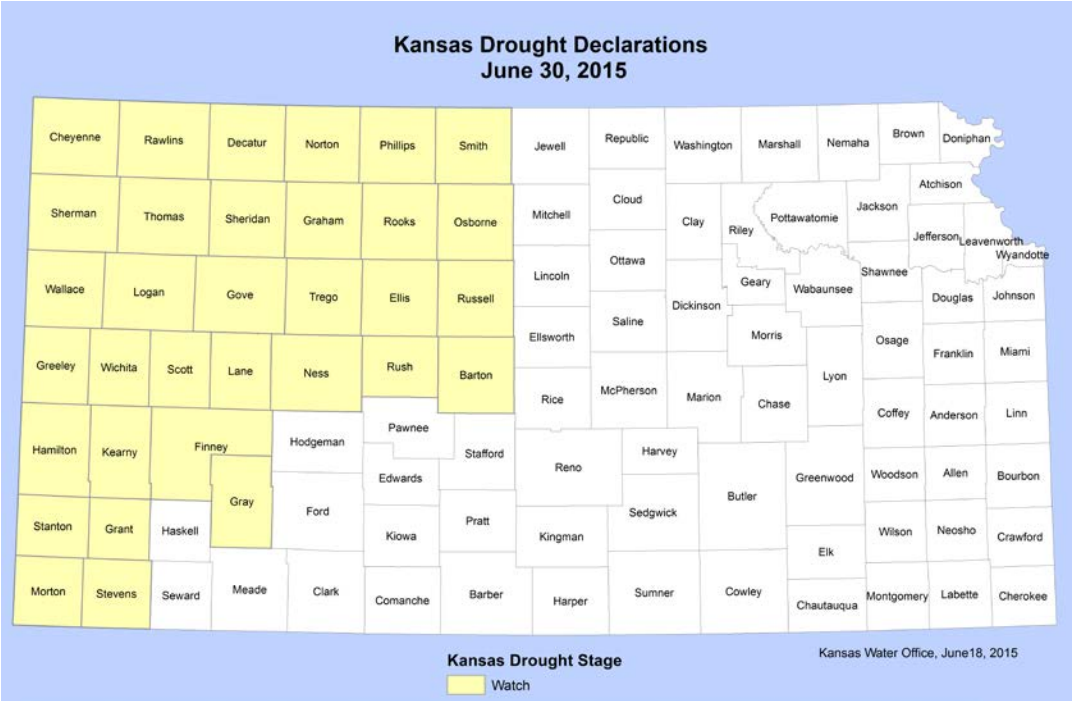
General

- In effect, June 29, 2015, Executive Order (EO) 15-04 issued by the Governor for a drought watch for 33 counties.
- The US Drought Monitor indicated drought conditions were gone by the end of the December with 2% of Kansas abnormally dry (parts of Barton, Cheyenne, Pawnee and Sherman counties) on December 29th.
- December 2, 2015, USDA designated Barton County as a Primary Disaster Area due to excessive rain, high winds and hail that occurred September 10, 2015, making a total of four counties primary and 24 contiguous counties for federal agricultural program assistance for the 2015 crop year.
- USDA declared 30 Kansas Counties Primary Disaster areas for 2015, due to drought. An additional 14 contiguous counties are also eligible federal for assistance.
- Disaster declaration by the President issued for severe storms, tornados, straight line winds and flooding May 4-June 21, 2015. This makes disaster aid available through Federal Emergency Management Agency (FEMA).

Lakes and Streams

- Minimum Desirable Streamflow (MDS) Administration was in effect on the Saline, Smoky Hill, Solomon, Republican rivers at some time in January 2016. It remains in effect on the Saline, and Smoky Hill rivers.
- Administration on the Republican River ceased on January 7, 2016.
- Blue-Green Algae Bloom Warning is in effect for the Hiawatha City Lake, Brown County; and Plainville Township Lake, Rooks County (November 17, 2015).

Kansas County Drought Declarations: Executive Order 15-04 was issued by Governor Brownback June 30, 2015, modifying drought declarations for Kansas counties. Drought watch is in effect for 33 counties as the overall conditions for plant growth and deficits in precipitation require careful consideration in planning for future water use.

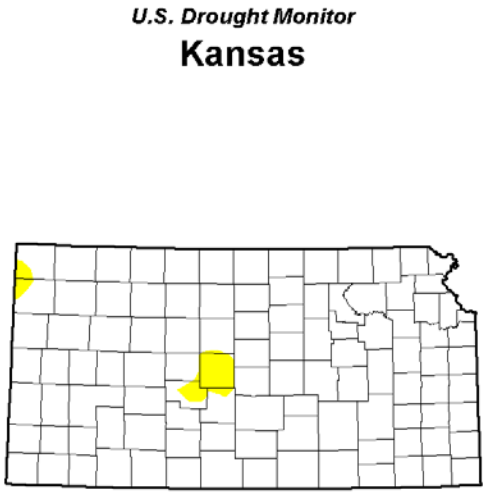


Drought Watch: Barton, Cheyenne, Decatur, Ellis, Finney, Gove, Graham, Grant, Gray, Greeley, Hamilton, Kearny, Lane, Logan, Morton, Ness, Norton, Osborne, Phillips, Rawlins, Rooks, Rush, Russell, Scott, Sheridan, Sherman, Smith, Stanton, Stevens, Thomas, Trego, Wallace, Wichita

General Conditions

Drought conditions didn't change during January. Abnormally dry areas remain in central and northwestern Kansas. While drier than normal conditions persisted across much of the state, January is a normally low precipitation month so changes are slow to develop. Wetter than normal conditions in the Central Climate Division weren't sufficient to erase the abnormally dry conditions. Some long-term hydrological deficits are in place affecting water supplies and reservoirs.

More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.



January 26, 2016
(Released Thursday, Jan. 28, 2016)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	97.84	2.16	0.00	0.00	0.00	0.00
Last Week 1/19/2016	97.84	2.16	0.00	0.00	0.00	0.00
3 Months Ago 10/27/2015	25.31	74.69	14.29	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 1/27/2015	0.46	99.54	37.66	18.58	1.88	0.00

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

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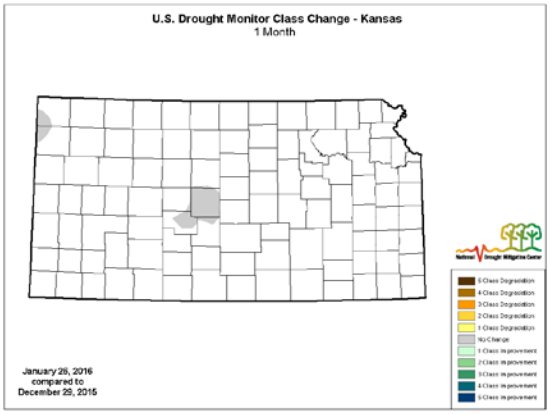
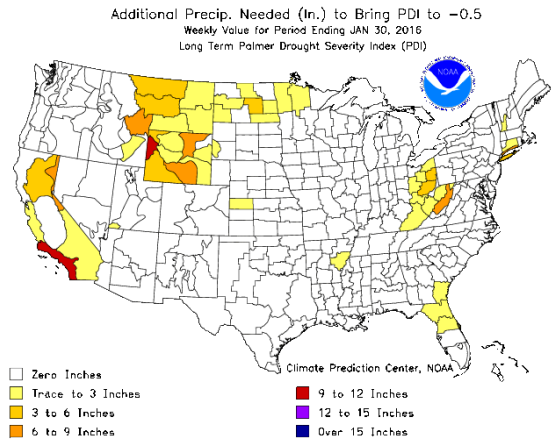
http://droughtmonitor.unl.edu/



Palmer Drought Severity Index - The Palmer Index (PDSI) is an indicator used in the U.S. Drought Monitor. The precipitation needed in Kansas to bring the Palmer Drought Index to near normal (-0.5) is shown in the map below. (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/addpcp.gif)



The next table provides climate division moisture needs to end drought.

Climate Division		Precipitation needed to End Drought (inches)			
	Week ending January 2	Week ending January 9	Week ending January 16	Week ending January 23	Week ending January 30
Northwest	-	-	0.11	0.14	0.33
West Central	-	-	-	-	-
Southwest	-	-	-	-	-
North Central	-	-	-	-	-
Central	-	-	-	-	-
South Central	-	-	-	-	-
Northeast	-	-	-	-	-
East Central	-	-	-	-	-
Southeast	-	-	-	-	-

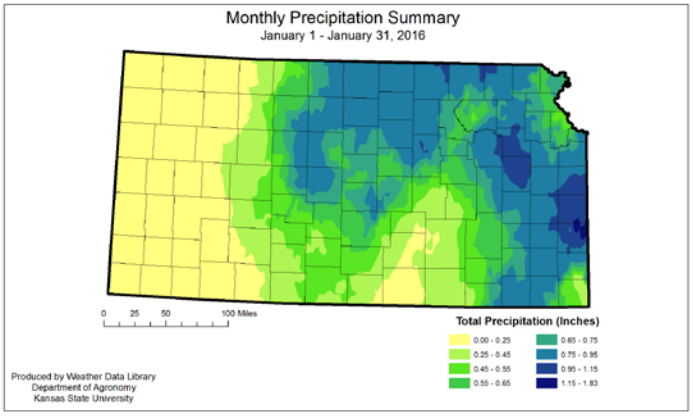
Climate Summary (Temperature and Precipitation)

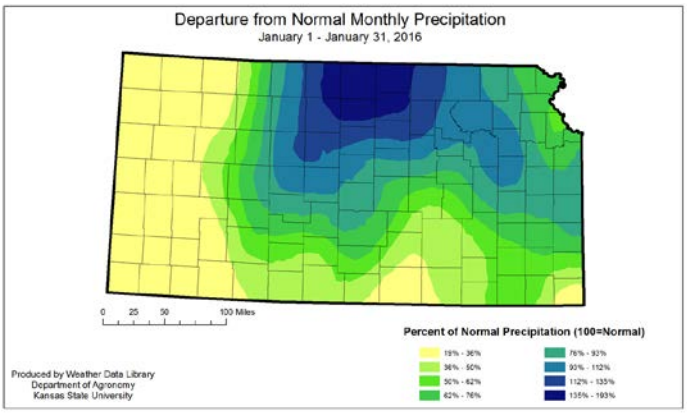
The overall pattern for January was drier and warmer than normal for much of the state. State-wide average precipitation was 0.44 inches. This ranks as the 50th driest January since 1895, and places it in the middle third of the range. The North Central and Central climate divisions were exceptions to this dry pattern. The North Central divisional average was 0.71 of an inch, or 110 percent of the normal. The Central divisional average was 0.79 of an inch, or 113 percent of normal. In contrast, the Northwest Division averaged just 0.06 of an inch of precipitation, which was 13 percent of normal. Still, there were 76 new daily record precipitation amounts. The bulk of these records occurred during the January 6-8th event.

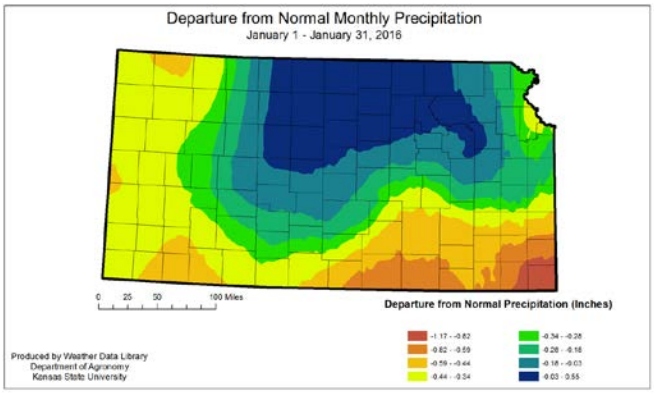
Flooding was not as much of an issue as was the case in the December storms. Despite the warmer than normal temperatures, snow was a feature during the month. The greatest 24 hour total was 9.5 inches at Haddam, Washington County, on the 22nd. Haddam was also the station with the greatest monthly total for the state at 10.5 inches.

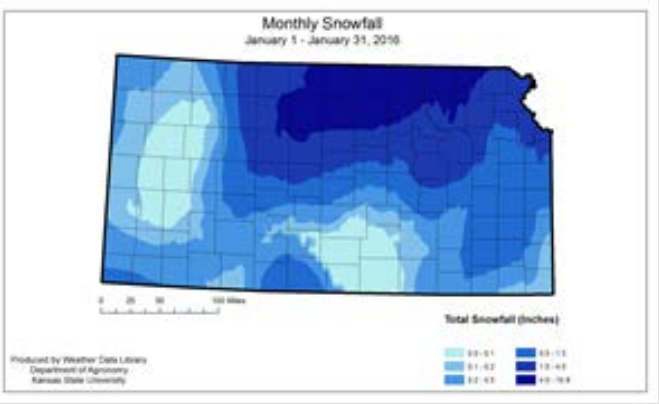
Precipitation summary for the month is provided in the table and maps below from the Kansas State University Weather Library.

Kansas Climate Division Precipitation Summary (inches) - Summary January 2016												
	January 1-31, 2016			January 1– January 31, 2016			April 1-January 31, 2016			September 1–January 31, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	0.06	-0.39	15	0.06	-0.39	15	20.34	0.83	104	5.46	0.54	109
West Central	0.13	-0.37	22	0.13	-0.37	22	20.92	2.15	111	5.46	0.49	106
Southwest	0.09	-0.38	17	0.09	-0.38	17	26.49	8.50	146	7.32	2.39	145
North Central	0.71	0.08	110	0.71	0.08	110	26.84	1.67	105	7.67	0.32	104
Central	0.79	0.10	113	0.79	0.10	113	27.80	1.77	105	8.63	1.12	114
South Central	0.34	-0.49	43	0.34	-0.49	43	33.62	6.09	121	9.83	1.15	113
Northeast	0.68	-0.13	86	0.68	-0.13	86	38.00	6.40	119	11.20	1.06	111
East Central	0.69	-0.25	73	0.69	-0.25	73	36.12	2.18	105	11.50	0.24	100
Southeast	0.59	-0.66	46	0.59	-0.66	46	40.20	3.45	108	12.82	-0.52	94
STATE	0.44	-0.30	56	0.44	-0.30	56	30.15	3.88	115	8.92	0.80	111

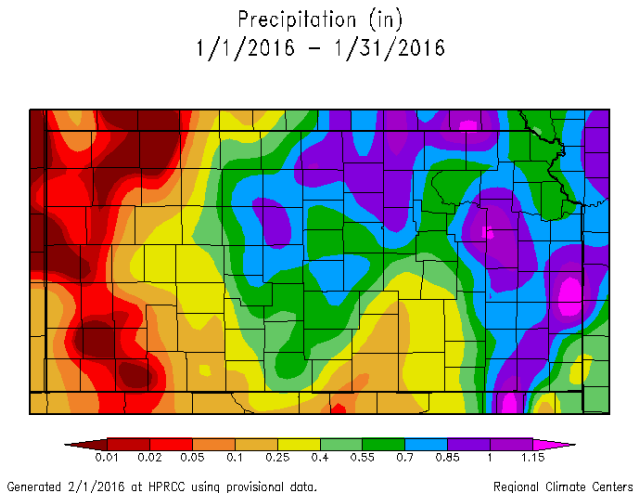


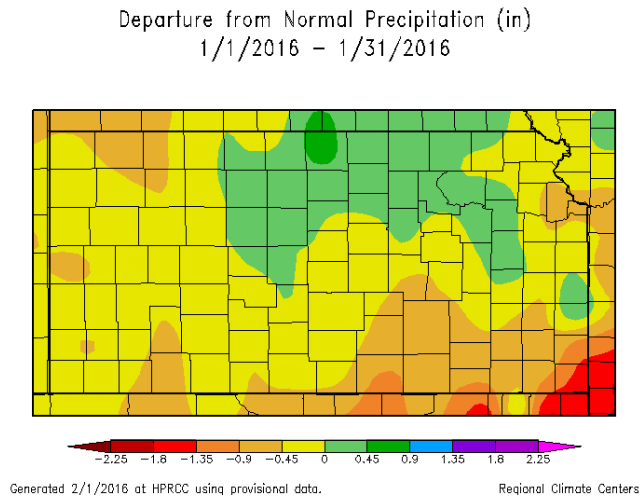






Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

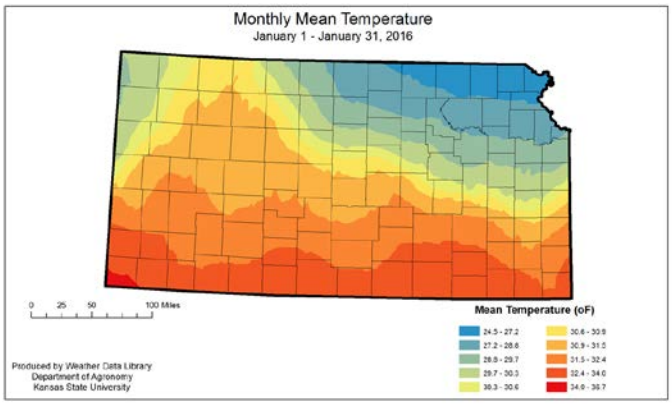


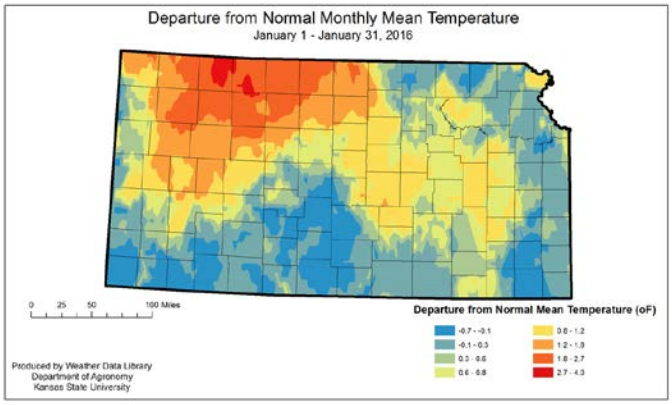


Temperatures also fell in the middle third of the distribution. The state-wide average temperature was 30.9° F, or 1.1 degrees warmer than normal. This is much closer to the normal than it was in December, when we saw the 4th warmest December on record. The eastern climate divisions were the closest to normal, with departures ranging from +0.6° F in the Southeast Division to -0.4° F in the Northeast. The Northwest Division had the greatest departure from normal, with an average of 31.1° F, or 2.6 degrees warmer than normal. There were 21 new daily high maximum temperature records set, although none of these were record highs for the month. In addition, 14 record warm minimum temperatures were recorded. The warmest reading for the month was 74° F at Sedan (Chautauqua County) on the 30th. The coldest reading was -11° F at Horton (Brown County) and Troy (Doniphan County) on the 18th. That places the range from warmest to coldest at 85 degrees.

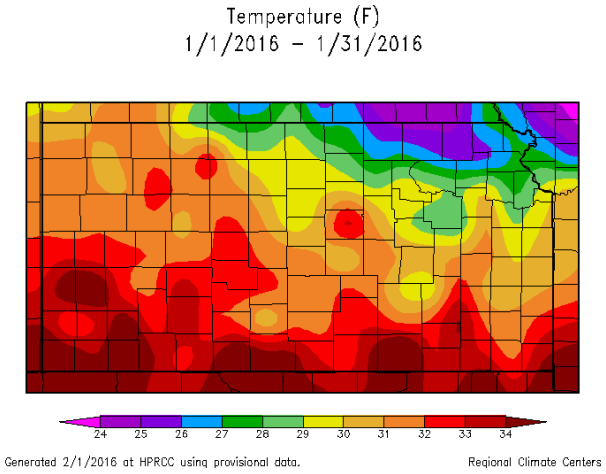
Temperature summary by the Kansas State University Weather Library for the month is provided in the table and maps below. The table below summarizes temperatures by Kansas climate division and various time periods. Slight differences in the average or extreme values presented may occur due to preliminary data.

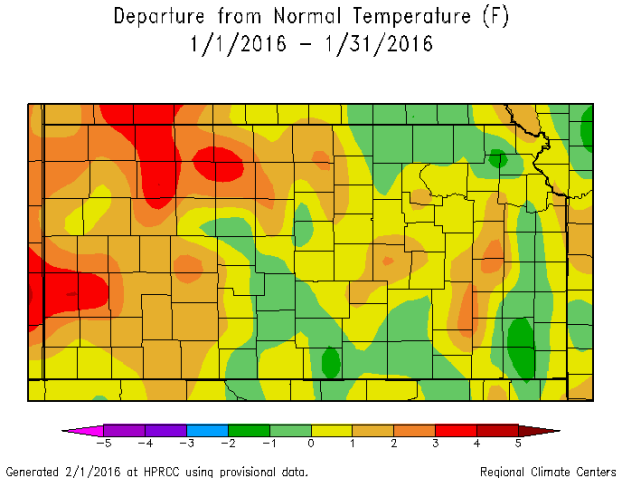
Climate Division	Kansas Climate Division Temperature Summary (°F)							
	January 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	43.9	18.3	31.1	2.6	65	29	2	10
West Central	45.6	18.1	31.8	2.1	66	29	3	10
Southwest	47.9	20.0	34.0	1.9	73	25	7	10
North Central	38.5	18.7	28.6	0.7	65	30	-8	10
Central	41.3	20.8	31.1	1.2	67	29	-1	10
South Central	43.7	22.4	33.1	1.0	71	30	3	11
Northeast	36.9	17.0	26.9	-0.4	69	30	-11	18
East Central	38.9	20.4	29.7	0.6	71	30	-2	11
Southeast	41.8	22.0	31.9	0.2	74	30	1	10
STATE	42.1	19.7	30.9	1.1	74	30th	-11	18th
Data Source: KSU Weather Library								





Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



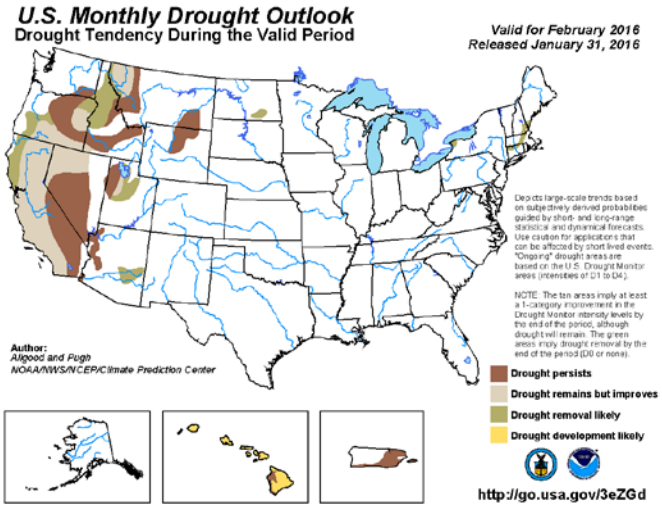


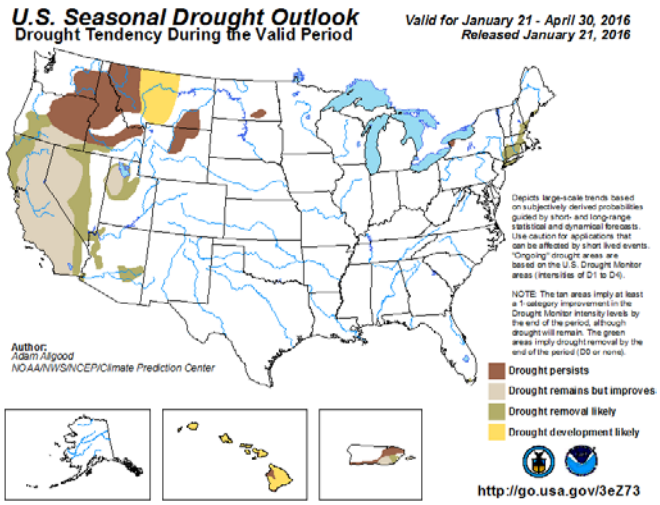
Severe weather was of the winter variety. There were 170 Local Storm Reports received at NWS Forecast offices during the month. The majority were for snow. However, there were reports of freezing rain, sleet and non-thunderstorm wind gusts. These gusts were reported in Northwest KS in Cheyenne and Rawlins counties on the 29th. There were no reports of hail or tornadoes.

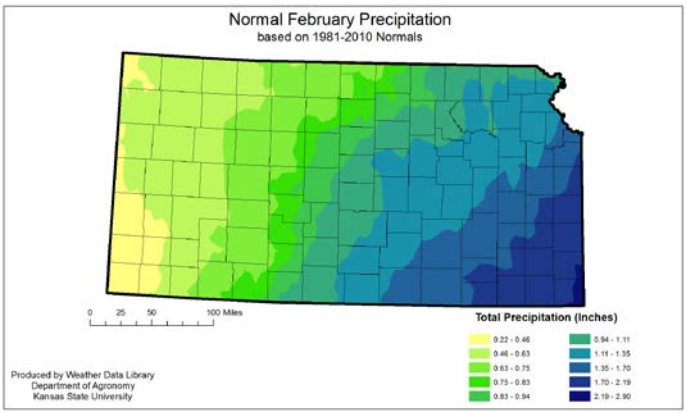
Future Outlook

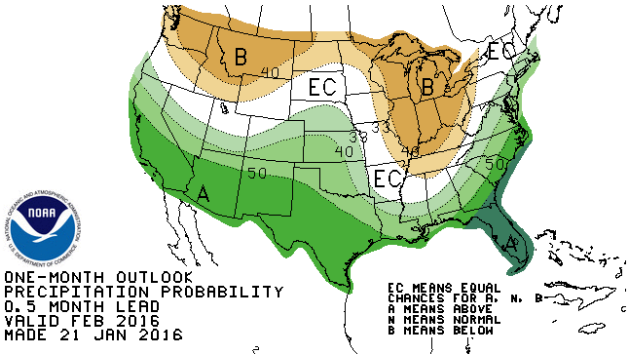
The drought outlook is for improving conditions, and the precipitation outlook for February is for increased chances of wetter than normal. However, we are still in a drier period of the year and either above or below normal precipitation will be slow to show impacts.

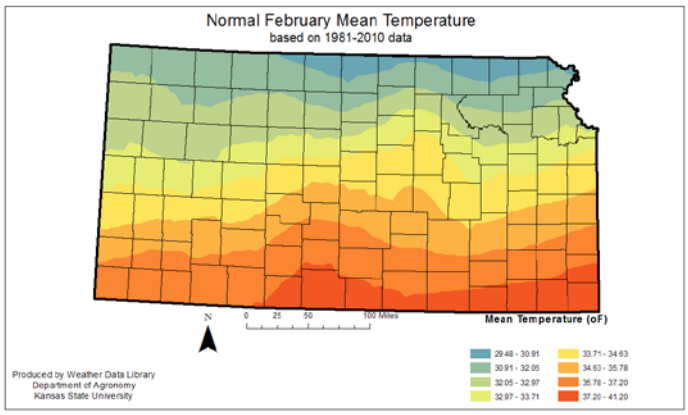
The Drought Outlooks for the month of February and the Season Outlook for Mid- January through the end of April 2016 are provided below.

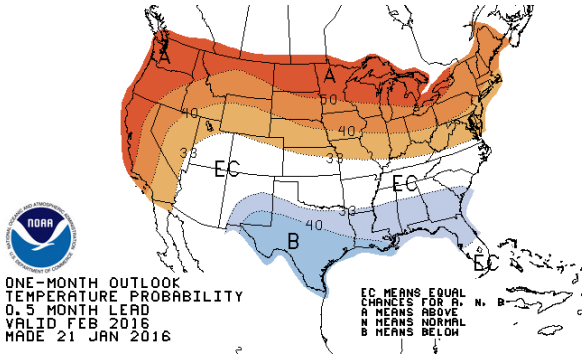




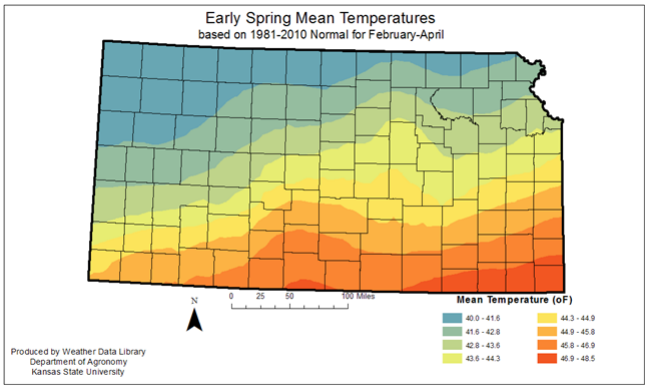


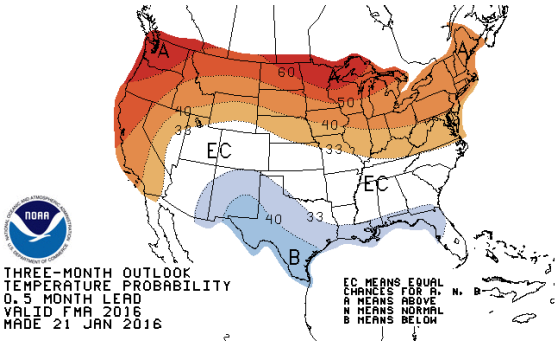


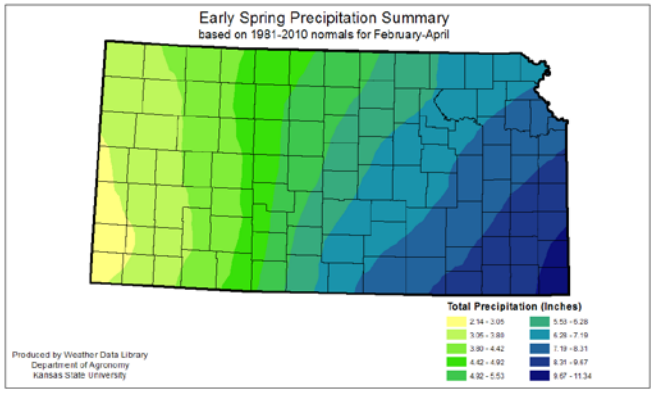


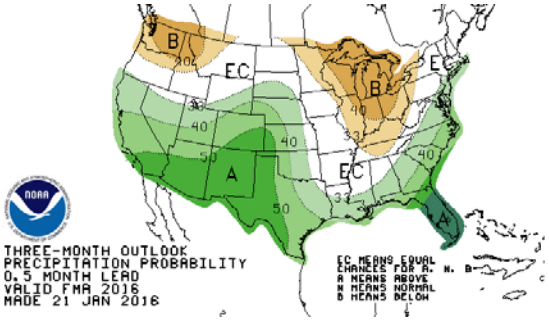


The early winter (three-month) outlook favors normal temperatures and above normal precipitation for February through April 2016.









Additional outlooks for additional 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. Evaluation of experience from this past year and update those plans to make sure they are prepared to address water supply needs should the drought not continue to ease.

Known issues:
Stage II water restrictions are in place for the City of **Russell,** Russell County water customers. The water restrictions include a prohibition on most outdoor watering, vehicle washing, filling of residential swimming pools, and washing exterior of buildings. It also requires industrial users to reduce use.

Stage III water restrictions have been in place for the City of **Victoria**, Ellis County since January 2014. No outdoor watering is allowed.

The City of **Natoma** in Osborne County reported to KDHE declining well water levels causing inability to pump two of three wells. A water watch (conservation plan) has been enacted.

Surface Water Supply Conditions
Kansas River basin: After a relatively wet December reservoir inflows subsided in January, allowing for evacuation of flood storage and releases from multipurpose pool to achieve the lower winter target elevations. Flows in the Kansas River remained high throughout the month.

Marais des Cygnes basin: River flow throughout the basin was well above median levels the entire month of January. High flows in the Marais des Cygnes River were a result of evacuation of flood storage from Melvern, Pomona, and Hillsdale reservoirs.

Cottonwood / Neosho basin: River flow throughout the basin remained at moderate levels for the month of January. All reservoirs ended the month slightly above normal pool elevations.

Verdigris basin: Flood pool releases from all reservoirs resulted in high river flow throughout the basin for most of the month. All reservoirs ended the month with a small amount of flood storage remaining.

Saline basin: Elevation at Wilson Lake was stable near record low in January. Flows in the Saline River remained inconsequential throughout the month.

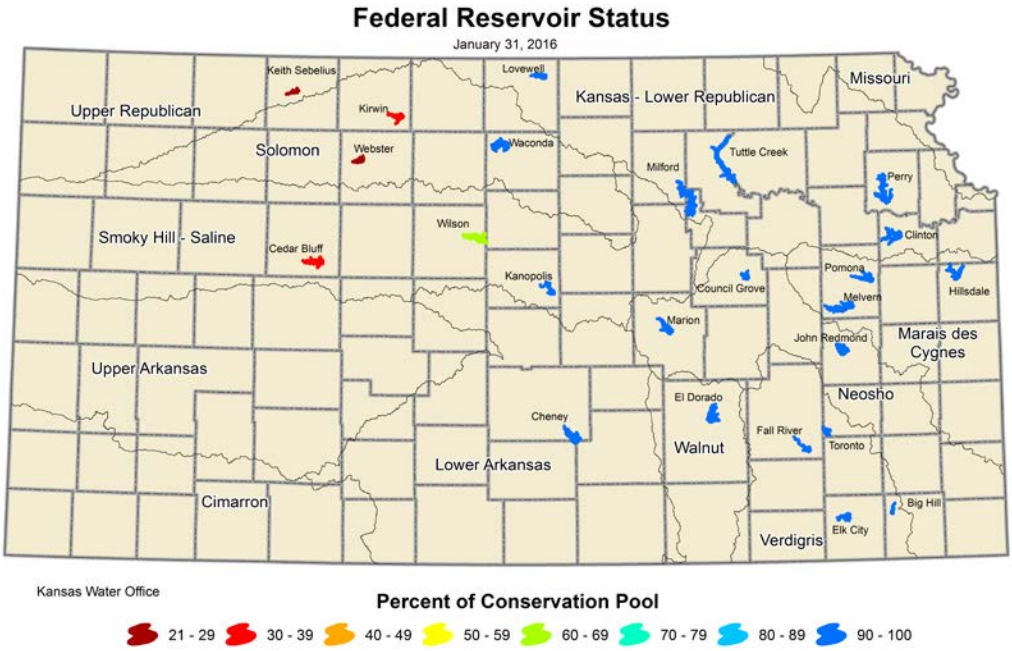
Smoky Hill basin: Smoky Hill basin streamflow remained low for January. Kanopolis Reservoir releases were minimal so the storage balance was positive but downstream base flow was healthy and the low flow target at the USGS gage near Mentor was maintained. Cedar Bluff Reservoir maintained a stable pool level in January.

Harmful Blue-Green Algal Blooms (lake water safety)
KDHE has issued two levels of public health protection notifications for blue-green algae (BGA) Blooms: a Public Health Watch and Public Health Warning. November 17, 2015 the sampling season closed. Two lakes remain on the warning list until the 2016 sampling season (April 1-Oct 31), Hiawatha City Lake, Brown County; and Plainville Township Lake, Rooks County.

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.

General Reservoir Conditions

The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool. Wilson Lake is also low at under 67 percent.



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		**2/1/2016**		
Norton[1]	2304.3	2287.9	-16.40	27.8
Harlan County, NE	1945.73	1934.1	-11.63	57.2
Lovewell[1]	1582.6	1582.4	-0.20	98.8
Milford[1]	1144.4	1142.6	-1.80	93.0
Cedar Bluff	2144	2119.2	-24.80	32.4
Kanopolis[1]	1463	1463.6	0.60	100.0
Wilson[1]	1516	1505.8	-10.20	66.5
Webster[1]	1892.5	1870.0	-22.45	22.8
Kirwin[1]	1729.3	1713.3	-15.95	36.8
Waconda[1]	1455.6	1454.4	-1.20	93.5
Tuttle Creek[1]	1075	1073.8	-1.20	95.1
Perry[1]	891.5	890.6	-0.90	95.7
Clinton[1]	875.5	875.5	0.00	100.0
Melvern[1]	1036	1034.5	-1.50	93.5
Pomona[1]	974	974.1	0.10	100.0
Hillsdale[1]	917	915.5	-1.50	91.2
Arkansas River Basin		**2/1/2016**		
Cheney	1421.6	1422.09	0.49	100.0
El Dorado	1339	1338.62	-0.38	99.0
Toronto[1]	901.5	901.91	0.41	100.0
Fall River[1]	948.5	948.94	0.44	100.0
Elk City[1]	796	796.81	0.81	100.0
Big Hill	858	858.12	0.12	100.0
Council Grove[1]	1274	1274.35	0.35	100.0
Marion[1]	1350.5	1350.71	0.21	100.0
John Redmond[1]	1039	1041.28	0.28	100.0

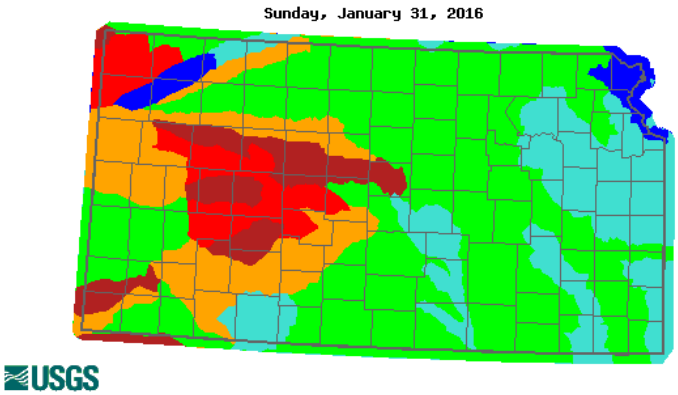
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

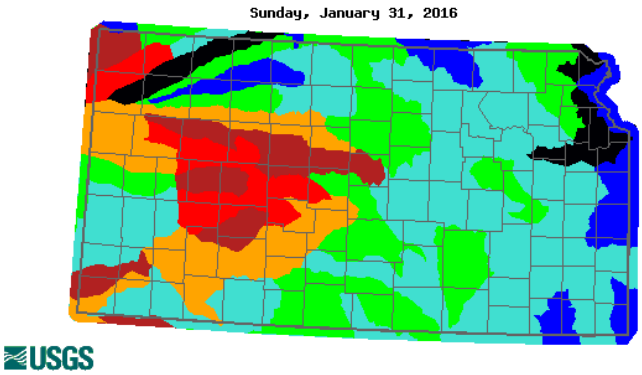
Note: The conservation pool is the water storage for non-flood purposes of the reservoir, set by the elevation of the top of the pool.
* Data from 11/02/2015 6 am, unavailable 11/1/15

Streamflow Conditions

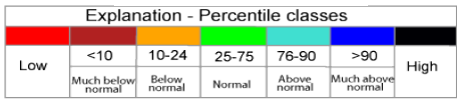
Kansas streamflows during July varied across the state, but remain below historical normal flows in parts of west and central Kansas.

The comparison of present **7-day** streamflow to historical is shown on the map below left and the **28-day** streamflow compared to historical is shown on the map below, right. Short term streamflow is significantly lower than historical average in many area of western Kansas.

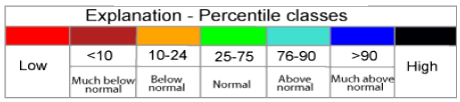




7-day streamflow



Monthly streamflow



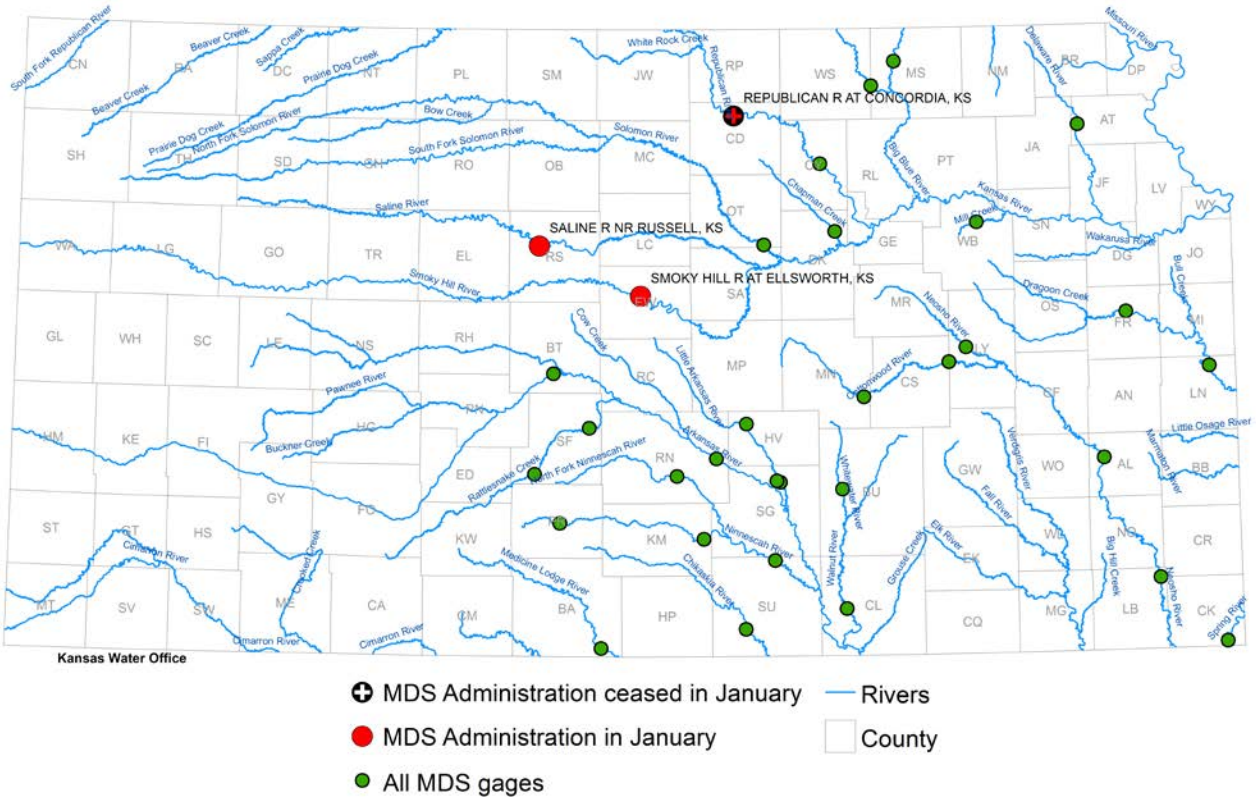
In general, a streamflow which is greater than the 75 percentile is considered *above normal*, a streamflow which is between 25 and 75 percentiles is considered *normal* and a streamflow which is less than the 25 percentile is considered *below normal*. Color codes are for basins with streamflow averages less than 25 percent of historic values.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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.

Streamflows in cubic feet per second (cfs)									
Gaging Station	**Flow Jan 7**	**Flow Jan 14**	**Flow Jan 21**	**Flow Jan 28**	**Flow Dec 31**	**Jan MDS**	**Feb MDS**	**Administration Date**	**Number of Rights Admin.**
Republican River at Concordia	Ice	Ice	Ice	215		100	125	11/18/15; ceased 01/07/16	(70)
Republican River at Clay Center	230	Ice	Ice	Ice		125	150	03/20/15; ceased 05/29/15	
Smoky Hill River at Ellsworth	19	Ice	Ice	19		20	20	03/23/15	3
Saline River near Russell	3	3	2	3		5	5	9/5/15	10
								TOTAL Admin. 01/31/16	13

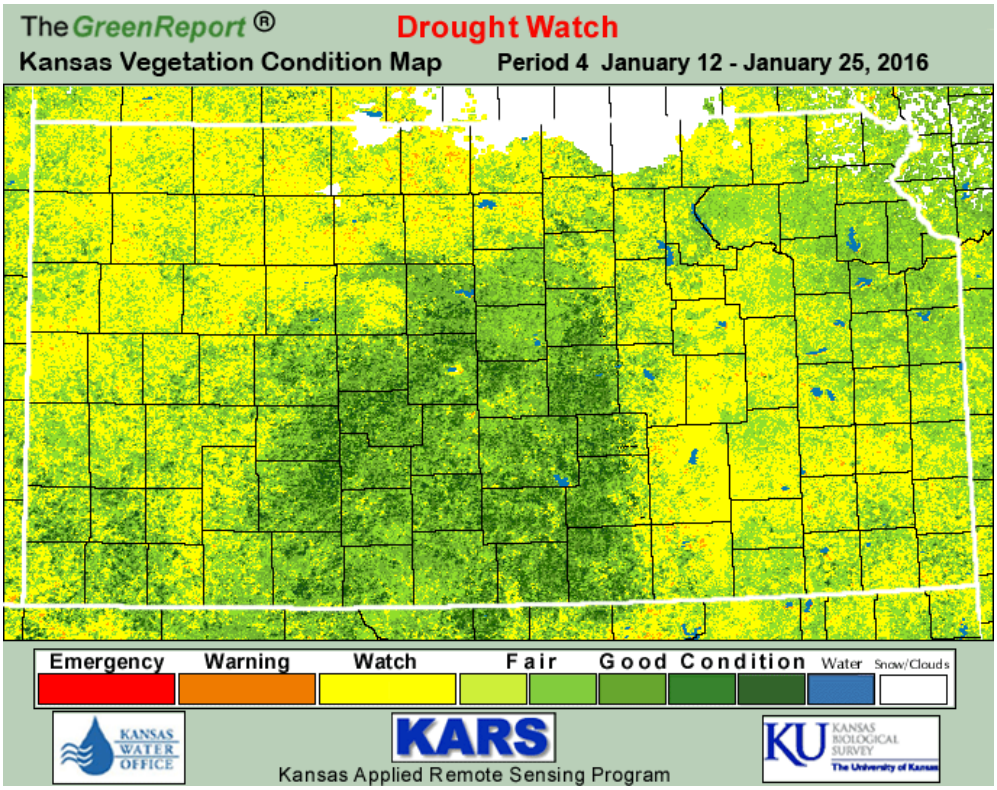
Kansas Minimum Desirable Streamflow (MDS) Gages Administration
January 31, 2016

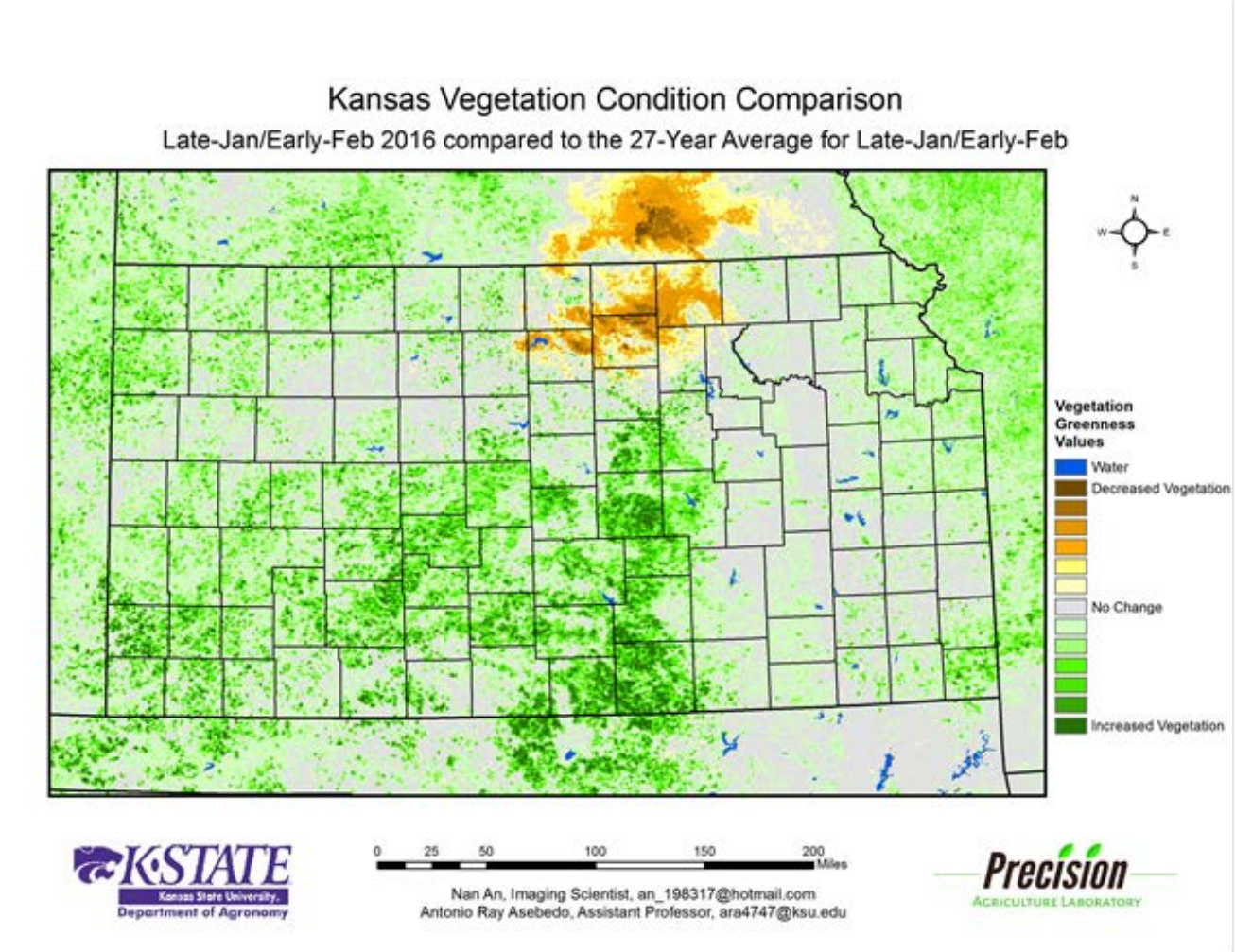


Soil, Crop and Vegetation
Kansas Vegetative Conditions

The Kansas Vegetative Condition map is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Green colors in the central areas this time of year indicate where winter wheat is dormant and in good shape.

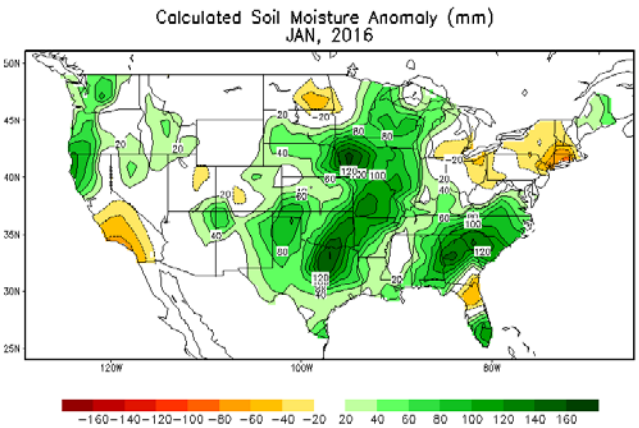
K-State Vegetative Caparison for late January indicates decreased vegetative activity in north central Kansas coincides with the area of heaviest snow in late January storm event. Highest vegetative activity is in Central and South Central climate divisions where wet conditions in December, and mild temperatures in January fueled growth.





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.
http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml



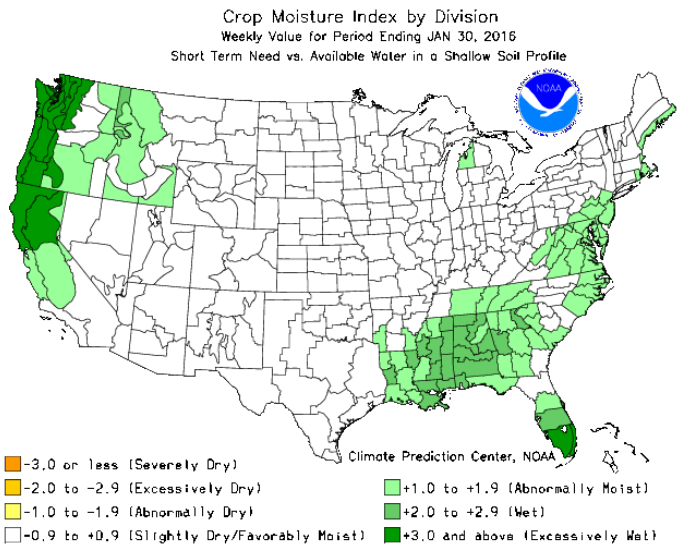
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the month of January 2016 reported topsoil moisture rated 3 percent very short, 16 short, 76 adequate, and 5 surplus. Subsoil moisture rated 5 percent very short, 17 short, 75 adequate, and 3 surplus.

Field Crops Report: Winter wheat condition rated 1 percent very poor, 7 poor, 37 fair, 49 good and 6 excellent.

Livestock Report: Cattle and calf conditions rated 0 percent very poor, 1 poor, 28 fair, 67 good and 4 excellent. Hay and roughage supplies rated 0 percent very short, 4 short, 86 adequate, 10 surplus. Stock water supplies rated 4 percent very short, 12 short, 86 adequate, and 2 surplus.
(http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)

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/JAWF Weekly Weather and Crop Bulletin.



Whenever the Governor or the U.S. Department of Agriculture declares all or any portion of the State is in a state of drought, certain conditions apply to motor carriers transporting hay or related animal forage feedstuffs to the geographic area specified in the drought declaration. Those certain conditions are as follows:

- Motor carrier registration and fuel tax permits are temporarily suspended;
- Licensing, certification, and permitting rules and regulations of the State Corporation Commission are temporarily suspended;
- These motor carriers may not operate during the period beginning 30 minutes after sunset and ending 30 minutes before sunrise and are required to comply with flags, signs, and lighting requirements applicable to over width vehicles;
- Motor carriers cannot operate during inclement weather;
- Oversize and overweight loads cannot be transported when visibility is less than one-half mile or when conditions of moderate to heavy rain, sleet, snow, fog, or smoke exist, or when highway surfaces are slippery due to ice or packed snow; and
- Motor carriers cannot transport a load of more than 12 feet in width and 14 feet, six inches, in height.

The provisions remain in effect until the drought declaration is terminated.

General Federal Disaster Assistance

USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of the historic drought. More information on these programs may be found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

The USDA Food and Nutrition Service provide food assistance to those in need in areas affected by a disaster. This Federal assistance is in addition to that provided by State and local governments. USDA provides disaster food assistance in three ways: provides foods to State agencies for distribution to shelters and other mass feeding sites; provides food to State agencies for distribution directly to households in need in certain limited situations; and authorizes State agencies to issue Disaster Supplemental Nutrition Assistance Program (D-SNAP) benefits.

Drought related program information is found at:
http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE&navtype=RT&parentnav=RURAL_DEVELOPMENT.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock

The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. The grazing losses must have occurred on or after Oct. 1, 2011. More detailed information on eligibility and sign up is available on the FSA fact sheet found at:
http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at: http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators. LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers

Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Conservation Reserve Program (CRP) – CRP acres may be used for haying or grazing under emergency conditions. CRP is a voluntary program that provides producers with annual rental payments on their land in exchange for planting resource-conserving crops on cropland to help prevent erosion, provide wildlife habitat and improve the environment. CRP acres can already be used for emergency haying and grazing during natural disasters to provide much needed feed to livestock. Given the widespread nature of this drought, forage for livestock is already substantially reduced. Haying and grazing will only be allowed following the local birds' primary nesting seasons. Especially sensitive lands, such as wetlands, stream buffers and rare habitats will not normally eligible.

Environmental Quality Incentives Program (EQIP) – This program provides assistance to farmers and ranchers by allowing them to modify current EQIP contracts to allow for prescribed grazing, livestock watering facilities, water conservation and other conservation activities to address drought conditions. EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to address natural resource concerns on their agricultural and forest land. The USDA Natural Resources Conservation Service (NRCS) will work closely with producers to modify existing EQIP contracts to ensure successful implementation of planned conservation practices. Where conservation activities have failed because of drought, NRCS will look for opportunities to work with farmers and ranchers to re-apply those activities. In the short term, funding will be targeted towards hardest hit drought areas.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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 Kansas Water Office web site, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center (NOAA CPC), assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see:

http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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 Kansas Water Office, provide guidance regarding drought preparedness and response.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

January 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	0.01	-0.37	3%	32.0	2.6	65 (30)	6 (10, 1)
Dodge City	0.28	-0.30	48%	33.5	1.3	65 (29,28)	8 (10)
Garden City	0.03	-0.31	9%	33.0	2.1	66 (29)	7 (10)
Goodland	0.04	-0.34	11%	31.9	2.3	65 (23)	5 (18)
Guymon, OK	0.14	-0.26	35%	36.4	0.8	75 (29)	14 (11,1)
Hill City	0.28	-0.17	62%	32.8	3.5	65 (29, 28)	2 (10)
Lamar, CO	0.01	-0.29	3%	32.9	4.0	73 (30)	3 (1)
McCook, NE	0.02	-0.49	4%	31.9	4.7	65 (28)	2 (10)
Springfield, CO	0.16	-0.21	43%	33.5	1.3	71 (30	5 (1)
Central							
Concordia	1.05	0.47	181%	29.6	1.0	58 (29)	-3 (10)
Hebron, NE				27.6	2.0	56 (14)	-8 (10)
Medicine Lodge	0.51	-0.20	72%	34.1	0.7	67 (29,28)	9 (10)
Ponca City, OK	0.16	-0.84	16%	38.0	3.1	70 (30)	18 (5)
Salina	0.72	0.09	114%	33.5	2.5	66 (29)	2 (10)
Wichita (ICT)	0.19	-0.64	23%	34.0	1.8	71 (29)	7 (10)
East							
Bartlesville, OK	0.57	-1.05	35%	34.9	-0.1	75 (29)	8 (10)
Chanute	0.78	-0.48	62%	33.3	0.7	71 (29)	6 (10)
Fall City, NE	0.47	-0.18	72%	27.7	1.2	61 (29)	-13 (18)
Johnson Co. Exec. Apt	0.78	-0.34	70%	30.1	0.0	66 (29)	0 (18)
Joplin, MO	0.30	-1.73	15%	35.4	0.5	73 (29)	6 (18)
Kansas City (MCI), MO	0.76	-0.31	71%	29.6	0.8	64 (29)	-3 (18,17)
St. Joseph, MO	0.59	0.03	105%	27.3	0.1	63 (29)	-10 (18)
Topeka (TOP	0.90	0.04	105%	30.9	1.2	68 (29)	3 (10)

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

KANSAS CLIMATE and DROUGHT UPDATE – February 2016 Summary

Climate, Drought Conditions and Responses for Kansas

General

- In effect, June 29, 2015, Executive Order (EO) 15-04 issued by the Governor for a drought watch for 33 counties.
- The US Drought Monitor indicated dry conditions in Edwards and Pawnee counties throughout February.
- The US Drought Monitor ended the month with the addition of dry conditions in Hamilton, Kearny, Stanton, Morton and parts of Gray counties in southwest Kansas and portions of Harper and Sumner counties in south central Kansas.

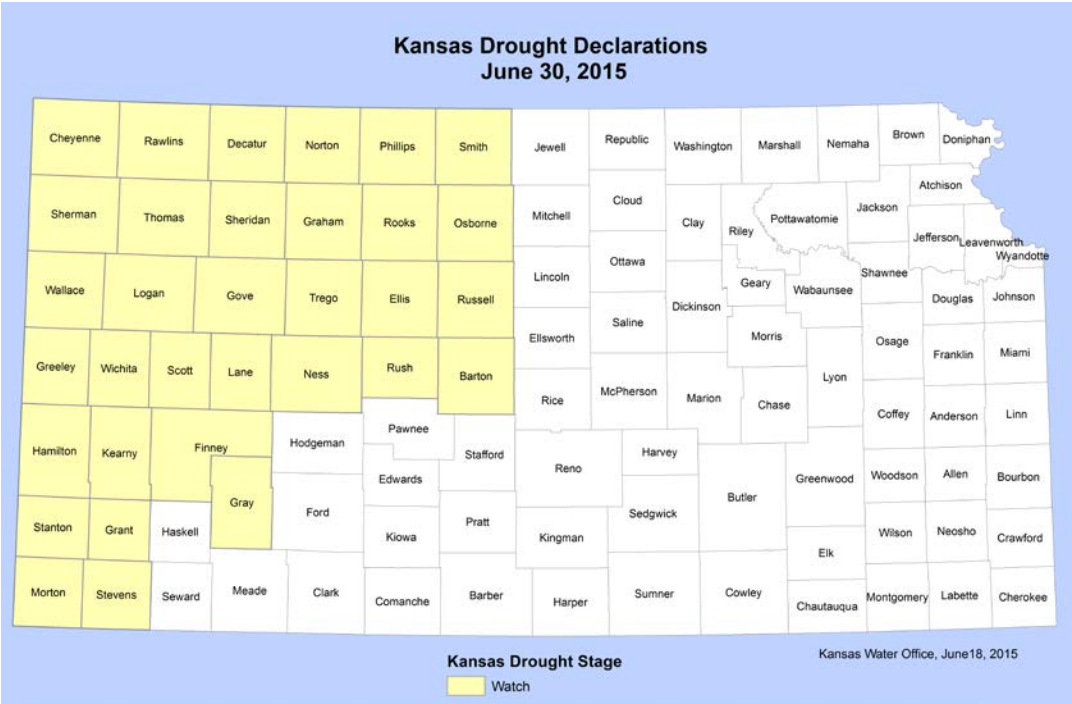
Lakes and Streams

- Minimum Desirable Streamflow (MDS) Administration was in effect on the Saline, Smoky Hill.
- Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool. Wilson Lake is also low at 66 percent.
- Blue-Green Algae Bloom Warning is in effect for the Hiawatha City Lake, Brown County; and Plainville Township Lake, Rooks County (November 17, 2015).

Fire

- Fire danger warnings issued by NOAA for entire state or parts throughout February due to winds, dry conditions and availability of fuel.

Kansas County Drought Declarations: Executive Order 15-04 was issued by Governor Brownback June 30, 2015, modifying drought declarations for Kansas counties. Drought watch is in effect for 33 counties as the overall conditions for plant growth and deficits in precipitation require careful consideration in planning for future water use.

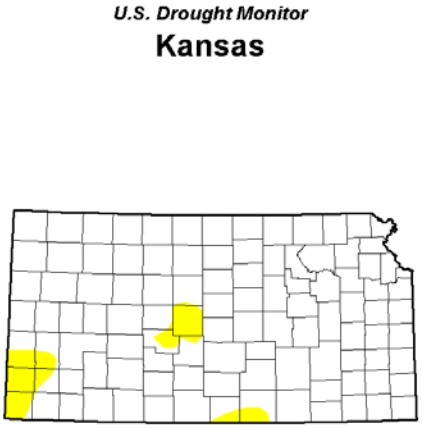


Drought Watch: Barton, Cheyenne, Decatur, Ellis, Finney, Gove, Graham, Grant, Gray, Greeley, Hamilton, Kearny, Lane, Logan, Morton, Ness, Norton, Osborne, Phillips, Rawlins, Rooks, Rush, Russell, Scott, Sheridan, Sherman, Smith, Stanton, Stevens, Thomas, Trego, Wallace, Wichita

General Conditions

February had warmer and drier conditions, resulting in an expansion of D0, or drier than normal conditions. This was mostly seen in the southwest, where active vegetation coupled with warm temperatures, high winds and low humidity are beginning to have impacts. Abnormally dry areas remain in central, Kansas. While drier than normal conditions were

seen across much of eastern parts of the state, this is a normally low precipitation month so changes are slow to develop. Some long-term hydrological deficits are in place affecting water supplies and reservoirs.



March 1, 2016
(Released Thursday, Mar. 3, 2016)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

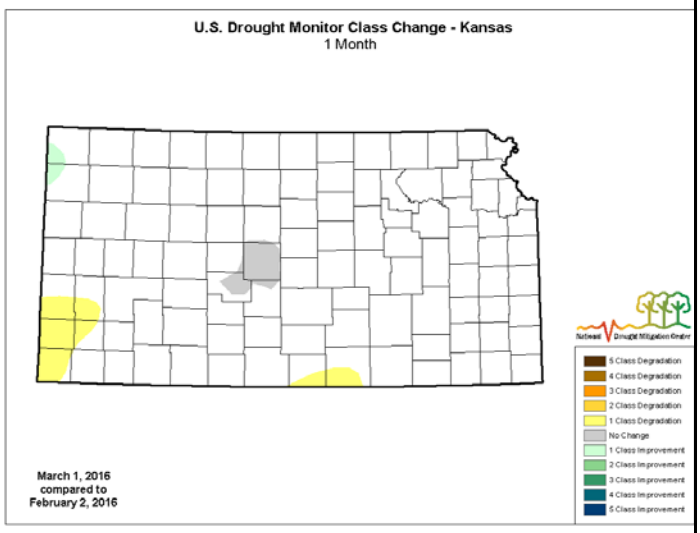
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	94.55	5.45	0.00	0.00	0.00	0.00
Last Week 2/23/2016	98.32	1.68	0.00	0.00	0.00	0.00
3 Months Ago 12/1/2015	46.33	53.67	4.51	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 3/3/2015	11.06	88.94	41.70	18.67	1.88	0.00

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

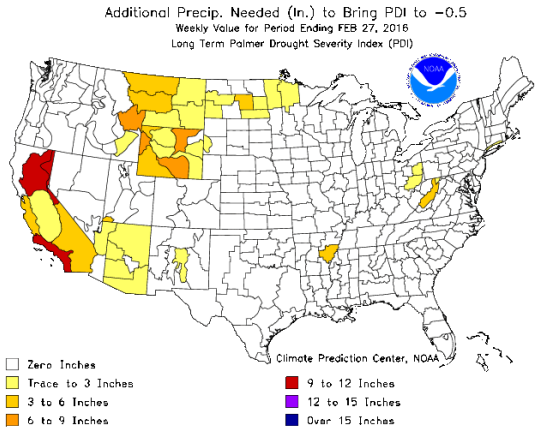
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
David Miskus
NOAA/NWS/NCEP/CPC

http://droughtmonitor.unl.edu/



http://droughtmonitor.unl.edu



More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.

Palmer Drought Severity Index - The Palmer Index (PDSI) is an indicator used in the U.S. Drought Monitor. The precipitation needed in Kansas to bring the Palmer Drought Index to near normal (-0.5) is shown in the map below.
(http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/addpcp.gif)

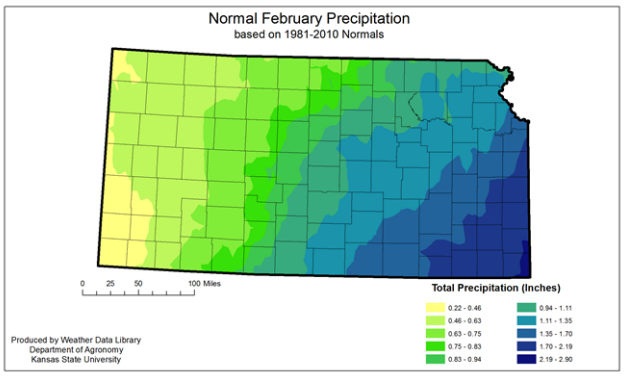
Kansas was considered out of drought for the entire month of February by the PDSI standards.

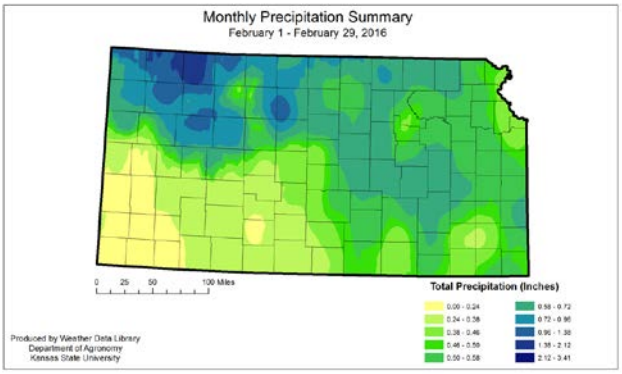
Climate Summary (Temperature and Precipitation)

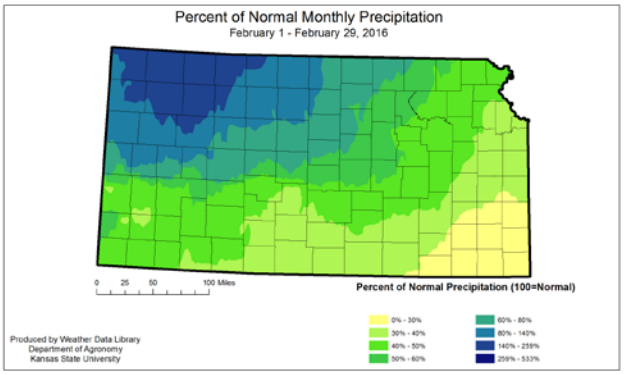
While the overall conditions for February were both warmer and drier than normal, there was as significant change in patterns over the month. It entered on a cold, wet note with locations in western Kansas seeing over a foot of snow. As the system moved east, the snow switched to rain. There were 67 daily precipitation records set on the 1st and 2nd of February. Colby 1SW and Sharon Springs set new records for daily totals in February. Colby reported 2.02 inches of liquid equivalent, while Sharon Springs reported 1.05 inches. Both records were set on the 2nd. Unfortunately, that was the only major event of the month. After the 3rd, there were only two dates where the state average precipitation was measurable at 0.01 inches -- the 16th and the 23rd. State-wide average for February was 0.54 inches. This ranks as the 34th driest February since 1895. As might be expected with the wet start, the Northwest and West Central divisions were exceptions to this dry pattern. The Northwest divisional average was 1.02 inches, or 182 percent of the normal. The West Central divisional average was 0.75 of an inch, or 116 percent of normal. In contrast, the Southeast and East Central division averaged just 0.47 of an inch of precipitation, which was 22 and 37 percent of normal, respectively. Still, there were 67 new daily record precipitation amounts. Flooding was not as much of an issue as was the case in the December storms. Despite the warmer than normal temperatures, snow was a feature during the month. The greatest 24 hour total was 14 inches at Sharon Springs, Wallace County, on the 2nd. Oberlin 1E was the station with the greatest monthly total for the state at 17 inches

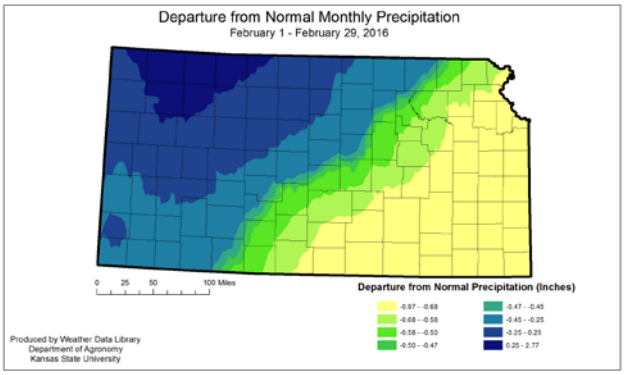
Precipitation summary for the month is provided in the table and maps below from the Kansas State University Weather Library.

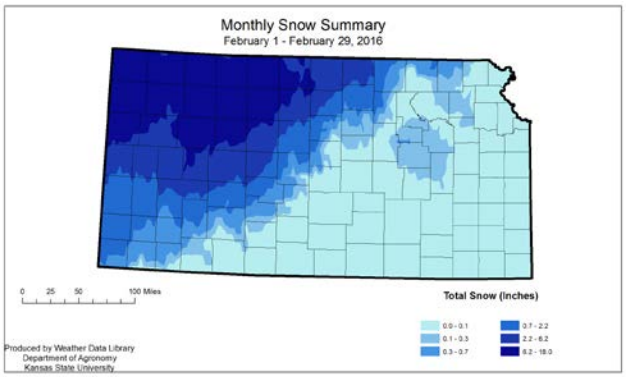
Kansas Climate Division Precipitation Summary (inches) - Summary January 2016												
	February 1-29, 2016			January 1– February 29, 2016			April 1-February 29, 2016			September 1–February 29, 2016		
Climate Division	**Actual**	**Depart Normal**	**Percent Normal**	**Actual**	**Depart Normal**	**Percent Normal**	**Actual**	**Depart Normal**	**Percent Normal**	**Actual**	**Depart Normal**	**Percent Normal**
Northwest	1.02	0.46	182	1.08	0.07	107	21.36	1.29	106	6.48	0.99	117
West Central	0.75	0.13	116	0.88	-0.25	73	21.67	2.28	111	6.21	0.61	108
Southwest	0.24	-0.33	41	0.31	-0.73	29	26.71	8.15	143	7.54	2.04	134
North Central	0.59	-0.27	69	1.36	-0.13	91	27.49	1.46	104	8.32	0.11	101
Central	0.60	-0.45	57	1.37	-0.38	78	28.38	1.29	103	9.21	0.65	106
South Central	0.39	-0.83	31	0.70	-1.35	34	33.98	5.23	117	10.20	0.30	103
Northeast	0.53	-0.64	49	1.27	-0.71	66	38.58	5.81	117	11.78	0.47	105
East Central	0.47	-0.93	33	1.16	-1.18	49	36.59	1.25	102	11.97	-0.68	92
Southeast	0.47	-1.33	26	1.06	-1.99	34	40.66	2.11	104	13.28	-1.86	86
STATE	0.54	-0.50	63	0.98	-0.79	59	30.69	3.38	112	9.46	0.30	106



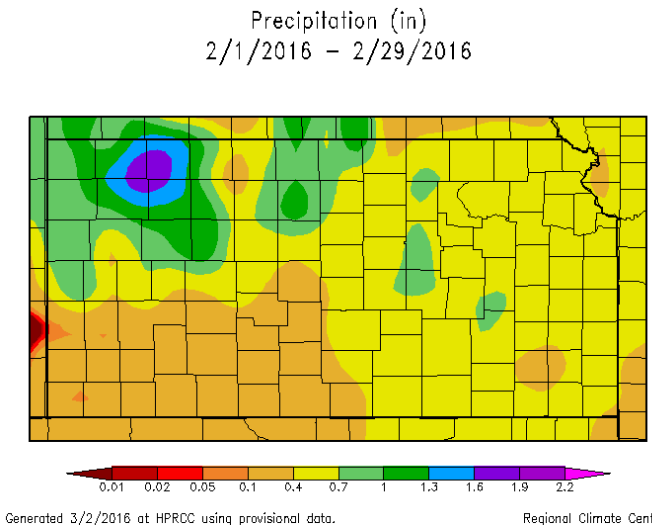


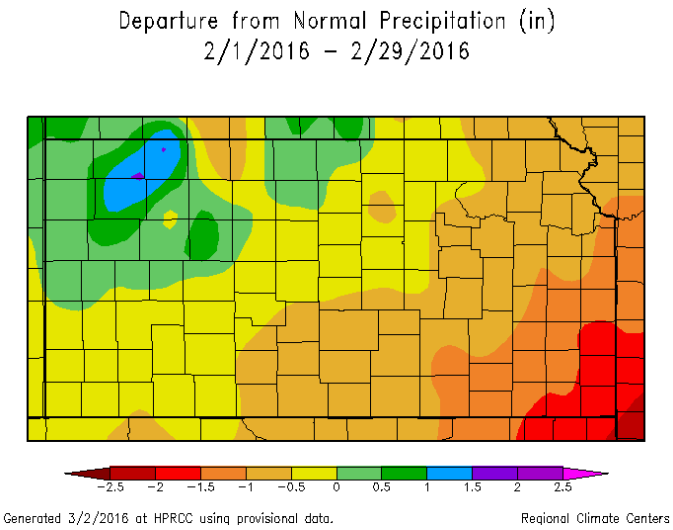






Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

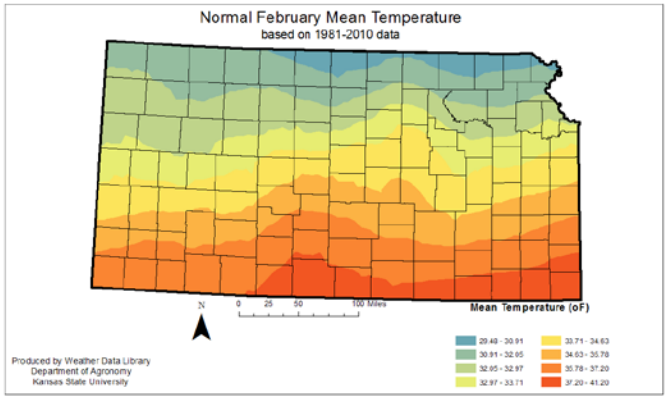


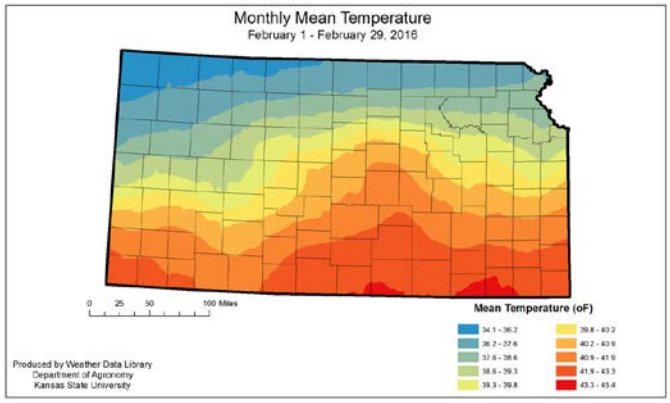


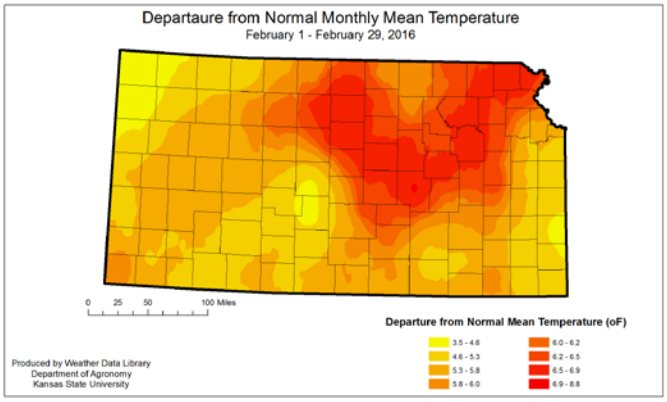
Temperatures were warmer than average across the state, with departures running from 3 to 8 degrees warmer than normal. State-wide average temperature was 39.8 oF or 5.7 ^{o}F warmer than normal. It ranks as the 12th warmest February on record. The warmest February occurred in 1960, with an average of 45.1 ^{o}F. There were 120 new daily high temperature records set in February. Seventeen of those records also set records as the warmest daily temperatures reported in February for those stations. The highest recorded temperature was 91 ^{o}F. That was reported at 3 locations--Ashland (Clark County), Hays 1S (Ellis County), Ness City (Ness County) -- all on the 18th. In addition to the record highs, there were 64 new record warm minimum temperatures. Wilson Lake set a new record warm minimum for February at their location. There were no new records set for either low maximum or low minimum temperatures. The coldest reading for the month was 1 ^{o}F, reported at Brewster 1W on the 4th.

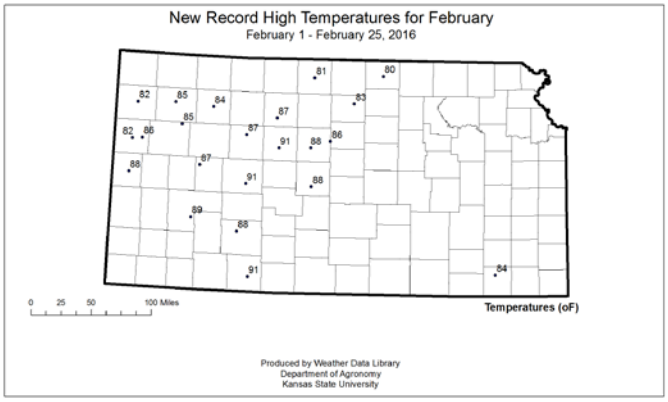
Temperature summary by the Kansas State University Weather Library for the month is provided in the table and maps below. The table below summarizes temperatures by Kansas climate division and various time periods. Slight differences in the average or extreme values presented may occur due to preliminary data.

Climate Division	Kansas Climate Division Temperature Summary (^{o}F)							
	February 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	50.0	23.5	36.8	5.0	87	19	1	4
West Central	53.3	24.1	38.7	5.5	91	19	3	4
Southwest	58.1	25.8	42.0	6.2	91	19	6	4
North Central	50.8	25.4	38.1	5.8	87	19	5	4
Central	54.1	26.7	40.4	6.1	91	19	7	4
South Central	57.0	27.8	42.4	5.7	89	18	14	4
Northeast	51.4	25.3	38.3	6.1	78	19	14	14
East Central	52.1	27.1	39.6	5.7	78	19	13	13
Southeast	55.2	28.4	41.8	5.1	81	21	10	4
STATE	53.6	26.0	39.8	5.7	91	19th	1	4th
Data Source: KSU Weather Library								

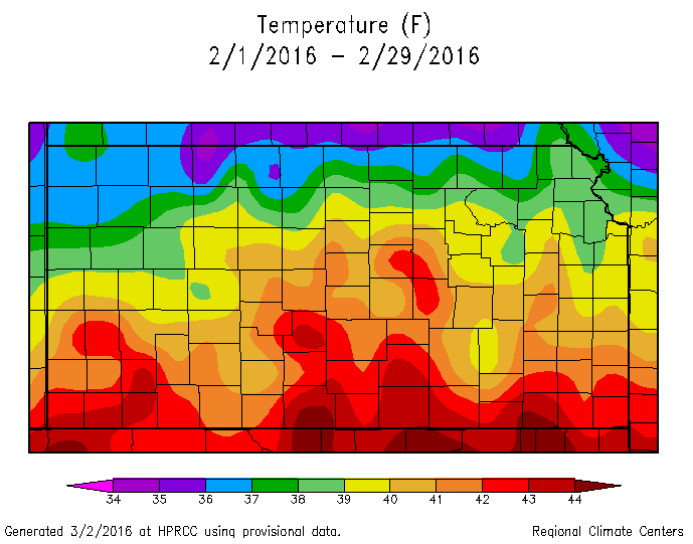


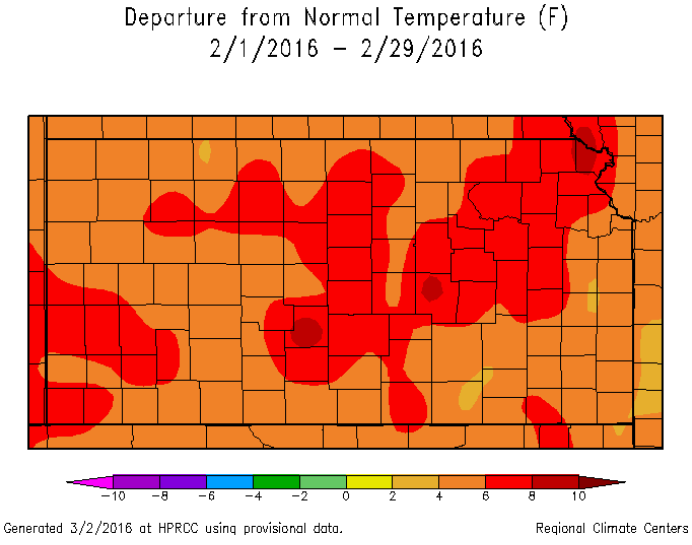






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



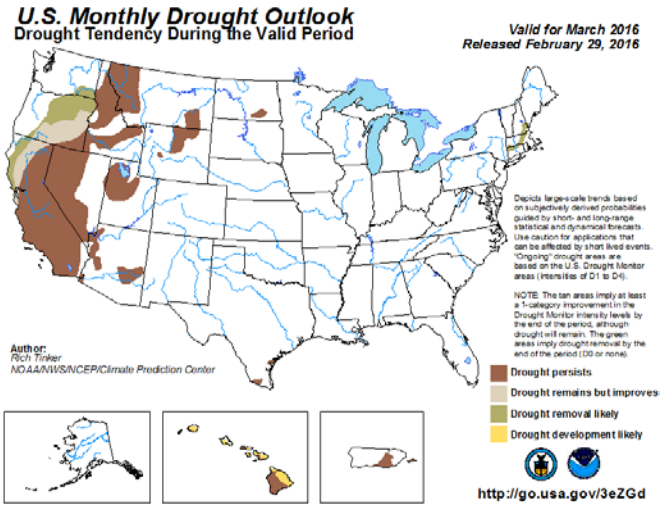


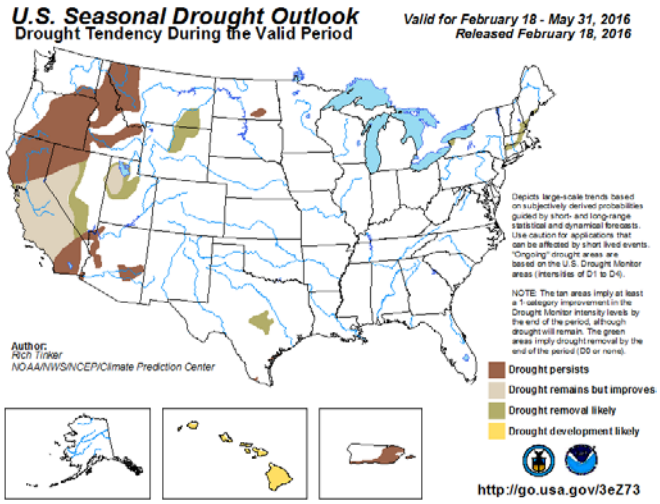
Severe weather was of the winter variety. There were 111 Local Storm Reports at NWS Forecast offices during the month. The majority were for snow. However, there were reports of heavy rain and non-thunderstorm wind gusts. The highest of these gusts was 61 mph reported at Russell, KS on the 19th. There were no reports of hail or tornadoes.

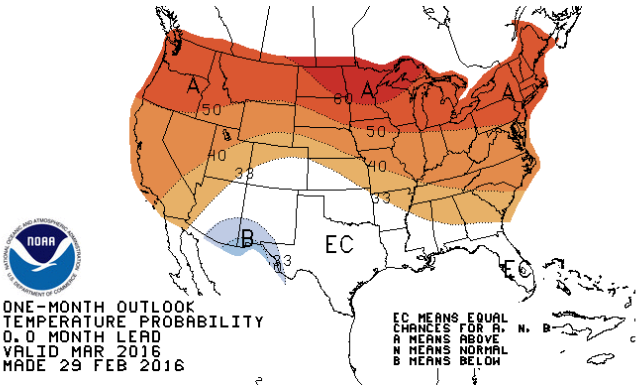
Future Outlook

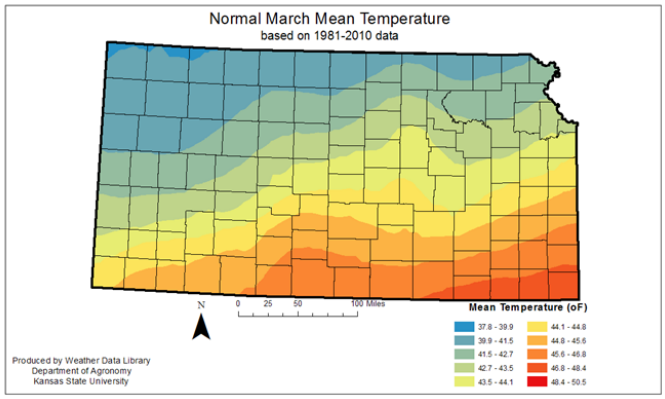
The precipitation outlook for March is for increased chances of wetter than normal. However, the short term outlooks are for drier than average conditions for the first half of the month.

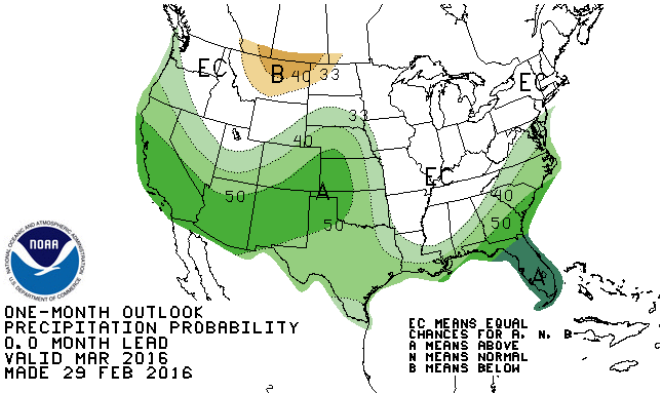
The Drought Outlooks for the month of March and the Season Outlook for Mid-February through the end of May 2016 are provided below.

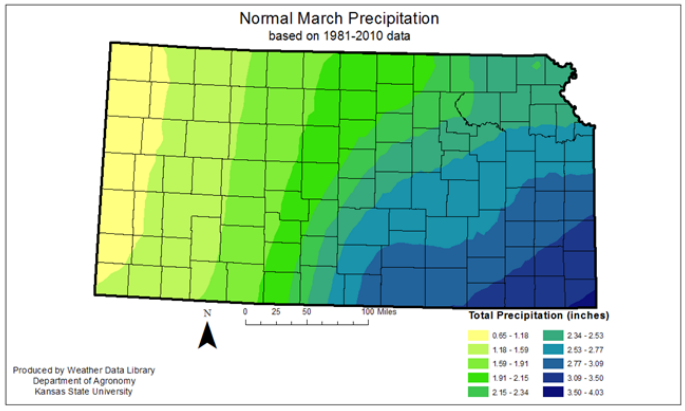




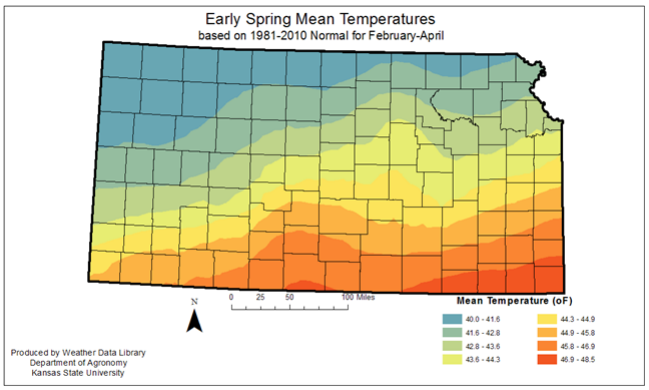


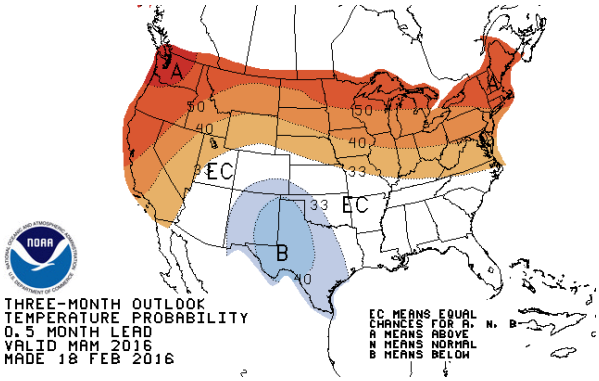


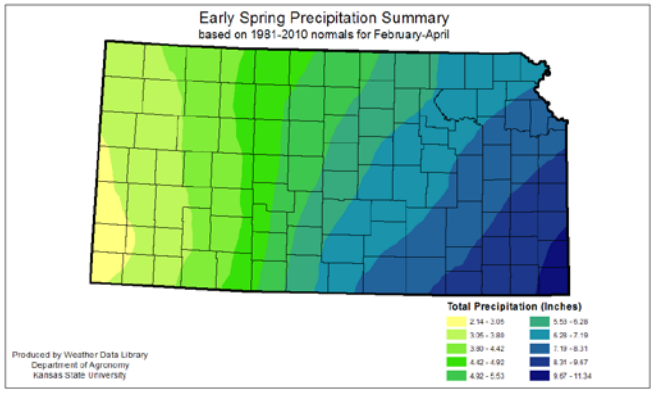


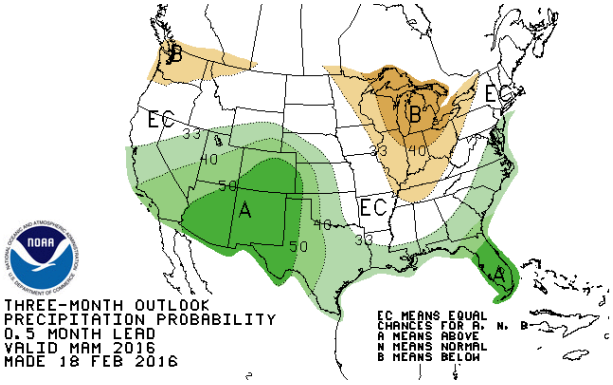


The early winter (three-month) outlook favors normal temperatures and above normal precipitation for February through April 2016.









Additional outlooks for additional 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. Evaluation of experience from this past year and update those plans to make sure they are prepared to address water supply needs should the drought not continue to ease.

Known issues:

Stage II water restrictions are in place for the City of **Russell,** Russell County water customers. The water restrictions include a prohibition on most outdoor watering, vehicle washing, filling of residential swimming pools, and washing exterior of buildings. It also requires industrial users to reduce use.

Stage III water restrictions have been in place for the City of **Victoria**, Ellis County since January 2014. No outdoor watering is allowed.

The City of **Natoma** in Osborne County reported to KDHE declining well water levels causing inability to pump two of three wells. A water watch (conservation plan) has been enacted.

Surface Water Supply Conditions

Kansas River basin: Inflows to Tuttle Creek, Perry, Milford, and Clinton reservoirs were all moderate during the month of February. Reservoir elevations are below the top of multipurpose pools due to the lower winter target elevations. Flows in the Kansas River maintained above median values for the majority of the month.

Marais des Cygnes basin: Streamflow was relatively healthy throughout the month. Melvern, Pomona, and Hillsdale reservoirs by-passed some inflow above the minimum release schedules to maintain the winter target elevations early in the month. Otherwise, minimum releases have been sufficient for downstream needs.

Cottonwood / Neosho basin: River flow throughout the basin remained at moderate levels for the month of February. All reservoirs ended the month slightly above normal pool elevations.

Verdigris basin: There were no significant runoff events in the Verdigris but streamflow was maintained at well above low flow targets. Reservoirs bypassed inflows as necessary and remained full.

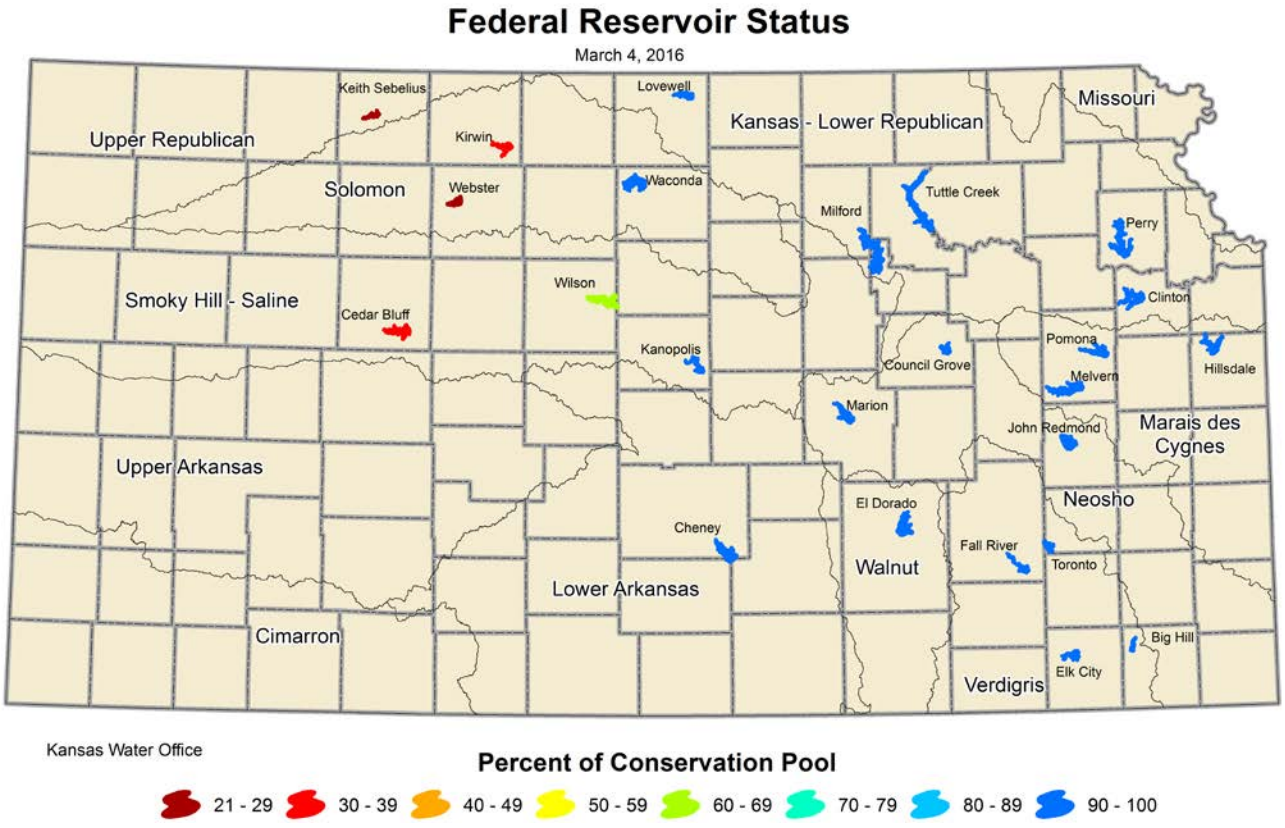
Saline basin: Elevation at Wilson Lake was stable near record low in February. Flows in the Saline River remained inconsequential throughout the month.

Smoky Hill basin: Smoky Hill basin streamflow remained low throughout February. Kanopolis Reservoir releases were minimal so the storage balance was stable but downstream base flow was healthy and the low flow target at the USGS gage near Mentor was maintained. Cedar Bluff Reservoir maintained a stable pool level.

Harmful Blue-Green Algal Blooms (lake water safety)
KDHE has issued two levels of public health protection notifications for blue-green algae (BGA) Blooms: a Public Health Watch and Public Health Warning. November 17, 2015 the sampling season closed. Two lakes remain on the warning list until the 2016 sampling season (April 1-Oct 31), Hiawatha City Lake, Brown County; and Plainville Township Lake, Rooks County.

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.

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool. Wilson Lake is also low at 66 percent.



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		**03/04/2016**		
Norton[1]	2304.3	2288.26	-16.04	28.7
Harlan County, NE	1945.73	1935.69	-10.04	62.2
Lovewell[1]	1582.6	1582.76	0.16	100.0
Milford[1]	1144.4	1143.24	-1.16	95.3
Cedar Bluff	2144	2119.27	-24.73	32.4
Kanopolis[1]	1463	1463.62	0.62	100.0
Wilson[1]	1516	1505.80	-10.20	66.2
Webster[1]	1892.5	1870.26	-22.19	23.3
Kirwin[1]	1729.3	1713.63	-15.62	37.6
Waconda[1]	1455.6	1454.30	-1.30	92.7
Tuttle Creek[1]	1075	1073.20	-1.80	92.6
Perry[1]	891.5	890.24	-1.26	93.7
Clinton[1]	875.5	875.48	-0.02	99.9
Melvern[1]	1036	1034.56	-1.44	93.5
Pomona[1]	974	972.66	-1.34	90.7
Hillsdale[1]	917	915.44	-1.56	90.7
Arkansas River Basin		**03/04/2016**		
Cheney	1421.6	1421.99	0.39	100.0
El Dorado	1339	1338.49	-0.51	98.0
Toronto[1]	901.5	901.69	0.19	100.0
Fall River[1]	948.5	948.73	0.23	100.0
Elk City[1]	796	795.99	-0.01	100.0
Big Hill	858	857.96	-0.04	100.0
Council Grove[1]	1274	1274.08	0.08	100.0
Marion[1]	1350.5	1350.84	0.34	100.0
John Redmond[1]	1039	1041.48	0.48	100.0

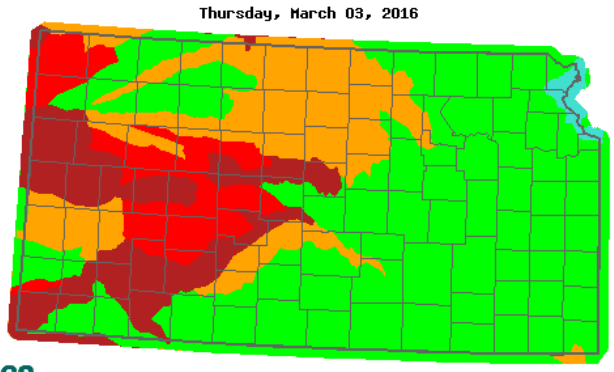
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

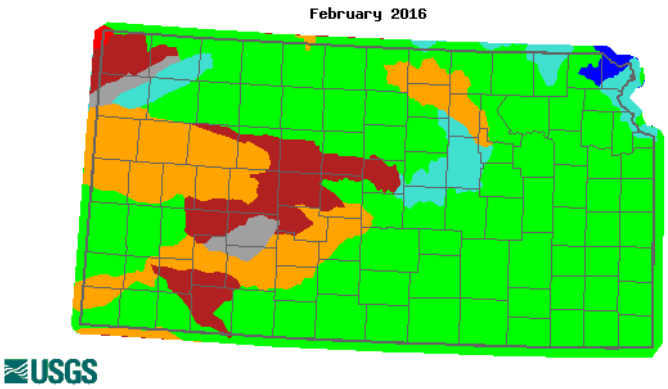
Note: The conservation pool is the water storage for non-flood purposes of the reservoir, set by the elevation of the top of the pool.
* Data from 11/02/2015 6 am, unavailable 11/1/15

Streamflow Conditions

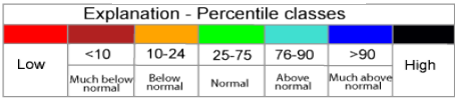
Kansas streamflows during July varied across the state, but remain below historical normal flows in parts of west and central Kansas.

The comparison of present **7-day** streamflow to historical is shown on the map below left and the **February** streamflow compared to historical is shown on the map below, right. Short term streamflow is significantly lower than historical average in many area of western Kansas.

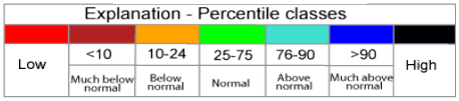




7-day streamflow



Monthly streamflow

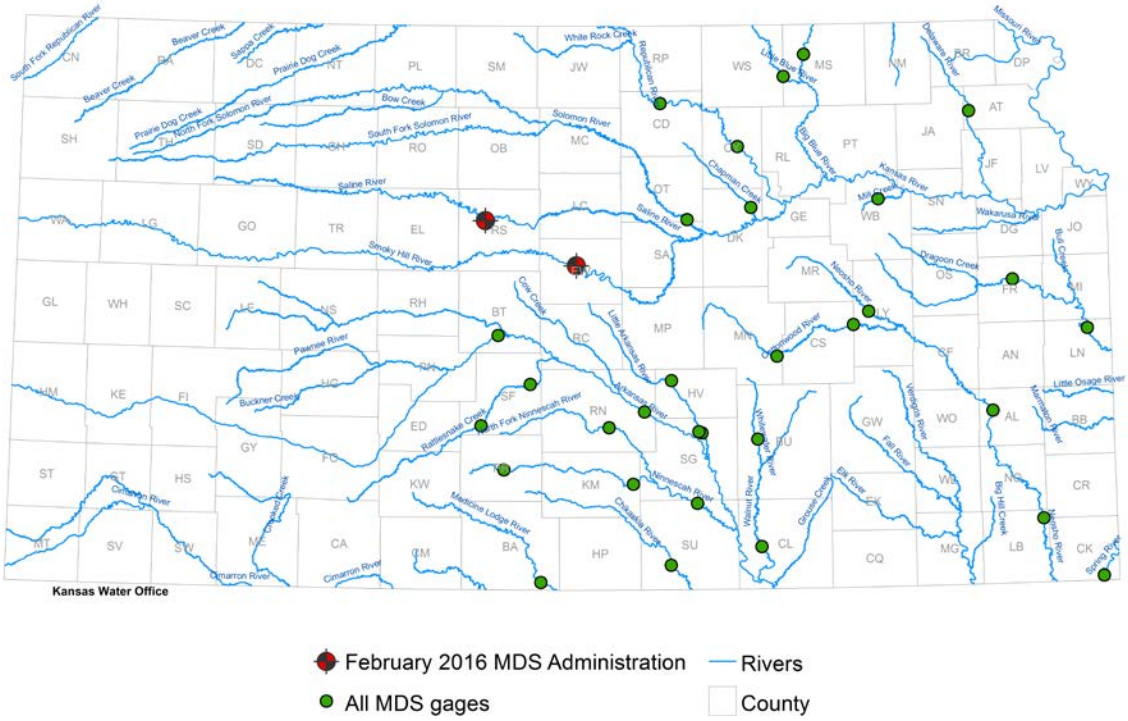


In general, a streamflow which is greater than the 75 percentile is considered *above normal*, a streamflow which is between 25 and 75 percentiles is considered *normal* and a streamflow which is less than the 25 percentile is considered *below normal*. Color codes are for basins with streamflow averages less than 25 percent of historic values.

Water Right Administration/Minimum Desirable Streamflow (MDS)

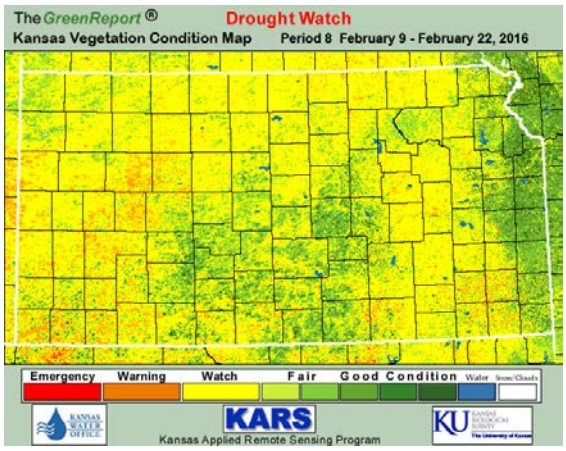
Minimum Desirable Streamflow (MDS) is being administered in Kansas. MDS administration requires water rights junior to MDS, usually with priority dates after April 12, 1984, to stop diverting water. Administration is ordered when streamflow drops below MDS for more than seven days.

Kansas Minimum Desirable Streamflow (MDS) Gages Administration
February 29, 2016



Streamflows in cubic feet per second (cfs)								
Gaging Station	**Flow Feb 4**	**Flow Feb 11**	**Flow Feb 18**	**Flow Feb 25**	**Feb MDS**	**March MDS**	**Administration Date**	**Number of Rights Admin.**
Republican River at Concordia	192	184	189	186	**125**	150	11/18/15; ceased 01/07/16	(70)
Republican River at Clay Center	495	296	283	271	**150**	200	03/20/15; ceased 05/29/15	
Smoky Hill River at Ellsworth	18	18	17	15	**20**	25	03/23/15	3
Saline River near Russell	3	2	2	ua	**5**	15	9/5/15	10
							TOTAL Admin. 01/31/16	13

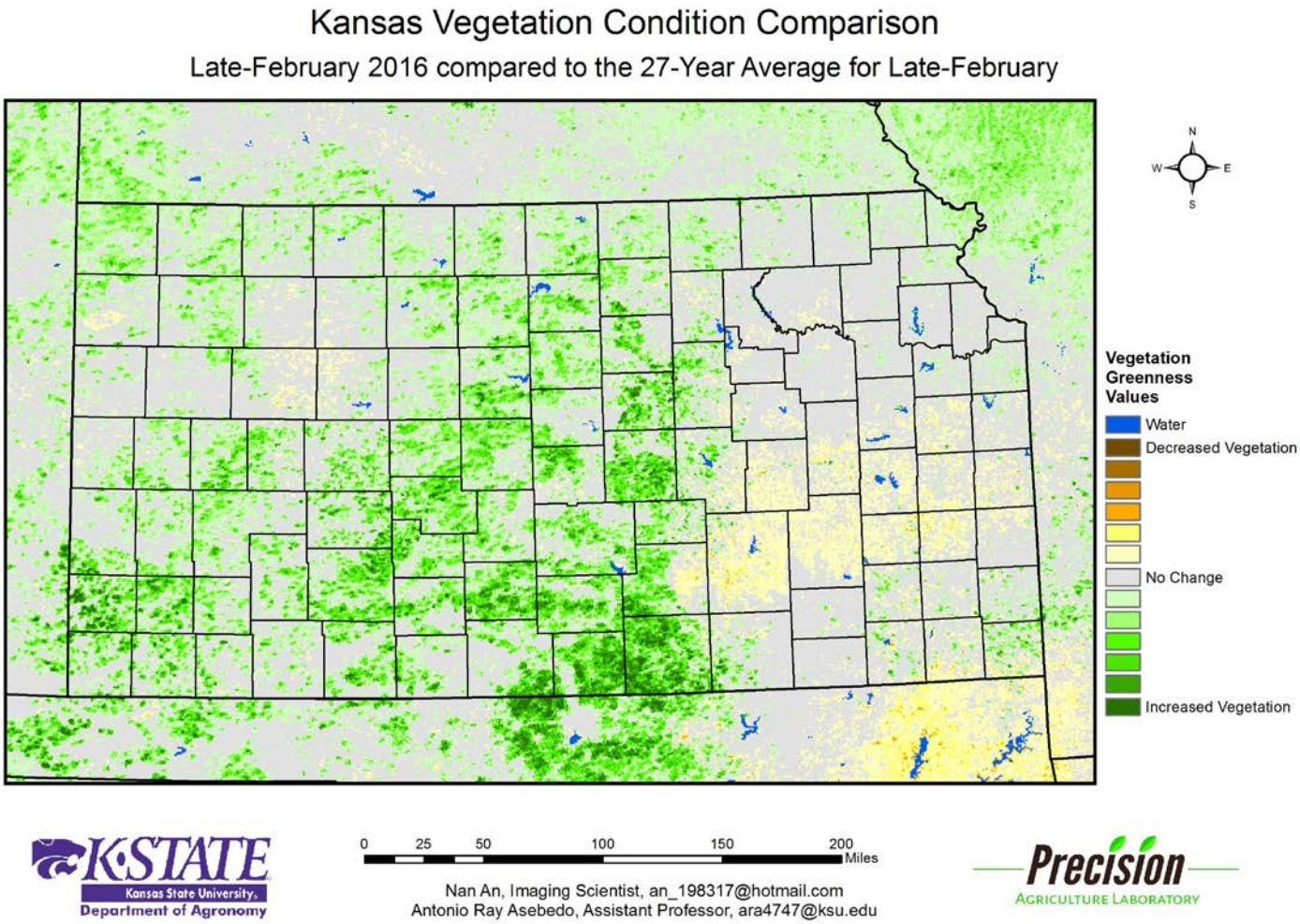
Soil, Crop and Vegetation
Kansas Vegetative Conditions



The Kansas Vegetative Condition map is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Green colors in the central and western areas of the state this time of year indicate where winter wheat is dormant and in good shape. Western areas and the Flint Hills are dry.

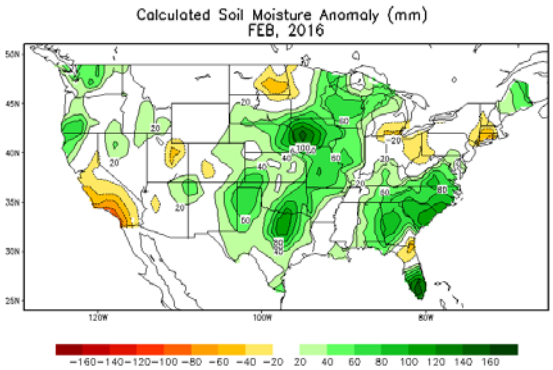
Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for February 23 – February 29 from

K-State's Precision Agriculture Laboratory shows that the area of above average photosynthetic activity continues to increase. The largest areas are in central and south Central, Kansas. Temperatures continue above normal across the state, with the warmest departures in the southwest. Increased activity at this time of the year brings concerns about increased water demand and the potential for freeze damage, with even a normal last freeze date



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.
http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml



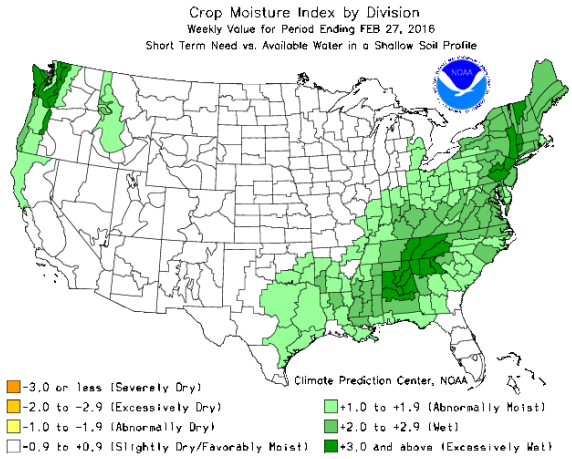
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the month of February 2016 reported topsoil moisture rated percent very short, 31 short, 63 adequate, and 1 surplus. Subsoil moisture supplies rated 6 percent very short, 24 short, 68 adequate, and 2 surplus.

Field Crops Report: Winter wheat condition rated 1 percent very poor, 5 poor, 35 fair, 51 good and 8 excellent.

Livestock Report: Cattle and calf conditions rated 0 percent very poor, 1 poor, 24 fair, 69 good and 6 excellent. Hay and roughage supplies rated 0 percent very short, 3 short, 86 adequate, 11 surplus. Stock water supplies rated 2 percent very short, 12 short, 84 adequate, and 2 surplus.
(http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)

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/JAWF Weekly Weather and Crop Bulletin.



Whenever the Governor or the U.S. Department of Agriculture declares all or any portion of the State is in a state of drought, certain conditions apply to motor carriers transporting hay or related animal forage feedstuffs to the geographic area specified in the drought declaration. Those certain conditions are as follows:

- Motor carrier registration and fuel tax permits are temporarily suspended;
- Licensing, certification, and permitting rules and regulations of the State Corporation Commission are temporarily suspended;
- These motor carriers may not operate during the period beginning 30 minutes after sunset and ending 30 minutes before sunrise and are required to comply with flags, signs, and lighting requirements applicable to over width vehicles;
- Motor carriers cannot operate during inclement weather;
- Oversize and overweight loads cannot be transported when visibility is less than one-half mile or when conditions of moderate to heavy rain, sleet, snow, fog, or smoke exist, or when highway surfaces are slippery due to ice or packed snow; and
- Motor carriers cannot transport a load of more than 12 feet in width and 14 feet, six inches, in height.

The provisions remain in effect until the drought declaration is terminated.

General Federal Disaster Assistance
USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of the historic drought. More information on these programs may be found at:
http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at:
http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of

losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

The USDA Food and Nutrition Service provide food assistance to those in need in areas affected by a disaster. This Federal assistance is in addition to that provided by State and local governments. USDA provides disaster food assistance in three ways: provides foods to State agencies for distribution to shelters and other mass feeding sites; provides food to State agencies for distribution directly to households in need in certain limited situations; and authorizes State agencies to issue Disaster Supplemental Nutrition Assistance Program (D-SNAP) benefits.

Drought related program information is found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE&navtype=RT&parentnav=RURAL_DEVELOPMENT.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock

The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. More detailed information on eligibility and sign up is available on the FSA fact sheet found at: http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at: http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators. LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers

Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Conservation Reserve Program (CRP): CRP acres may be used for haying or grazing under emergency conditions. CRP is a voluntary program that provides producers with annual rental payments on their land in exchange for planting resource-conserving crops on cropland to help prevent erosion, provide wildlife habitat and improve the environment. CRP acres can already be used for emergency haying and grazing during natural disasters to provide much needed feed to livestock. Given the widespread nature of this drought, forage for livestock is already substantially reduced. Haying and grazing will only be allowed following the local birds' primary nesting seasons. Especially sensitive lands, such as wetlands, stream buffers and rare habitats will not normally eligible.

Environmental Quality Incentives Program (EQIP): EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to address natural resource concerns on their agricultural and forest land. This program provides assistance to affected farmers and ranchers by allowing them to modify current EQIP contracts to allow for prescribed grazing, livestock watering facilities, water conservation and other conservation activities to address drought conditions. Where conservation activities have failed because of drought, NRCS will look for opportunities to work with farmers and ranchers to re-apply those activities. In the short term, funding will be targeted towards hardest hit drought areas.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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 Kansas Water Office web site, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center (NOAA CPC), assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing

drought as identified by the U.S. Drought Monitor. Also see:
http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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 Kansas Water Office, provide guidance regarding drought preparedness and response.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

February 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	0.80	0.38	190%	36.6	5.0	80 (18)	2 (4,3)
Dodge City	0.31	-0.37	46%	41.3	5.4	88 (18)	15 (4)
Garden City	0.19	-0.35	35%	41.1	6.3	89 (18)	6 (4)
Goodland	0.82	0.33	167%	37.6	5.3	82 (18)	6 (4)
Guymon, OK	0.29	-1.80	14%	45.3	6.7	88 (18)	17 (4,3)
Hill City	0.61	0.09	117%	39.3	6.4	85 (18)	10 (4)
Lamar, CO	0.11	-0.26	30%	39.8	6.2	87 (18)	-1 (4)
McCook, NE	0.99	0.37	160%	37.4	6.5	76 (27,18)	5 (4)
Springfield, CO	0.16	-0.28	36%	39.8	4.4	83 (18)	6 (4)
Central							
Concordia	0.51	-0.28	65%	39.3	6.6	78 (18)	15 (14)
Hebron, NE				36.0	6.4	77 (27)	8 (4)
Medicine Lodge	0.38	-0.66	37%	43.9	5.7	81 (18)	15 (4)
Ponca City, OK	0.80	-0.54	60%	45.2	5.5	79 (18)	16 (26)
Salina	0.52	-0.65	44%	42.4	6.9	79 (18)	17 (26)
Wichita (ICT)	0.55	-0.63	47%	44.1	6.9	77 (18)	18 (4)
East							
Bartlesville, OK	0.51	-1.46	26%	44.4	4.6	82 (20)	15 (4)
Chanute	0.30	-1.60	16%	42.8	5.4	77 (20,18)	15 (4)
Fall City, NE	0.59	-0.35	63%	37.9	7.0	77 (18)	15 (13)
Johnson Co. Exec. Apt	0.47	-1.10	30%	39.5	4.7	73 (18)	16 (13)
Joplin, MO	0.37	-1.95	16%	43.6	3.8	78 (20)	17 (10,4)
Kansas City (MCI), MO	0.40	-1.06	27%	39.1	5.6	75 (20)	15 (13,4)
St. Joseph, MO	0.32	-0.61	34%	37.3	5.3	76 (20)	14 (13,9)
Topeka (TOP	0.37	-0.95	28%	40.7	6.3	78 (18)	17 (14)

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

KANSAS CLIMATE and DROUGHT UPDATE – March 2016 Summary

Climate, Drought Conditions and Responses for Kansas

General

- In effect, June 29, 2015, Executive Order (EO) 15-04 issued by the Governor for a drought watch for 33 counties.
- The US Drought Monitor indicated dry conditions increased in extent and degree throughout March in much of Kansas.
- The US Drought Monitor ended the month with the addition of abnormally dry conditions in 74% of Kansas with moderate drought affecting 22.2%. The moderate drought conditions are in south west and south central areas.

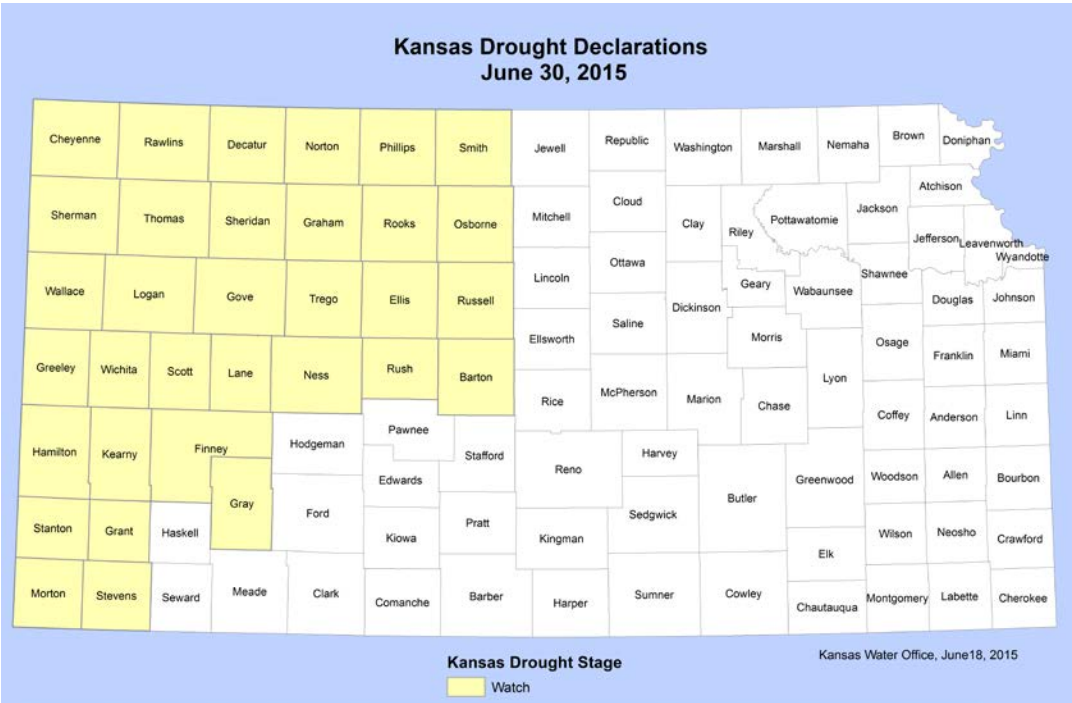
Lakes and Streams

- Minimum Desirable Streamflow (MDS) Administration was in effect on the Saline, Smoky Hill and Little Arkansas rivers. Cessation of pumping ordered to begin March 18 on the Little Arkansas at Alta Mills and Valley Center gages.
- Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool. Wilson Lake is also low at 66 percent.

Fire

- Wildfires burned at least 300,000 acres in south central Kansas March 22-29, causing evacuations, highway closure, and loss of property and livestock. (Over 400,000 acres burned in Oklahoma and Kansas.)
- Fire danger warnings issued by NOAA for entire state or parts throughout March due to winds, dry conditions and availability of fuel.

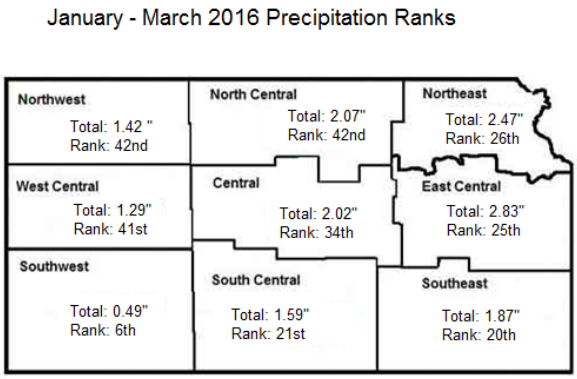
Kansas County Drought Declarations: Executive Order 15-04 was issued by Governor Brownback June 30, 2015, modifying drought declarations for Kansas counties. Drought watch is in effect for 33 counties as the overall conditions for plant growth and deficits in precipitation require careful consideration in planning for future water use.



Drought Watch: Barton, Cheyenne, Decatur, Ellis, Finney, Gove, Graham, Grant, Gray, Greeley, Hamilton, Kearny, Lane, Logan, Morton, Ness, Norton, Osborne, Phillips, Rawlins, Rooks, Rush, Russell, Scott, Sheridan, Sherman, Smith, Stanton, Stevens, Thomas, Trego, Wallace, Wichita

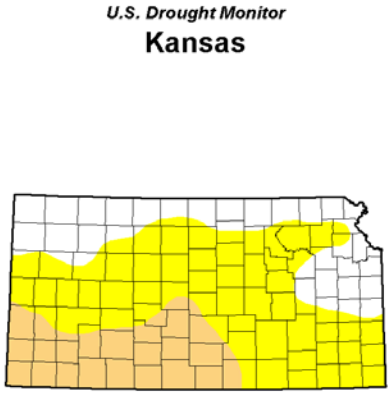
General Conditions

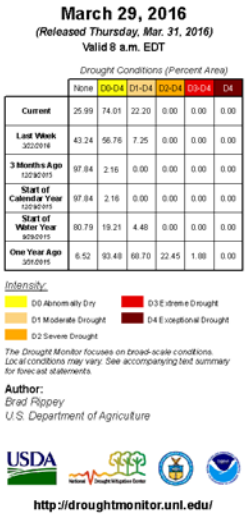
The dry weather that has persisted into April has raised concerns. In western Kansas, this has been the 6th driest start to the year since 1895. Below is a map showing the total rainfall for 2016 by division and the historical rank.



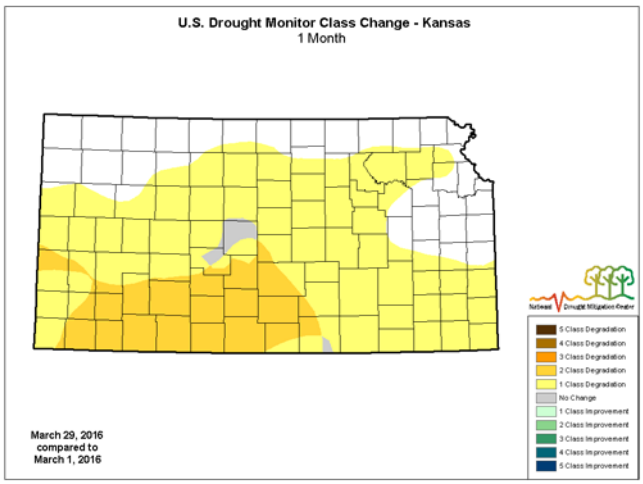
With a very dry start to the year, drought has increased across the state. Impacts of these drought conditions have been felt in several ways with one of the biggest issues being prolonged periods of critical fire weather. Contributing to these fire weather concerns is the wetter than normal conditions that prevailed during last primary production season for grass – May to July. Those wet conditions favored high amounts of fine fuels. The lack of snow cover to pack the grass down has left grasses vertically aligned and able to carry fire very well (Weather Data Laboratory, KSU).

As might be expected with the warmer and drier conditions, there was broad expansion of drier than normal conditions, and moderate drought in the U.S. Drought Monitor issued March 29, 2016. The moderate drought was mostly seen in the southwest and south central Kansas, where active vegetation coupled with warm temperatures, high winds and low humidity are beginning to have impacts. The disappointing moisture totals, despite the snowy end to the month are likely to fuel further expansion in drought conditions. Currently about a quarter of the state is drought-free. The previous week more than 40 percent of the state was drought free. Some long-term hydrological deficits are in place affecting water supplies and reservoirs.

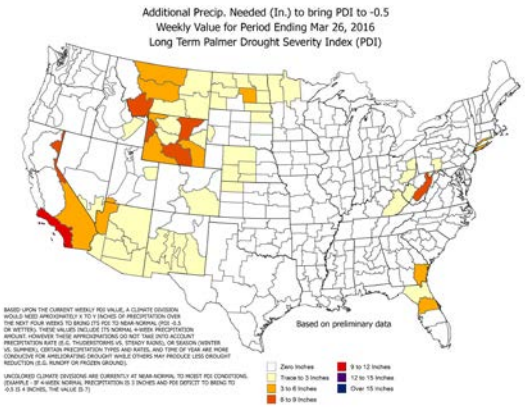




	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	25.99	74.01	22.20	0.00	0.00	0.00
Last Week 3/22/2016	43.24	56.76	7.25	0.00	0.00	0.00
3 Months Ago 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 3/31/2015	6.52	93.48	68.70	22.45	1.88	0.00



More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.

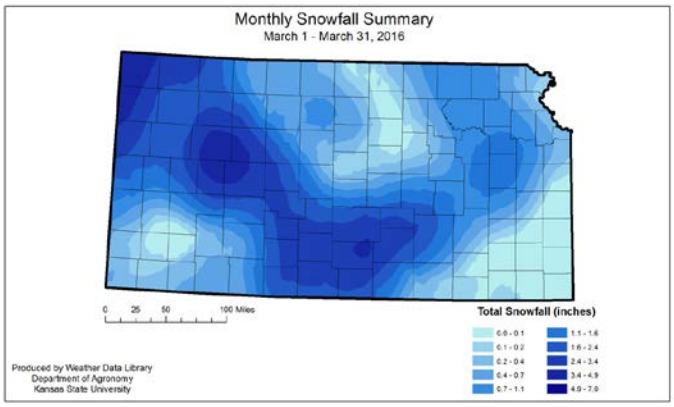


Palmer Drought Severity Index - The Palmer Index (PDSI) is an indicator used in the U.S. Drought Monitor. The precipitation needed in Kansas to bring the Palmer Drought Index to near normal (-0.5) is shown in the map below.
(http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/addpcp.gif)

The majority of Kansas was considered out of drought for the entire month of March by the PDSI standards. However, the Northwest Climate Division entered into the drought category needing 0.44 inches the week ending March 12; 0.79 inches the week ending March 19; 0.80 inches the week ending March 26, 2016 and 1.53 inches the week ending April 2, 2016.

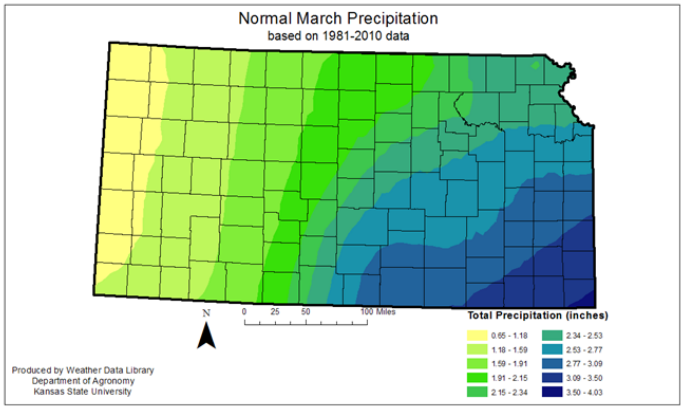
Climate Summary (Temperature and Precipitation)

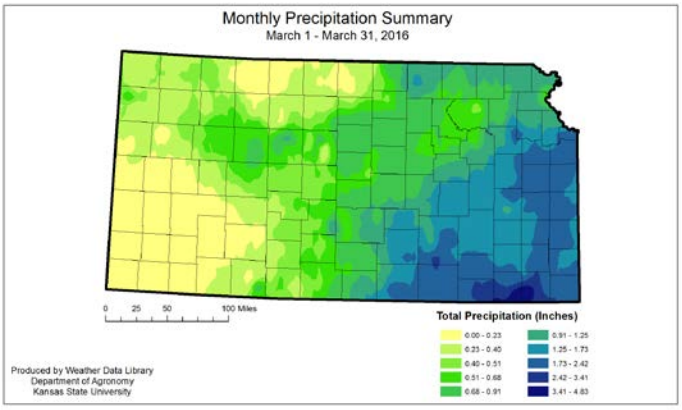
The overall precipitation pattern for March was drier than normal. The Southeast Division came closest to normal with an average of 1.89 inches or 61 percent of normal. In contrast, the Southwest Division averaged just 0.05 inches, or 3 percent of normal. The Garden City airport reported only a trace of precipitation in the entire month. The state wide average precipitation was 0.77 inches, or 31 percent of normal. This ranks as the 14th driest March on record. Despite the overall dry pattern, a few locations saw significant rain and a small portion of south eastern Kansas actually had above normal precipitation for the month. The greatest monthly total was 4.83 inches at Mound Valley 3WSW, Labette County (NWS). The greatest total for CoCoRaHS stations was 2.87 inches at Wichita 4.5 ENE, Sedgwick County. Twelve locations set new daily precipitation records for March. Not surprisingly, Mound Valley was one of those locations with 2.66 inches of the monthly total reported on the 31st. Despite the warmer than normal temperatures, snow was again a feature during the month. The greatest 24 hour total was 6 inches at Kingman, Kingman County, on the 27th. Hutchinson 10SW was the station with the greatest monthly total for the state at 7.9 inches.

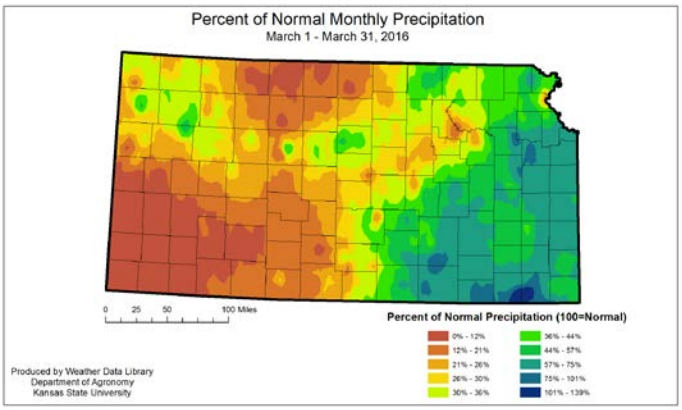


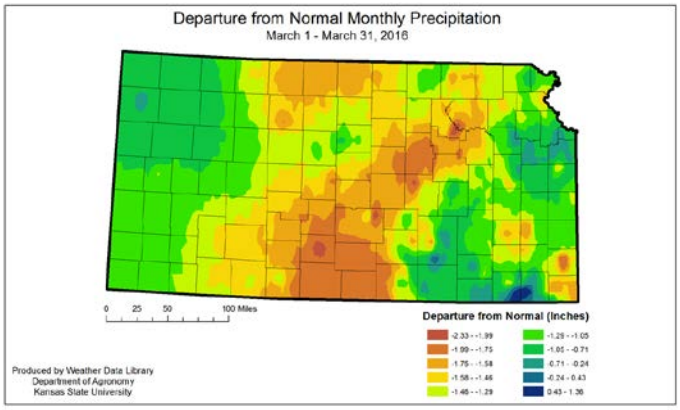
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

Kansas Climate Division Precipitation Summary (inches)												
	March 1-31, 2016			January 1– March 31, 2016			April 1-March 31, 2016			September 1–March 31, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	0.29	-1.05	23	1.38	-0.97	60	21.57	0.21	100	6.77	-0.06	99
West Central	0.42	-1.01	28	1.32	-1.23	49	22.11	1.34	105	6.65	-0.37	92
Southwest	0.05	-1.34	3	0.36	-2.07	14	26.76	6.86	133	7.59	0.70	108
North Central	0.44	-1.62	20	1.81	-1.74	50	27.72	-0.29	97	8.77	-1.50	84
Central	0.63	-1.66	27	1.97	-2.07	49	28.85	-0.44	97	9.81	-1.04	89
South Central	0.97	-1.68	35	1.67	-3.04	34	34.95	3.63	111	11.17	-1.39	88
Northeast	0.99	-1.34	42	2.26	-2.04	52	39.08	4.08	111	12.78	-0.86	94
East Central	1.26	-1.43	46	2.42	-2.61	47	37.65	-0.27	98	13.23	-2.11	84
Southeast	1.89	-1.17	61	2.95	-3.16	48	42.40	0.91	101	15.17	-3.02	82
STATE	0.77	-1.38	31	1.76	-2.17	42	31.34	1.96	106	10.23	-1.08	91

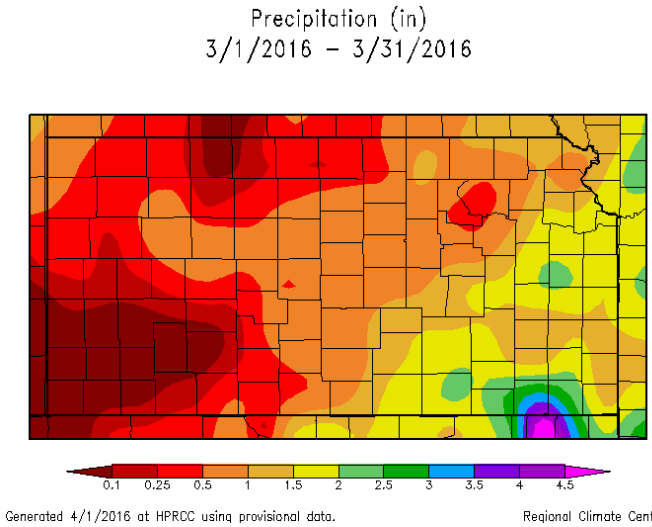


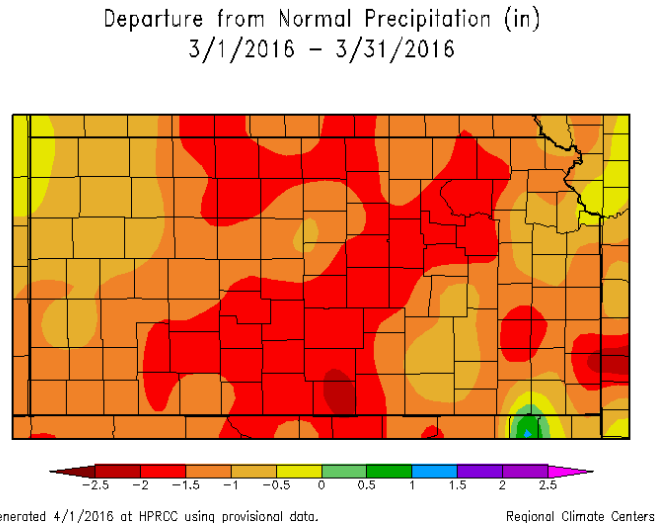






Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

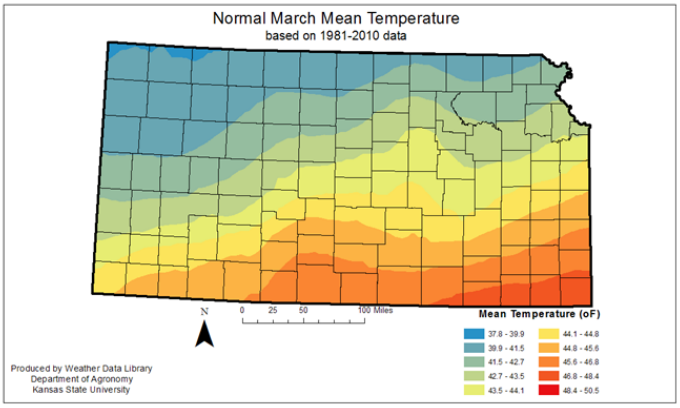


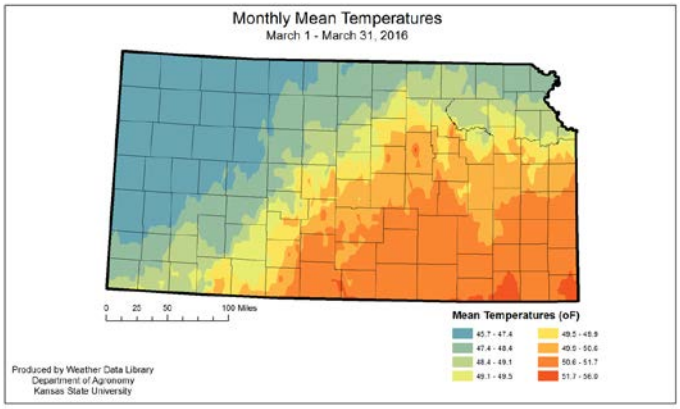


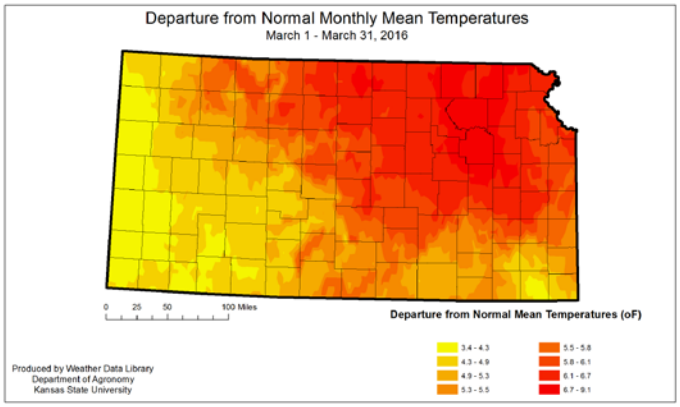
March started with much warmer than normal temperatures, continuing the trend from February. The state-wide average temperature was 48.7°F, which was 5.2 degrees warmer than normal. That places this March as the 10th warmest on record. The warmest March occurred in 2012, when the average temperature was 55.5°F. The coldest March recorded was in 1916, when the average temperature was just 30.3°F. The Northeastern Division had the largest departure with a mean temperature of 48.7°F, or 6.0 degrees warmer than average. There were fewer daily record highs than in February, but still 35 new daily records established. In addition to the new record high temperatures, there were 57 new record warm minimum temperatures set as well. The warmest high temperature was 90°F recorded at Ashland (Clark County) on the 23rd. There was one new record cold high temperature: 39°F set at WaKeeney (Trego County) on the 23rd. The coldest reading for the month was 2°F observed at WaKeeney (Trego County) on the 27th. This illustrates the rapid temperature swings that were prevalent throughout the month. Daily temperature swings of over 50 degrees were seen on several occasions. All parts of the state saw temperatures below 32°F, prolonging the winter season. These low temperatures after the warm conditions in February and early March brought concerns of damage to vegetation that moved out of dormancy early. This was especially true for winter wheat.

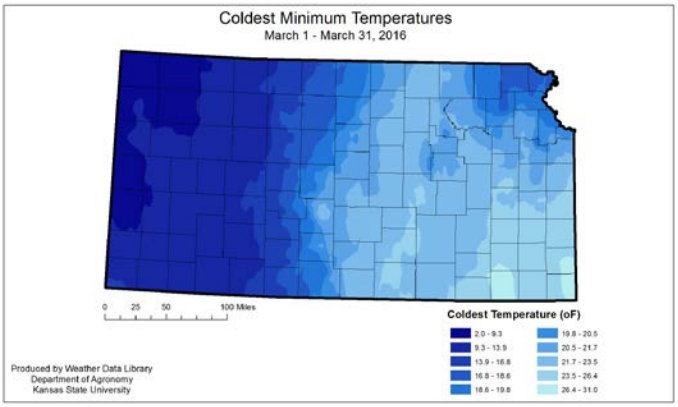
Temperature summary by the Kansas State University Weather Library for the month is provided in the table and maps below. The table below summarizes temperatures by Kansas climate division and various time periods. Slight differences in the average or extreme values presented may occur due to preliminary data.

Climate Division	Kansas Climate Division Temperature Summary (°F)							
	March 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	63.0	27.9	45.5	5.0	86	22	6	21
West Central	64.9	27.7	46.3	4.4	87	23	2	27
Southwest	66.5	31.1	48.8	4.4	90	23	8	21
North Central	63.6	32.8	48.2	5.7	82	23	18	1
Central	65.2	34.2	49.7	5.6	87	23	17	20
South Central	66.3	36.5	51.4	5.6	88	22	15	19
Northeast	62.8	34.7	48.7	6.0	82	24	16	2
East Central	63.4	35.8	49.6	5.5	82	31	19	3
Southeast	64.0	37.1	50.5	4.4	81	15	20	26
STATE	64.4	33.1	48.7	5.2	90	23rd	2	27th
Data Source: KSU Weather Library								

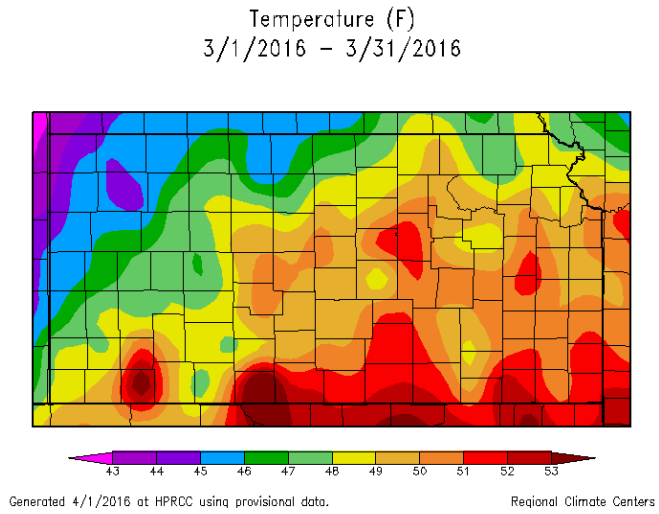


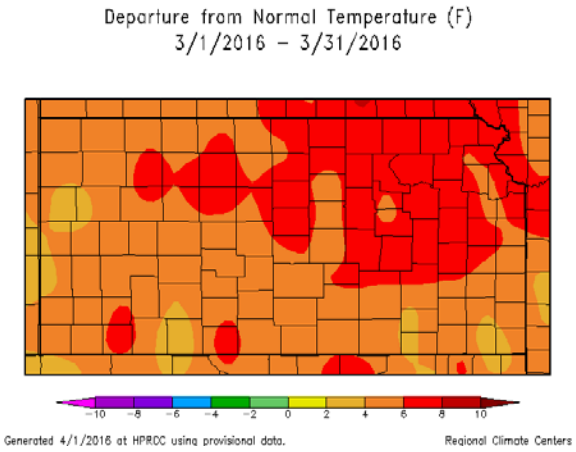






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.

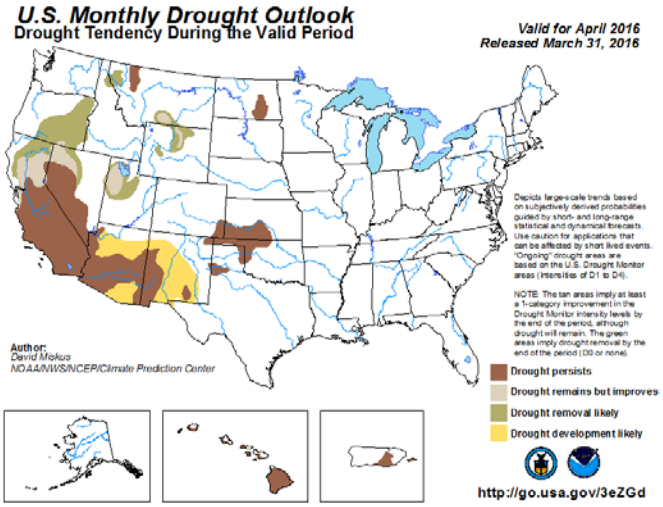


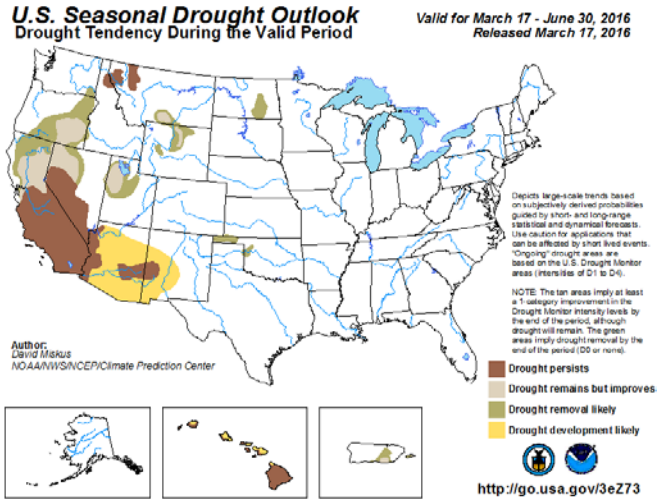


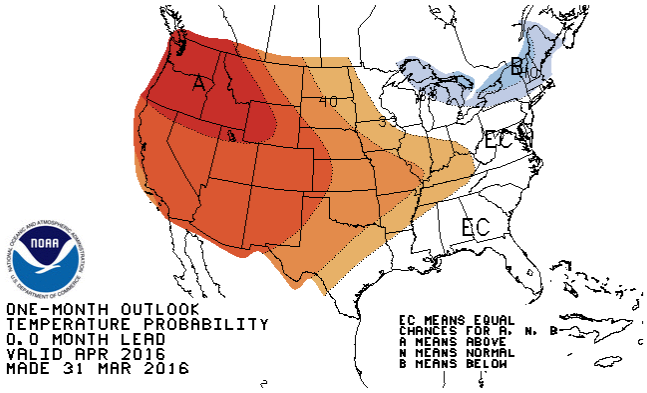
Severe weather season moved slowly in March. There was one tornado reported in Cowley County, as well as 12 hail reports and one severe wind report. The major event was the Anderson Creek fire in south central Kansas. One of the largest wildfires in Kansas history started in Oklahoma. Extreme fire weather conditions with winds in excess of 50 mph and humidity levels as low as 15 percent drove the fire into Kansas in Barber and Comanche counties. Almost 400,000 acres were burned before the fire was contained. This was the largest of many wildfires across the state as extreme fire weather conditions were prevalent this month and fuel loads were high due to ample moisture in the fall.

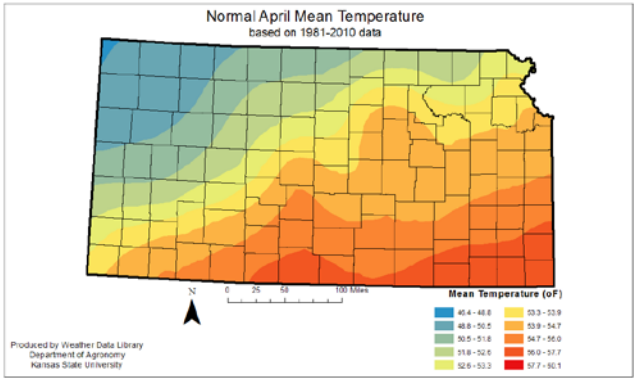
Future Outlook

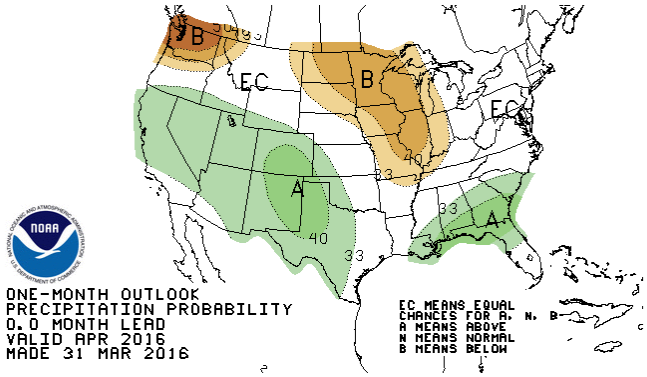
The precipitation outlook for April is neutral, with equal chances for above or below normal precipitation. However, the short term outlooks are for drier than average conditions for the first half of the April and forecast confidence is low at this time of the year. The Drought Outlooks for the month of April and the Season Outlook for Mid-March through the end of June 2016 are provided below.

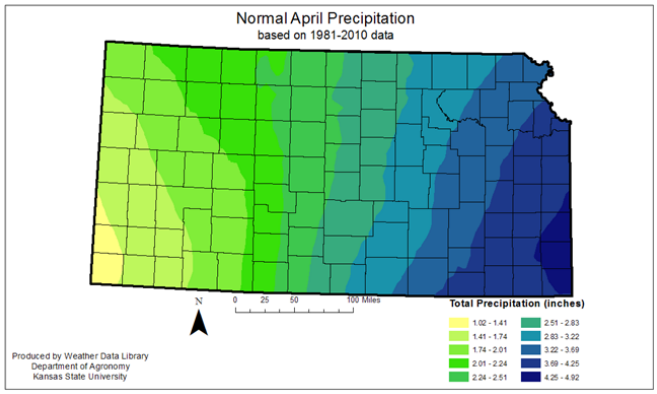




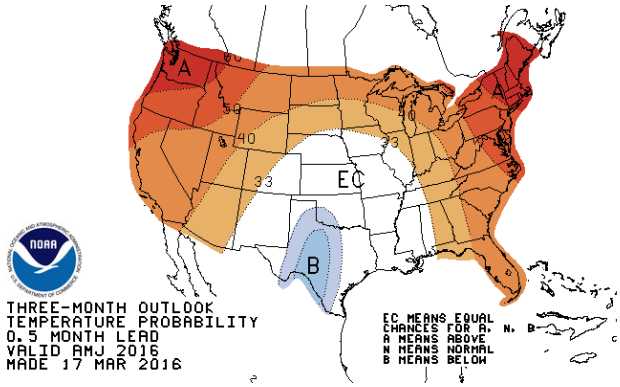


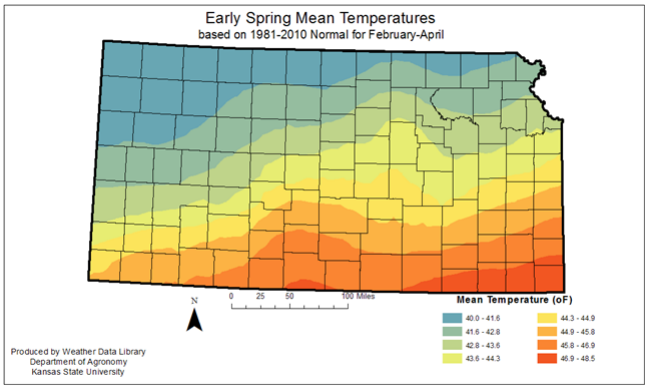


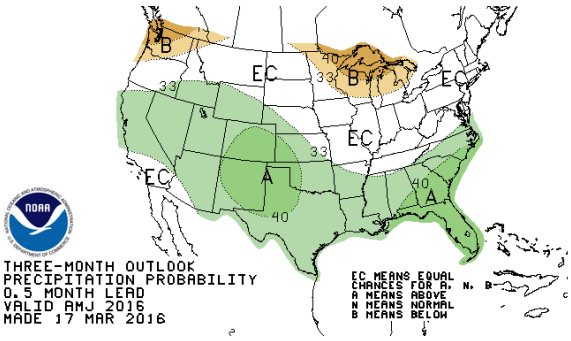


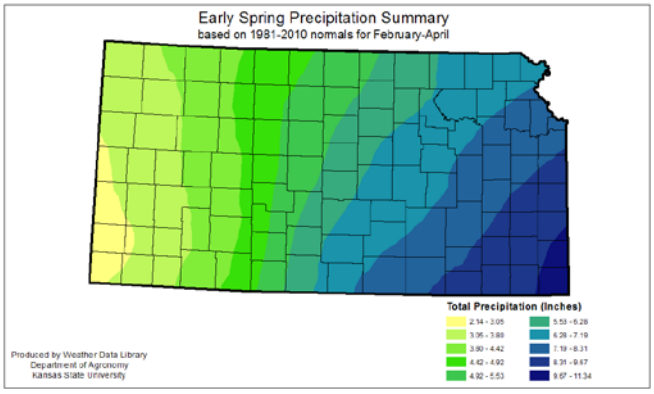


The early winter (three-month) outlook favors normal temperatures and above normal precipitation for February through April 2016.









Additional outlooks for additional 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. Evaluation of experience from this past year and update those plans to make sure they are prepared to address water supply needs should the drought not continue to ease.

Known issues:

Stage II water restrictions are in place for the City of **Russell,** Russell County water customers. The water restrictions include a prohibition on most outdoor watering, vehicle washing, filling of residential swimming pools, and washing exterior of buildings. It also requires industrial users to reduce use.

Stage III water restrictions have been in place for the City of **Victoria**, Ellis County since January 2014. No outdoor watering is allowed.

The City of **Natoma** in Osborne County reported to KDHE declining well water levels causing inability to pump two of three wells. A water watch (conservation plan) has been enacted.

Osborne Rural Water District 01A has reported declining water levels and intermittent inability to pump some wells.

Surface Water Supply Conditions

Kansas River basin: Inflows to Tuttle Creek, Perry, Milford, and Clinton reservoirs all declined during the month of March. Reservoir levels remained below the top of multipurpose pools due to lack of significant inflow. Storage

evacuated for winter target elevations has not been recovered. Flows in the Kansas River declined and were 50% to 60% of the historical median values for the majority of the month.

Marais des Cygnes basin: Streamflow was sufficient but moderate to low throughout the month. Melvern, Pomona, and Hillsdale reservoirs also maintained near the winter target elevations. Minimum release gate settings were maintained.

Cottonwood / Neosho basin: River flow throughout the basin remained at moderate levels for the month of March. All reservoirs ended the month slightly above normal pool elevations.

Verdigris basin: There were no significant runoff events in the Verdigris basin and streamflow was remained well below historical median values but still above low flow targets. Reservoirs bypassed inflows as necessary and remained full.

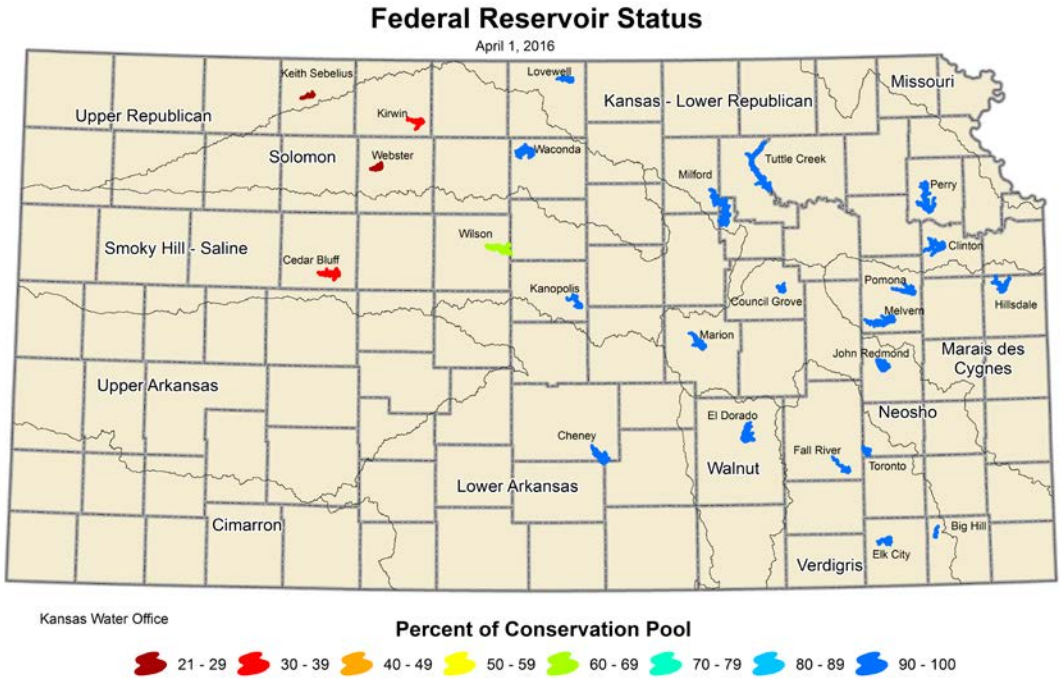
Saline basin: Elevation at Wilson Lake was stable near record low in March. Flows in the Saline River remained inconsequential throughout the month.

Smoky Hill basin: Smoky Hill basin streamflow remained low throughout March. Kanopolis Reservoir releases were minimal so the storage balance was stable but downstream base flow was healthy and the low flow target at the USGS gage near Mentor was maintained. Cedar Bluff Reservoir experienced a slight decline over the month.

Harmful Blue-Green Algal Blooms (lake water safety)
KDHE has issued two levels of public health protection notifications for blue-green algae (BGA) Blooms: a Public Health Watch and Public Health Warning. November 17, 2015 the sampling season closed. Two lakes remain on the warning list until the 2016 sampling season (April 1-Oct 31), Hiawatha City Lake, Brown County; and Plainville Township Lake, Rooks County.

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.

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool. Wilson Lake is also low.



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		**04/01/2016 6 AM**		
Norton[1]	2304.3	2288.29	-16.01	28.8
Harlan County, NE	1945.73	1936.86	-8.87	66.1
Lovewell[1]	1582.6	1582.86	0.26	100.0
Milford[1]	1144.4	1143.47	-0.93	96.2
Cedar Bluff	2144	2119.18	-24.82	32.2
Kanopolis[1]	1463	1463.50	0.50	100.0
Wilson[1]	1516	1505.65	-10.35	65.8
Webster[1]	1892.5	1870.27	-22.18	23.3
Kirwin[1]	1729.3	1713.72	-15.53	37.9
Waconda[1]	1455.6	1454.26	-1.34	92.5
Tuttle Creek[1]	1075	1073.39	-1.61	93.3
Perry[1]	891.5	890.41	-1.09	94.5
Clinton[1]	875.5	875.87	0.37	100.0
Melvern[1]	1036	1034.70	-1.30	94.1
Pomona[1]	974	973.07	-0.93	93.4
Hillsdale[1]	917	915.73	-1.27	92.3
Arkansas River Basin		**04/01/2016 8 AM**		
Cheney	1421.6	1421.60	0.00	100.0
El Dorado	1339	1138.38	-200.62	100.0
Toronto[1]	901.5	901.97	0.47	100.0
Fall River[1]	948.5	948.91	0.41	100.0
Elk City[1]	796	796.41	0.41	100.0
Big Hill	858	858.00	0.00	100.0
Council Grove[1]	1274	1274.11	0.11	100.0
Marion[1]	1350.5	1350.80	0.30	100.0
John Redmond[1]	1039	1041.41	0.41	100.0

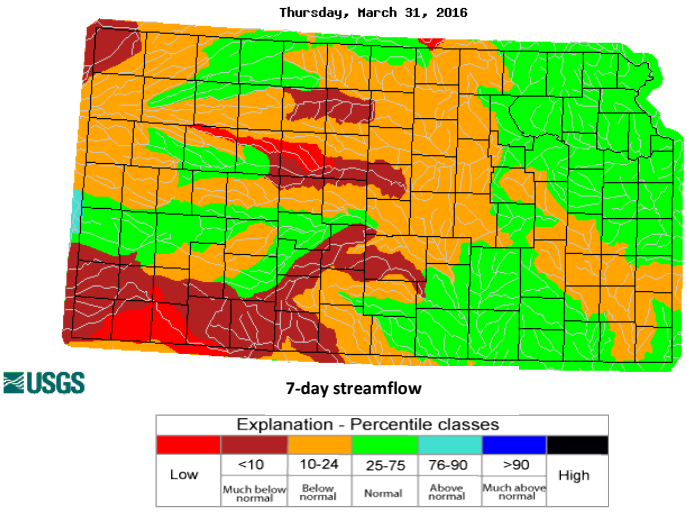
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

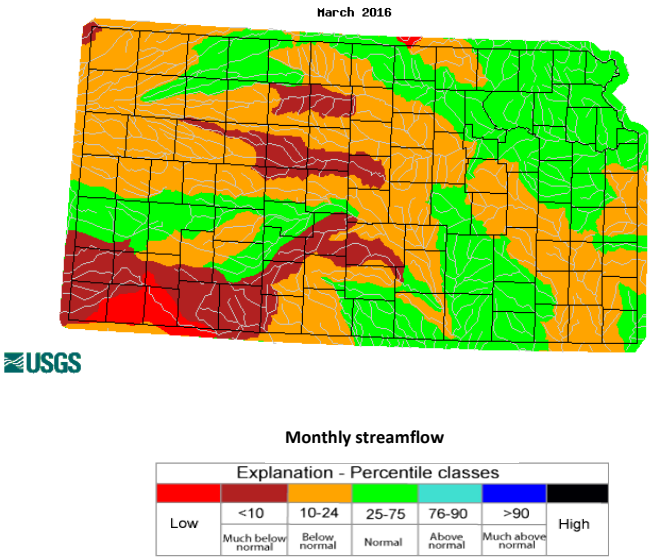
Note: The conservation pool is the water storage for non-flood purposes of the reservoir, set by the elevation of the top of the pool.

Streamflow Conditions

Kansas streamflows during July varied across the state, but remain below historical normal flows in parts of west and central Kansas.

The comparison of present **7-day** streamflow to historical is shown on the map below left and the **February** streamflow compared to historical is shown on the map below, right. Short term streamflow is significantly lower than historical average in many area of western Kansas.



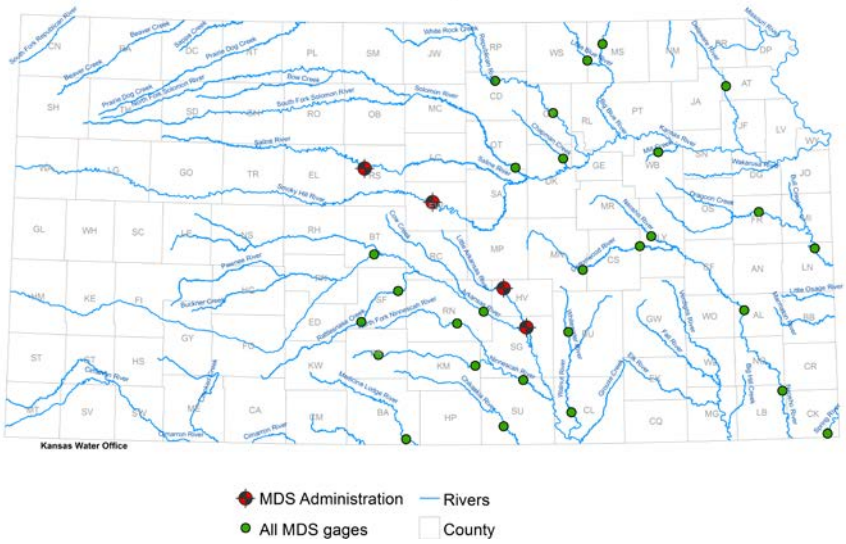


In general, a streamflow which is greater than the 75 percentile is considered *above normal*, a streamflow which is between 25 and 75 percentiles is considered *normal* and a streamflow which is less than the 25 percentile is considered *below normal*. Color codes are for basins with streamflow averages less than 25 percent of historic values.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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.

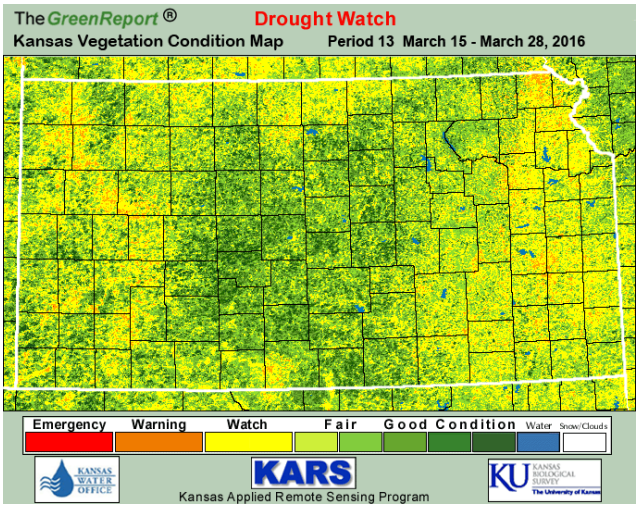
Kansas Minimum Desirable Streamflow (MDS) Gages Administration
March 31, 2016



Streamflows as of March 31, 2016	cubic feet per second ((cfs)			
Gaging Station	**Current Flow**	**Mar MDS**	**Apr MDS**	**Comment**
Republican River at Concordia	144	150	150	Admin began November 18, 2015; 70 files. Admin ceased January 7, 2016.
Republican River at Clay Center	216	200	250	
Smoky Hill River at Ellsworth	13	25	30	Admin began June 26, 2015; 3 files.
Saline River near Russell	2	15	15	Admin began September 5, 2015; 10 files.
Little Arkansas River at Alta Mills	10	8	8	Admin begins March 18, 2016; 8 files.
Little Arkansas River at Valley Center	60	20	20	Admin begins March 18, 2016; 21 files.
Medicine Lodge River near Kiowa	64	60	60	

Soil, Crop and Vegetation
Kansas Vegetative Conditions

The Kansas Vegetative Condition map is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Green colors in the central and western areas of the state this time of year indicate where winter wheat is starting to grow and in good shape. The eastern side is very dry for this time of year.

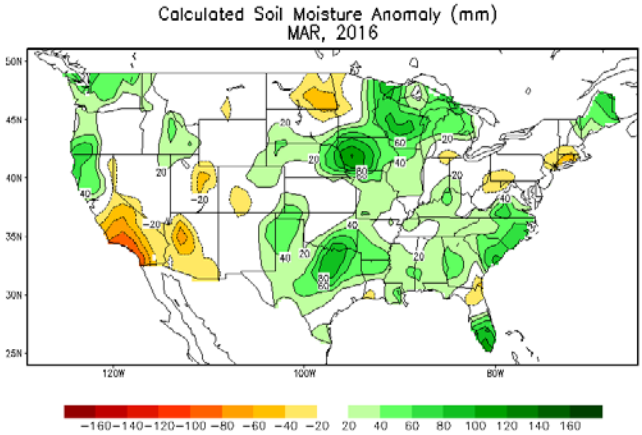


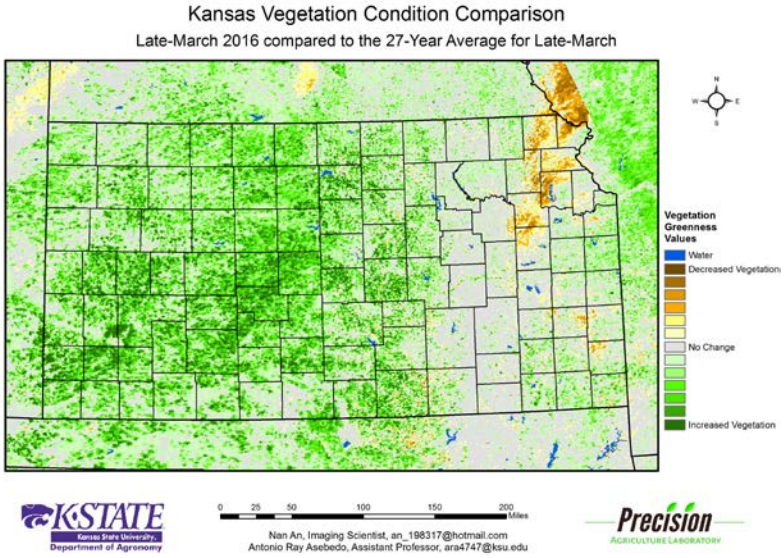
Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for late March from K-State's Precision Agriculture Laboratory shows that the area of above average photosynthetic activity continues to increase. The

largest areas with the greatest increase are in central and south central Kansas. Even with the recent cool weather, temperatures continue above normal across the state, with the warmest departures in the Southwest. The impact of the recent freeze is not yet visible.

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.
http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml



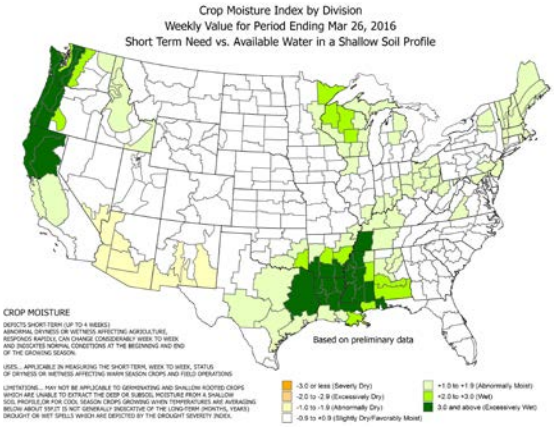


Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report released March 28, 2016 reported topsoil moisture 10 percent very short, 38 short, 51 adequate, and 1 surplus. Subsoil moisture rated 8 percent very short, 30 short, 61 adequate, and 1 surplus.

Field Crops Report: Winter wheat condition rated 1 percent very poor, 6 poor, 37 fair, 49 good and 7 excellent.

Livestock Report: Cattle and calf conditions rated 0 percent very poor, 2 poor, 23 fair, 69 good and 6 excellent. Hay and roughage supplies rated 0 percent very short, 5 short, 85 adequate, 10 surplus. Stock water supplies rated 4 percent very short, 15 short, 80 adequate, and 1 surplus.
(http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

Whenever the Governor or the U.S. Department of Agriculture declares all or any portion of the State is in a state of drought, certain conditions apply to motor carriers transporting hay or related animal forage feedstuffs to the geographic area specified in the drought declaration. Those certain conditions are as follows:

- Motor carrier registration and fuel tax permits are temporarily suspended;
- Licensing, certification, and permitting rules and regulations of the SCC are temporarily suspended;
- These motor carriers may not operate during the period beginning 30 minutes after sunset and ending 30 minutes before sunrise and are required to comply with flags, signs, and lighting requirements applicable to over width vehicles;
- Motor carriers cannot operate during inclement weather;
- Oversize and overweight loads cannot be transported when visibility is less than one-half mile or when conditions of moderate to heavy rain, sleet, snow, fog, or smoke exist, or when highway surfaces are slippery due to ice or packed snow; and
- Motor carriers cannot transport a load of more than 12 feet in width and 14 feet, six inches, in height.

The provisions remain in effect until the drought declaration is terminated.

Fire

Strong winds and dry conditions contributed to the largest Kansas Wildfire recorded. This wildfire started in Woods County, Oklahoma March 22, but moved into Kansas, burning an estimated 400,000 acres total, 300,000 acres in Kansas. Other Kansas losses included 15 homes and three bridges, power lines, cattle and fences. March 23, 2016, Governor Brownback declared a State of Disaster Emergency for Barber, Comanche, Harvey, and Reno counties. A federal Fire Management Assistance Grant has been approved for Barber and Comanche counties. Preliminary damage estimates for Kansas are in excess of $1 million.

A satellite image (on right) shows the Anderson Creek fire five days after it was sparked in Oklahoma. Here, it is still smoldering but mostly contained. Photo by NASA/Aqua/MODIS

General Federal Disaster Assistance

USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of the historic drought. More information on these programs may be found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

The USDA Food and Nutrition Service provide food assistance to those in need in areas affected by a disaster. This Federal assistance is in addition to that provided by State and local governments. USDA provides disaster food assistance

in three ways: provides foods to State agencies for distribution to shelters and other mass feeding sites; provides food to State agencies for distribution directly to households in need in certain limited situations; and authorizes State agencies to issue Disaster Supplemental Nutrition Assistance Program (D-SNAP) benefits.

Drought related program information is found at:
http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE&navtype=RT&parentnav=RURAL_DEVELOPMENT.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock

The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. More detailed information on eligibility and sign up is available on the FSA fact sheet found at: http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at: http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators. LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers

Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Conservation Reserve Program (CRP): CRP acres may be used for haying or grazing under emergency conditions. CRP is a voluntary program that provides producers with annual rental payments on their land in exchange for planting resource-conserving crops on cropland to help prevent erosion, provide wildlife habitat and improve the environment. CRP acres can already be used for emergency haying and grazing during natural disasters to provide much needed feed to livestock. Given the widespread nature of this drought, forage for livestock is already substantially reduced. Haying and grazing will only be allowed following the local birds' primary nesting seasons. Especially sensitive lands, such as wetlands, stream buffers and rare habitats will not normally eligible.

Environmental Quality Incentives Program (EQIP): EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to address natural resource concerns on their agricultural and forest land. This program provides assistance to affected farmers and ranchers by allowing them to modify current EQIP contracts to allow for prescribed grazing, livestock watering facilities, water conservation and other conservation activities to address drought conditions. Where conservation activities have failed because of drought, NRCS will look for opportunities to work with farmers and ranchers to re-apply those activities. In the short term, funding will be targeted towards hardest hit drought areas.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

March 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	1.07	0.18	120%	44.0	4.3	79 (22)	12 (20)
Dodge City	0.04	-1.55	3%	48.5	4.1	85 (22)	12 (20)
Garden City	T	-1.46	0%	47.9	4.3	88 (22)	10 (20)
Goodland	0.55	-0.52	51%	45.3	4.8	81 (21)	12 (20)
Guymon, OK	0.26	-1.17	18%	50.6	4.3	88 (22)	13 (20)
Hill City	0.20	-1.43	12%	47.7	5.9	82 (7)	13 (20)
Lamar, CO	0.12	-0.72	14%	45.8	3.3	83 (22)	4 (20)
McCook, NE	0.48	-0.88	35%	45.7	6.3	83 (21)	9 (20)
Springfield, CO	0.06	-1.07	5%	43.9	1.1	82 (22)	5 (20)
Central							
Concordia	0.45	-1.56	22%	49.1	6.1	78 (23,7)	22 (20,1)
Hebron, NE				47.6	7.5	79 (23,7)	22 (25,20)
Medicine Lodge	0.67	-1.59	30%	51.8	5.1	83 (22)	20 (20,19)
Ponca City, OK	1.42	-1.29	52%	53.4	4.6	83 (14)	24 (19)
Salina	0.70	-1.69	29%	51.4	6.0	82 (22)	23 (25)
Wichita (ICT)	1.53	-1.16	57%	52.5	6.0	81 (30)	25 (25)
East							
Bartlesville, OK	1.94	-1.54	56%	52.4	3.6	82 (23)	23 (21)
Chanute	1.41	-1.63	46%	52.2	5.1	80 (23)	24 (25)
Fall City, NE	1.40	-0.94	60%	49.0	7.1	80 (30)	19 (2,1)
Johnson Co. Exec. Apt	2.09	-0.54	79%	50.4	5.5	75 (23)	22 (2)
Joplin, MO	2.57	-0.85	75%	53.2	4.3	78 (23,14)	27 (25)
Kansas City (MCI), MO	2.72	0.35	115%	50.5	6.3	78 (23)	21 (2)
St. Joseph, MO	0.87	-1.38	39%	48.6	5.7	78 (23)	16 (2)
Topeka (TOP	2.00	-0.19	91%	51.0	6.2	80 (23)	24 (25,2)

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

KANSAS CLIMATE and DROUGHT UPDATE – April 2016 Summary

Climate, Drought Conditions and Responses for Kansas

General

- In effect, June 29, 2015, Executive Order (EO) 15-04 issued by the Governor for a drought watch for 33 counties.
- The US Drought Monitor indicated dry conditions increased in extent and degree in early April but improved as the moth progressed.
- The US Drought Monitor ended the month with abnormally dry conditions in 57% of Kansas, an improvement from the previous week of 67%.
- Moderate drought affecting 11% on April 26, down from 15% the previous week.

Lakes and Streams

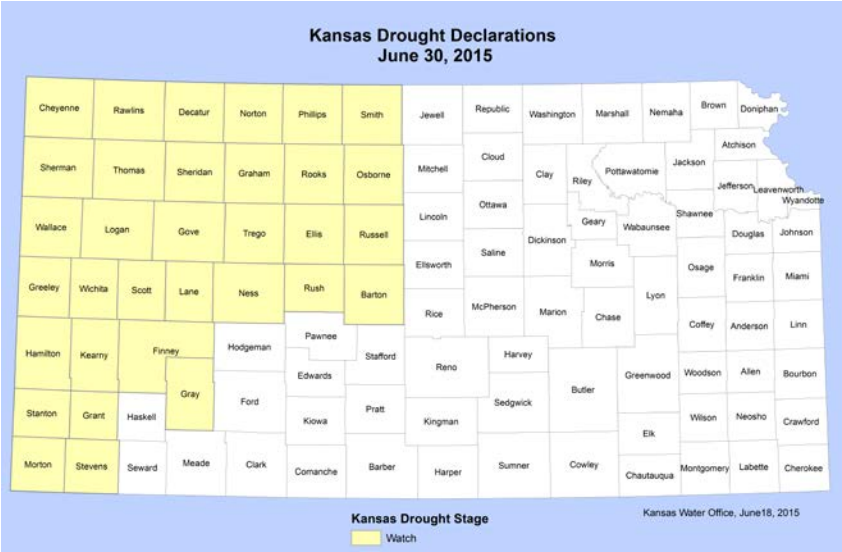
- Minimum Desirable Streamflow (MDS) Administration was in effect on the Saline, Smoky Hill, Little Arkansas and the Republican rivers sometime during the month.
- Administration began on the Republican River on April 19.
- The Administration order on the Little Arkansas at Alta Mills and Valley Center gages was lifted April 15.
- Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool. Wilson Lake is also low at 66 percent.

Fire

- Wildfires burned at least 10,000 acres in Kansas in early April, causing evacuations and destroying at least 4 homes.

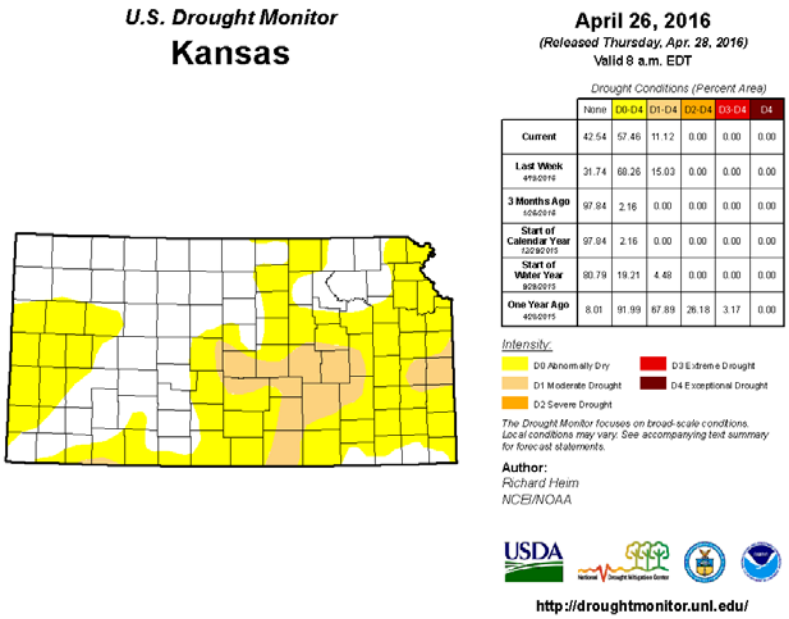
Kansas County Drought Declarations: Executive Order 15-04 was issued by Governor Brownback June 30, 2015, modifying drought declarations for Kansas counties. Drought watch is in effect for 33 counties as the overall conditions for plant growth and deficits in precipitation require careful consideration in planning for future water use.

Drought Watch: Barton, Cheyenne, Decatur, Ellis, Finney, Gove, Graham, Grant, Gray, Greeley, Hamilton, Kearny, Lane, Logan, Morton, Ness, Norton, Osborne, Phillips, Rawlins, Rooks, Rush, Russell, Scott, Sheridan, Sherman, Smith, Stanton, Stevens, Thomas, Trego, Wallace, Wichita

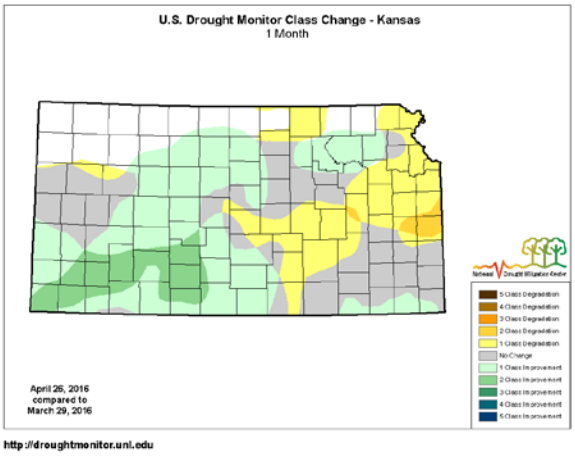


General Conditions

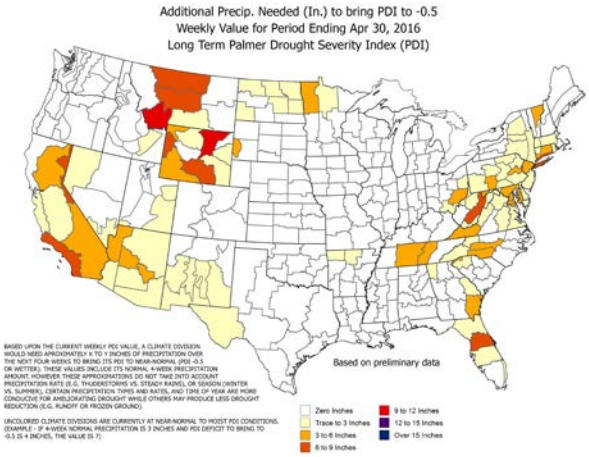
The wet end to the month resulted in dramatic improvements in the drought status. The end of March saw only 26 percent of the state as drought free. The last Drought Monitor issued in April had 43 percent of the state labeled drought free. Additional improvement will show in the first May map, as precipitation at the end of April is included in the analysis. The precipitation outlook for May favors wetter than average conditions in most of the state, with only the Northeast in neutral, with equal chances for above or below normal precipitation. However, the short term outlooks are for wetter than average conditions for the first half of the month state-wide.



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	42.54	57.46	11.12	0.00	0.00	0.00
Last Week 4/19/2016	31.74	68.26	15.03	0.00	0.00	0.00
3 Months Ago 1/26/2016	97.84	2.16	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.49	0.00	0.00	0.00
One Year Ago 4/28/2015	8.01	91.99	67.89	26.18	3.17	0.00



More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.



Palmer Drought Severity Index - The Palmer Index (PDSI) is an indicator used in the U.S. Drought Monitor. The precipitation needed in Kansas to bring the Palmer Drought Index to near normal (-0.5) is shown in the map below.
(http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/addpcp.gif)

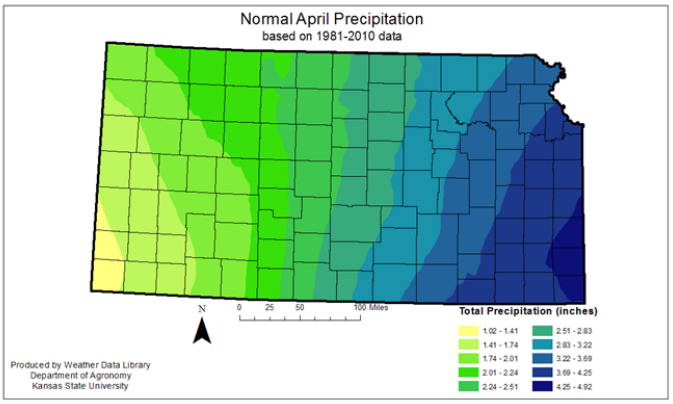
Precipitation Needed to Bring PDI to Normal					
Climate Division	April 2	April 9	April 16	April 23	April 30
Northwest	0.80	3.64	-	-	-
West Central	-	1.48	-	-	-
Southwest	-	-	-	-	-
North Central	-	-	-	-	-
Central	-	-	-	-	-
South Central	-	-	-	-	-
Northeast	-	1.03	2.49	-	-
East Central	-	1.92	2.75	-	-
Southeast	-	1.62	1.6	-	-

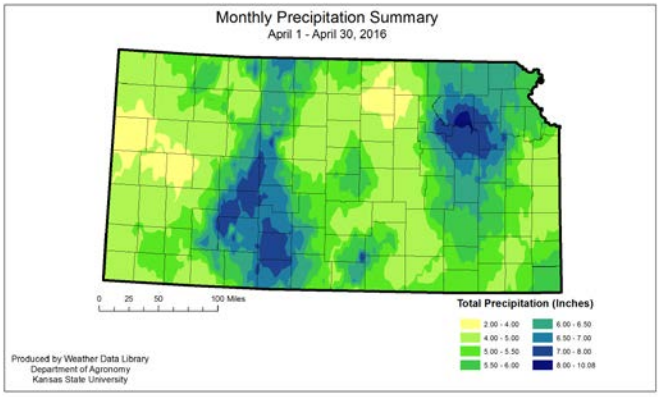
Climate Summary (Temperature and Precipitation)

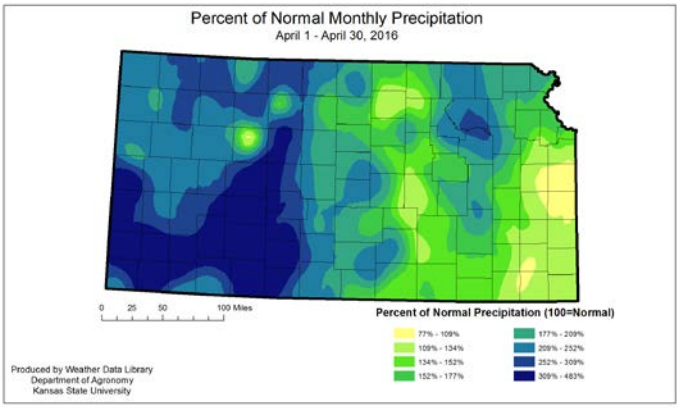
After a dry start to the month, April ended with a wet pattern. The Southeast Division and East Central divisions came closest to normal. The Southeast Division averaged 5.40 inches which was 138 percent of normal; the East Central Division average 5.14 inches which was 142 percent of normal. The remaining divisions ranged from 176 percent of normal in the North Central Division to 335 percent of normal in the Southwestern Division. These rainfall amounts brought year-to-date totals at or above normal for all but the East Central and Southeastern Divisions. Dodge City went from one of the driest starts to the year on record to the wettest May on record. The state wide average precipitation was 5.18 inches, or 207 percent of normal. This ranks as the 4th wettest April on record. The greatest monthly total was 9.53 inches at Montezuma, Gray County (NWS). The greatest total for CoCoRaHS stations was 9.68 inches at Dodge City 9.1 WNW, Ford County. There were 159 new daily record precipitation totals. Twenty-one of those were record high amounts for April, and two set all-time daily rainfall records. The all-time records both occurred on April 17th: 5.48 inches at Cedar Bluff Dam, and 5.31 inches at McCracken.

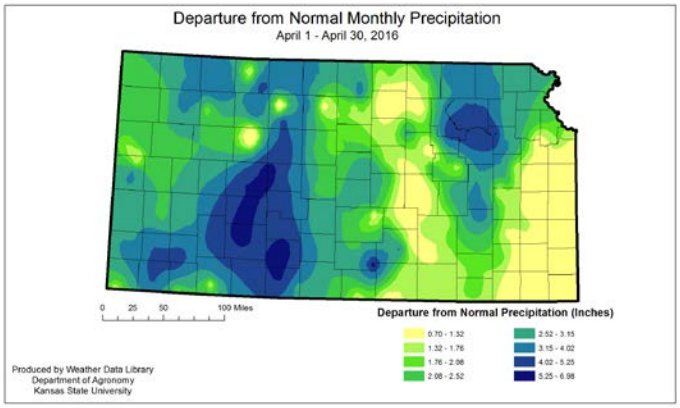
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

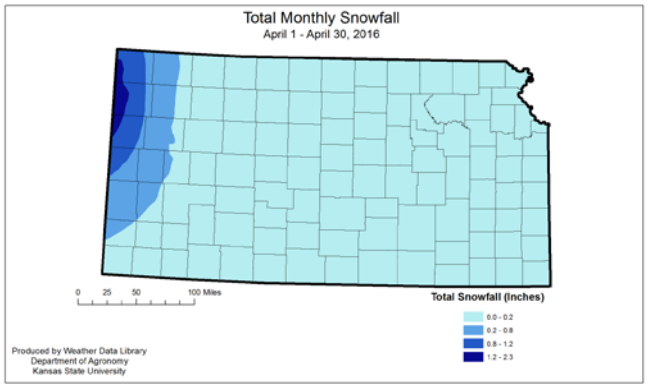
Kansas Climate Division Precipitation Summary (inches)												
	April 1-30, 2016			January 1– April 30, 2016			April 1 - April 30, 2016			September 1–April 30, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	4.53	2.42	214	5.91	1.45	132	4.53	2.42	214	11.31	2.38	126
West Central	4.55	2.62	236	5.88	1.39	128	4.55	2.62	236	11.21	2.25	122
Southwest	5.62	3.96	335	5.99	1.90	144	5.62	3.96	335	13.22	4.67	152
North Central	4.39	1.84	176	6.18	0.08	102	4.39	1.84	176	13.14	0.32	103
Central	5.17	2.48	199	7.14	0.42	109	5.17	2.48	199	14.98	1.44	112
South Central	5.56	2.83	210	7.26	-0.18	100	5.56	2.83	210	16.75	1.46	111
Northeast	6.10	2.81	187	8.37	0.77	111	6.10	2.81	187	18.89	1.96	112
East Central	5.14	1.55	142	7.62	-1.00	87	5.14	1.55	142	18.42	-0.51	95
Southeast	5.40	1.47	138	8.28	-1.76	82	5.40	1.47	138	20.50	-1.63	91
STATE	5.18	2.48	207	6.94	0.31	110	5.18	2.48	207	15.41	1.40	114



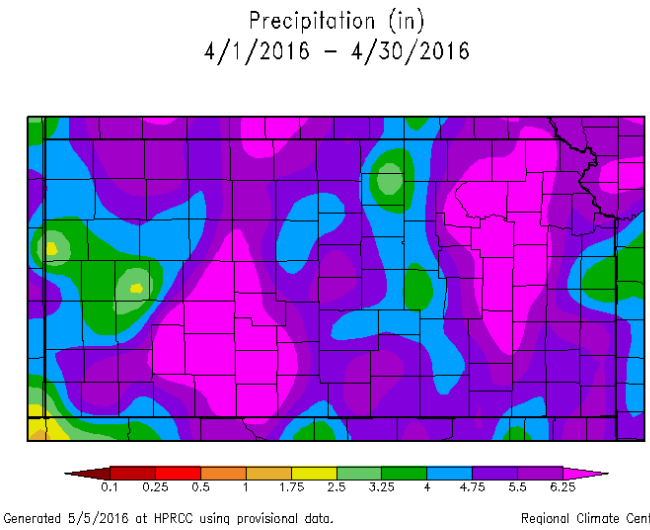


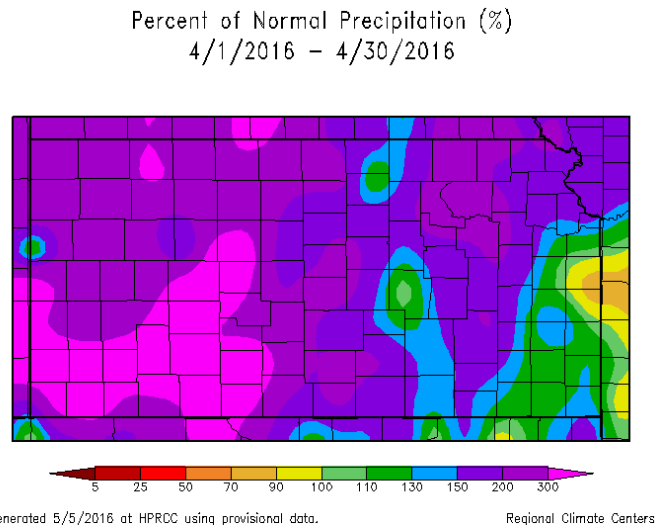






Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

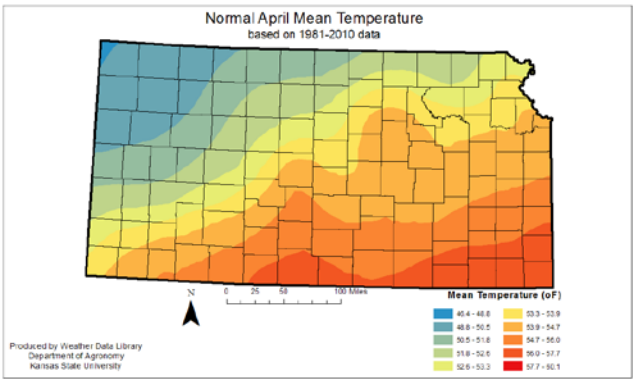


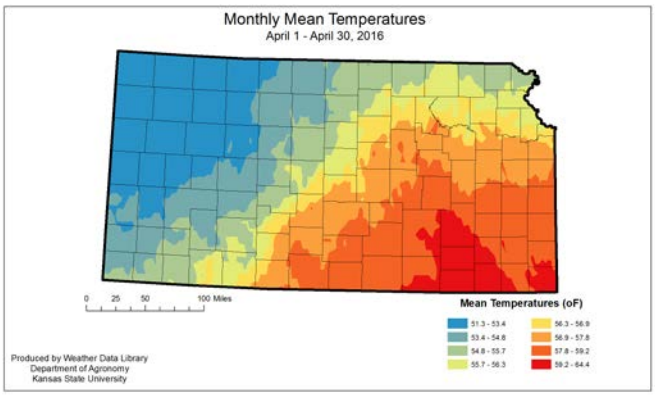


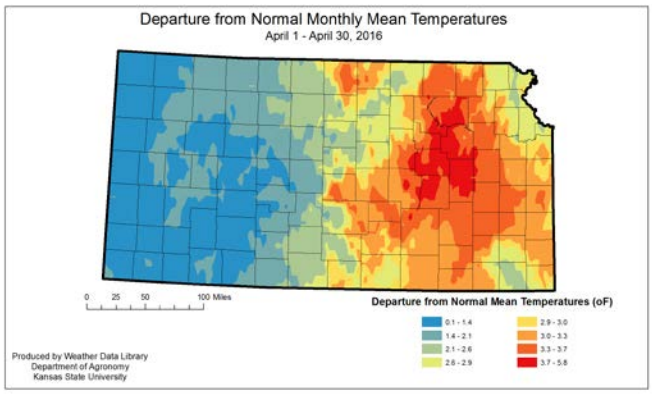
The warm, dry conditions that dominated March continued through the first half of April. This resulted in warmer than normal conditions for the month as a whole, although not as extreme as last month. The mean temperature for April was 55.6 ^{o}F which was 1.9 degrees warmer than normal. While on the warm side of the distribution, it was only the 36th warmest since 1895. The South Central Division had the largest departure with a mean temperature of 58.4 ^{o}F, or 2.8 degrees warmer than average. The West Central Division was closest to normal, with a mean temperature of 52.1 ^{o}F or 0.9 degrees warmer than normal. The number of record daily highs was fewer than in previous months with only 6 new records. In addition to the new record high temperatures, there were just 3 new record warm minimum temperatures set. The warmest high temperature was 91 ^{o}F recorded at Ashland (Clark County) on the 4th and at Hudson (Stafford County) on the 26th. There were 6 new record cold high temperatures. All of these new record cold high temperatures occurred on the 30th of the month, as a cold front brought snow to end the month. These low temperatures so late in the season brought concerns of damage to vegetation that moved out of dormancy early.

Temperature summary by the Kansas State University Weather Library for the month is provided in the table and maps below. The table below summarizes temperatures by Kansas climate division and various time periods. Slight differences in the average or extreme values presented may occur due to preliminary data.

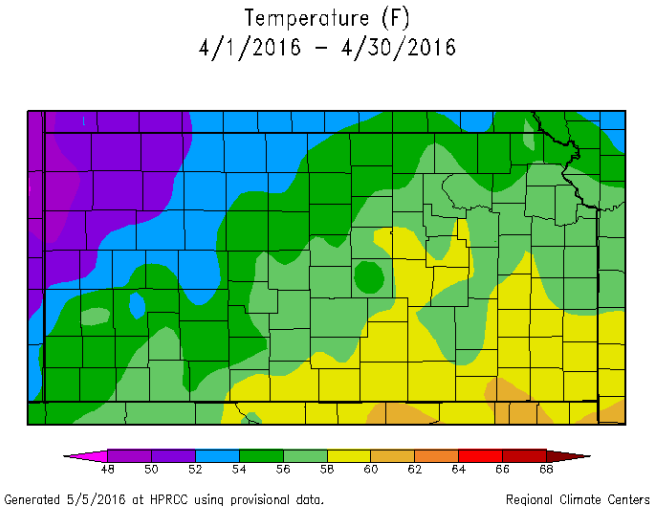
Climate Division	Kansas Climate Division Temperature Summary (°F)							
	April 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	65.7	36.5	51.1	1.0	83	24	22	2
West Central	67.1	37.0	52.1	0.9	84	6	21	2
Southwest	69.5	40.4	54.9	1.1	91	6	18	2
North Central	68.7	41.6	55.2	2.0	86	6	24	2
Central	70.0	42.4	56.2	2.0	89	5	22	2
South Central	71.6	45.1	58.4	2.8	91	26	24	2
Northeast	68.4	44.3	56.4	2.6	87	6	22	12
East Central	69.3	45.2	57.2	2.7	86	6	23	3
Southeast	70.5	46.7	58.6	2.4	87	10	23	2
STATE	69.0	42.1	55.6	1.9	91	26th	18	2nd
Data Source: KSU Weather Library								

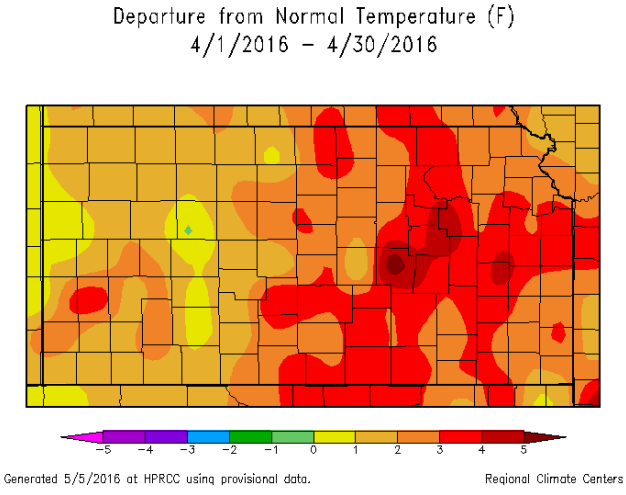






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



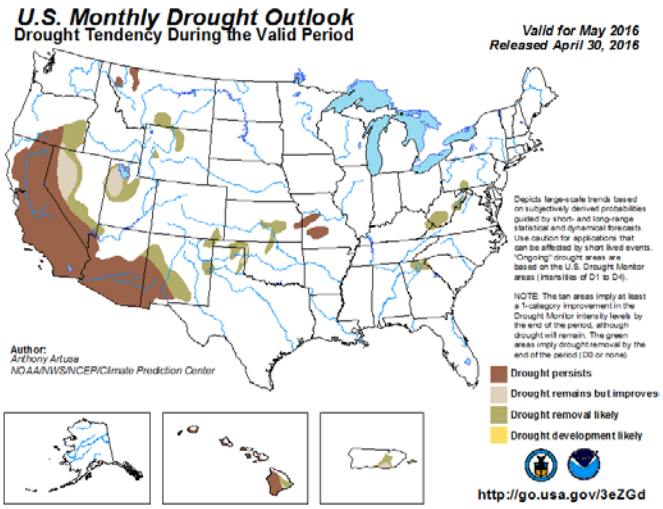


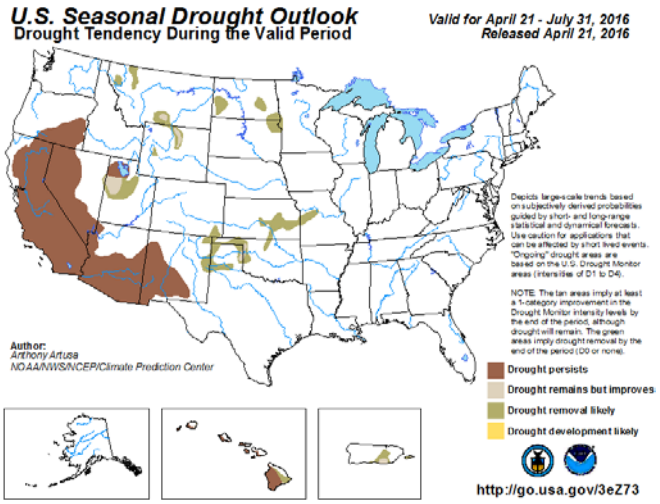
Along with the increased rainfall pattern there was an increase in severe weather reports. There were 7 tornadoes reported, as well as 41 reports of damaging wind. The most common severe weather report was hail reports. There were 119 reports of hail during the month.

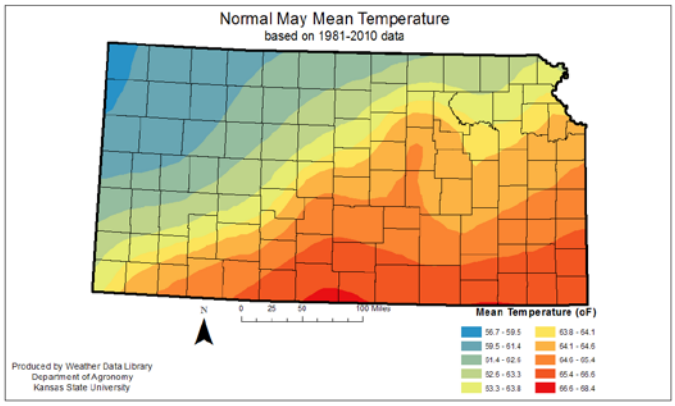
Future Outlook

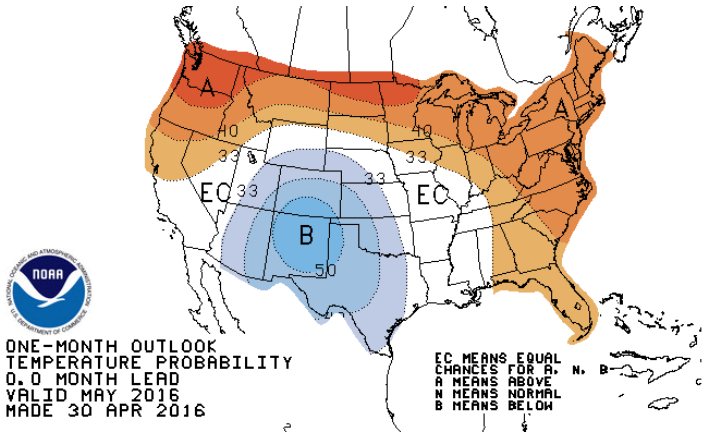
The May outlook favors increased chances of wetter than normal conditions state-wide. The temperature outlook is neutral, with equal chances of above or below normal temperatures.

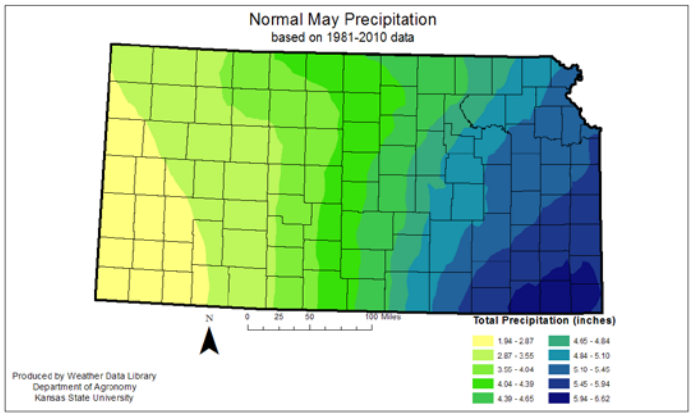
The Drought Outlooks for the month of May and through the end of July are provided below. Individual temperature and precipitation outlooks are also provided.

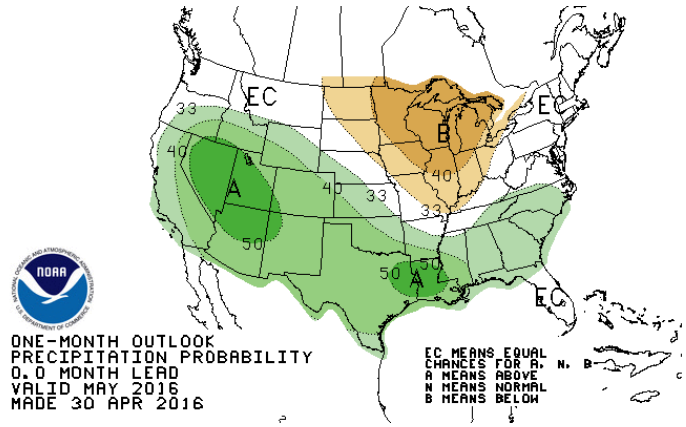




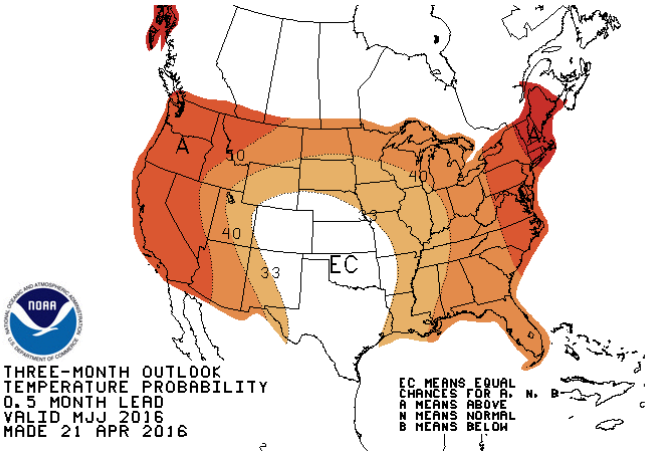








The spring-early summer outlook favors normal temperatures and above normal precipitation May through July.



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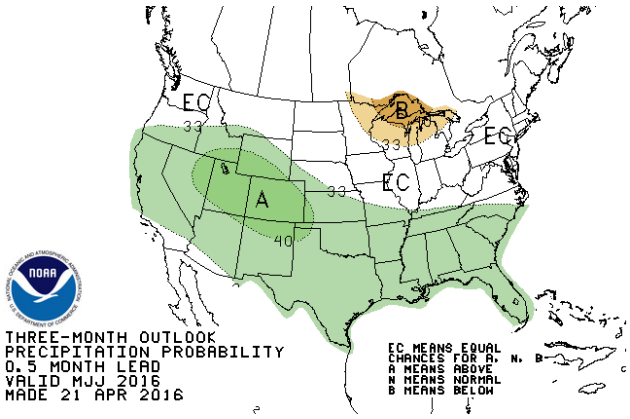
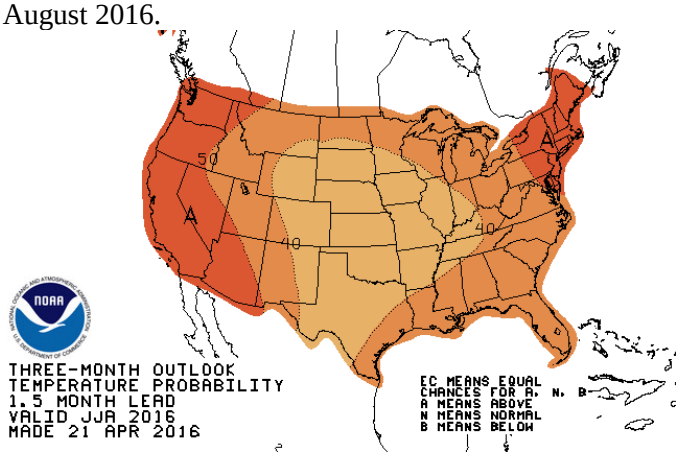
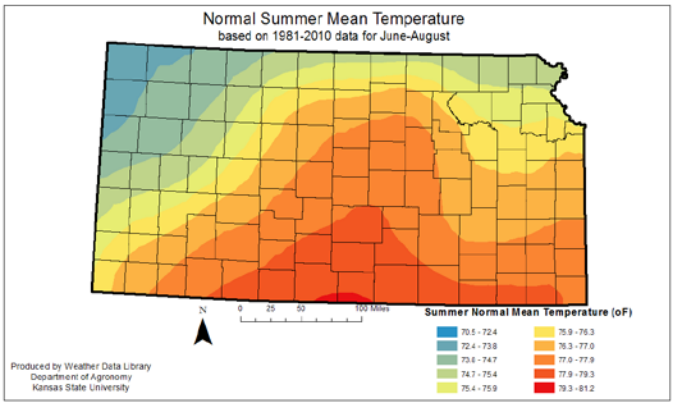
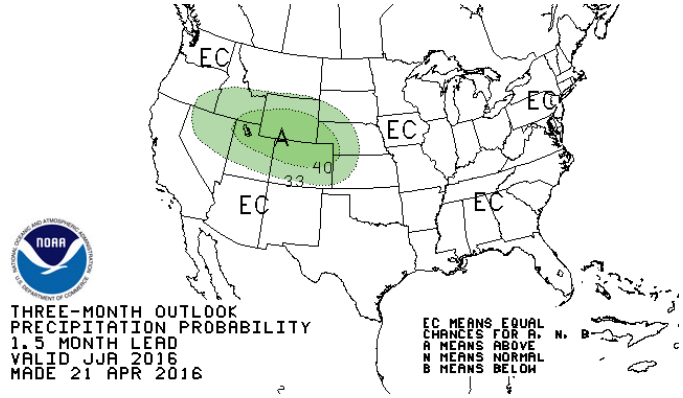
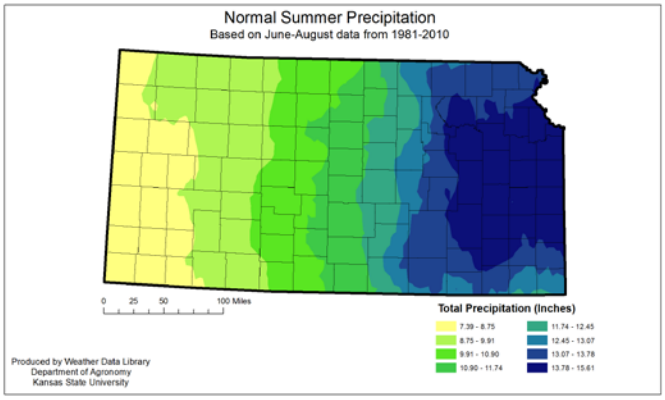


The summer (three-month) outlook favors above normal temperatures and above normal precipitation for June through August 2016.









Additional outlooks for additional 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. Evaluation of experience from this past year and update those plans to make sure they are prepared to address water supply needs should the drought not continue to ease.

Known issues:
Stage II water restrictions are in place for the City of **Russell,** Russell County water customers as of May 9, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on most outdoor watering, vehicle washing, filling of residential swimming pools, and washing exterior of buildings. It also requires industrial users to reduce use.

Stage III water restrictions have been in place for the City of **Victoria**, Ellis County since January 2014. No outdoor watering is allowed. (May 9, 2016, http://victoriaks.com/utilities.htm .)

The City of **Natoma** in Osborne County reported to KDHE declining well water levels causing inability to pump two of three wells. A water warning (conservation plan) was enacted April 14. Rains the week of April 15-21 provided some recharge to the aquifer.

Surface Water Supply Conditions
Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoir pool levels remained relatively stable and inflows were low for the majority of April. Late month precipitation events quickly brought all reservoirs into flood operations and the Kansas River ended the month well above historical median flow values.

Marais des Cygnes basin: Streamflow was sufficient but moderate to low throughout the majority of April. The late April precipitation instigated flood pool operations at Melvern and Pomona reservoirs. Hillsdale Reservoir did receive a healthy portion of inflow but only enough to recover to normal pool from the lower winter target elevation. The Marais des Cygnes River did reach flood stage at La Cygne.

Cottonwood / Neosho basin: River flow throughout the basin remained at moderate levels for the majority of April. Most of eastern Kansas stream flow rose significantly in the last week of the month, particularly in the lower Neosho basin. Marion and Council Grove reservoirs experienced a moderate rise and John Redmond Reservoir was more than 12 feet into the flood pool by April 30. Minor flooding occurred in the lower system.

Verdigris basin: Moderate to high flows were experienced throughout the basin, the high flows being in the second half of April. All reservoirs were operated in the flood pools throughout the month.

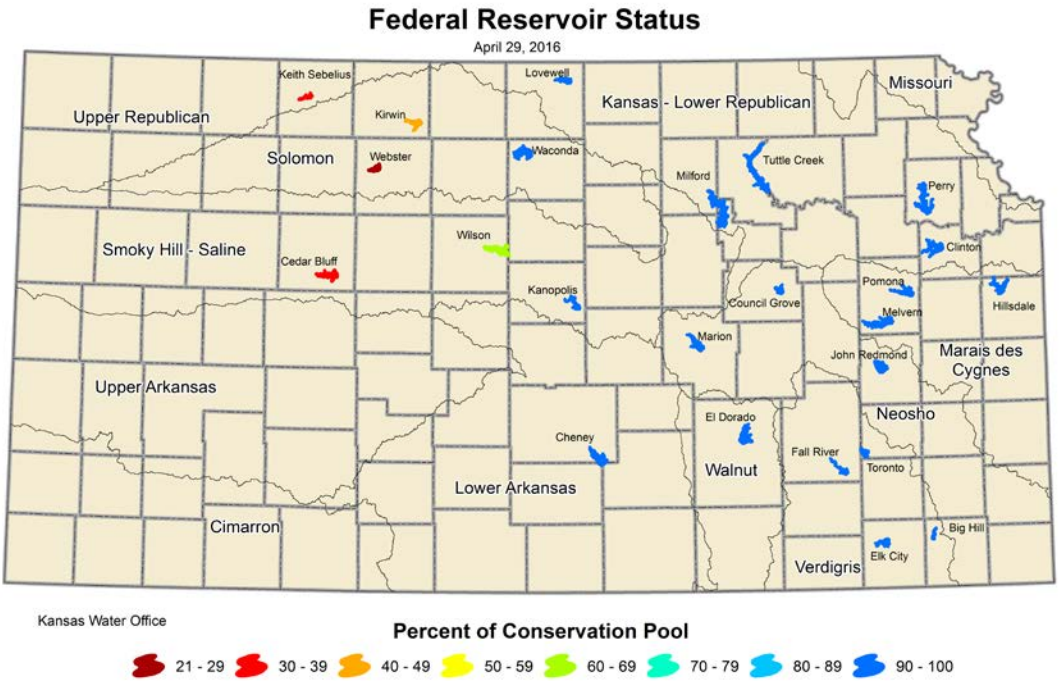
Saline basin: Elevation at Wilson Lake gained some water in storage late in the month after setting a new record low in April.

Smoky Hill basin: The Middle and Lower Smoky Hill basin received a significant rain and runoff event in mid-April. High streamflow was recorded as far upstream as Schoenchen. Significant recharge to alluvial aquifer occurred as well. Kanopolis Reservoir levels increased to the summer target elevation, almost 5 feet above the conservation pool elevation. Discharge continues through the uncontrolled notch spillway. Cedar Bluff Reservoir experienced some inflow and increased about a foot in elevation.

Harmful Blue-Green Algal Blooms (lake water safety)
KDHE has issued two levels of public health protection notifications for blue-green algae (BGA) Blooms: a Public Health Watch and Public Health Warning. November 17, 2015 the sampling season closed. Two lakes remain on the warning list until the 2016 sampling season (April 1-Oct 31), Hiawatha City Lake, Brown County; and Plainville Township Lake, Rooks County.

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.

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool. Wilson Lake is also low.



Kansas Federal Reservoir Conservation Pool Levels

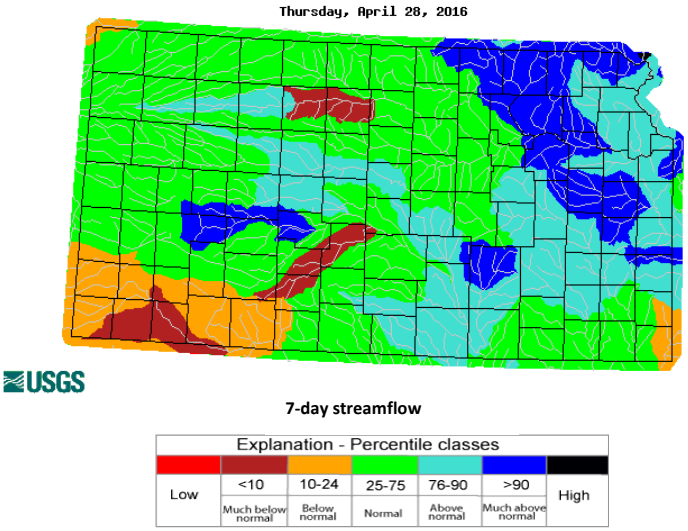
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**04/29/2016 06:00 AM**		
Norton[1]	2304.3	2289.09	-15.21	31.1
Harlan County, NE	1945.73	1938.96	-6.77	73.4
Lovewell[1]	1582.6	1584.60	2.00	100.0
Milford[1]	1144.4	1144.17	-0.23	99.1
Cedar Bluff	2144	2119.83	-24.17	33.2
Kanopolis[1]	1463	1465.68	2.68	100.0
Wilson[1]	1516	1505.96	-10.04	66.7
Webster[1]	1892.5	1871.94	-20.51	27.1
Kirwin[1]	1729.3	1714.67	-14.58	40.7
Waconda[1]	1455.6	1454.64	-0.96	94.5
Tuttle Creek[1]	1075	1081.56	6.56	100.0
Perry[1]	891.5	897.46	5.96	100.0
Clinton[1]	875.5	882.24	6.74	100.0
Melvern[1]	1036	1041.41	5.41	100.0
Pomona[1]	974	986.18	12.18	100.0
Hillsdale[1]	917	917.08	0.08	100.0
Arkansas River Basin		**04/29/2016 08:00 AM**		
Cheney	1421.6	1421.63	0.03	100.0
El Dorado	1339	1339.56	0.56	100.0
Toronto[1]	901.5	910.51	9.01	100.0
Fall River[1]	948.5	953.72	5.22	100.0
Elk City[1]	796	796.99	0.99	100.0
Big Hill	858	858.25	0.25	100.0
Council Grove[1]	1274	1275.54	1.54	100.0
Marion[1]	1350.5	1350.69	0.19	100.0
John Redmond[1]	1039	1051.02	10.02	100.0

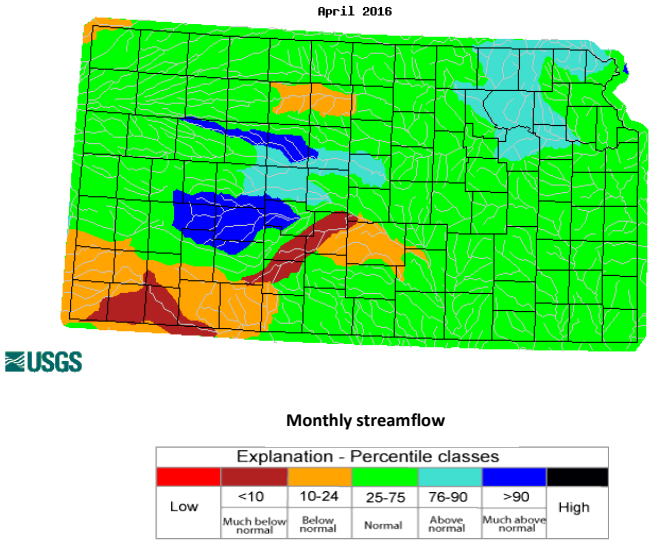
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the **February** streamflow compared to historical is shown on the map below, right. Short term streamflow is significantly lower than historical average in many area of western Kansas.

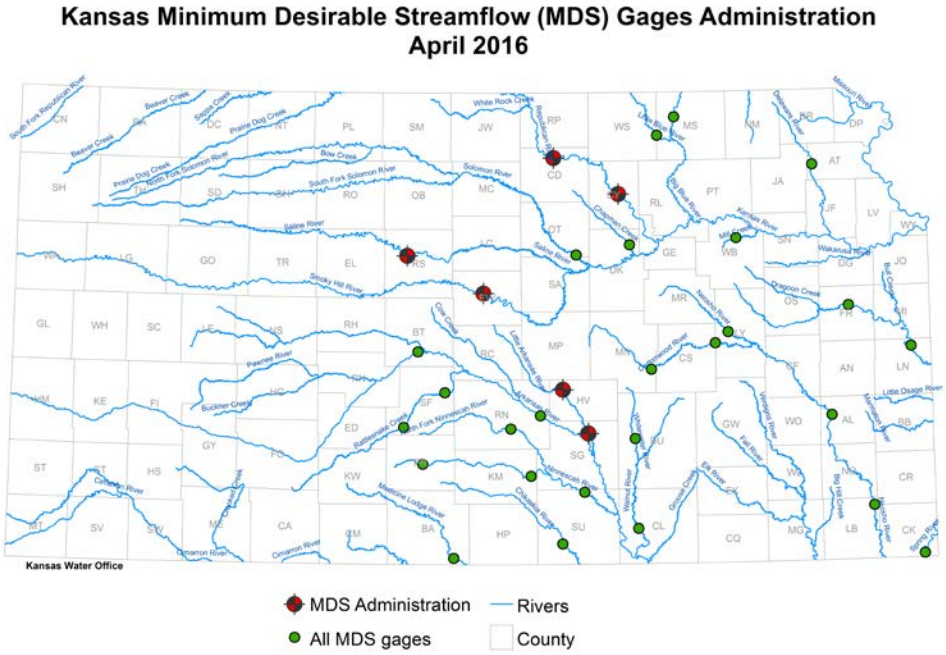




In general, a streamflow which is greater than the 75 percentile is considered *above normal*, a streamflow which is between 25 and 75 percentiles is considered *normal* and a streamflow which is less than the 25 percentile is considered *below normal*. Color codes are for basins with streamflow averages less than 25 percent of historic values.

Water Right Administration/Minimum Desirable Streamflow (MDS)

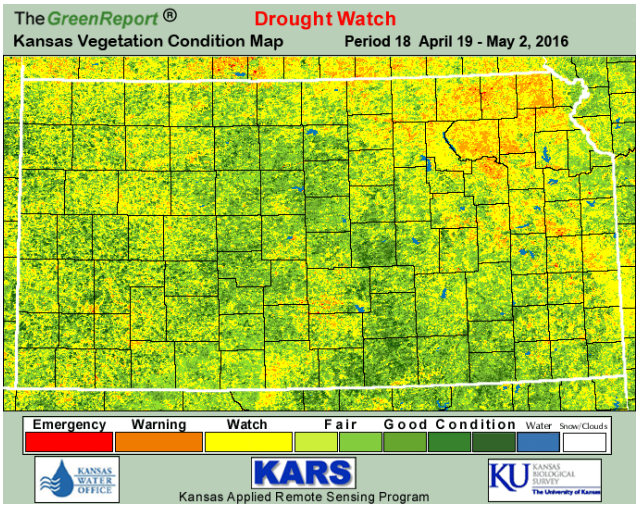
Minimum Desirable Streamflow (MDS) is being administered in Kansas. MDS administration requires water rights junior to MDS, usually with priority dates after April 12, 1984, to stop diverting water. Administration is ordered when streamflow drops below MDS for more than seven days.

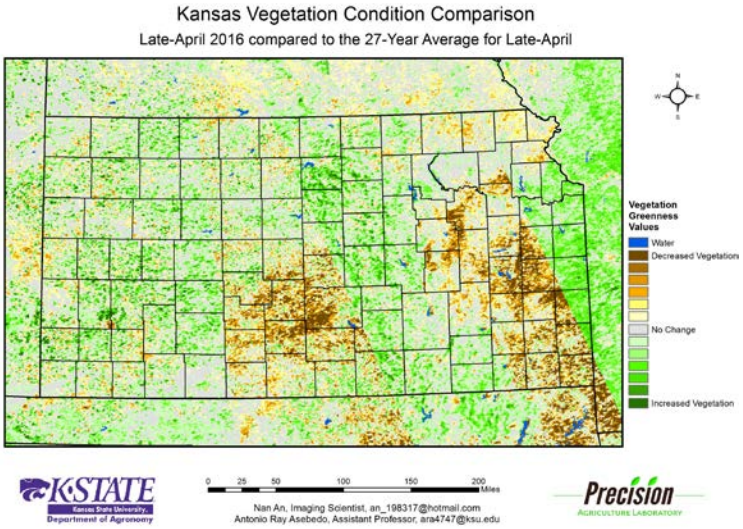


Streamflows as of April 28, 2016	cubic feet per second ((cfs)			
Gaging Station	**Current Flow**	**Apr MDS**	**May MDS**	**Comment**
Republican River at Concordia	1,720	150	150	Admin began April 19, 2016; 71 files.
Republican River at Clay Center	692	250	250	Admin began April 19, 2016; 147 files.
Smoky Hill River at Ellsworth	131	30	35	Admin began June 26, 2015; 3 files.
Saline River near Russell	56	15	15	Admin began September 5, 2015; 10 files.
Little Arkansas River at Alta Mills	20	8	8	Admin begins March 18, 2016; 8 files. Admin ceased April 15, 2016.
Little Arkansas River at Valley Center	118	20	20	Admin begins March 18, 2016; 21 files. Admin ceased April 15, 2016.

Soil, Crop and Vegetation
Kansas Vegetative Conditions

The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Recent moisture has improved conditions in most of the state. The northeast area of Kansas remains dry.

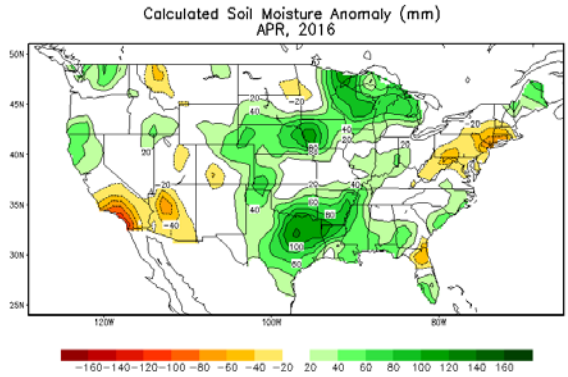




Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report (on left) for late April from K-State's Precision Agriculture Laboratory shows that areas of below average photosynthetic activity impact parts of south central and eastern Kansas.

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. http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml



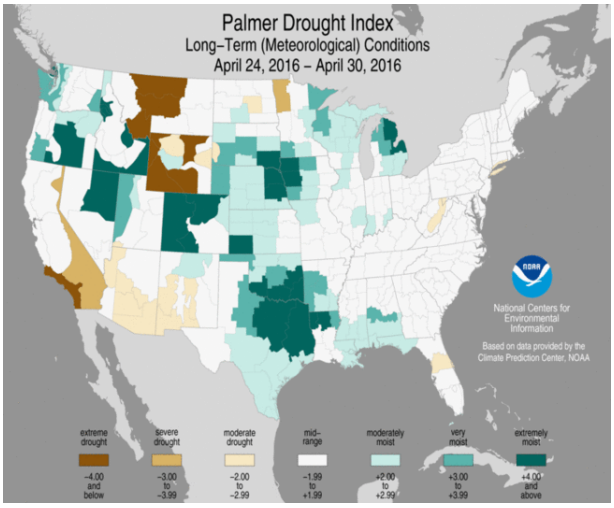
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The

Kansas report released May 1, 2016 reported topsoil moisture rated 3 percent very short, 8 short, 72 adequate, and 17 surplus. Subsoil moisture rated 4 percent very short, 13 short, 77 adequate, and 6 surplus.

Field Crops Report: Winter wheat condition rated 2 percent very poor, 8 poor, 38 fair, 46 good, and 6 excellent.

Livestock Report: Pasture and range conditions rated 1 percent very poor, 4 poor, 30 fair, 59 good, and 6 excellent
Stock water supplies were 3 percent very short, 8 short, 84 adequate, and 5 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

Whenever the Governor or the U.S. Department of Agriculture declares all or any portion of the State is in a state of drought, certain conditions apply to motor carriers transporting hay or related animal forage feedstuffs to the geographic area specified in the drought declaration. Those certain conditions are as follows:

- Motor carrier registration and fuel tax permits are temporarily suspended;
- Licensing, certification, and permitting rules and regulations of the SCC are temporarily suspended;
- These motor carriers may not operate during the period beginning 30 minutes after sunset and ending 30 minutes before sunrise and are required to comply with flags, signs, and lighting requirements applicable to over width vehicles;
- Motor carriers cannot operate during inclement weather;
- Oversize and overweight loads cannot be transported when visibility is less than one-half mile or when conditions of moderate to heavy rain, sleet, snow, fog, or smoke exist, or when highway surfaces are slippery due to ice or packed snow; and
- Motor carriers cannot transport a load of more than 12 feet in width and 14 feet, six inches, in height.

The provisions remain in effect until the drought declaration is terminated.

Fire
Multiple wildfires were reported the first week of April, most occurring on April 5. An estimated 400-500 acres burned in Riley County destroying one mobile home and causing evacuation of 100-150 residents in the mobile home park. Approximately 6,000 Geary county acres burned. In Wabaunsee County approximately 600 acres were burned, destroying one house and outbuilding. In Morton County a large grass fire burned approximately 3,800 acres and destroyed two homes and at least multiple outbuildings. Seven wildfires were reported in Pottawatomie County.

General Federal Disaster Assistance
USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of the historic drought. More information on these programs may be found at:
http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

The USDA Food and Nutrition Service provide food assistance to those in need in areas affected by a disaster. This Federal assistance is in addition to that provided by State and local governments. USDA provides disaster food assistance in three ways: provides foods to State agencies for distribution to shelters and other mass feeding sites; provides food to State agencies for distribution directly to households in need in certain limited situations; and authorizes State agencies to issue Disaster Supplemental Nutrition Assistance Program (D-SNAP) benefits.

Drought related program information is found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE&navtype=RT&parentnav=RURAL_DEVELOPMENT.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock

The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. More detailed information on eligibility and sign up is available on the FSA fact sheet found at: http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at: http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators. LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers

Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Conservation Reserve Program (CRP): CRP acres may be used for haying or grazing under emergency conditions. CRP is a voluntary program that provides producers with annual rental payments on their land in exchange for planting resource-conserving crops on cropland to help prevent erosion, provide wildlife habitat and improve the environment. CRP acres can already be used for emergency haying and grazing during natural disasters to provide much needed feed to livestock. Given the widespread nature of this drought, forage for livestock is already substantially reduced. Haying and grazing will only be allowed following the local birds' primary nesting seasons. Especially sensitive lands, such as wetlands, stream buffers and rare habitats will not normally eligible.

Environmental Quality Incentives Program (EQIP): EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to address natural resource concerns on their agricultural and forest land. This program provides assistance to affected farmers and ranchers by allowing them to modify current EQIP contracts to allow for prescribed grazing, livestock watering facilities, water conservation and other conservation activities to address drought conditions. Where conservation activities have failed because of drought, NRCS will look for opportunities to work with farmers and ranchers to re-apply those activities. In the short term, funding will be targeted towards hardest hit drought areas.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

April 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	4.65	3.19	318%	49.3	1.4	81 (23)	18 (1)
Dodge City	8.08	6.26	444%	57.7	0.8	89 (5)	26 (2)
Garden City	4.57	2.82	261%	54.1	1.1	85 (23,5)	23 (2)
Goodland	3.99	2.40	251%	50.2	1.0	81 (23)	25 (1)
Guymon, OK	5.26	3.75	348%	57.2	2.0	89 (5)	27 (2)
Hill City	6.72	4.60	317%	54.1	2.5	84 (23)	27 (1)
Lamar, CO	1.29	-0.03	98%	52.5	0.3	87 (23)	16 (1)
McCook, NE	6.10	3.79	264%	51.3	1.8	80 (23)	27 (2)
Springfield, CO	0.40	-0.87	31%	50.6	-1.0	84 (5)	18 (1)
Central							
Concordia	1.90	-0.55	78%	56.2	3.1	81 (3)	29 (9)
Hebron, NE	4.39	1.60	157%	54.6	3.6	82 (23,3)	27 (12, 1)
Medicine Lodge	4.94	2.51	203%	59.4	3.3	89 (10,5)	25 (2)
Ponca City, OK	3.83	0.39	111%	60.7	2.2	89 (10)	28 (2)
Salina	4.37	1.32	143%	58.5	3.3	89 (5)	27 (2,1)
Wichita (ICT)	6.23	3.64	241%	60.0	3.9	87 (5)	27 (2)
East							
Bartlesville, OK	3.56	-0.42	89%	60.2	1.4	87 (10,5)	28 (2)
Chanute	5.47	1.07	124%	59.7	2.9	87 (10)	26 (2)
Fall City, NE	5.70	2.52	179%	56.3	3.1	83 (3)	26 (9)
Johnson Co. Exec. Apt	4.50	0.51	113%	57.3	2.2	78 (3)	29 (2)
Joplin, MO	4.55	0.08	102%	60.3	1.9	82 (5)	29 (2)
Kansas City (MCI), MO	7.15	3.45	193%	57.1	2.3	81 (3)	29 (2)
St. Joseph, MO	6.43	2.64	170%	56.3	2.1	84 (3)	25 (9)
Topeka (TOP	6.92	3.39	196%	58.3	3.2	83 (5)	29 (2)

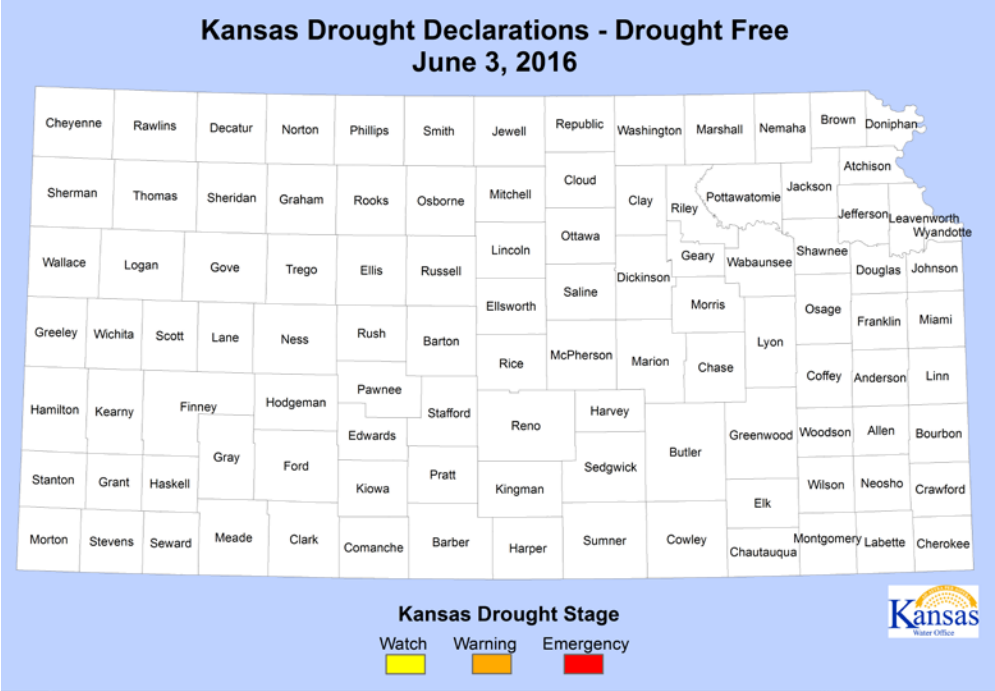
1. Airport Automated Observation Stations (NWS/FAA)
2. Departure from 1981-2010 normal value
T - Trace; M - Missing; --- no normal value from which to calculate departure or percent of normal
Source: National Weather Service F-6 Climate Summaries

KANSAS CLIMATE and DROUGHT UPDATE – May 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

- **June 3, 2016 Governor's Executive Order (EO) 16-02, rescinded EO15-04 removing the drought watch from 33 counties.**



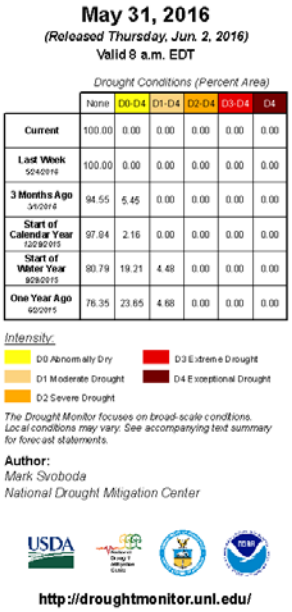
- No Kansas counties are under a drought declaration for the first time since April 2011.
- The US Drought Monitor indicated a drought free Kansas beginning May 19, 2016.
- Localized minor flooding, and flash flooding occurred in May in various locations across Kansas.

Lakes and Streams

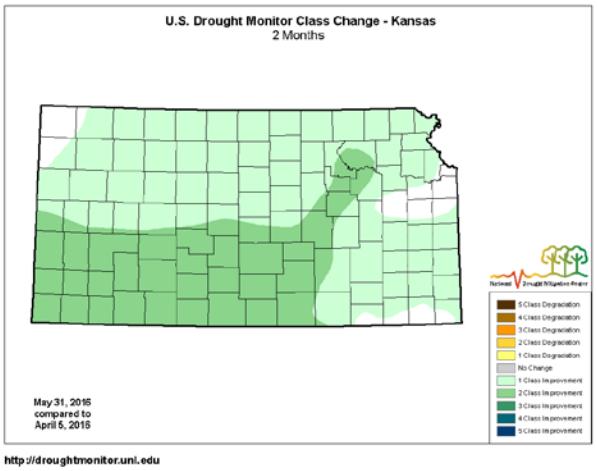
- Minimum Desirable Streamflow (MDS) Administration was in ended on the Saline, Smoky Hill, and the Republican rivers during May.
- Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool.
- Three lakes are on the public health warning list due to blue-green algae blooms: Hiawatha City Lake, Brown County; Marion Reservoir, Marion County and Plainville Township Lake, Rooks County.

General Conditions

The wet month resulted in dramatic improvements in the drought status. The end of April saw 43 percent of the state as drought free. The U.S. Drought Monitor indicated improvement in drought classification that began in late April continued into the first weeks in May. Dry conditions were removed from all Kansas on the May 17, 2016 Drought Monitor, the first time the entire state was considered drought free since April 2011. In Kansas, the Drought Monitor is one of many considerations for state drought declarations. Water resource conditions strongly influence state declared status. Corresponding to the improvements the water supply reservoirs and most streams are flowing and shallow ground water aquifers recharged.

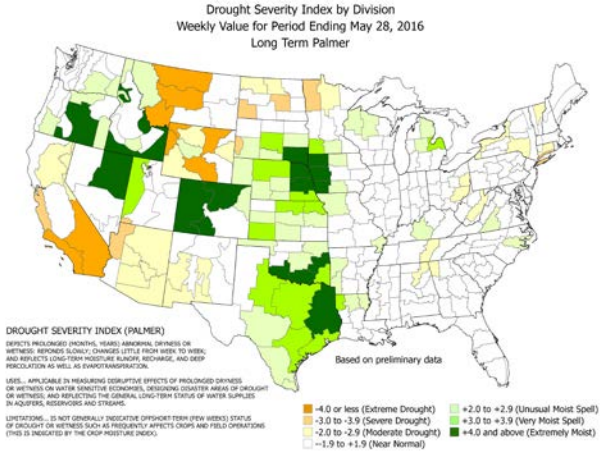


	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	100.00	0.00	0.00	0.00	0.00	0.00
Last Week 5/24/2016	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago 3/1/2016	94.55	5.45	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 6/2/2015	76.35	23.65	4.68	0.00	0.00	0.00



More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.

Palmer Drought Severity Index - The Palmer Index (PDSI) is an indicator used in the U.S. Drought Monitor. The Long term PDSI for the period ending May 28, 2016 indicates all of Kansas is near normal or moist.



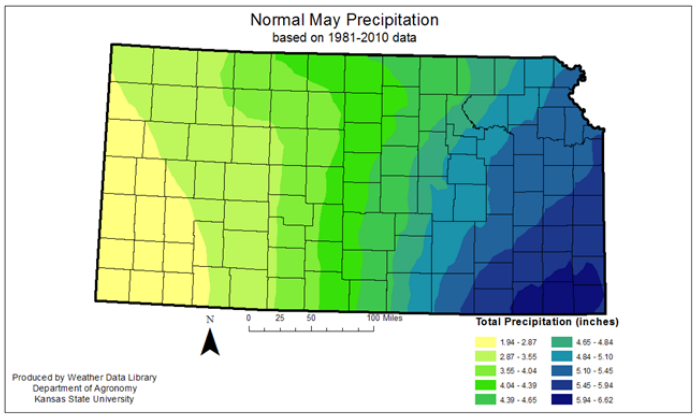
Climate Summary (Temperature and Precipitation)

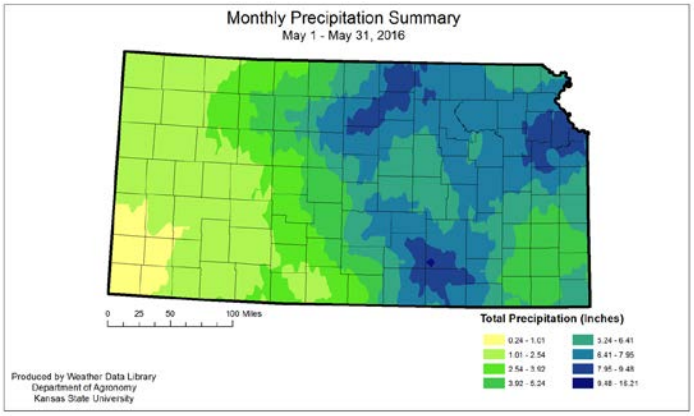
The wet conditions that ended April moved east in May. The month ended almost exactly at normal. The North Central and Northeastern climate divisions were the wettest, at 151 percent of normal for the North Central Division and 133 percent of normal for the Northeast. The Southwest Division was the driest, averaging just 1.22 inches or 44 percent of normal. Despite that dryness, the year-to-date average for the division is still at 113 percent of normal. May ranks as the 33rd wettest May on record. The greatest monthly total was 16.21 inches at Rock, Cowley County (NWS). The greatest total for CoCoRaHS stations was 11.98 inches at Hunter, Mitchell County. There were 92 new daily record precipitation totals. Twenty-one of those were record high amounts for May. None of these set monthly records.

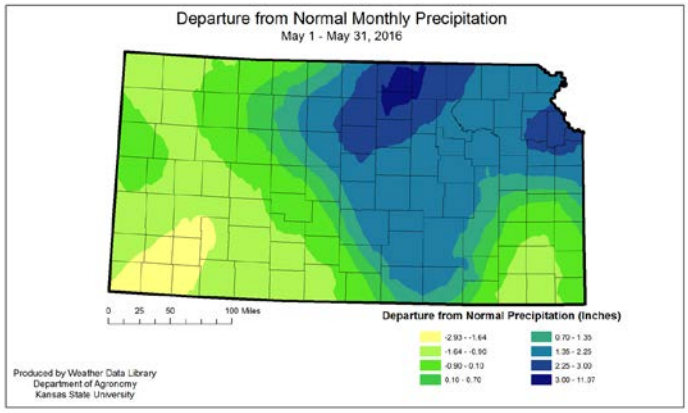
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

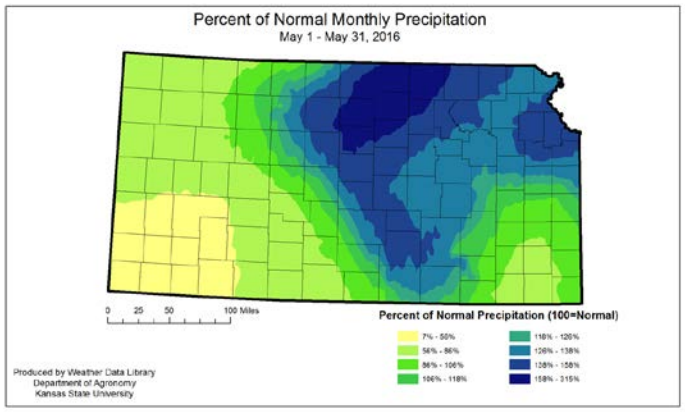
Kansas Climate Division Precipitation Summary (inches)

Climate Division	May 1-31, 2016			January 1– May 31, 2016			April 1 – May 31, 2016			September 1–May 31, 2016		
	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	2.43	-1.05	69	9.31	1.37	117	7.92	2.33	141	14.70	2.29	118
West Central	1.80	-1.25	59	7.99	0.46	105	6.65	1.67	134	13.32	1.31	109
Southwest	1.28	-1.49	44	7.80	0.94	113	7.43	3.00	168	15.03	3.71	131
North Central	6.32	2.22	151	12.70	2.50	123	10.91	4.26	163	19.66	2.74	115
Central	5.68	1.38	131	12.76	1.73	117	10.79	3.80	156	20.60	2.76	116
South Central	5.27	0.83	115	12.43	0.55	104	10.73	3.56	149	21.92	2.19	111
Northeast	6.52	1.70	133	14.78	2.36	118	12.50	4.39	153	25.29	3.54	116
East Central	6.19	0.99	117	13.82	0.00	99	11.34	2.55	127	24.62	0.49	100
Southeast	5.88	0.05	102	14.13	-1.74	90	11.25	1.48	116	26.35	-1.61	94
STATE	4.52	0.31	100	11.64	0.81	108	9.88	2.97	145	20.12	1.90	112

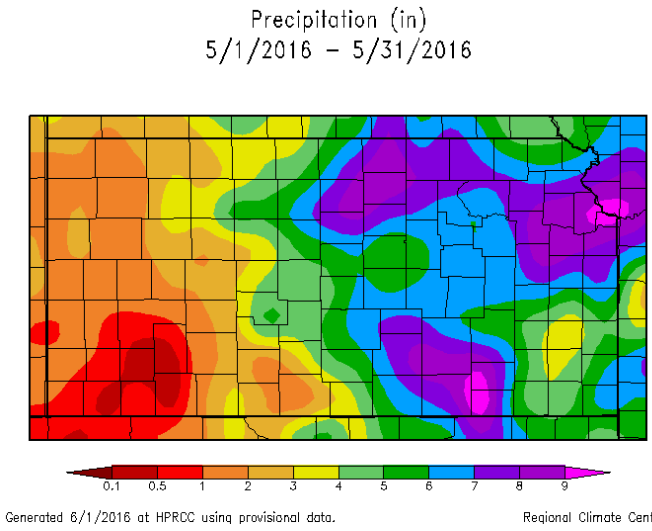


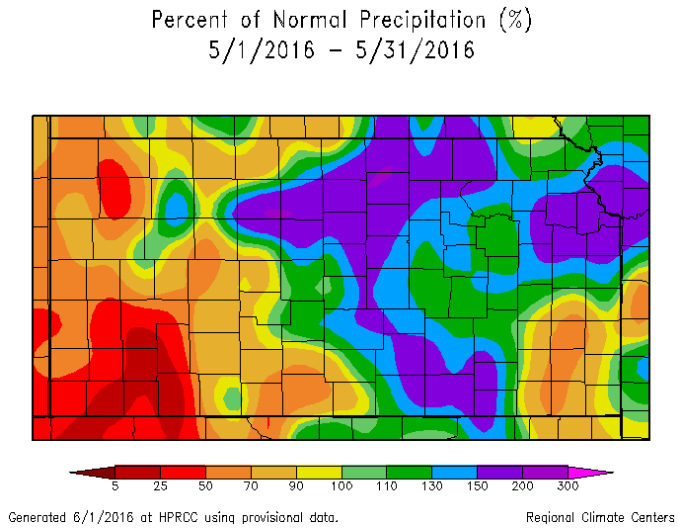






Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .



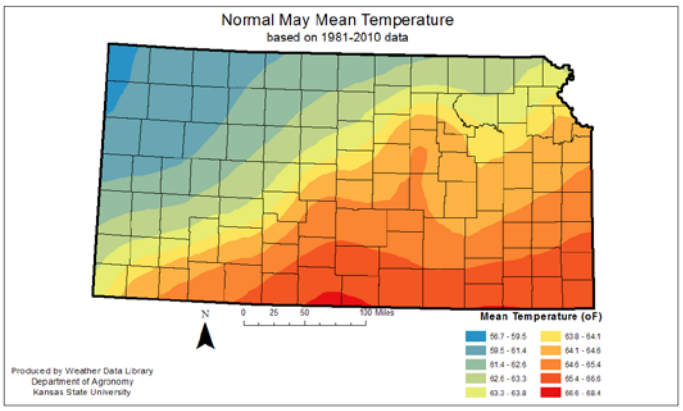


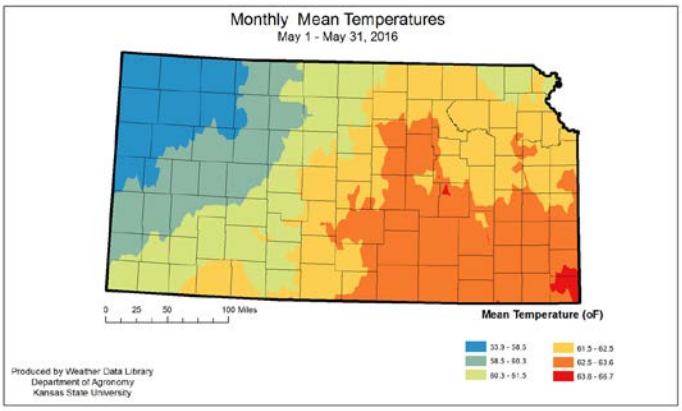
Spring ended on a cool note across the state. The mean temperature for the state was 61.3^{o} F, which was 2.5 degrees cooler than normal. While on the cool side of the distribution, it was only the 27th coolest since 1895. The Southeast Division had the largest departure with a mean temperature 62.6^{o} F, or -3.1 degrees cooler than average. The North Central Division was closest to normal, with a mean temperature of 61.7^{o} F or -1.8 degrees cooler than normal. There were no daily record high temperatures, and only two record warm low temperatures. On the cold side of the record, there were 77 record low maximum temperatures and 5 record low minimum temperatures during the month. The warmest high temperature was 94° F recorded at Medicine Lodge (Barber County) on the 27th. The coldest temperature was 28° F

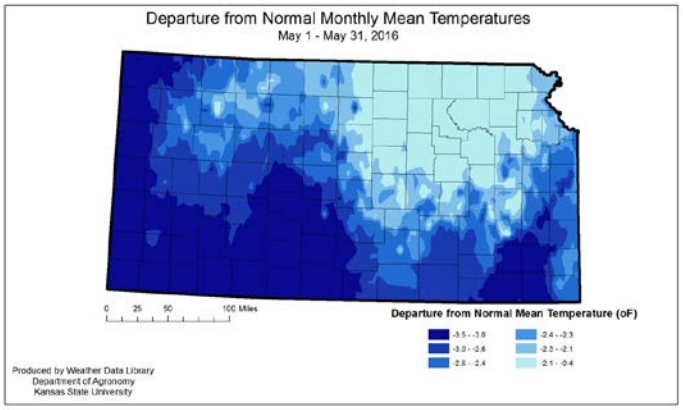
recorded at Sharon Springs (Wallace County) on the 2nd. The low temperatures so late in the season brought concerns of damage to vegetation that moved out of dormancy early. This was especially true for winter wheat.

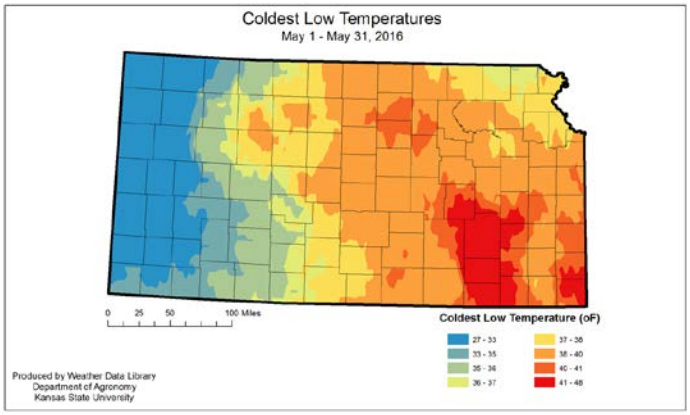
Temperature summary by the Kansas State University Weather Library for the month is provided in the table and maps below. The table below summarizes temperatures by Kansas climate division and various time periods. Slight differences in the average or extreme values presented may occur due to preliminary data.

Climate Division	Kansas Climate Division Temperature Summary (°F)							
	May 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	71.1	45.3	58.2	-2.4	90	23	29	3
West Central	72.1	45.9	59.0	-2.6	92	22	28	2
Southwest	74.9	47.5	61.2	-2.9	94	26	29	2
North Central	73.5	50.0	61.7	-1.8	90	30	36	14
Central	73.9	50.5	62.2	-2.4	89	10	36	2
South Central	74.6	51.3	63.0	-2.7	92	26	32	14
Northeast	72.6	51.4	62.0	-2.0	88	8	35	15
East Central	72.4	51.8	62.1	-2.4	88	31	31	15
Southeast	73.0	52.3	62.6	-3.1	89	27	35	6
STATE	73.1	49.6	61.3	-2.5	94	26th	28	2nd
Data Source: KSU Weather Library								

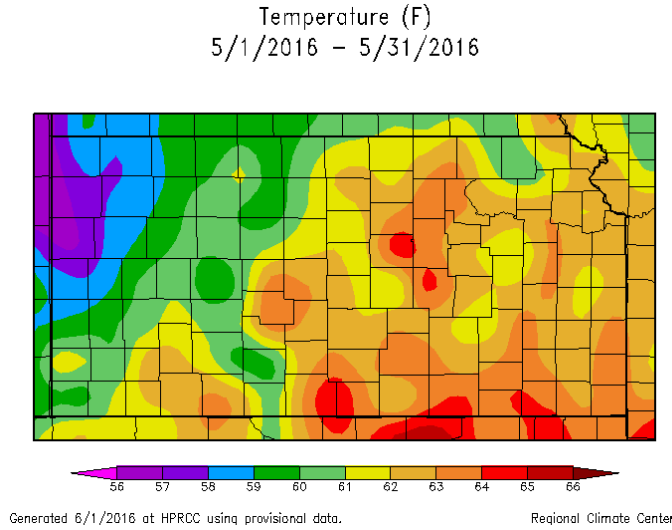


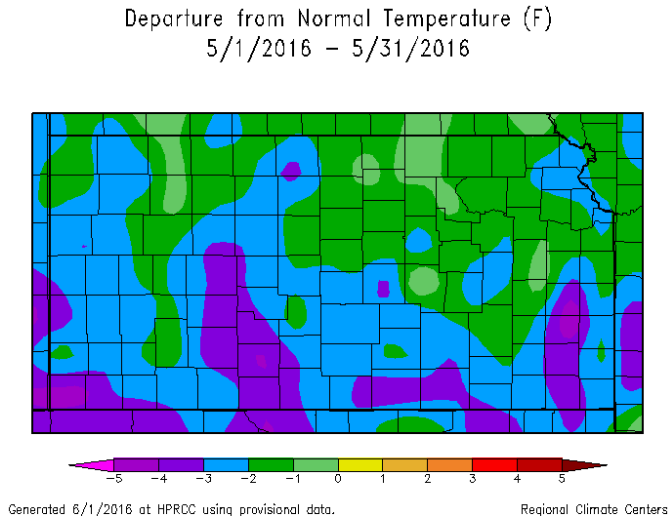






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



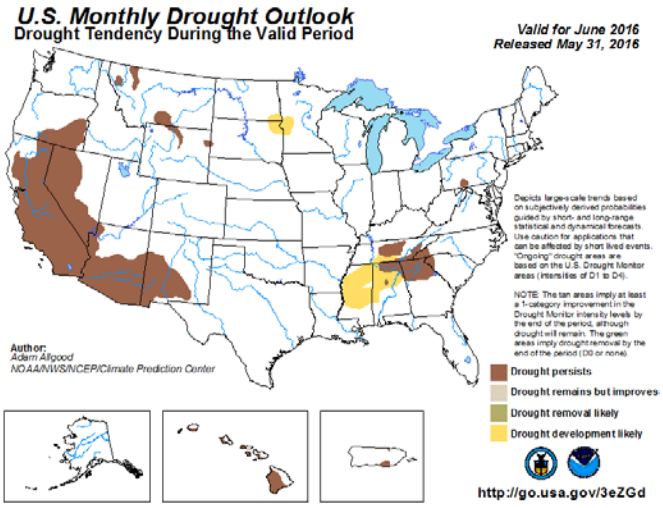


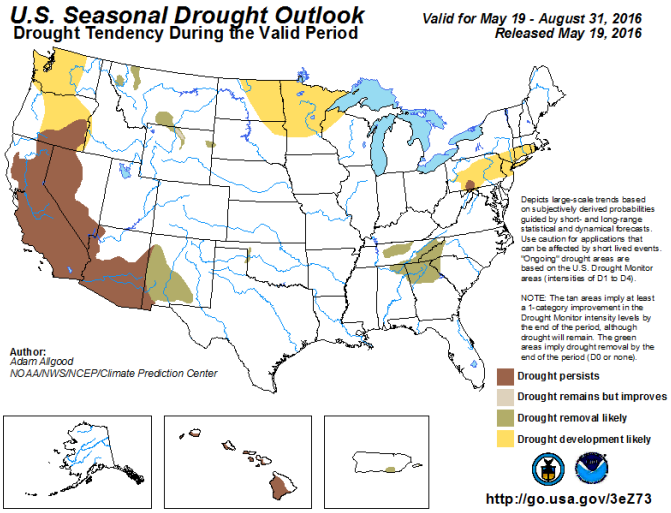
Along with the increased rainfall pattern there was an increase in severe weather reports. There were 59 tornadoes reported, as well as 104 reports of damaging wind. The most common severe weather report was hail reports. There were 223 reports of hail during the month.

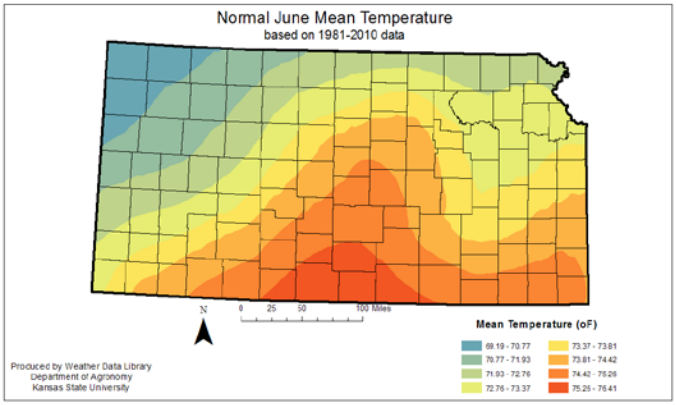
Future Outlook

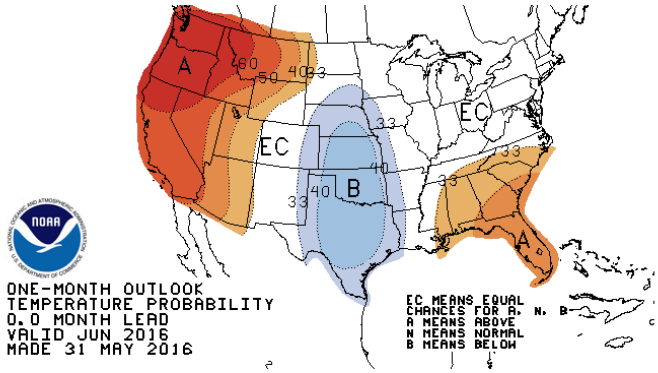
The precipitation outlook for June is for wetter than average conditions. However, the short term outlooks are for drier than average conditions for the first half of the month state-wide. If the drier conditions persist, abnormally dry conditions are likely to reappear, particularly in the western divisions.

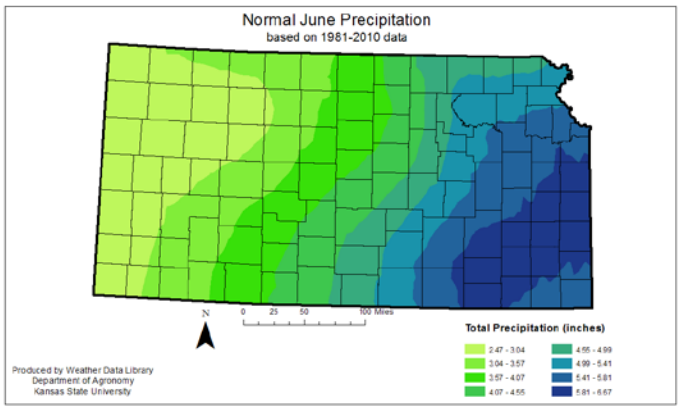
The Drought Outlooks for the month of May and through the end of July are provided below. Individual temperature and precipitation outlooks are also provided.

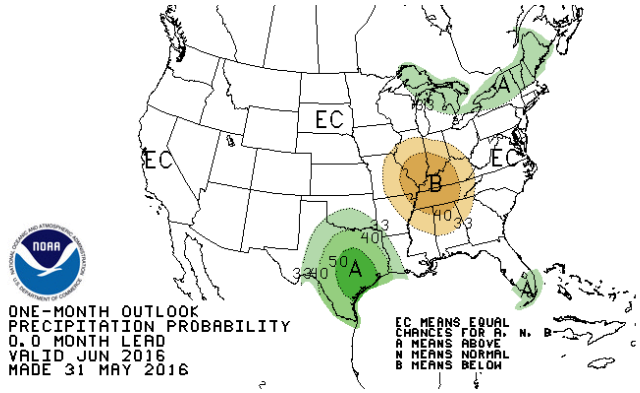




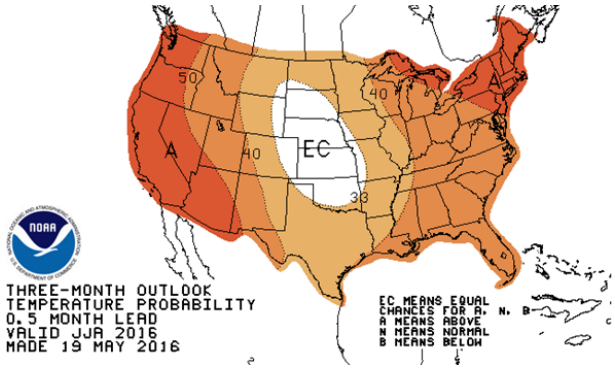


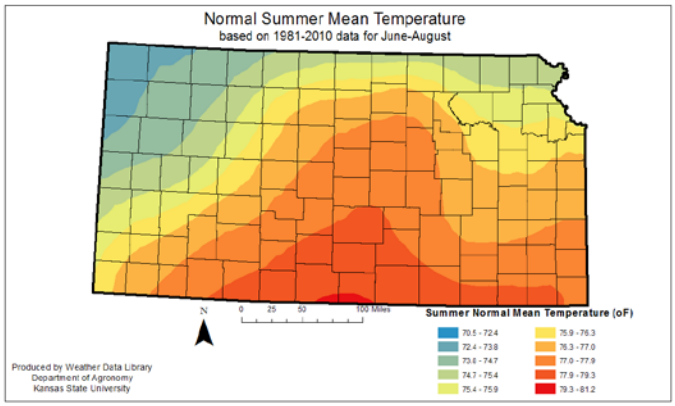


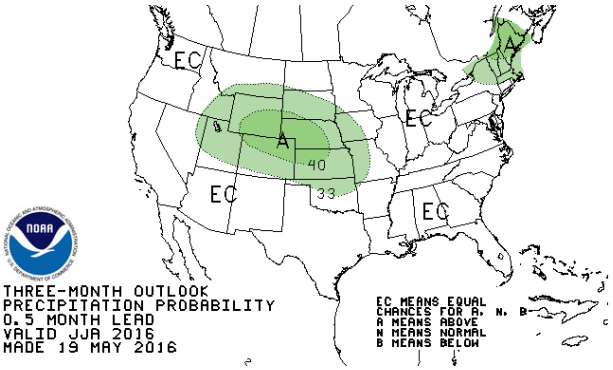


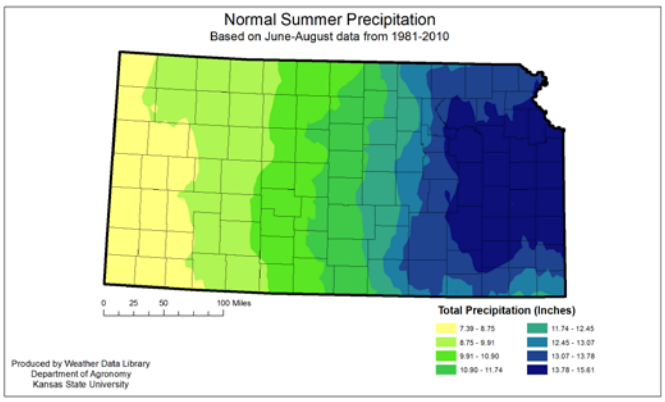


The summer (three-month) outlook favors above normal temperatures and above normal precipitation for June through August 2016.









Additional outlooks for additional 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.

Known issues:

Stage II water restrictions, under Resolution 03-16 are in place for the City of **Russell,** Russell County water customers as of June 3, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the City of **Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (June 3, 2016, http://victoriaks.com/utilities.htm .)

Surface Water Supply Conditions

Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs were all in flood pool operations throughout the month of May. Evacuation of flood storage was halted from time to time due to flooding conditions along the Missouri River. The Kansas River maintained flow well above historical median flow values and some minor lowland flooding was experienced.

Marais des Cygnes basin: Frequent precipitation events maintained elevated inflow to all basin reservoirs. Melvern, Pomona, and Hillsdale reservoirs were all in flood pool operations for the majority of May. The Marais des Cygnes River experienced high flows throughout the month, both from runoff and reservoir flood pool releases.

Cottonwood / Neosho basin: River flow throughout the basin remained well above normal levels in May. Significant portions of the flood pools at Marion, Council Grove, and John Redmond reservoirs were used during the month but only minor flooding was observed along the Upper Neosho and Cottonwood Rivers.

Verdigris basin: Moderate to high flows were experienced throughout the month of May. All reservoirs remained at flood pool elevations and no flooding was recorded along the main stem rivers.

Saline basin: Elevation at Wilson Lake gained almost 4 feet in pool elevation in the month of May, over 25 thousand acre-feet of water. The elevation is still 6 feet low but this is the most significant inflow the reservoir has received since it started to decline in 2012.

Smoky Hill basin: The Middle Smoky Hill basin maintained streamflow at a moderate level in May and the Lower system spiked with a more intense event later in the month. Kanopolis Reservoir pool level increased above the summer target elevation, almost 9 feet above the multipurpose elevation. Discharge continues through the uncontrolled notch spillway but the service gates were opened up to help evacuate storage and bring the level down to the seasonal target. Cedar Bluff Reservoir experienced some inflow and increased slightly.

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.

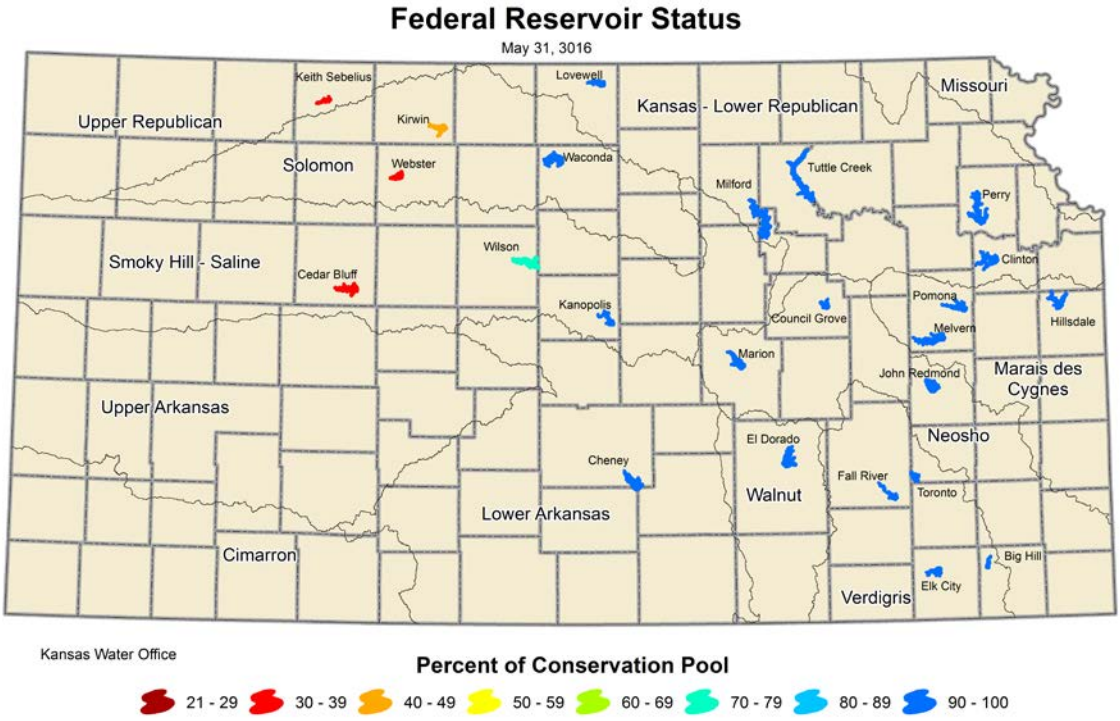
There are no lakes in a public health watch at this time.

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.

As of June 2, 2016 three lakes are on the public health warning list: Hiawatha City Lake, Brown County; Marion Reservoir, Marion County and Plainville Township Lake, Rooks County.

General Reservoir Conditions

The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool.



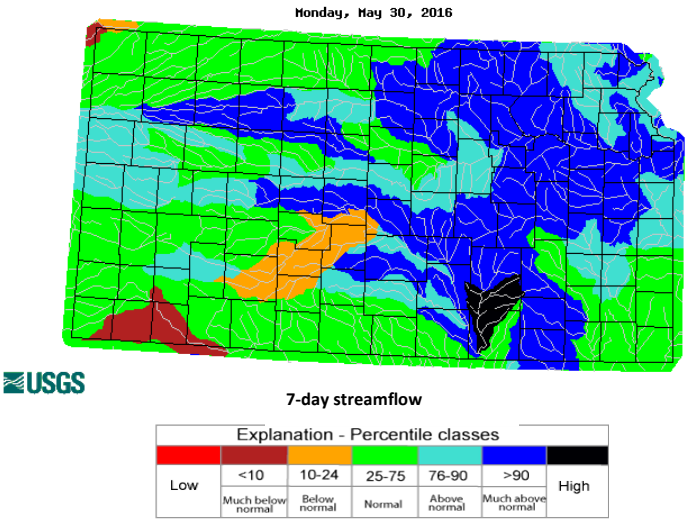
Kansas Federal Reservoir Conservation Pool Levels

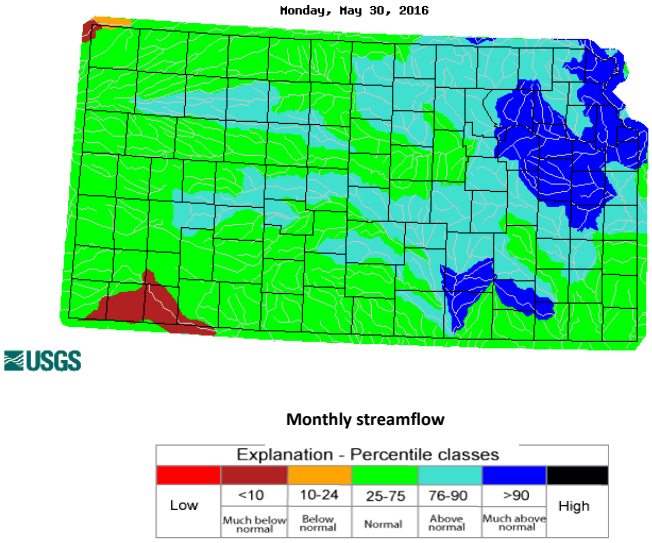
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**5/31/2016 6:00 AM**		
Norton[1]	2304.3	2289.68	-14.62	32.8
Harlan County, NE	1945.73	1940.47	-5.26	79.0
Lovewell[1]	1582.6	1585.22	2.62	100.0
Milford[1]	1144.4	1154.38	9.98	100.0
Cedar Bluff	2144	2120.30	-23.70	34.1
Kanopolis[1]	1463	1471.75	8.75	100.0
Wilson[1]	1516	1509.79	-6.21	78.5
Webster[1]	1892.5	1876.01	-16.44	37.4
Kirwin[1]	1729.3	1716.28	-12.97	45.9
Waconda[1]	1455.6	1457.98	2.38	100.0
Tuttle Creek[1]	1075	1096.09	21.09	100.0
Perry[1]	891.5	905.14	13.64	100.0
Clinton[1]	875.5	885.76	10.26	100.0
Melvern[1]	1036	1043.56	7.56	100.0
Pomona[1]	974	987.01	13.01	100.0
Hillsdale[1]	917	920.26	3.26	100.0
Arkansas River Basin		**6/01/2016 8:00 AM**		
Cheney	1421.6	1424.14	2.54	100.0
El Dorado	1339	1341.39	2.39	100.0
Toronto[1]	901.5	908.23	6.73	100.0

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
Fall River[1]	948.5	952.18	3.68	100.0
Elk City[1]	796	795.83	-0.17	99.0
Big Hill	858	858.16	0.16	100.0
Council Grove[1]	1274	1279.91	5.91	100.0
Marion[1]	1350.5	1353.31	2.81	100.0
John Redmond[1]	1039	1056.36	15.36	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.				

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the month's streamflow compared to historical is shown on the map below, right.





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.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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. **As of the end of May there is no MDS administration occuring.**

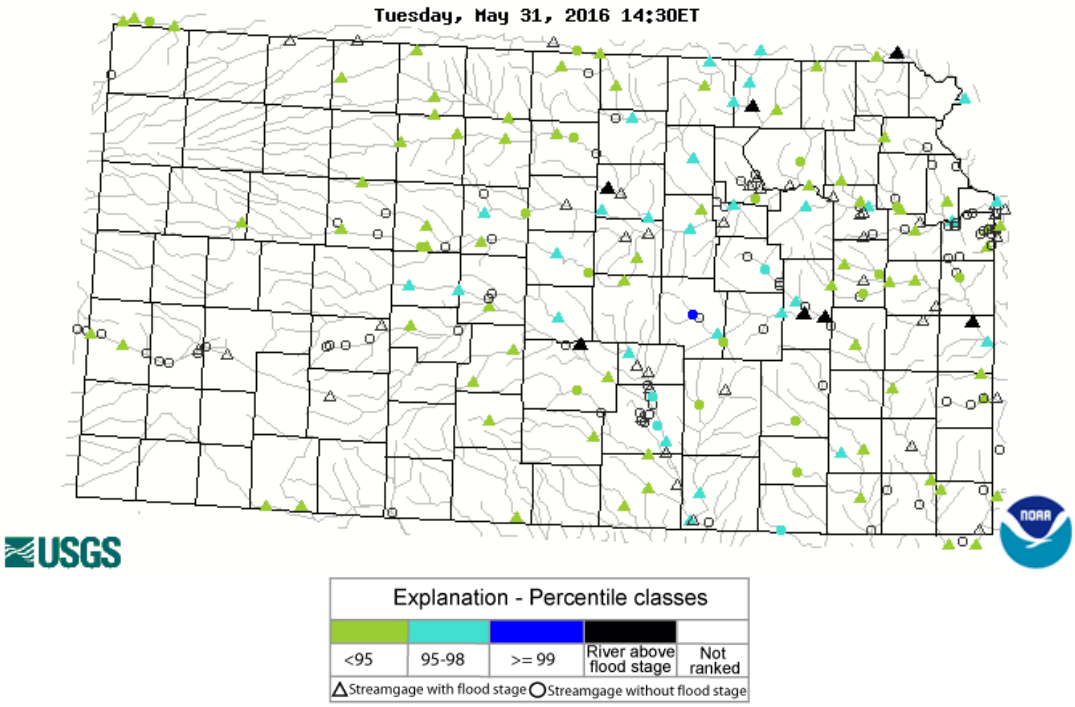
Streamflows as of May 26, 2016	**cubic feet per second ((cfs)**			
Gaging Station	**Current Flow**	**May MDS**	**June MDS**	**Comment**
Republican River at Concordia	1,760	150	150	Admin began April 19, 2016; 71 files. Admin ceased May 13, 2016.
Republican River at Clay Center	10,000	250	250	Admin began April 19, 2016; 147 files. Admin ceased May 13, 2016.
Smoky Hill River at Ellsworth	340	35	45	Admin began June 26, 2015; 3 files. Admin ceased May 3, 2016.
Saline River near Russell	1,310	15	12	Admin began Sept. 5, 2015; 10 files. Admin ceased May 3, 2016.

Flooding

The Table below summarizes recent flood conditions for May 2016 from USGS WaterWatch data. Note flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor Flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience.

USGS Station Name	Drain. Area (mi^2)	NWS flood stage (ft)	No. of days above flood stage	NWS flood class	Highest peak from 2016-05-01 to 2016-05-31				Historical Peaks	
					Date	Stage (ft)	Stream flow (date) [ft3/s]	Rank	No. of years	Max. (year) [ft3/s]
REPUBLICAN R AT CLAY CENTER, KS	24542	15	1	minor	5/11/2016	15.71	7240	76	99	195000 (1935)
SALINE R NR WAKEENEY, KS	696	13	1	minor	5/24/2016	14.83	4980	7	45	13000 (1957)
BIG BLUE R AT BLUE RAPIDS, KS	8342	26	1	minor	5/11/2016	31.3	--	--	--	--
MARAIS DES CYGNES R AT LA CYGNE,	2669	25	1	minor	5/1/2016	27.37	16900	18	30	131000 (2007)
COW C NR HUTCHINSON, KS	859.5	9.5	2	minor	5/4/2016	9.96	--	--	--	--
SLATE C AT WELLINGTON, KS	154	19	2	minor	5/17/2016	20.28	2940	36	55	28500 (1975)
LIGHTNING C NR MCCUNE, KS	197	12	2	minor	5/18/2016	13.89	3470	47	64	67500 (1993)

USGS WaterWatch provides streamflow based on USGS monitored stream gages. The map below shows the location of stream gages where the water level was at or above flood stage (black triangle) or at high flow (blue circles) on May 31. The high flow conditions are expressed as percentiles that compare the current instantaneous flow value to historical daily mean flow values for all days of the year. Flood conditions may be more extensive than shown because the NWS has not identified a flood stage at all USGS stream gaging sites. NWS flood stage is found on the NWS River Conditions Map.



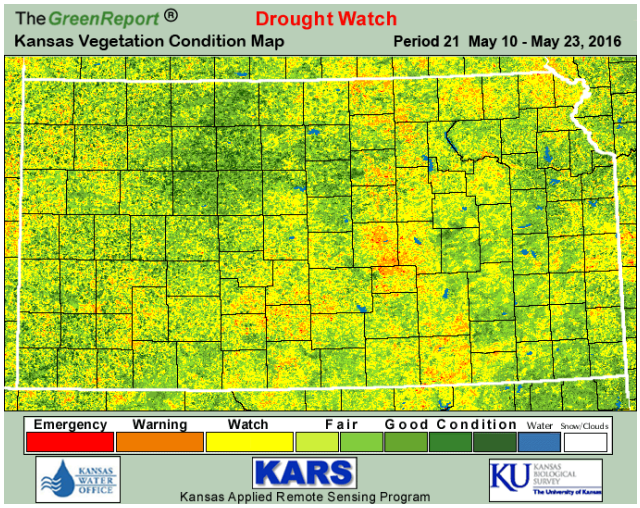
Throughout May, numerous impacts were reported from heavy rains. A few examples follow, but this is not an inclusive list.

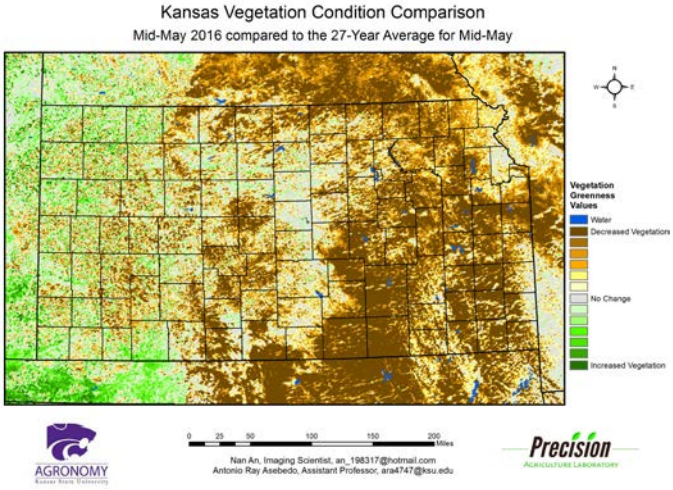
- Heavy rain and flash flooding was reported May 4 in Manhattan and other potions of central and northeast Kansas. Water in downtown Manhattan was three feet deep at times.
- May 26 road flooding was responsible road closures including: U.S. Highway 24 north of Lawrence due to standing water between Tee Pee Junction and U.S. Highway 59 in Jefferson County; K-5 in Leavenworth County over 7-Mile Creek; K-92 in Leavenworth County over Stranger Creek; and K-192 in Leavenworth County over Stranger Creek.
- Mulberry Creek approached flood stage, flooding roads and crop land in and near Salina May 27.
- Flash flood on tributary to Arkansas River near Wichita swept boy away May 28.

Soil, Crop and Vegetation

Kansas Vegetative Conditions

The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Recent moisture has improved conditions in most of the state. Some central areas remain dry. Eastern and western Kansas is in great shape.

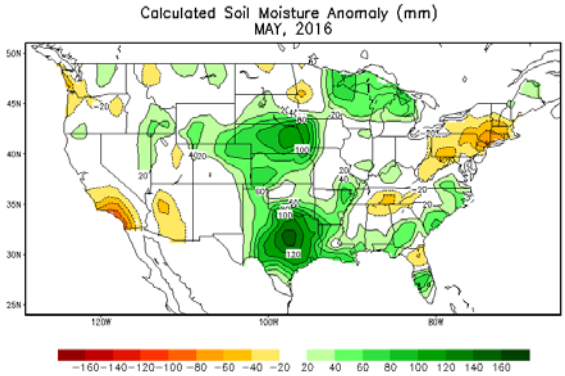




Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for May 17-May 23 from K-State's Precision Agriculture Laboratory shows that the area of above average photosynthetic activity is confined to the western divisions. The areas of lower productivity in east are due to persistent rain and cool temperatures.

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. http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml



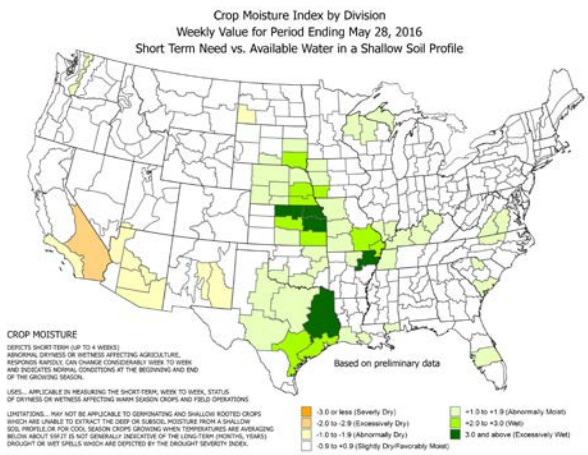
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for the week ending May 29, 2016 reported topsoil moisture 2 percent very short, 5 short, 73 adequate, and 20 surplus. Subsoil moisture rated 2 percent very short, 8 short, 79 adequate, and 11 surplus.

The southwest climate division is reported 7 percent very short for top soil and subsoil moisture and 14 percent short topsoil moisture and 17 percent short subsoil moisture.

Field Crops Report: Winter wheat condition rated 1 percent very poor, 7 poor, 32 fair, 50 good, and 10 excellent. Corn condition rated 0 percent very poor, 3 poor, 32 fair, 61 good, and 4 excellent.

Livestock Report: Pasture and range conditions rated 0 percent very poor, 2 poor, 24 fair, 61 good, and 13 excellent. Stock water supplies were 2 percent very short, 4 short, 83 adequate, and 11 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

Whenever the Governor or the U.S. Department of Agriculture declares all or any portion of the State is in a state of drought, certain conditions apply to motor carriers transporting hay or related animal forage feedstuffs to the geographic area specified in the drought declaration. Those certain conditions are as follows:

- Motor carrier registration and fuel tax permits are temporarily suspended;
- Licensing, certification, and permitting rules and regulations of the SCC are temporarily suspended;
- These motor carriers may not operate during the period beginning 30 minutes after sunset and ending 30 minutes before sunrise and are required to comply with flags, signs, and lighting requirements applicable to over width vehicles;
- Motor carriers cannot operate during inclement weather;
- Oversize and overweight loads cannot be transported when visibility is less than one-half mile or when conditions of moderate to heavy rain, sleet, snow, fog, or smoke exist, or when highway surfaces are slippery due to ice or packed snow; and
- Motor carriers cannot transport a load of more than 12 feet in width and 14 feet, six inches, in height.

The provisions remain in effect until the drought declaration is terminated.

General Federal Disaster Assistance

USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of the historic drought. More information on these programs may be found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

The USDA Food and Nutrition Service provide food assistance to those in need in areas affected by a disaster. This Federal assistance is in addition to that provided by State and local governments. USDA provides disaster food assistance in three ways: provides foods to State agencies for distribution to shelters and other mass feeding sites; provides food to State agencies for distribution directly to households in need in certain limited situations; and authorizes State agencies to issue Disaster Supplemental Nutrition Assistance Program (D-SNAP) benefits.

Drought related program information is found at:
http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE&navtype=RT&parentnav=RURAL_DEVELOPMENT.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock

The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. More detailed information on eligibility and sign up is available on the FSA fact sheet found at: http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at:
http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators. LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers

Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Conservation Reserve Program (CRP): CRP acres may be used for haying or grazing under emergency conditions. CRP is a voluntary program that provides producers with annual rental payments on their land in exchange for planting resource-conserving crops on cropland to help prevent erosion, provide wildlife habitat and improve the environment. CRP acres can already be used for emergency haying and grazing during natural disasters to provide much needed feed to livestock. Given the widespread nature of this drought, forage for livestock is already substantially reduced. Haying and grazing will only be allowed following the local birds' primary nesting seasons. Especially sensitive lands, such as wetlands, stream buffers and rare habitats will not normally eligible.

Environmental Quality Incentives Program (EQIP): EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to address natural resource concerns on their agricultural and forest land. This program provides assistance to affected farmers and ranchers by allowing them to modify current EQIP contracts to allow for prescribed grazing, livestock watering facilities, water conservation and other conservation activities to address drought conditions. Where conservation activities have failed because of drought, NRCS will look for opportunities to work with farmers and ranchers to re-apply those activities. In the short term, funding will be targeted towards hardest hit drought areas.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

May 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	1.71	-0.87	66%	57.4	-1.2	90 (21)	28 (2)
Dodge City	2.41	-0.44	85%	61.0	-3.2	85 (25)	35 (2)
Garden City	0.70	-2.18	24%	61.0	-2.3	90 (24)	32 (2)
Goodland	1.96	-0.99	66%	57.6	-1.8	88 (22)	29 (2)
Guymon, OK	1.01	-1.43	41%	62.6	-2.3	91 (24)	36 (2)
Hill City	5.13	1.35	136%	61.3	-1.2	89 (6)	37 (14,2)
Lamar, CO	0.19	-1.83	9%	59.8	-2.4	93 (21)	27 (2)
McCook, NE	2.60	-0.53	83%	59.2	-0.4	85 (23,22)	32 (2)
Springfield, CO	0.68	-1.68	29%	57.5	-3.8	86 (21)	29 (2)
Central							
Concordia	8.26	4.10	199%	62.0	-1.1	85 (29)	39 (3)
Hebron, NE	7.01	2.21	146%	61.5	-0.2	85 (29,7)	37 (14,3)
Medicine Lodge	2.28	-1.02	69%	64.6	-2.4	94 (25)	37 (3)
Ponca City, OK	5.80	0.99	121%	66.2	-1.4	90 (25)	39 (3)
Salina	5.51	0.76	116%	64.4	-0.9	88 (29,25)	41 (15,3)
Wichita (ICT)	7.06	2.49	154%	64.8	-1.2	90 (25)	41 (3)
East							
Bartlesville, OK	7.01	1.69	132%	64.5	-3.2	87 (29,25)	38 (3)
Chanute	3.83	-1.97	66%	63.6	-2.3	86 (26)	38 (3)
Fall City, NE	4.81	0.23	105%	63.4	-0.4	87 (29)	37 (15)
Johnson Co. Exec. Apt	7.56	2.13	139%	62.0	-2.7	84 (7)	40 (15)
Joplin, MO	6.31	0.60	111%	63.7	-3.3	88 (26)	39 (3)
Kansas City (MCI), MO	9.50	4.27	182%	62.7	-1.8	86 (30)	39 (15)
St. Joseph, MO	5.92	0.50	109%	62.7	-1.7	87 (30,29)	37 (15)
Topeka (TOP	8.82	3.91	180%	63.5	-1.5	88 (7)	39 (3)

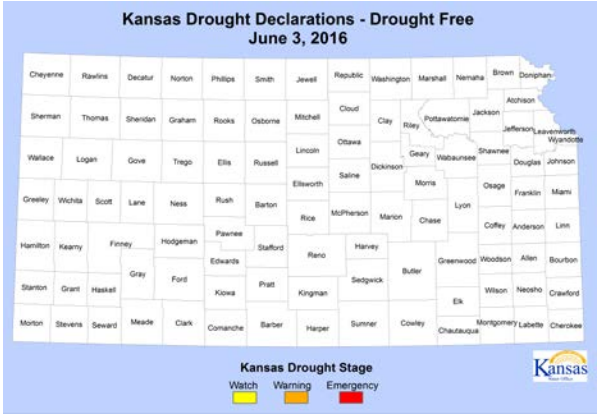
1. Airport Automated Observation Stations (NWS/FAA)
2. Departure from 1981-2010 normal value
T - Trace; M - Missing; --- no normal value from which to calculate departure or percent of normal
Source: National Weather Service F-6 Climate Summaries

KANSAS CLIMATE and DROUGHT UPDATE – June 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

- **June 3, 2016 Governor's Executive Order (EO) 16-02, rescinded EO15-04 removing the drought watch from 33 counties.**
- The US Drought Monitor indicated dry conditions developed at the end of June for eastern Kansas.

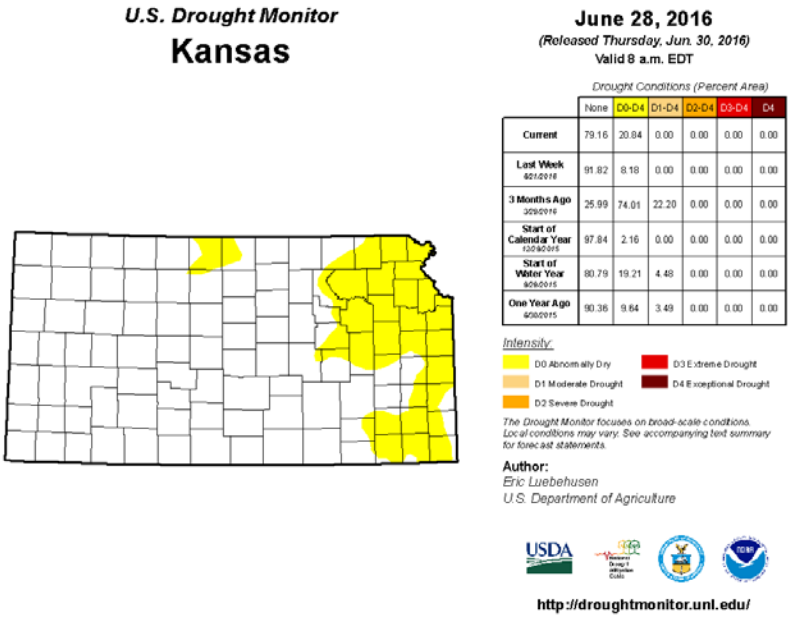


Lakes and Streams

- Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain below conservation pool.
- Lakes on the public health warning list due to blue-green algae blooms: Central Park Lake, Shawnee County; Lake Afton, Sedgwick County; Marion Reservoir, Marion County; and Milford Reservoir Zones A, B & C Clay, Dickinson and Geary County.
- Lakes on public health watch list due to blue-green algae blooms: Cheney Lake, Reno County; Marion County State Fishing Lake, Marion County; and McLaughlin Lake Sedgwick County.

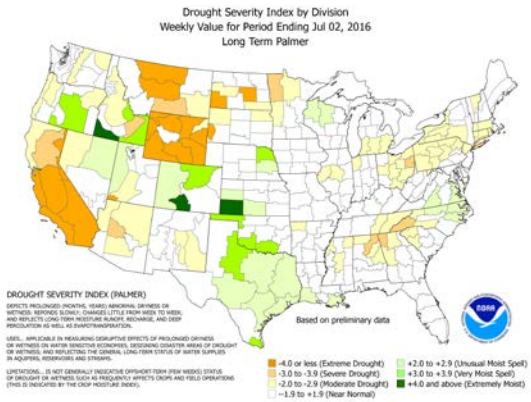
General Conditions

More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	79.16	20.84	0.00	0.00	0.00	0.00
Last Week 6/21/2016	91.82	8.18	0.00	0.00	0.00	0.00
3 Months Ago 3/29/2016	25.99	74.01	22.20	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 6/30/2015	90.36	9.64	3.49	0.00	0.00	0.00

Palmer Drought Severity Index - The Palmer Index (PDSI) is an indicator used in the U.S. Drought Monitor. The Long term PDSI for the period ending July 2, 2016 indicates all of Kansas is near normal or moist.



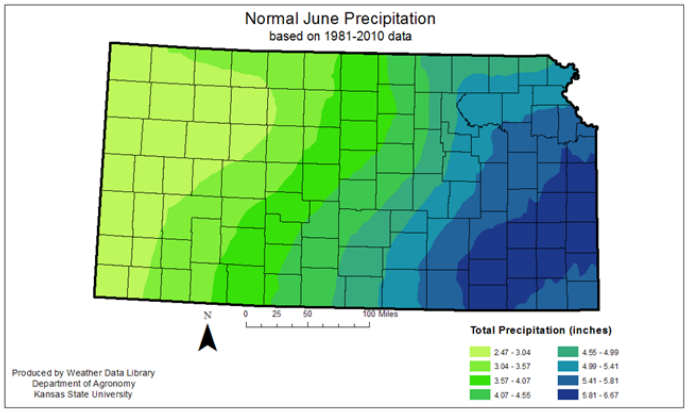
Climate Summary (Temperature and Precipitation)

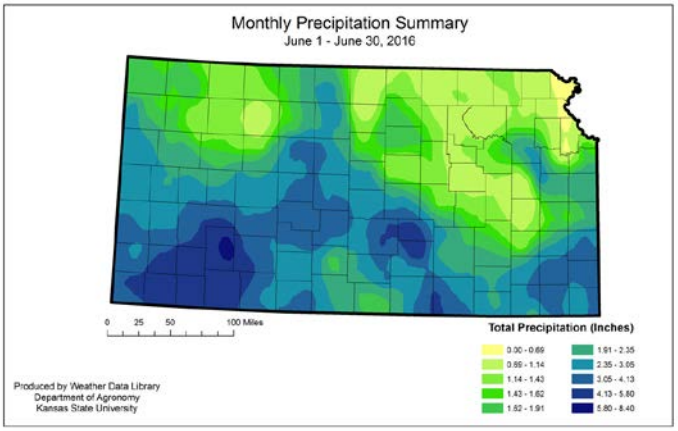
June made a quick turn-around with both temperature and precipitation in most of the state. Only the Southwest Climate Division averaged above normal precipitation for the month. The June average precipitation in Southwest Division Kansas was 5.14 inches or 158 percent of normal. In contrast, the Northeast Division averaged just 0.98 inches or 19 percent of normal. The statewide average was 2.53 inches or 65 percent of normal. That places this June as the 23rd driest since 1896. The driest June on record occurred in 1911, when the statewide average total was just 0.68 inches. Despite the overall dry pattern, there were 32 new record daily rainfall totals. Of those, Cimarron's daily record 4.89 inches set on June 13th set a new monthly record as well. The greatest 24 hour total for a NWS station was 5.80 inches at Bentley 2E,

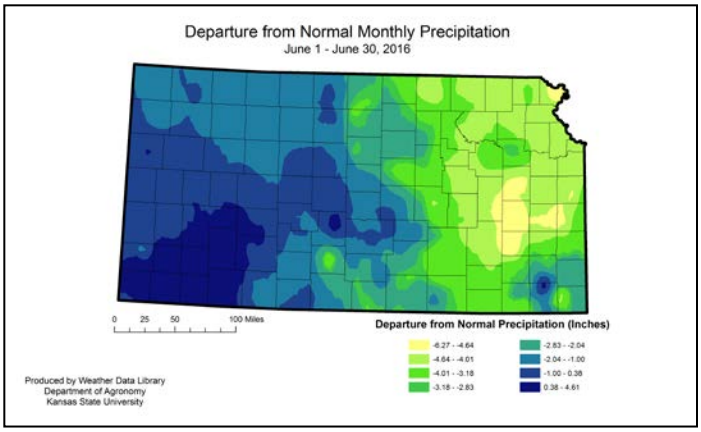
Sedgwick County, on the 16th. The greatest 24 hour total for a CoCoRaHS station was 6.13 inches at Halstead 0.4 S, Harvey County, also on the 16th. Highest monthly totals: 9.79 inches at Winfield, Cowley County (NWS); 7.52 inches at Wichita 6.9 NW, Sedgwick County (CoCoRaHS).

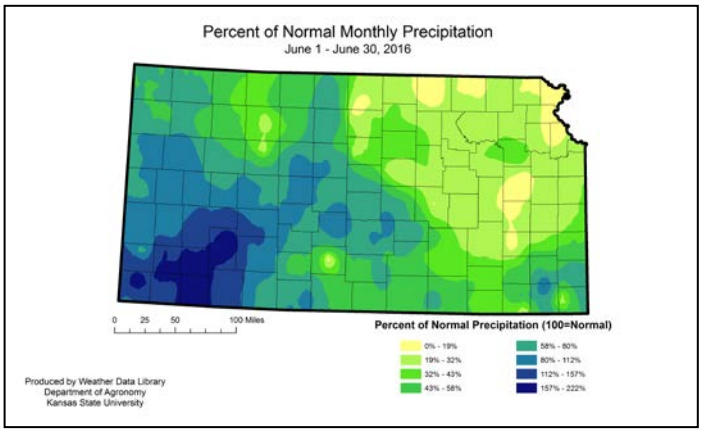
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

Kansas Climate Division Precipitation Summary (inches)												
Climate Division	June 1-30, 2016			January 1– June 30, 2016			April 1 – June 30, 2016			September 1–June 30, 2016		
	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	1.19	-1.64	41	10.73	-0.04	99	9.34	0.93	110	16.12	0.88	105
West Central	2.33	-0.48	82	10.69	0.34	102	9.35	1.56	119	16.02	1.20	106
Southwest	5.14	1.95	158	12.96	2.91	127	12.59	4.97	164	20.19	5.68	137
North Central	1.27	-2.56	33	14.66	0.63	104	12.88	2.39	123	21.62	0.86	104
Central	2.22	-1.85	57	14.98	-0.11	101	13.01	1.95	120	22.82	0.91	105
South Central	3.11	-1.63	68	15.53	-1.10	94	13.84	1.92	117	25.03	0.55	103
Northeast	0.98	-4.15	19	15.87	-1.68	90	13.59	0.35	102	26.38	-0.50	98
East Central	1.68	-3.86	30	15.36	-4.00	78	12.88	-1.45	89	26.16	-3.51	87
Southeast	3.14	-2.74	53	16.96	-4.79	78	14.09	-1.56	90	29.19	-4.65	85
STATE	2.53	-1.70	65	14.26	-0.81	97	12.51	1.37	116	22.74	0.29	104

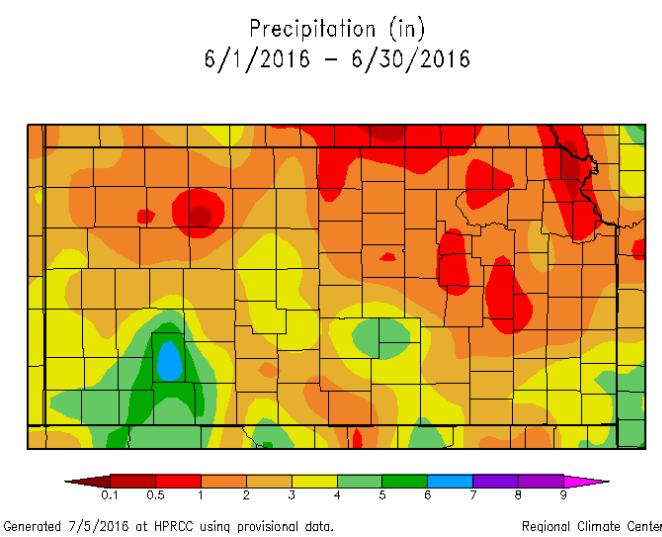


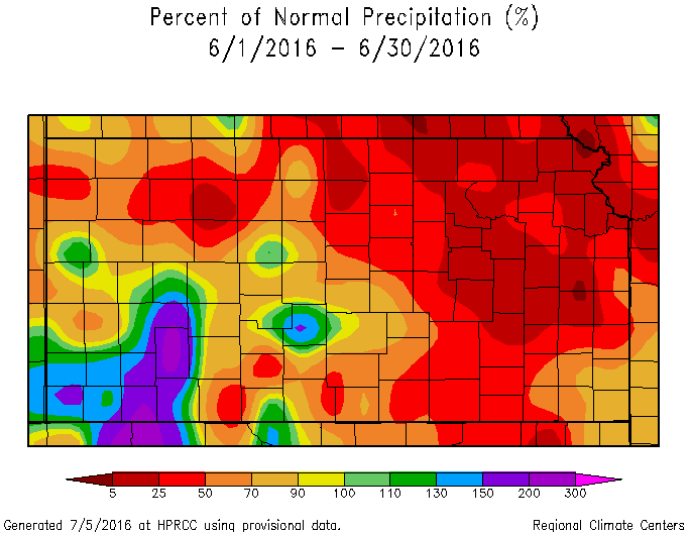






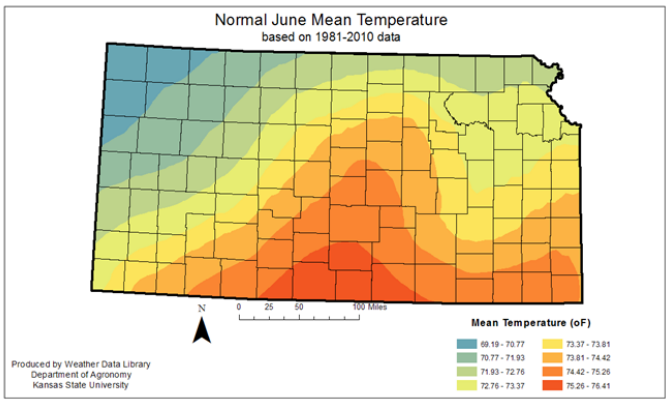
Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

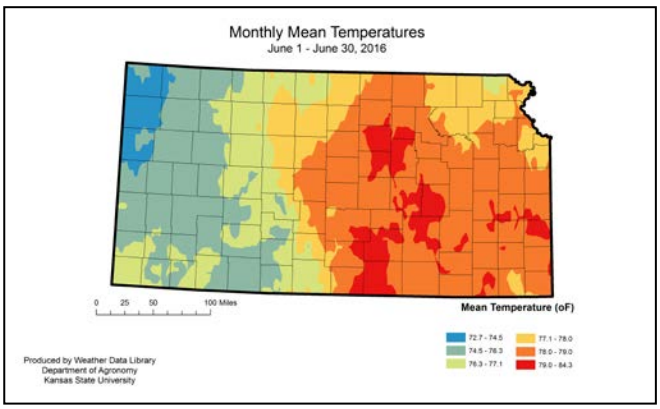


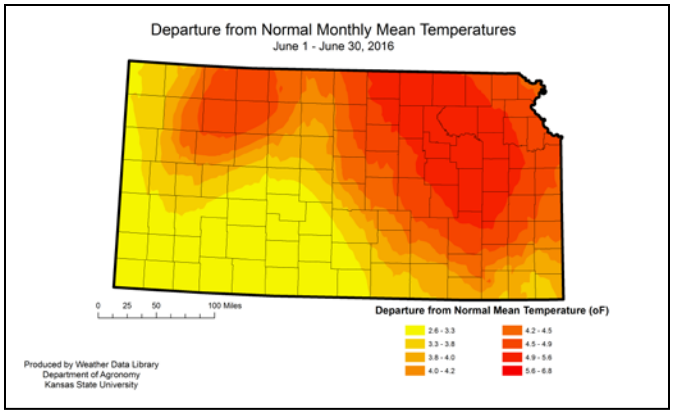


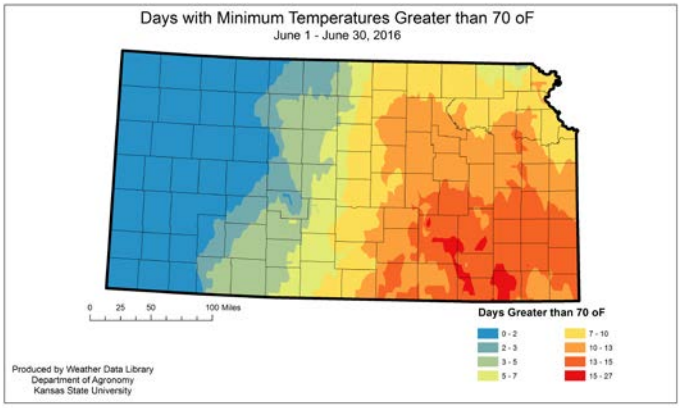
On the temperature side, this was the 10th warmest June since 1896. The statewide average temperature was 77.5 °F. Not surprisingly, the Southwest Division was closest to normal for the month. The average was 76.7 °F, or 2.9 degrees warmer than normal. The warmest division was the East Central where average temperature was 78.4 °F or 4.9 degrees warmer than normal. There were 61 new daily record high temperatures set. In addition there were 31 new record warm minimum temperatures. Of those, 4 set new record warm minimum temperatures for the month of June. Toronto Lake set a new record of 78 °F on the 18th, then tied it again on the 23rd. The highest temperature recorded for the month was 106 °F, set at both Abilene, Dickinson County, and Salina, Saline County, on the 15th. The coldest temperature recorded for the month was 42 °F, reported at Brewster 4W in Thomas County on the 5th.

Climate Division	Kansas Climate Division Temperature Summary (°F)							
	June 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	90.8	59.8	75.3	4.1	105	21	42	5
West Central	90.7	60.6	75.7	3.6	104	22	45	5
Southwest	90.9	62.4	76.7	2.9	102	23	46	5
North Central	91.2	65.0	78.1	4.5	104	16	50	7
Central	91.3	65.6	78.4	3.8	106	15	49	5
South Central	91.0	66.0	78.5	3.2	104	16	45	3
Northeast	89.7	65.9	77.8	4.7	104	23	50	7
East Central	89.2	67.5	78.4	4.8	105	23	53	3
Southeast	89.1	67.5	78.3	3.8	100	23	53	6
STATE	90.4	64.5	77.5	3.9	106	15th	42	5th
Data Source: KSU Weather Library								

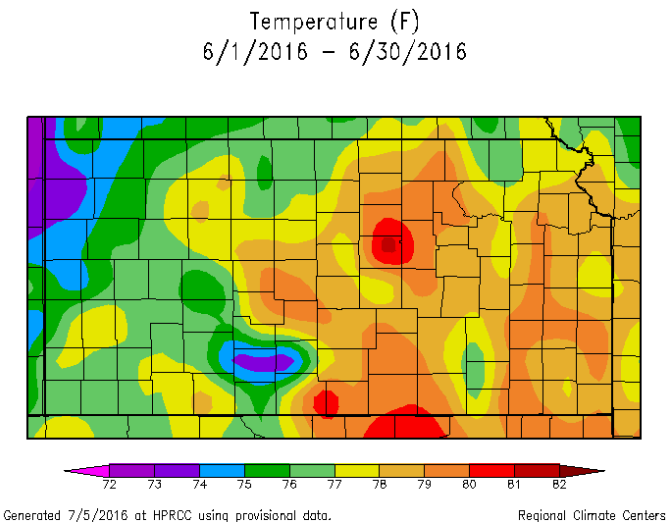


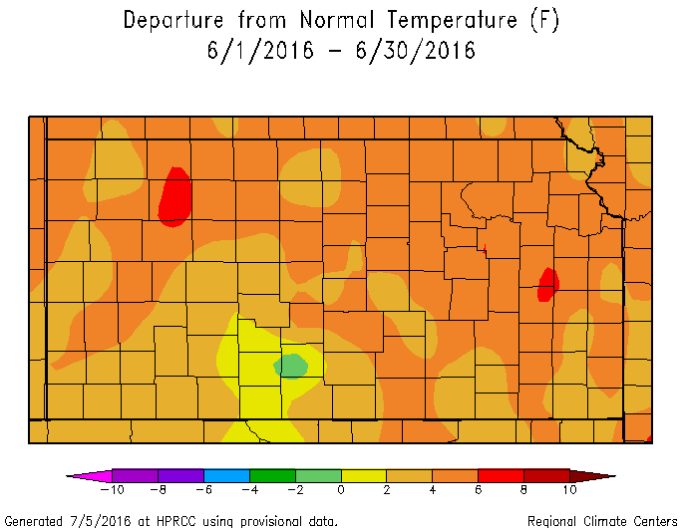






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



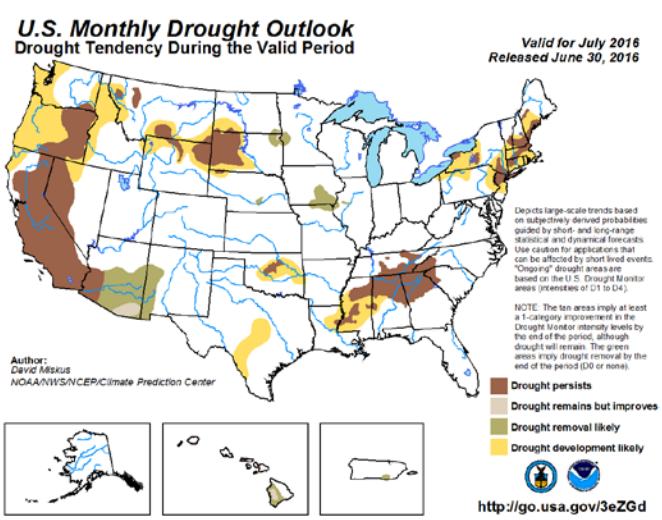


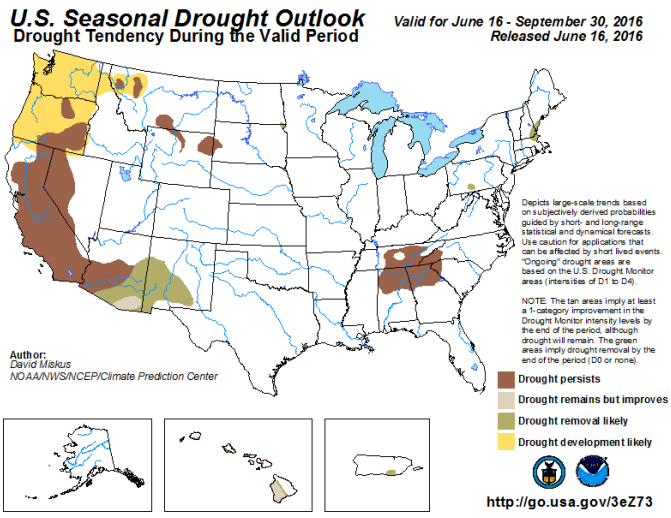
As the rainfall pattern decreased, there were also fewer severe weather reports. There were no tornadoes reported in June. There were 51 hail reports which were much fewer than the 223 reported in May. The most common severe weather report was damaging winds. There were 86 damaging wind reports in the month.

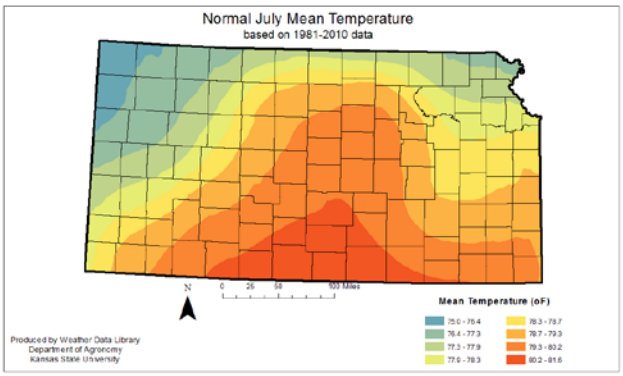
Future Outlook

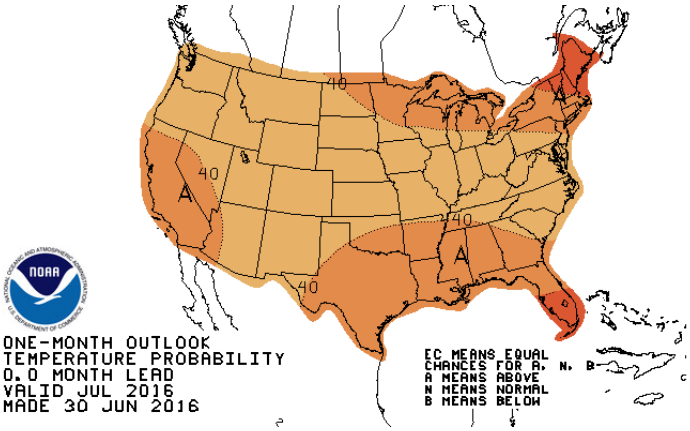
The precipitation outlook for June is for wetter than average conditions. However, the short term outlooks are for drier than average conditions for the first half of the month state-wide. If the drier conditions persist, abnormally dry conditions are likely to reappear, particularly in the western divisions.

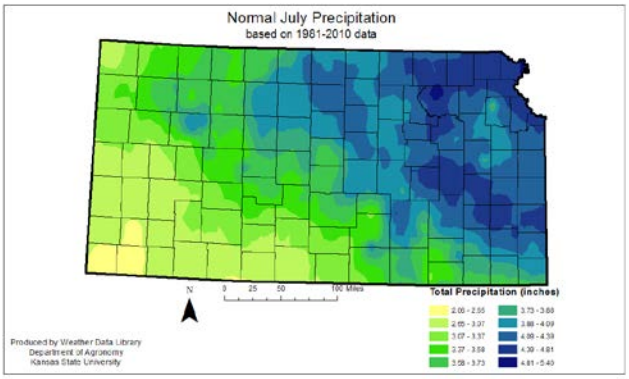
The Drought Outlooks are provided below. Individual temperature and precipitation outlooks are also provided.

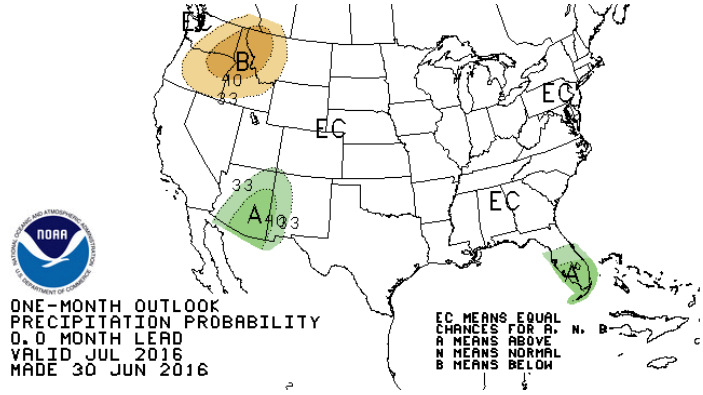




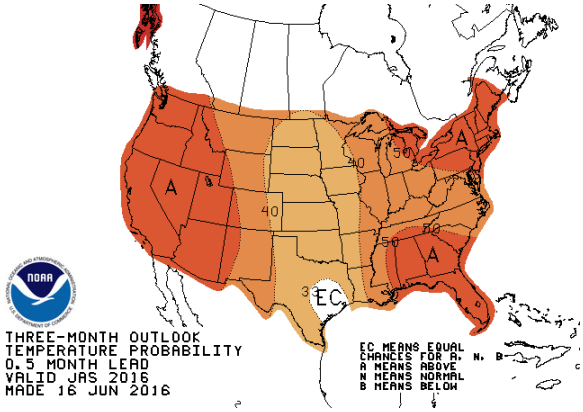


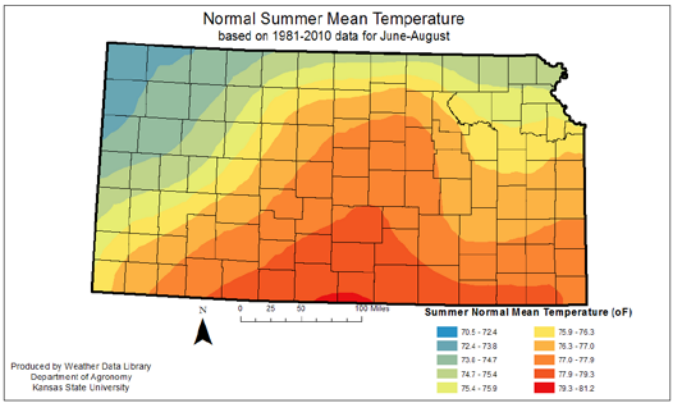


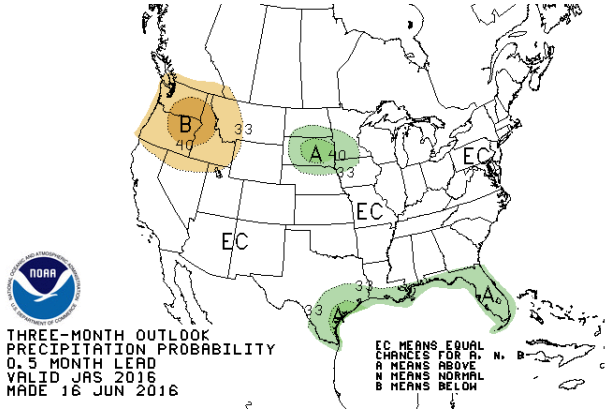


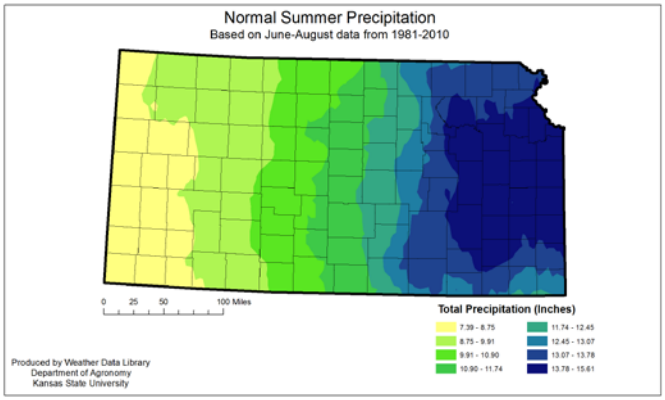


The summer (three-month) outlook favors above normal temperatures and above normal precipitation for June through September 2016.









Additional outlooks for additional 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.

Known issues:
Stage II water restrictions, under Resolution 03-16 are in place for the City of **Russell,** Russell County water customers as of July 5, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the City of **Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (July 5, 2016, http://victoriaks.com/utilities.htm.)

Surface Water Supply Conditions
Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs were evacuating flood pool storage through the first half of the month. Inflows diminished significantly from May but the Kansas River was maintained well above historical median flow values for the majority of June. Storage is in good shape throughout the basin.

Marais des Cygnes basin: The majority of June was relatively dry but the Marais des Cygnes River flow remained near or above median historical values most of the month while Melvern, Pomona, and Hillsdale reservoirs evacuated flood pool storage captured in May.

Cottonwood / Neosho basin: Despite lower than normal precipitation in June, river flow throughout the basin was healthy from reservoir releases from flood storage, particularly downstream of John Redmond.

Verdigris basin: High flows were experienced in early June but declined to low levels by the end of the month. All reservoirs maintained full or nearly full conservation storage.

Saline basin: Elevation at Wilson Lake gained storage throughout the month of June, almost 7 thousand acre-feet. The elevation is 5.4 feet low but this is the highest elevation since the spring of 2014.

Smoky Hill basin: The middle Smoky Hill basin maintained streamflow at a moderate level in June. Kanopolis reservoir pool level increased above the summer target elevation, almost 9 feet above the multipurpose elevation. Discharge continues through the uncontrolled notch spillway but the service gates were opened up to help evacuate storage and bring the level down to the seasonal target. Cedar Bluff Reservoir steadily declined over the month.

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.

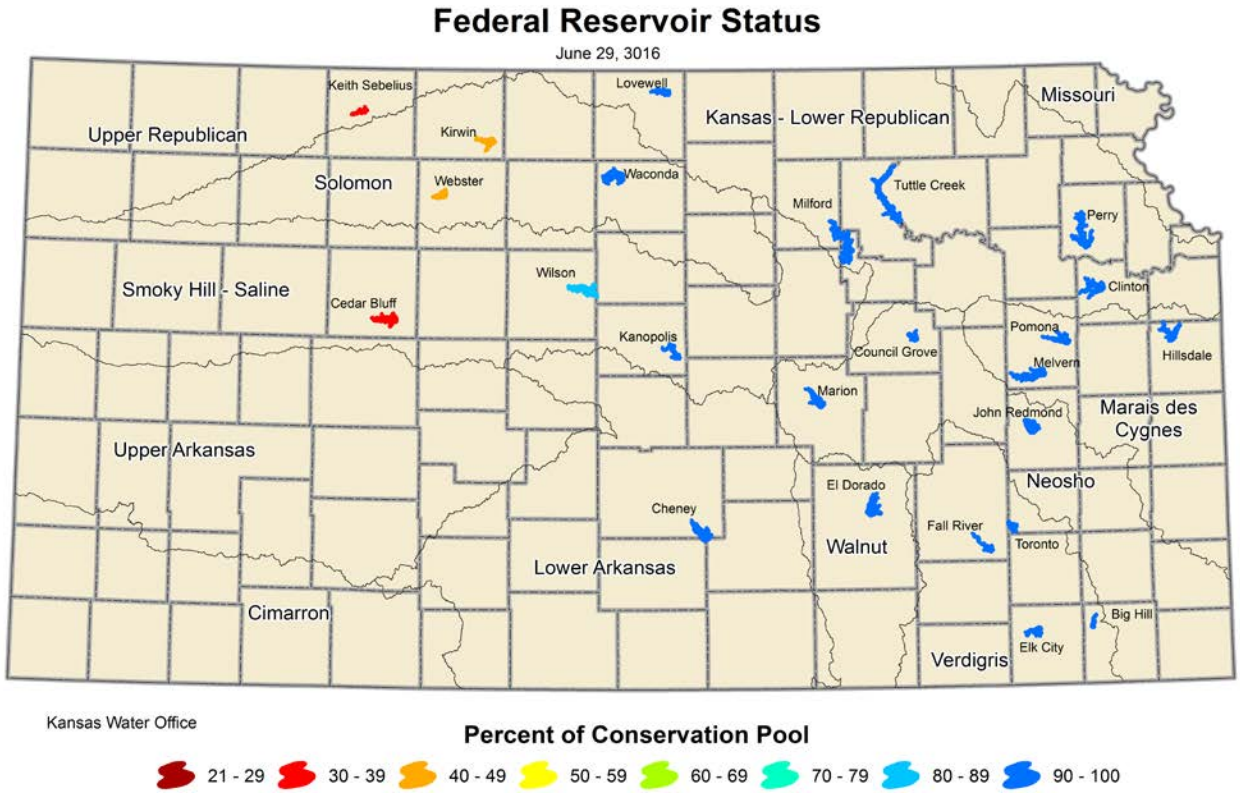
There are no lakes in a public health watch at this time.

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.

As of June 30, 2016 four lakes are on the public health warning list: Central Park Lake, Shawnee County; Lake Afton, Sedgwick County; Marion Reservoir, Marion County; and Milford Reservoir Zones A, B & C Clay, Dickinson and Geary County.

Three lakes are on public health watch: Cheney Lake, Reno County; Marion County State Fishing Lake, Marion County; and McLaughlin Lake Sedgwick County.

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool.



Kansas Federal Reservoir Conservation Pool Levels

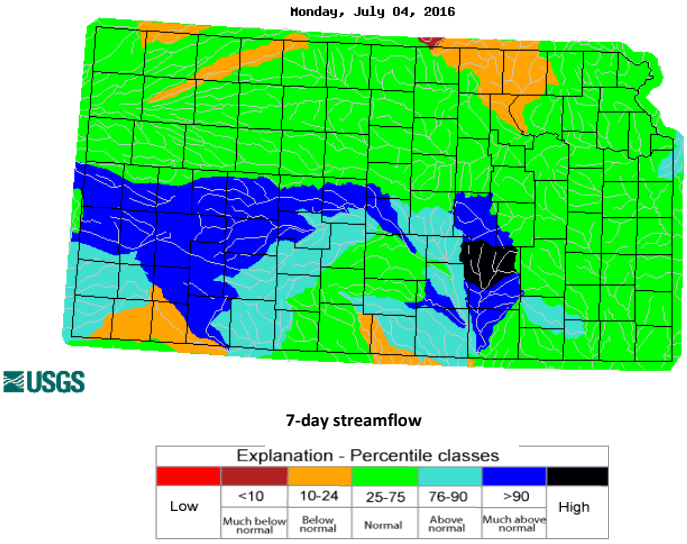
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**06/29/2016 06:00 AM**		
Norton[1]	2304.3	2289.17	-15.13	31.4
Harlan County, NE	1945.73	1939.62	-6.11	75.8
Lovewell[1]	1582.6	1583.22	0.62	100.0
Milford[1]	1144.4	1144.52	0.12	100.0
Cedar Bluff	2144	2120.08	-23.92	33.7
Kanopolis[1]	1463	1467.64	4.64	100.0
Wilson[1]	1516	1510.57	-5.43	81.1
Webster[1]	1892.5	1876.64	-15.81	39.1
Kirwin[1]	1729.3	1715.61	-13.64	43.7
Waconda[1]	1455.6	1455.40	-0.20	98.9
Tuttle Creek[1]	1075	1075.57	0.57	100.0
Perry[1]	891.5	892.13	0.63	100.0
Clinton[1]	875.5	876.22	0.72	100.0
Melvern[1]	1036	1036.63	0.63	100.0
Pomona[1]	974	975.98	1.98	100.0
Hillsdale[1]	917	917.31	0.31	100.0
Arkansas River Basin		**06/29/2016 08:00 AM**		
Cheney	1421.6	1421.78	0.18	100.0
El Dorado	1339	1339.10	0.10	100.0
Toronto[1]	901.5	901.62	0.12	100.0
Fall River[1]	948.5	948.62	0.12	100.0
Elk City[1]	796	796.10	0.10	100.0
Big Hill	858	858.14	0.14	100.0
Council Grove[1]	1274	1274.11	0.11	100.0
Marion[1]	1350.5	1350.23	-0.27	98.0
John Redmond[1]	1039	1041.32	0.32	100.0

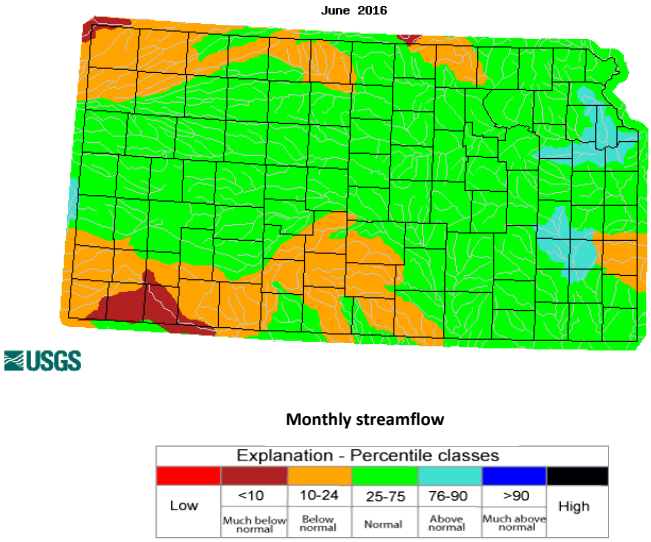
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the month's streamflow compared to historical is shown on the map below, right.





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.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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.

Streamflows as of June 30, 2016	**cubic feet per second ((cfs)**			
Gaging Station	**Current Flow**	**June MDS**	**July MDS**	**Comment**
Republican River at Concordia	255	150	150	Admin began April 19, 2016; 71 files. Admin ceased May 13, 2016.
Republican River at Clay Center	550	250	200	Admin began April 19, 2016; 147 files. Admin ceased May 13, 2016.
North Fork Ninnescah River above Cheney	20	30	10	

Flooding

The Table below summarizes recent flood conditions for June 2016 from USGS WaterWatch data. Note flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor Flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience.

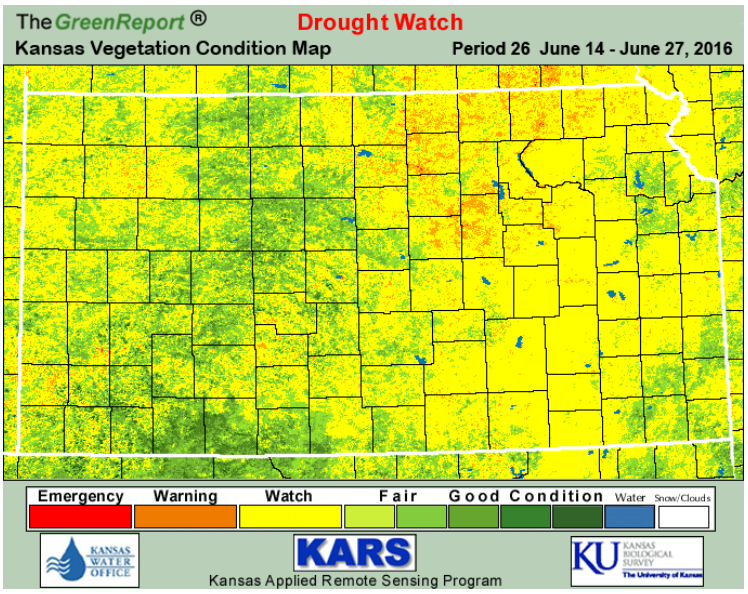
USGS station number	**USGS station name**	**Drain. area [mi^2]**	**NWS flood stage [ft]**	**No. of days above flood stage**	**NWS flood class**	**Highest peak from 2016-06-01 to 2016-06-30**				**Historical Peaks**	
						Date	**Stage [ft]**	**Stream flow (date) [ft^3/s]**	**Rank**	**No. of years**	**Max. (year) [ft^3/s]**
06876700	SALT C NR ADA, KS	384	18	2	moderate	2016-06-01	19.18	1630	19	55	16000 (1961)
06884700	BIG BLUE R AT BLUE RAPIDS, KS	8342	26	2	minor	2016-06-01	27.44	--	--	--	
07143310	COW C NR HUTCHINSON, KS	859.5	9.5	2	moderate	2016-06-01	10.65	--	--	--	
07182390	NEOSHO R AT NEOSHO RAPIDS, KS	2753	22	1	minor	2016-06-01	22.5	357 (2016-06-23)	<	5	24900 (2010)

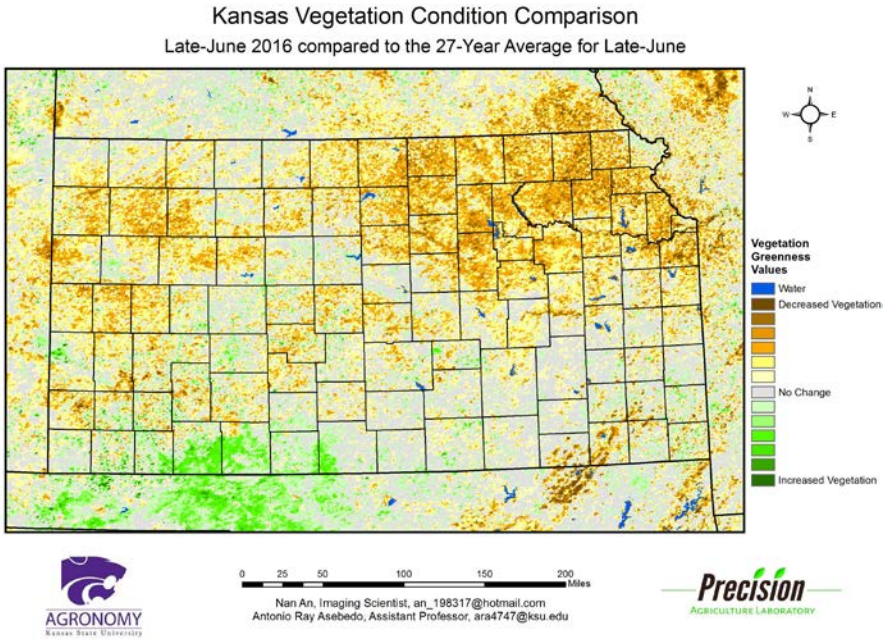
USGS WaterWatch provides streamflow based on USGS monitored stream gages. NWS flood stage is found on the NWS River Conditions Map.

Soil, Crop and Vegetation

Kansas Vegetative Conditions

The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Little rain and high temps have caused conditions to deteriorate throughout the eastern areas of the state. Patches of stressed vegetation are showing up state-wide also.



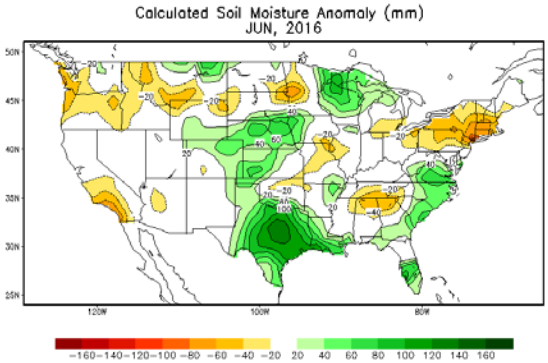


Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for June 21 – June 27, 2016 from K-State's Precision Agriculture Laboratory shows lower vegetative activity continues in the Northeastern areas of the state, where wet weather was quickly replaced by hot, dry conditions. Increased photosynthetic activity is most visible in the Southwest Divisions. Continued rains, and closer to normal temperatures have favored vegetative activity in this area

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. http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

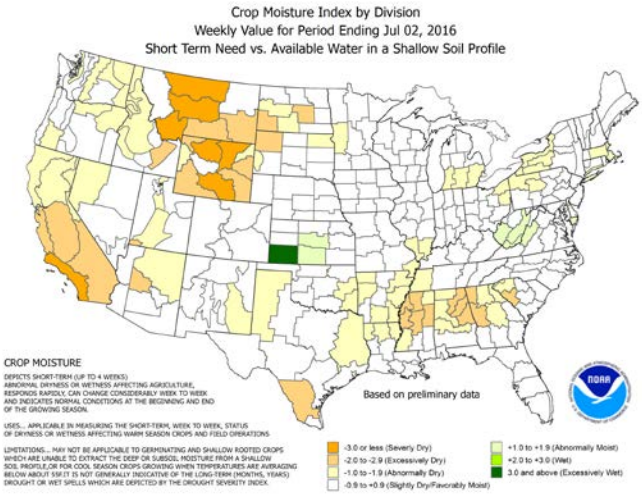
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.



USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for the week ending June 26, 2016 reported topsoil moisture
6 percent very short, 24 short, 65 adequate, and 5 surplus. Subsoil moisture rated 3 percent very short, 20 short, 75 adequate, and 2 surplus.

Field Crops Report: Winter wheat condition rated 1 percent very poor, 7 poor, 28 fair, 48 good, and 16 excellent. Corn condition rated 2 percent very poor, 6 poor, 27 fair, 58 good, and 7 excellent. Soybean condition rated 2 percent very poor, 6 poor, 33 fair, 55 good, and 4 excellent. Sorghum condition rated 0 percent very poor, 2 poor, 24 fair, 71 good, and 3 excellent. Cotton condition rated 0 percent very poor, 1 poor, 30 fair, 65 good and 4 excellent

Livestock Report: Pasture and range conditions rated 0 percent very poor, 4 poor, 25 fair, 60 good, and 13 excellent.



Stock water supplies were 2 percent very short, 4 short, 83 adequate, and 11 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)

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/JAWF Weekly Weather and Crop Bulletin.

General Federal Disaster Assistance

USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of drought and other natural disasters. More information on these programs may be found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

The USDA Food and Nutrition Service provide food assistance to those in need in areas affected by a disaster. This Federal assistance is in addition to that provided by State and local governments. USDA provides disaster food assistance in three ways: provides foods to State agencies for distribution to shelters and other mass feeding sites; provides food to State agencies for distribution directly to households in need in certain limited situations; and authorizes State agencies to issue Disaster Supplemental Nutrition Assistance Program (D-SNAP) benefits.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock

The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. More detailed information on eligibility and sign up is available on the FSA fact sheet found at: http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at: http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators.

LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers

Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

June 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	4.00	1.12	139%	74.0		5.5	104 (21)
Dodge City	2.71	-0.53	84%	76.4		2.5	101 (22)
Garden City	5.08	1.60	146%	76.2		3.4	97 (22,21)
Goodland	1.62	-1.63	50%	74.3		4.6	102 (21)
Guymon, OK	2.64	-0.30	90%	78.2		4.1	102 922)
Hill City	0.56	-2.20	20%	78.4		5.5	104 (21)
Lamar, CO	1.22	-1.13	52%	76.1		4.5	107 (21)
McCook, NE	2.85	-0.53	84%	75.0		5.1	101 (21)
Springfield, CO	0.18	-2.32	7%	73.1		1.8	98 (21)
Central							
Concordia	1.17	-2.88	29%	78.8		5.4	102 (15)
Hebron, NE	0.24	-4.54	5%	77.5		5.5	100 (21,15)
Medicine Lodge	1.90	-2.21	46%	80.0		3.4	104 (15)
Ponca City, OK	0.77	-4.29	15%	81.2		4.6	101 (22)
Salina	0.45	-3.66	11%	81.2		5.6	106 (15)
Wichita (ICT)	2.83	-2.37	54%	81.1		5.2	103 (15)
East							
Bartlesville, OK	1.44	-3.93	27%	79.2		3.0	100 (22)
Chanute	3.20	-2.83	53%	79.2		4.6	100 (22)
Fall City, NE	1.10	-3.78	23%	78.4		5.1	102 (22,15)
Johnson Co. Exec. Apt	1.61	-4.17	28%	77.8		4.5	98 (22,15)
Joplin, MO	6.12	0.26	104%	78.8		3.3	98 (22)
Kansas City (MCI), MO	0.98	-4.25	19%	78.6		5.1	99 (22)
St. Joseph, MO	0.71	-3.47	17%	79.0		5.4	102 (22)
Topeka (TOP	2.39	-3.01	44%	79.4		5.2	103 (22)

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

KANSAS CLIMATE and DROUGHT UPDATE – July 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

- No Kansas County was under a State drought stage in July.
- The US Drought Monitor indicated dry conditions various weeks in July for small areas of Kansas.

Lakes and Streams

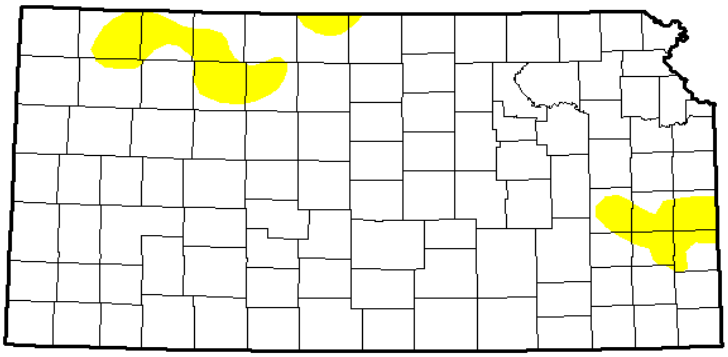
- Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain below conservation pool.
- Lakes on the public health warning list due to blue-green algae blooms: Atchison County Park Lake, Atchison County; Lake Afton, Sedgwick County; Overbrook City Lake, Osage County; and Milford Reservoir Zones C, Clay and Geary County. (July 28, 2016)
- **Milford Reservoir Zone C, Clay and Geary County is CLOSED**.
- Lakes on public health watch list due to blue-green algae blooms: Central Park Lake, Shawnee County; McLaughlin Lake Sedgwick County; Melvern Outlet Pond, Osage County, and Milford Reservoir Zone B, Geary County. (July 28, 2016)

General Conditions

Despite the wetter than average conditions state-wide, there was an expansion of abnormally dry conditions in the Northwest. This region of the state missed out on most of the precipitation events. The wetter pattern in the eastern third of the state reduced the abnormally dry conditions there. The last U.S. Drought Monitor issued in June had just over 20 percent of the state as abnormally dry; the latest Drought Monitor places the total in abnormally dry conditions at just over 13 percent. More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.

U.S. Drought Monitor

Kansas



July 26, 2016

(Released Thursday, Jul. 28, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	93.53	6.47	0.00	0.00	0.00	0.00
Last Week 7/19/2016	95.84	4.16	0.00	0.00	0.00	0.00
3 Months Ago 4/26/2016	42.54	57.46	11.12	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 7/28/2015	68.33	31.67	3.49	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

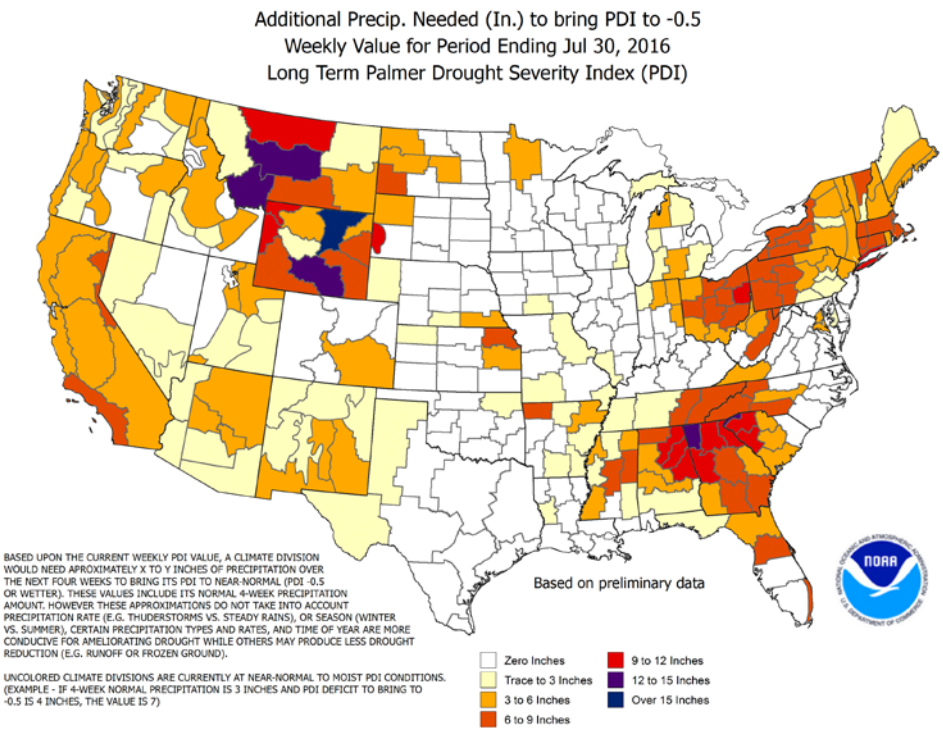
Author:

Brad Rippey

U.S. Department of Agriculture

http://droughtmonitor.unl.edu/

Palmer Drought Severity Index (PDSI) - The Palmer Index is an indicator used in the U.S. Drought Monitor. The PDI for the period ending July 30, 2016 indicates moisture is needed in the Northwest, Northeast and East Central Climate divisions.



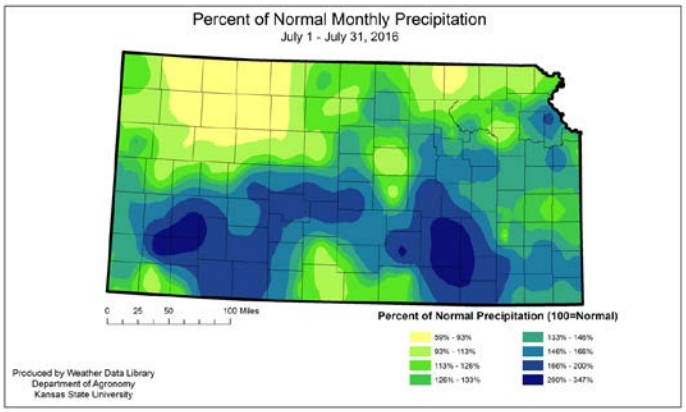
Climate Summary (Temperature and Precipitation)

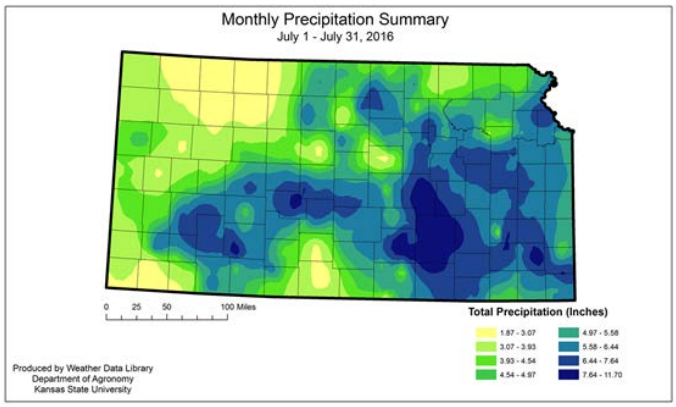
Warm humid weather was the rule for Kansas this July, although the departures from normal were not as great as in June.

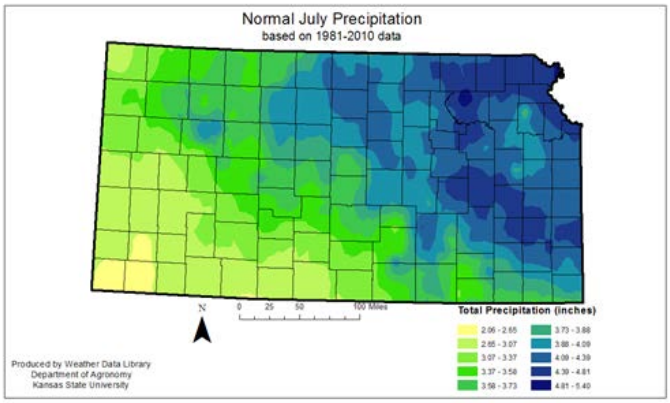
State-wide rainfall for July was above normal; however the Northwest Climate Division missed out on the extra rainfall. The Northwest Division averaged 2.23 inches or just 66 percent of normal. In contrast, the Southeast Division averaged 7.57 inches or 187 percent of normal. This July ranks as the 18th wettest in the 122 years of record. The wettest July on record occurred in 1993, when the statewide average total was 9.28 inches. With the overall wet pattern, there were 107 new record daily rainfall totals. Of those, two reports, on July 2nd, set new monthly records as well: Ulysses with 2.89 inches and Wichita with 5.72 inches. The greatest 24 hour total for a NWS station was 6.53 inches at Easton, Leavenworth County, on the 3rd. The greatest 24 hour total for a CoCoRaHS station was 8.09 inches at Bel Aire 0.5 WSW, Sedgwick County, also on the 3rd. Highest monthly totals: 11.47 inches at Virgil, Greenwood County (NWS); 11.70 inches at Ingalls 6.2 WNW, Gray County (CoCoRaHS).

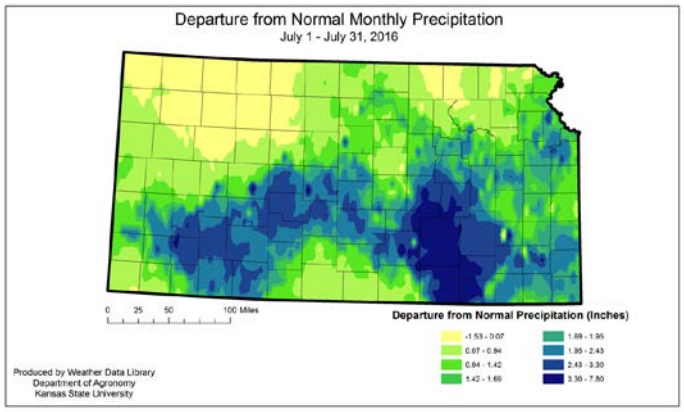
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

Kansas Climate Division Precipitation Summary (inches)												
	July 1-31, 2016			January 1– July 31, 2016			April 1 – July 31, 2016			September 1–July 31, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	2.33	-1.17	66	13.22	-1.05	92	11.84	-0.07	99	18.58	-0.16	99
West Central	3.73	0.28	109	14.19	0.39	102	12.85	1.61	114	19.52	1.25	105
Southwest	4.89	2.11	176	16.80	3.97	130	16.43	6.03	157	24.03	6.74	137
North Central	4.26	0.16	103	18.92	0.79	104	17.13	2.54	117	25.88	1.02	103
Central	5.20	1.26	132	20.06	1.03	106	18.09	3.09	121	27.90	2.05	108
South Central	5.04	1.52	143	20.36	0.21	101	18.66	3.22	121	29.85	1.85	107
Northeast	4.87	0.53	111	20.75	-1.14	94	18.47	0.88	104	31.25	0.02	99
East Central	5.72	1.44	133	21.05	-2.59	88	18.57	-0.05	99	31.85	-2.11	92
Southeast	7.57	3.53	187	24.30	-1.49	94	21.43	1.75	109	36.53	-1.34	96
STATE	4.94	1.22	133	18.98	0.19	102	17.22	2.35	117	27.45	1.27	106

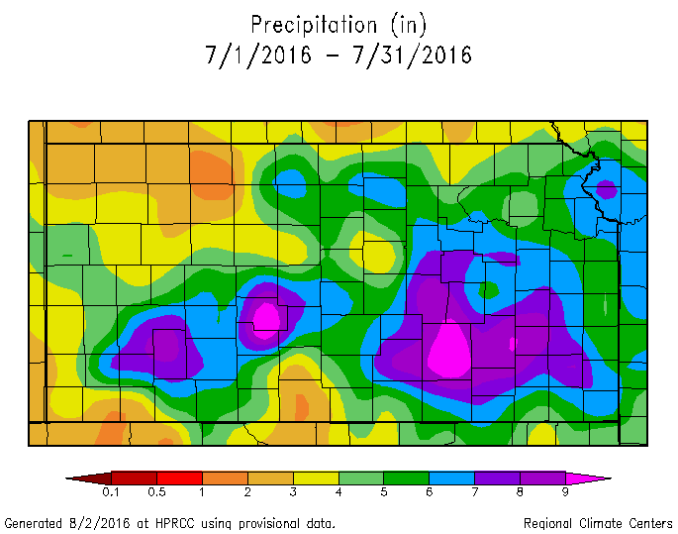


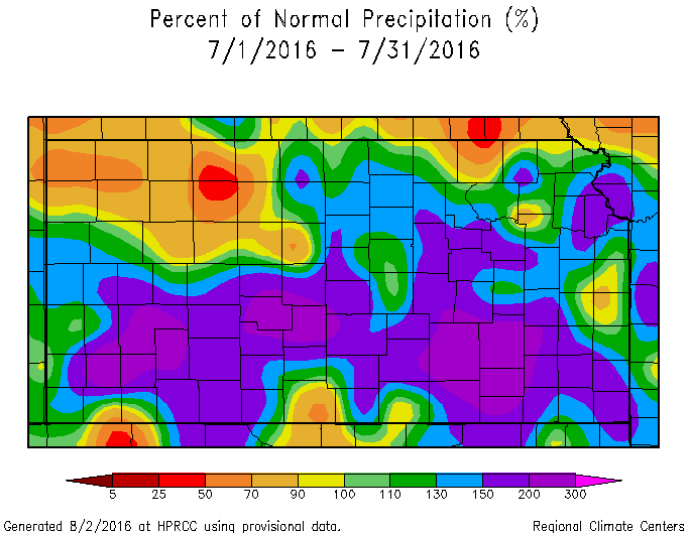






Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

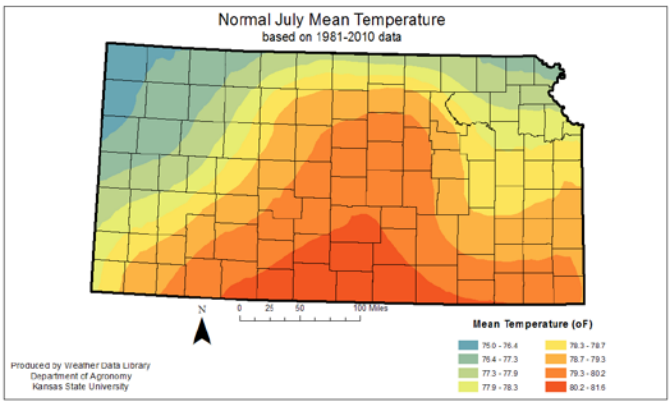


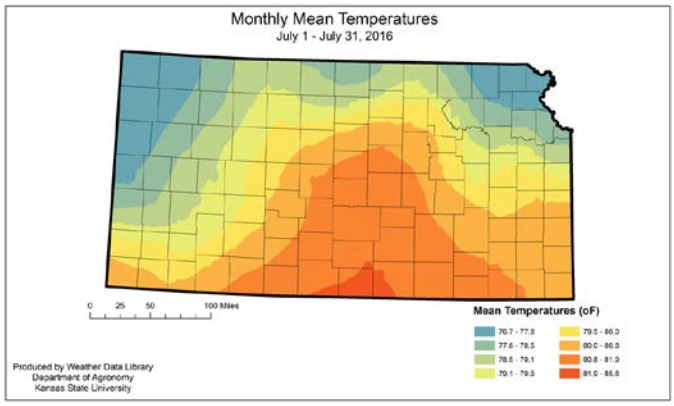


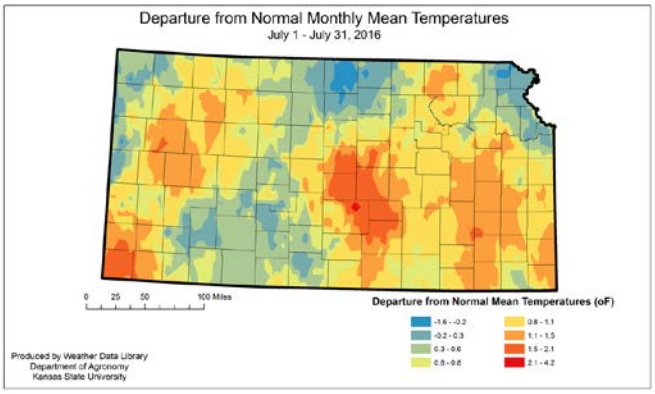
On the temperature side, this was the 47th warmest since 1896, which places it in the middle range of the distribution. The statewide average temperature was 79.4° F or 0.8° F warmer than normal. The North Central Division was closest to normal for the month. Their average was 79.2° F, or just 0.2 degrees warmer than normal. The warmest division was the Southwest Division where average temperature was 80.2° F or 1.3 degrees warmer than normal. There were only 3 events that tied daily record high temperatures. In contrast, 30 new low maximum temperature records were set. Most of the departure came in the low temperatures. There were 23 new record warm minimum temperatures set, and 32 records tied. Of those, 2 tied record warm minimum temperatures for the month of July. The highest temperature recorded for the

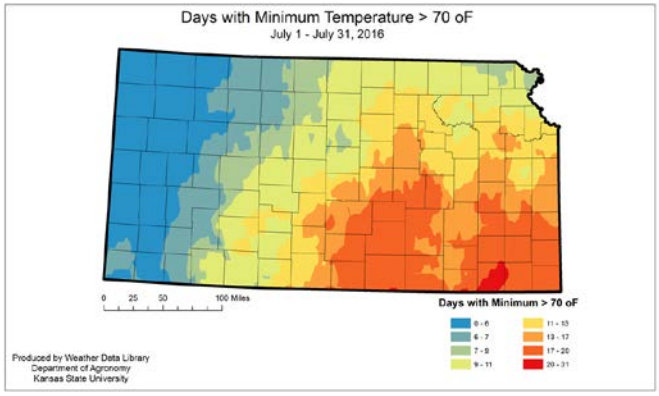
month was 109° F, set at Salina, Saline County, on the 22nd. The coldest temperature recorded for the month was 41° F at Horton, Brown County, on the 13th.

Climate Division	Kansas Climate Division Temperature Summary (°F)							
	July 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	91.7	64.1	77.9	1.1	106	22	51	21
West Central	92.2	64.9	78.6	1.2	107	24	55	13
Southwest	93.9	66.5	80.2	1.3	107	24	54	16
North Central	90.6	67.9	79.2	0.2	105	23	54	3
Central	92.1	69.0	80.6	0.6	109	22	59	16
South Central	93.6	70.1	81.8	1.4	106	24	53	10
Northeast	88.0	68.2	78.1	0.3	102	23	41	13
East Central	88.7	69.8	79.3	0.8	100	23	61	26
Southeast	89.6	70.6	80.1	0.7	101	25	58	15
STATE	91.2	67.9	79.5	0.8	109	15th	41	21st
Data Source: KSU Weather Library								

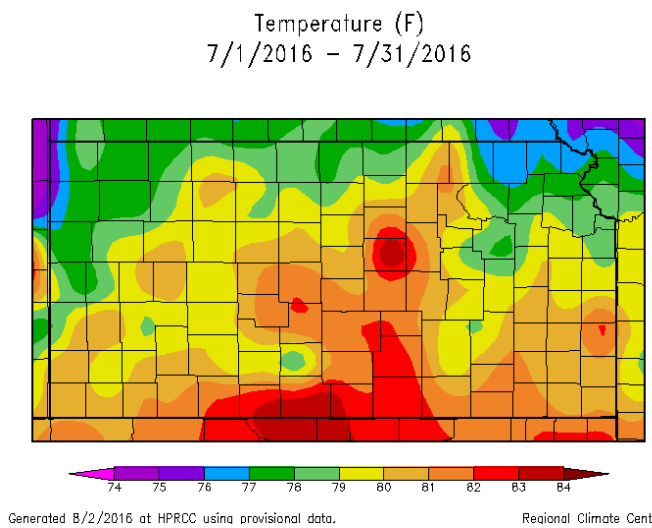


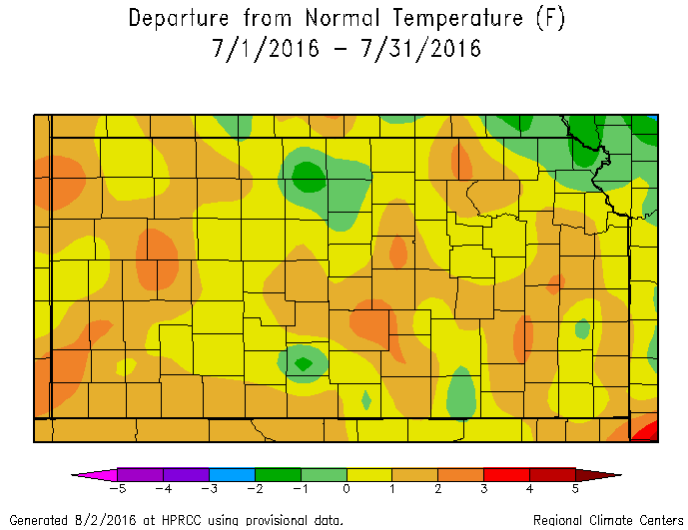






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



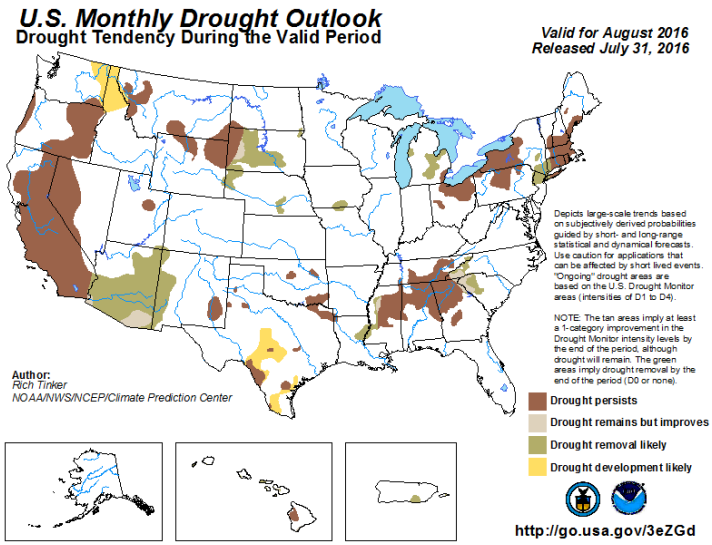


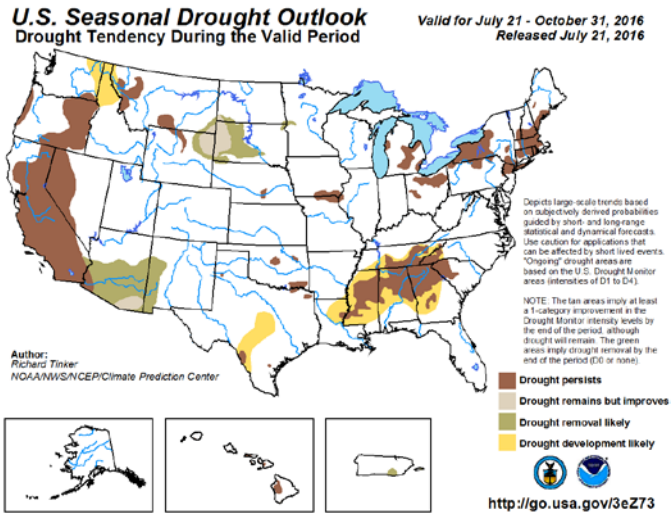
With the wetter pattern than seen in June, there were also more severe weather reports. There were eight tornadoes reported in July. The most severe of these struck Eureka, KS on the 7th. Fortunately there were no deaths or injuries reported with the event. There were a total of 56 hail reports which was similar to June's total of 51 events. The most common severe weather report was damaging winds. There were 180 damaging wind reports in the month.

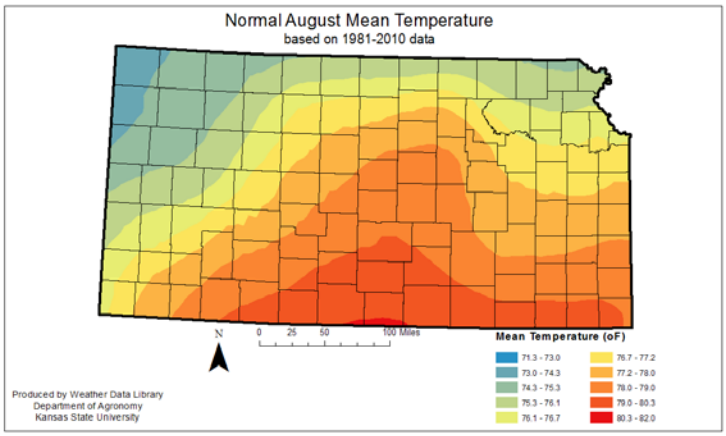
Future Outlook

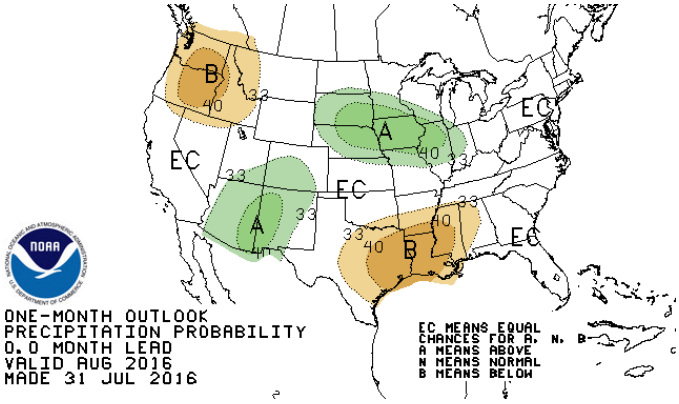
The precipitation outlook for August is neutral, with it equally likely to have above or below normal precipitation. Statewide, the outlook is for an increased chance of warmer than normal temperatures. This is likely to follow July's pattern, with the departure as warmer than normal low temperatures.

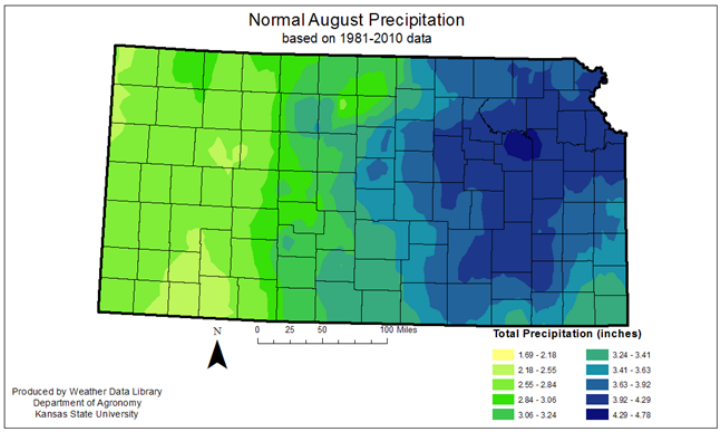
Both the Drought Outlooks and individual temperature and precipitation outlooks are provided below. Average temperature and precipitation maps are included for reference.

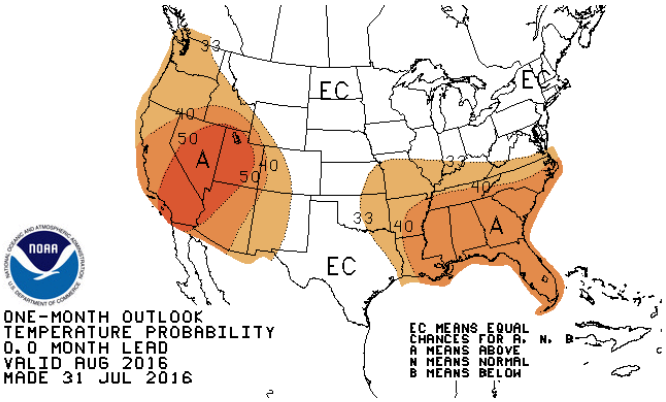




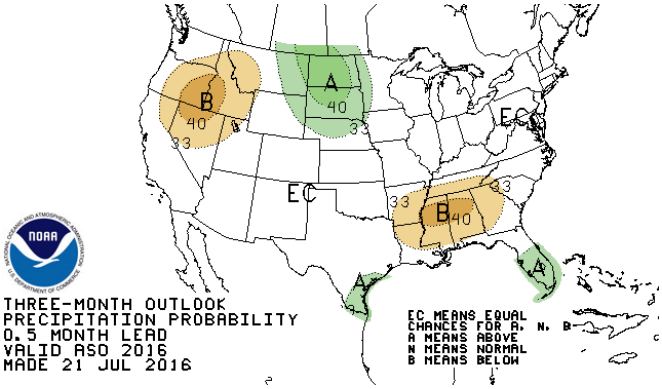


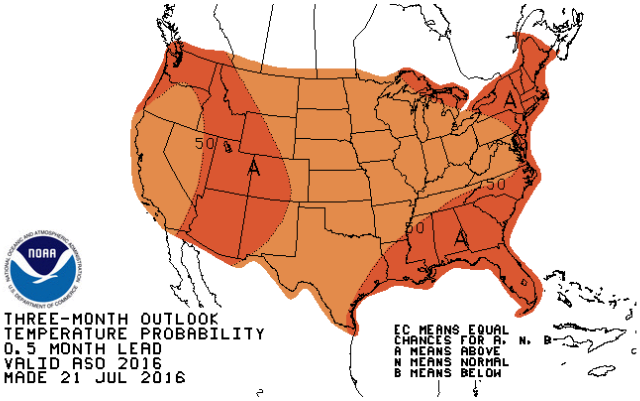






The three-month outlook favors above normal temperatures and normal precipitation for August through October 2016.





Additional outlooks for additional 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.

Known issues:

Stage II water restrictions, under Resolution 03-16 are in place for the **City of Russell,** Russell County water customers as of July 31, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the **City of Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (July 31, 2016, http://victoriaks.com/utilities.htm.)

Surface Water Supply Conditions

Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs began and ended the month with full conservation storage. Inflows were sufficient to maintain storage and streamflow in the Kansas River was very "normal" – near historic median values.

Marais des Cygnes basin: Melvern, Pomona, and Hillsdale reservoirs maintained storage in excess of conservation throughout the month of July. Some flood pool storage was evacuated which helped kept flow in the Marais des Cygnes River above median levels.

Cottonwood / Neosho basin: A few precipitation events maintained river flow and storage in July. River flow remained at or above normal in July throughout the basin, particularly downstream of John Redmond Reservoir.

Verdigris basin: Toronto, Fall River, and Elk City reservoirs maintained storage in excess of conservation pool and Big Hill Reservoir only dropped below normal pool elevation for three days in July. Storage and stream flow were healthy.

Saline basin: Elevation at Wilson Lake rose slightly over the month of July. Conservation pool is still a little more than 5 feet low.

Smoky Hill basin: The middle Smoky Hill basin maintained streamflow at a moderate level in July. Kanopolis Reservoir pool level declined in the second half of the month without significant inflow events and ended the month about a foot below the seasonal target elevation. Discharge continues through the uncontrolled notch spillway. Cedar Bluff Reservoir gained just under 2 thousand acre-feet (about ½ foot in elevation) early in July but steadily declined for the second half of the month.

Harmful Blue-Green Algal Blooms (lake water safety)

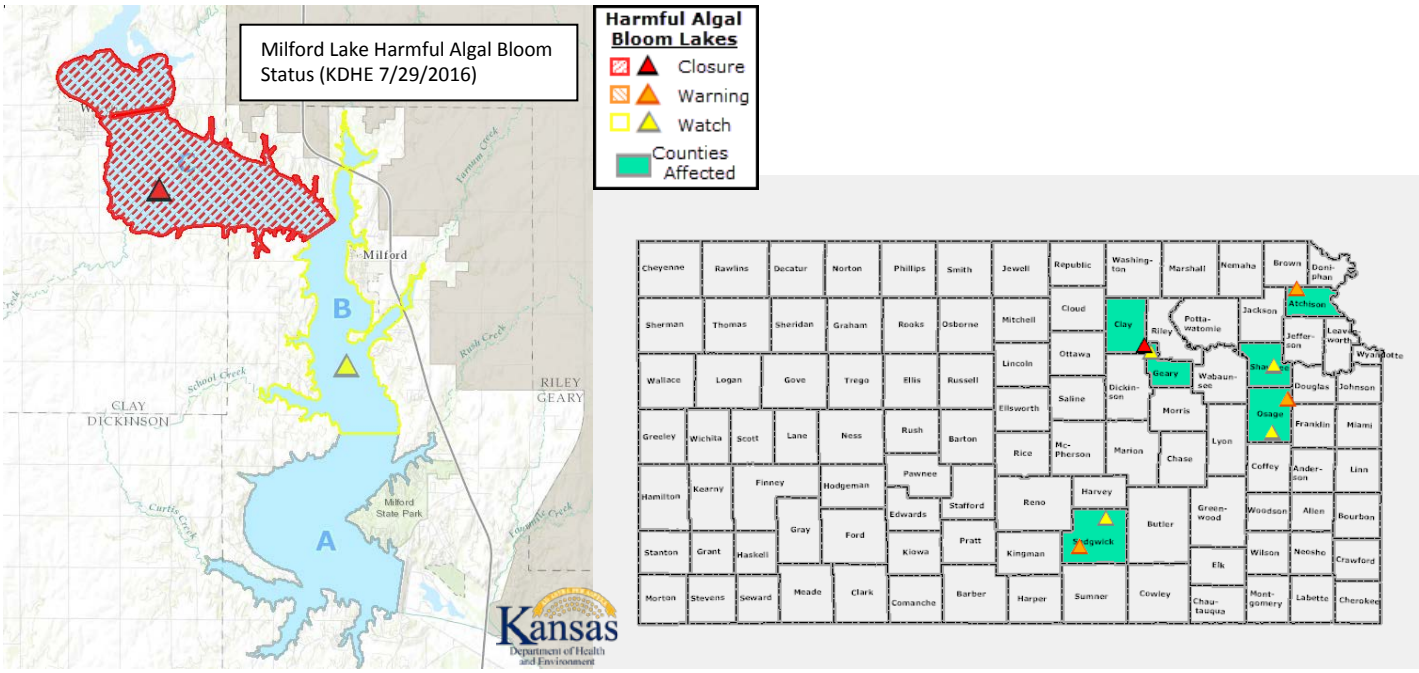
KDHE issues two levels of public health protection notifications for blue-green algae (BGA) Blooms: a Public Health Watch and Public Health Warning.

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.

As of July 28, 2016, a public health watch was in place for Central Park Lake, Shawnee County; McLaughlin Lake in Valley Center, Sedgewick County; Melvern Outlet Pond, Osage County; and Milford Lake- Zone B, Geary County.

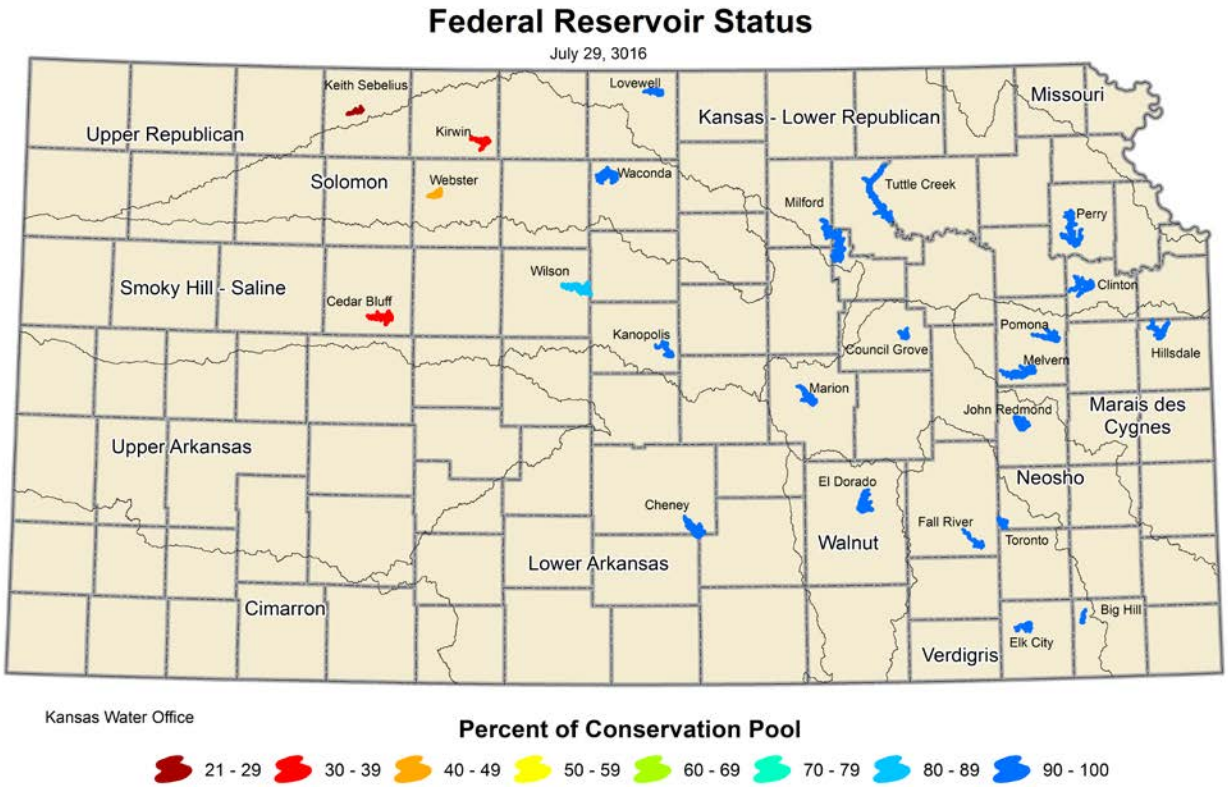
Public Health Warning–Notifies public that conditions are unsafe, that contact with the water should not occur, and all conditions of Public Health Watch remain in effect.

As of July 28, 2016 four lakes are on the public health warning list: Atchison County Park Lake, Atchison County; Lake Afton, Sedgwick County; Overbrook City Lake, Osage County; and Milford Reservoir Zone C, Clay and Geary Counties. Milford Zone C has been closed.



General Reservoir Conditions

The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool.



Kansas Federal Reservoir Conservation Pool Levels

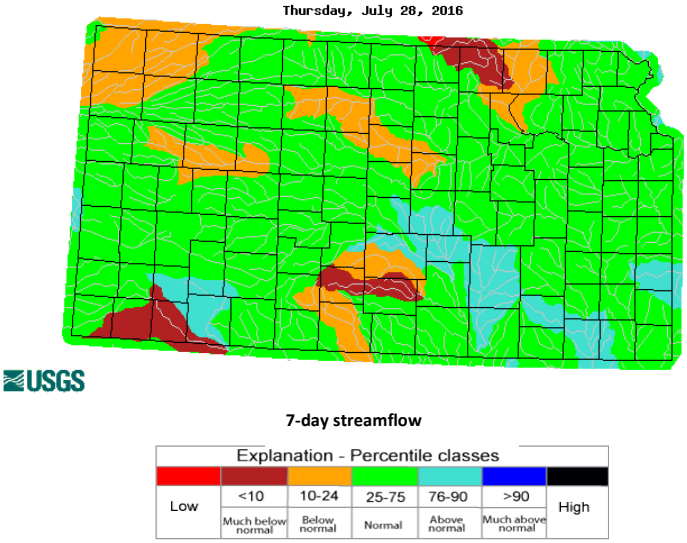
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**07/29/2016 06:00 AM**		
Norton[1]	2304.3	2288.46	-15.84	29.3
Harlan County, NE	1945.73	1937.57	-8.16	68.5
Lovewell[1]	1582.6	1581.70	-0.90	92.7
Milford[1]	1144.4	1145.09	0.69	100.0
Cedar Bluff	2144	2120.40	-23.60	34.3
Kanopolis[1]	1463	1466.87	3.87	100.0
Wilson[1]	1516	1510.68	-5.32	81.4
Webster[1]	1892.5	1876.72	-15.73	39.3
Kirwin[1]	1729.3	1712.77	-16.48	35.2
Waconda[1]	1455.6	1455.01	-0.59	96.6
Tuttle Creek[1]	1075	1075.38	0.38	100.0
Perry[1]	891.5	893.64	2.14	100.0
Clinton[1]	875.5	875.94	0.44	100.0
Melvern[1]	1036	1036.44	0.44	100.0
Pomona[1]	974	974.23	0.23	100.0
Hillsdale[1]	917	917.18	0.18	100.0
Arkansas River Basin		**07/29/2016 08:00 AM**		
Cheney	1421.6	1422.42	0.82	100.0
El Dorado	1339	1340.61	1.61	100.0
Toronto[1]	901.5	902.27	0.77	100.0
Fall River[1]	948.5	949.57	1.07	100.0
Elk City[1]	796	796.48	0.48	100.0
Big Hill	858	858.38	0.38	100.0
Council Grove[1]	1274	1273.93	-0.07	100.0
Marion[1]	1350.5	1350.45	-0.05	100.0
John Redmond[1]	1039	1042.25	1.25	100.0

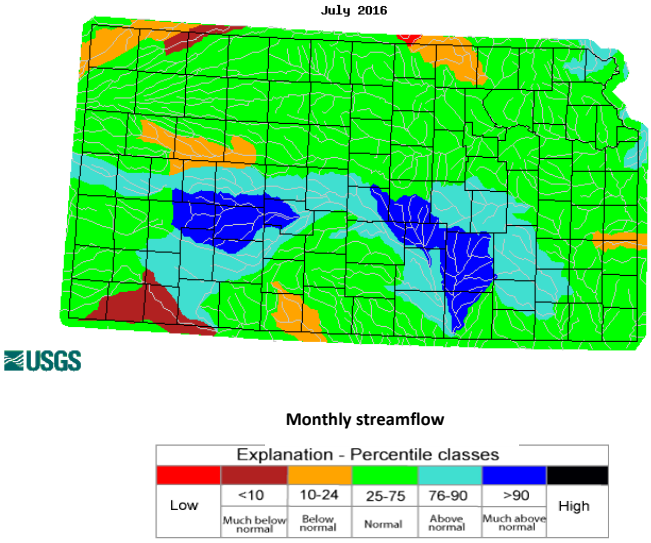
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the month's streamflow compared to historical is shown on the map below, right.





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.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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.

Streamflows as of July 28, 2016	**cubic feet per second ((cfs)**			
Gaging Station	**Current Flow**	**July MDS**	**August MDS**	**Comment**
Republican River at Concordia	195	150	150	Admin began April 19, 2016; 71 files. Admin ceased May 13, 2016.
Republican River at Clay Center	321	200	200	Admin began April 19, 2016; 147 files. Admin ceased May 13, 2016.
Little Blue River near Barnes	75	75	80	
Medicine Lodge River near Kiowa	4	6	1	

Flooding

The table below summarizes recent flood conditions for July 2016 from USGS WaterWatch data. Note flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor Flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience.

USGS Station Number	USGS Station Name	Drain. Area [mi^2]	NWS Flood Stage [ft]	No. of Days Above Flood Stage	NWS flood class *	Highest peak from 2016-07-01 to 2016-07-25				Historical Peaks	
						Date	Stage [ft]	Stream flow (date) [ft^3/s]	Rank	No. of Yrs	Max. (year) [ft^3/s]
06891850	STRANGER C AT EASTON, KS	216	17	4	▲	2016-07-03	19.01	5030	--	--	--
07143310	COW C NR HUTCHINSON, KS	859.5	9.5	6	▲	2016-07-06	10.99	--	--	--	--
07143665	L ARKANSAS R AT ALTA MILLS, KS	736	22	4	▲	2016-07-04	25.01	7440	15	42	30100 (1973)
07143672	L ARKANSAS R AT HWY 50 NR HALSTEAD, KS	759	25	5	▲	2016-07-04	26.72	8750	3	19	11000 (2007)
07144050	EMMA C AT SEDGWICK, KS	--	19	1	▲	2016-07-03	19.83	7740	--	--	--
07144100	L ARKANSAS R NR SEDGWICK, KS	1239	22	2	▲	2016-07-04	23.81	13600	6	21	17600 (1998)
07144480	COWSKIN C AT 119TH ST AT WICHITA, KS	86	18	2	▲	2016-07-03	19.8	3480	5	14	5870 (2009)
07144550	ARKANSAS R AT DERBY, KS	40830	12	1	▲	2016-07-03	13.66	31100	9	46	58300 (1998)
07145200	SF NINNESCAH R NR MURDOCK, KS	650	8	1	▲	2016-07-03	8.56	3630	42	64	28700 (1979)
07146500	ARKANSAS R AT ARKANSAS CITY, KS	43713	11	5	▲	2016-07-05	14.95	34000	32	97	103000 (1923)
07147190	WHITEWATER R AT AUGUSTA, KS	456.00	21	3	▲	2016-07-03	24.56	--	--	--	--
07147800	WALNUT R AT WINFIELD, KS	1880	18	4	▲	2016-07-05	22.94	25300	38	96	105000 (1944)
07147900	WALNUT R AT ARKANSAS CITY, KS	1952	18	2	▲	2016-07-05	18.86	--	--	--	--
07157500	CROOKED C NR ENGLEWOOD, KS	1157	6.5	2	▲	2016-07-03	7.29	368	44	72	13600 (1955)
07180400	COTTONWOOD R NR FLORENCE, KS	754	22	1	▲	2016-07-03	23.03	10700	23	54	73700 (1998)

* ▲=Minor Flooding ▲=Moderate Flooding

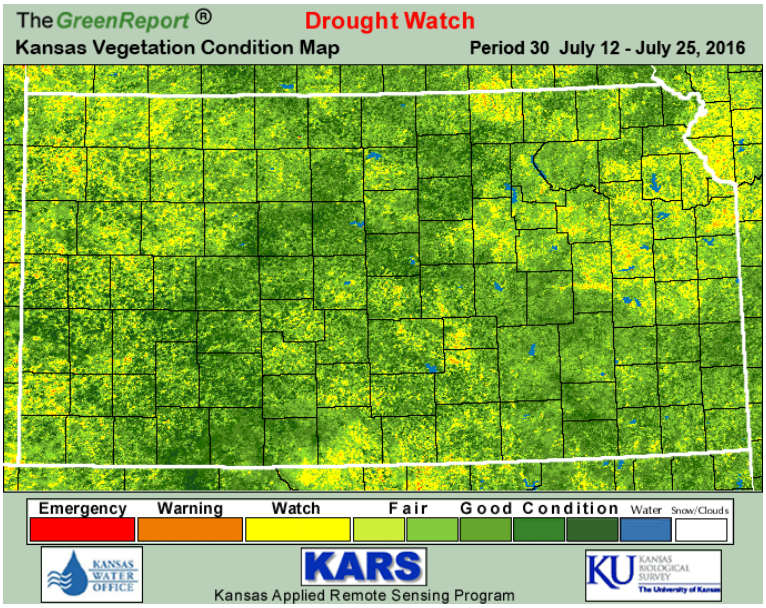
Note: USGS WaterWatch provides streamflow based on USGS monitored stream gages. NWS flood stage is found on the NWS River Conditions Map.

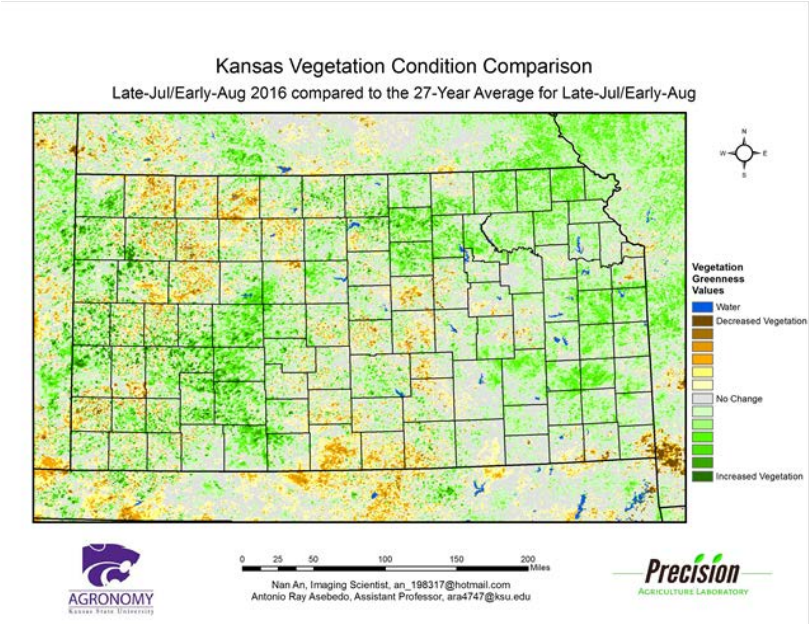
Soil, Crop and Vegetation

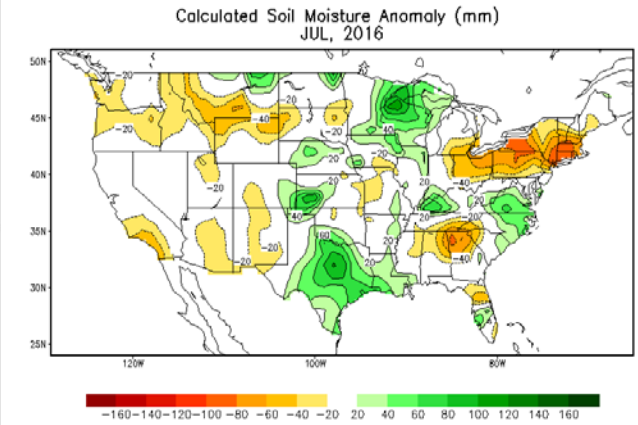
Kansas Vegetative Conditions

The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Despite warmer temperatures, most the state is in great condition.

Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for late July 2016 from K-State's Precision Agriculture Laboratory shows lower vegetative activity is most evident in parts of Northwestern KS. Intermittent rains and more seasonal temperatures have reduced vegetative stress.







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.
http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

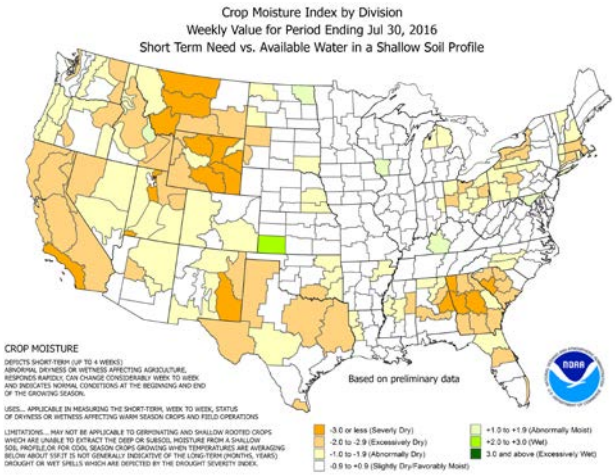
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for the week ending July 31, 2016 reported topsoil 4 percent very short, 18 short, 74 adequate, and 4 surplus. Subsoil moisture rated 3 percent very short, 17 short, 78 adequate, and 2 surplus.

Field Crops Condition: Corn condition rated 1 percent very poor, 6 poor, 26 fair, 57 good, and 10 excellent. Soybean condition rated 2 percent very poor, 7 poor, 33 fair, 52 good, and 6 excellent. Sorghum condition rated 1 percent very

poor, 3 poor, 22 fair, 64 good, and 10 excellent. Cotton condition rated 1 percent very poor, 1 poor, 33 fair, 63 good, and 2 excellent. Sunflower condition rated 0 percent very poor, 2 poor, 29 fair, 63 good, and 6 excellent. Alfalfa hay condition rated 1 percent very poor, 5 poor, 31 fair, 58 good, and 5 excellent.

Livestock Report: Pasture and range conditions rated 1percent very poor, 5 poor, 25 fair, 61 good, and 8 excellent. Stock water supplies were 1 percent very short, 7 short, 90 adequate, and 2 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

General Federal Disaster Assistance

USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of drought and other natural disasters. More information on these programs may be found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock
The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. More detailed information on eligibility and sign up is available on the FSA fact sheet found at: http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at:
http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators. LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers
Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Kansas Climate Summary
The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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
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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

July 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	2.16	-0.97	69%	76.7	2.2	103 (20)	53 (12)
Dodge City	5.30	2.22	172%	80.1	0.5	101 (23,22)	58 (16)
Garden City	7.57	4.79	272%	78.7	0.5	100 (22)	57 (16,15)
Goodland	2.75	-0.72	79%	77.7	2.0	104 (22,21)	56 (12)
Guymon, OK	1.77	-0.89	67%	82.9	3.3	110 (11)	60 (16)
Hill City	2.30	-1.41	62%	80.4	1.3	103 (5)	61 (16)
Lamar, CO	0.57	-2.32	20%	79.8	2.5	105 (21,16)	56 (16)
McCook, NE	2.38	-0.87	73%	78.0	2.1	104 (20)	54 (12)
Springfield, CO	0.20	-2.63	7%	78.0	1.8	103 (23)	54 (30)
Central							
Concordia	6.17	2.25	157%	79.1	0.0	100 (21,5)	61 (3)
Hebron, NE	2.45	-1.68	59%	77.3	0.2	99 (21)	58 (26)
Medicine Lodge	2.59	-0.79	77%	83.4	1.3	106 (22)	63 (15)
Ponca City, OK	6.55	3.22	197%	83.8	2.1	102 (24,23)	66 (14)
Salina	2.33	-1.96	54%	83.7	2.6	109 (22)	66 (15)
Wichita (ICT)	9.67	6.35	291%	83.6	2.5	105 (23,22)	67 (15,2)
East							
Bartlesville, OK	4.31	0.90	126%	81.9	0.8	102 (24)	65 (29,14)
Chanute	4.49	0.12	103%	80.9	1.4	97 (24)	66 (15)
Fall City, NE	4.99	-0.55	90%	77.3	-0.2	98 (5)	59 (30,3)
Johnson Co. Exec. Apt	4.39	0.67	118%	78.2	-0.1	96 (24,21)	62 (3)
Joplin, MO	5.30	1.49	139%	80.7	0.5	98 (24)	65 (15)
Kansas City (MCI), MO	8.76	4.31	197%	78.6	0.3	96 (21)	61 (3)
St. Joseph, MO	8.54	3.35	165%	78.1	1.0	96 (21)	59 (30)
Topeka (TOP	5.36	1.54	140%	80.0	1.0	100 (22)	63 (30)

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

KANSAS CLIMATE and DROUGHT UPDATE – August 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

- No Kansas County was under a State drought stage in August.
- The US Drought Monitor indicated dry conditions various weeks for small areas of Kansas during the month, with August ending with the majority of Rawlins County and sliver of western Decatur County in moderate drought (D1).
- Minor Flooding occurred at six locations in August (USGS WaterWatch data).

Lakes and Streams

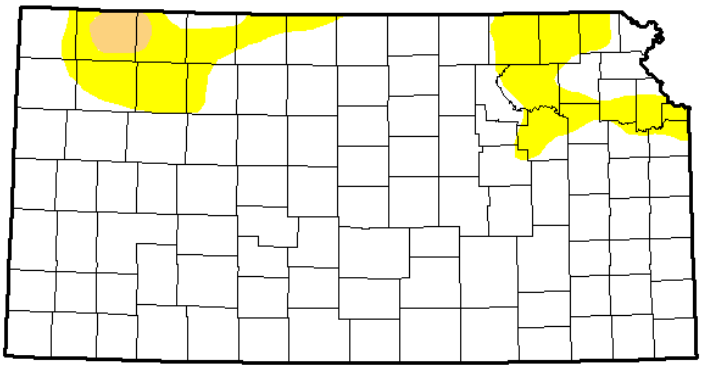
- Norton, Cedar Bluff, Webster, Wilson and Kirwin reservoirs were below conservation pool throughout August.
- Lakes on the public health warning list due to blue-green algae blooms: Milford Reservoir Zones B & C, Clay and Geary Counties; Overbrook City Lake, Osage County; and South Lake, Johnson County. (September 2, 2016)
- Lakes on public health watch list due to blue-green algae blooms: Atchison County Park Lake, Atchison County; Lake Afton, Sedgwick County; Milford Reservoir Zone A, Geary County. (September 2, 2016)

General Conditions

The U.S. Drought Monitor reflected the above normal precipitation coupled with near normal temperatures to allow for removal of the abnormally dry conditions in the eastern third of the state. On the other hand, the continued below normal rainfall in the Northwest Climate Division resulted in an intensification of drought in that region. Abnormal dry conditions returned to the map for the first time since April 26th, 2016.

U.S. Drought Monitor

Kansas



August 23, 2016

(Released Thursday, Aug. 25, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	87.36	12.64	0.97	0.00	0.00	0.00
Last Week 8/16/2016	86.96	13.04	0.00	0.00	0.00	0.00
3 Months Ago 5/24/2016	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 8/25/2015	93.12	6.88	0.00	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

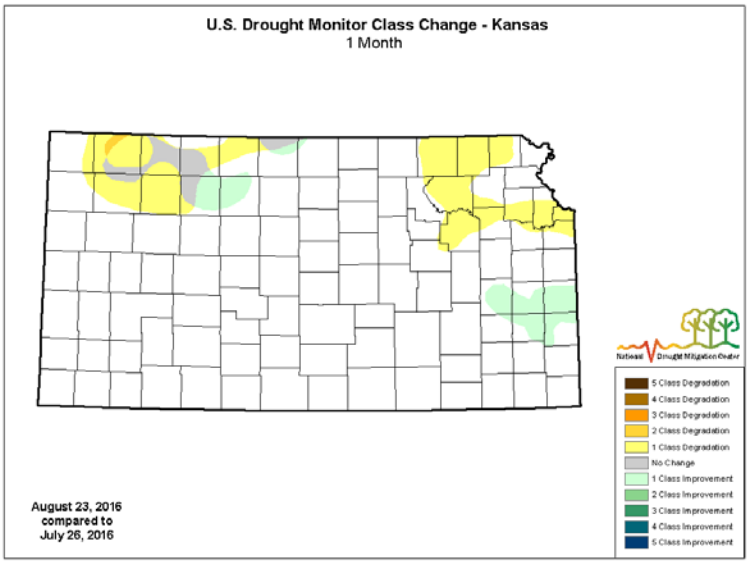
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Brad Rippey

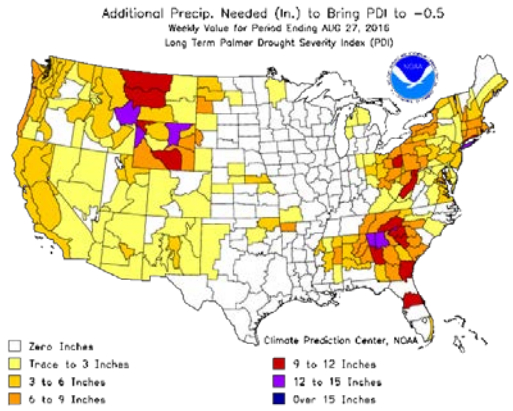
U.S. Department of Agriculture

http://droughtmonitor.unl.edu/



http://droughtmonitor.unl.edu

More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.



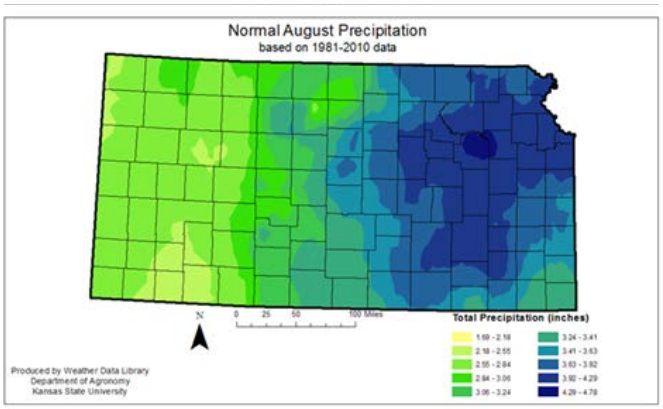
Palmer Drought Severity Index (PDSI) - The Palmer Index is an indicator used in the U.S. Drought Monitor. The PDI for the period ending August 27, 2016 indicates a trace to three inches of moisture is needed over the next four weeks in the Northwest and Northeast Climate Divisions to bring those areas to their normal moisture conditions.

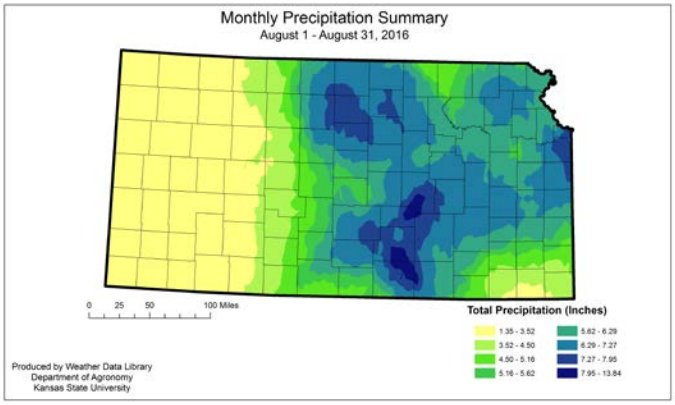
Climate Summary (Temperature and Precipitation)

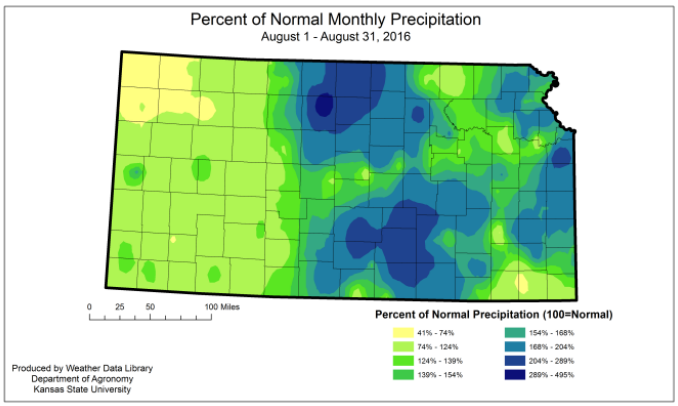
State-wide rainfall for August was well above normal. However the Northwest Climate Division missed out on the extra rainfall again. The Northwest Division averaged 1.74 inches or just 64 percent of normal. In contrast, the South Central Division averaged 6.42 inches or 186 percent of normal. This August ranks as the 51st wettest in the 122 years of record. The wettest August on record occurred in 1927, when the statewide average total was 6.63 inches. With the overall wet pattern it is no surprise that there were 127 new record daily rainfall totals. Of those, four reports set new monthly records, and two set new all-time records as well: 6.84 inches at Peck 2S, Sedgwick County on the 20th and 2.84 inches at Goff 3WSW on the 26th. The 6.84 inches at Peck 2S was the greatest 24 hour total for a NWS station. The greatest 24 hour total for a CoCoRaHS station was 6.22 inches at Haysville 3.8 SSE, Sedgwick County, also on the 20th. Highest monthly totals: 13.84 inches at Peck 2S, Sedgwick County (NWS) and 13.01 inches at Mulvane 1.5 ESE, Sumner County (CoCoRaHS).

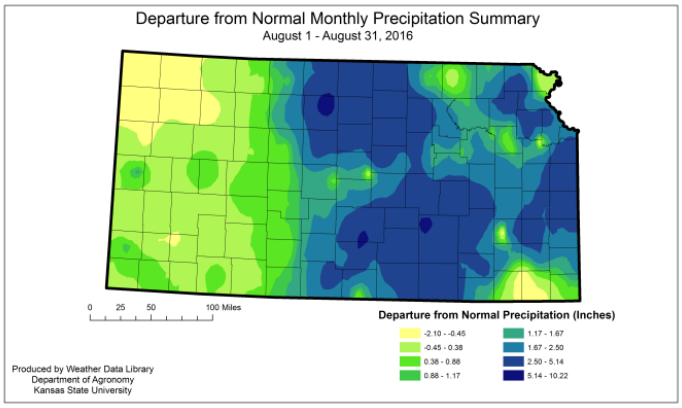
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

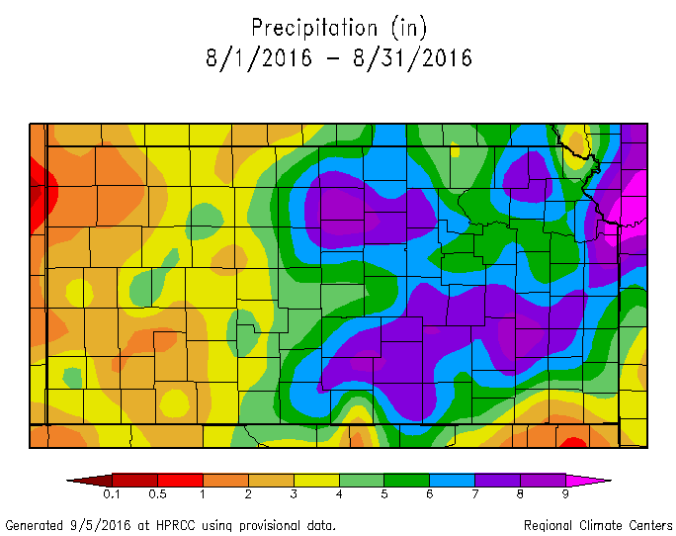
Kansas Climate Division Precipitation Summary (inches)												
	August 1-31, 2016			January 1– August 31, 2016			April 1 – August 31, 2016			September 1– August 31, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	2.10	-0.58	78	15.54	-1.41	91	14.15	-0.44	97	20.89	-0.14	99
West Central	2.99	0.43	116	17.24	0.89	104	15.90	2.10	114	22.57	2.41	112
Southwest	2.61	-0.06	97	19.27	3.76	123	18.89	5.81	143	26.50	6.35	132
North Central	6.11	2.86	187	25.00	3.61	116	23.21	5.37	129	31.96	4.18	115
Central	6.33	2.79	176	26.44	3.87	117	24.48	5.94	132	34.29	5.40	119
South Central	6.59	3.18	191	26.95	3.39	114	25.25	6.40	133	36.44	6.98	124
Northeast	5.25	1.36	136	25.71	-0.08	99	23.43	1.95	108	36.22	0.76	102
East Central	6.02	1.94	147	26.89	-0.84	96	24.42	1.72	106	37.69	-0.76	98
Southeast	6.16	2.41	162	30.24	0.71	102	27.36	3.93	117	42.46	1.60	104
STATE	4.94	1.64	144	23.86	1.77	108	22.10	3.93	121	32.33	3.19	111

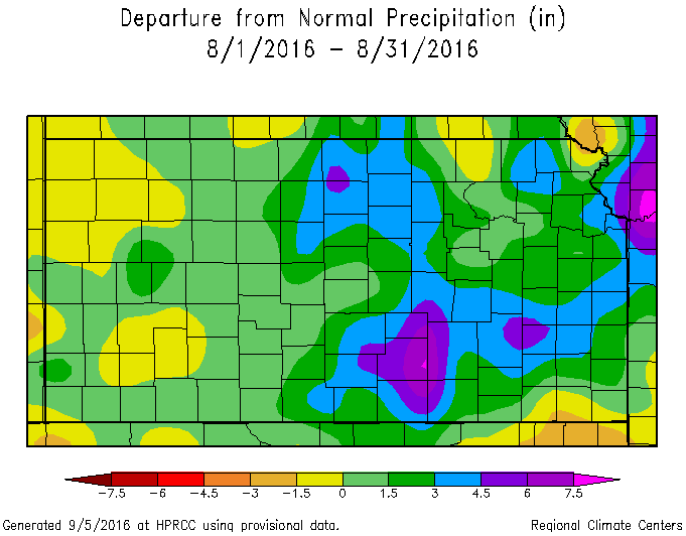










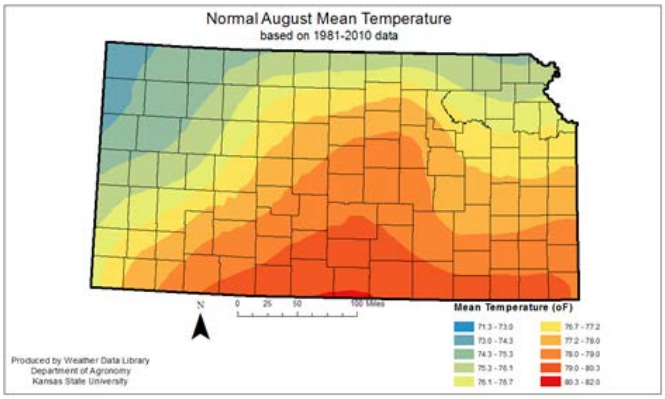


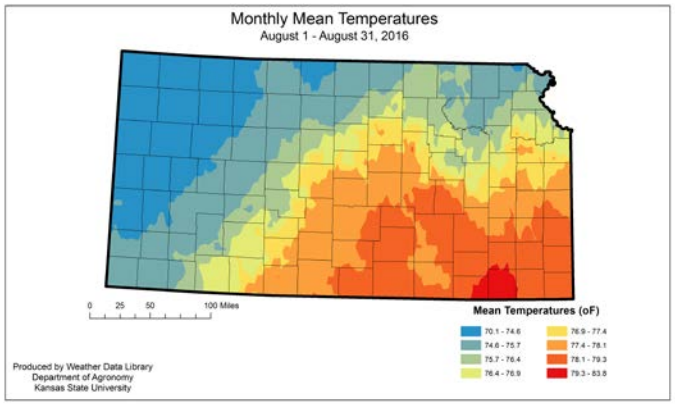
Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

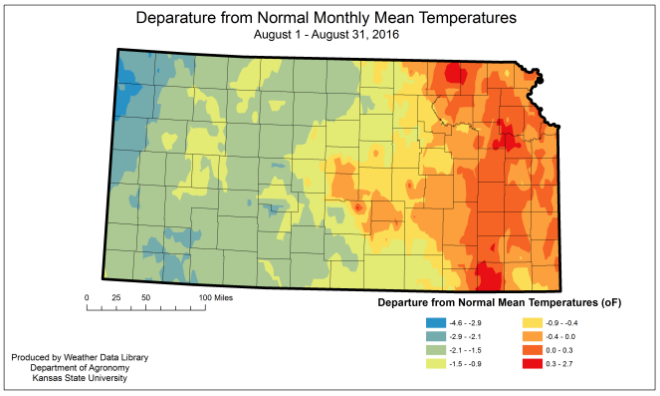
August had very close to normal temperatures, but was much wetter than normal over most of the state. The state-wide average temperature was 76.2 ^{o}F, or 0.7 degrees cooler than normal. The standard deviation for the mean temperature is 2.7 ^{o}F, so this isn't a significant departure. On the temperature side, this was the 43rd warmest since 1896, which places it in the middle range of the distribution. The Southeast Division was closest to normal for the month. Their average was 78.4 ^{o}F, or exactly normal. The warmest division was the Northeast Division where average temperature was 78.2 ^{o}F or

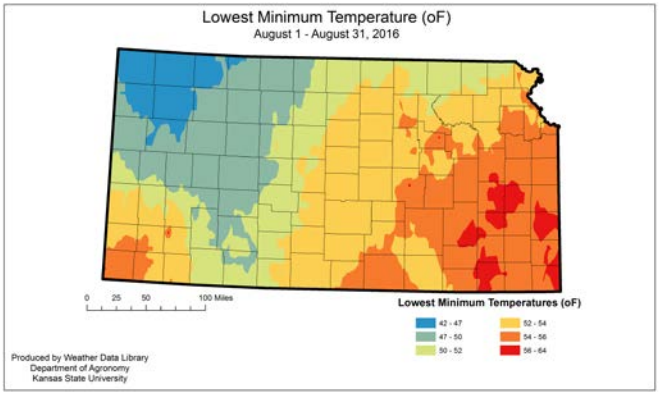
0.4 degrees warmer than normal. There was only 1 event that tied the daily record high temperature, when Salina reached 103 °F on the 11th. In contrast, 36 new low maximum temperature records were set. There were 11 new record warm minimum temperatures set, and 12 records tied. The highest temperature recorded was 104 °F set at two locations: Hutchinson Airport, Reno County, and Salina, Saline County, on the 3rd. The coldest temperature recorded for the month was 42 °F at Atwood, Rawlins County, on the 21st.

Climate Division	Kansas Climate Division Temperature Summary (°F)							
	August 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	86.6	59.6	73.1	-1.5	103	2	42	21
West Central	87.3	60.7	74.0	-1.4	100	2	47	21
Southwest	88.7	63.1	75.9	-1.2	103	12	49	21
North Central	86.8	65.0	75.9	-0.9	99	4	49	21
Central	88.2	65.9	77.0	-1.0	104	3	48	21
South Central	89.5	67.4	78.4	-0.6	102	3	47	22
Northeast	86.1	66.5	76.3	0.4	98	5	53	21
East Central	86.4	67.7	77.1	0.1	101	5	51	23
Southeast	88.5	68.3	78.4	0.0	102	5	53	22
STATE	87.6	64.9	76.2	-0.7	104	15th	42	21st
Data Source: KSU Weather Library								

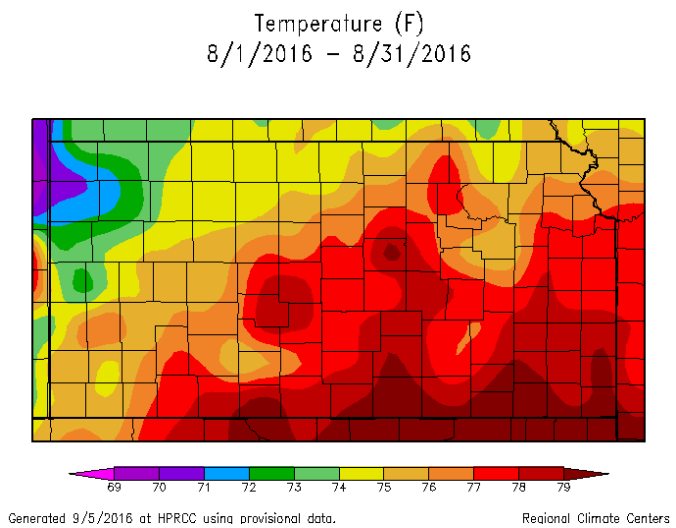


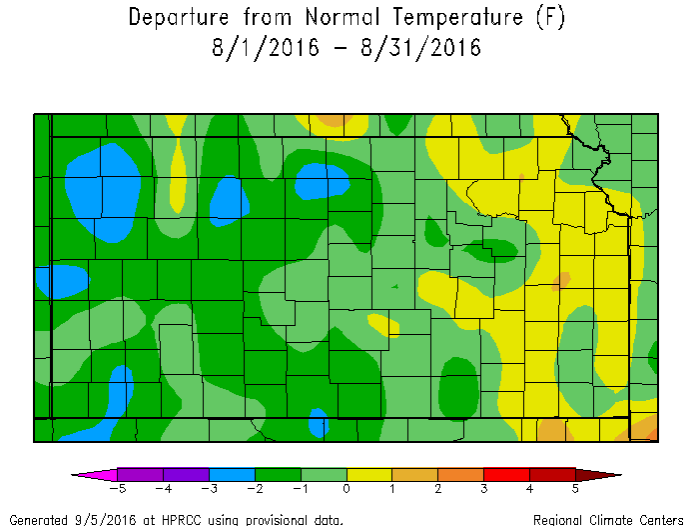






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



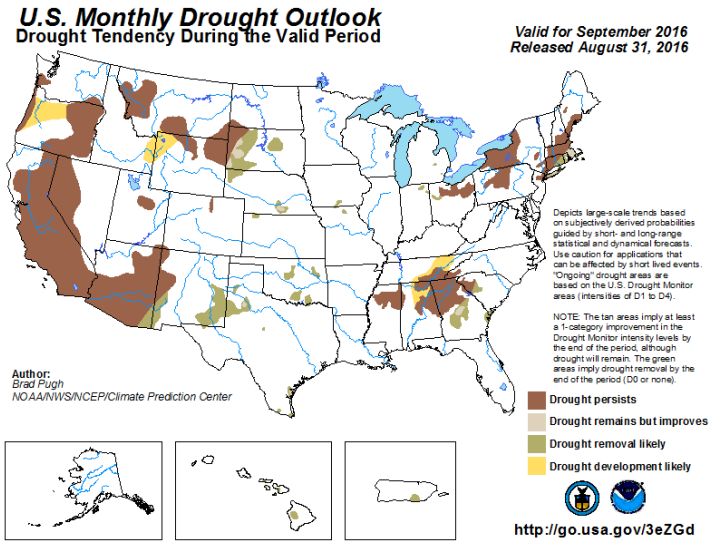


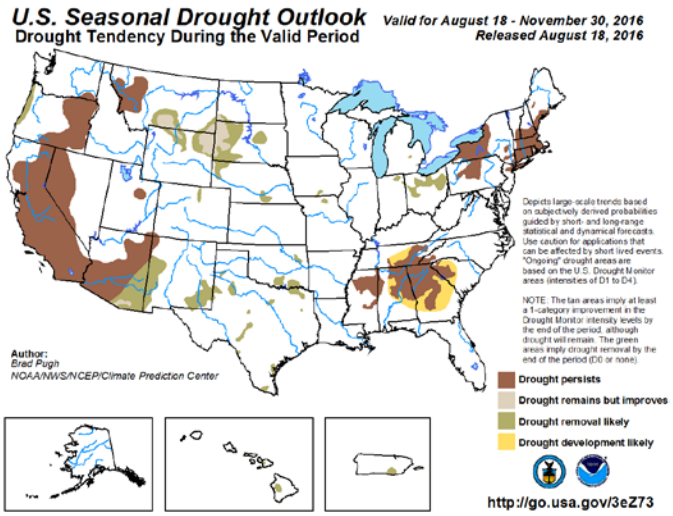
With the continued wet pattern severe weather was also a factor, although not to the degree that was seen in July. There were two tornadoes reported in August. Fortunately there were no deaths or injuries reported with the events. There were a total of 27 hail reports. The most common severe weather report was damaging winds, with 65 damaging wind reports in the month.

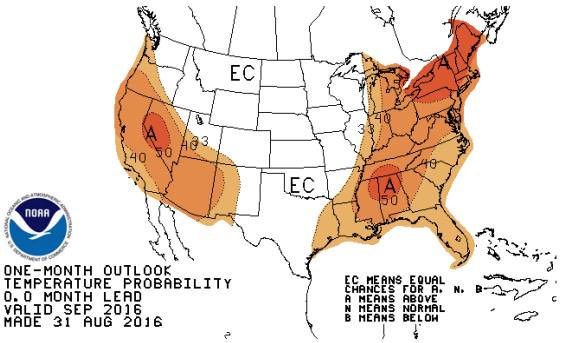
Future Outlook

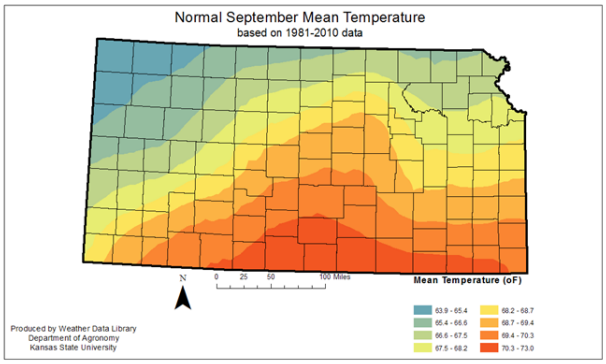
The precipitation outlook for September is neutral, with it equally likely to have above or below normal precipitation. Statewide, the outlook is also equal chance of above or below normal temperatures.

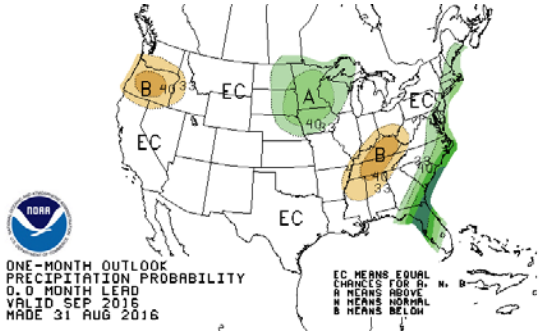
Both the Drought Outlooks and individual temperature and precipitation outlooks are provided below. Average temperature and precipitation maps are included for reference.

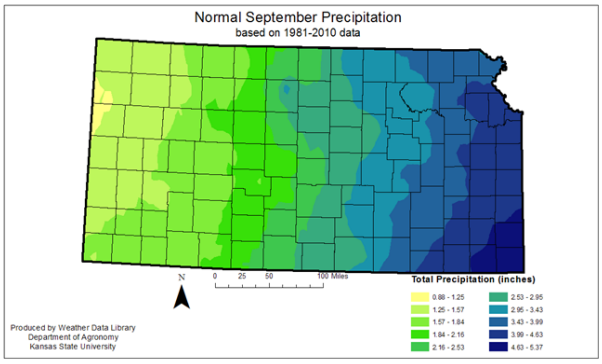




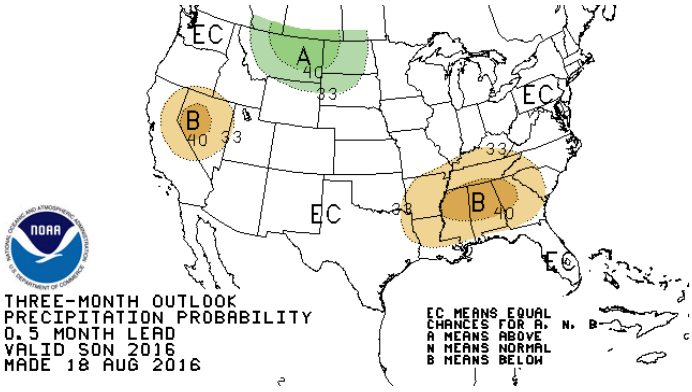


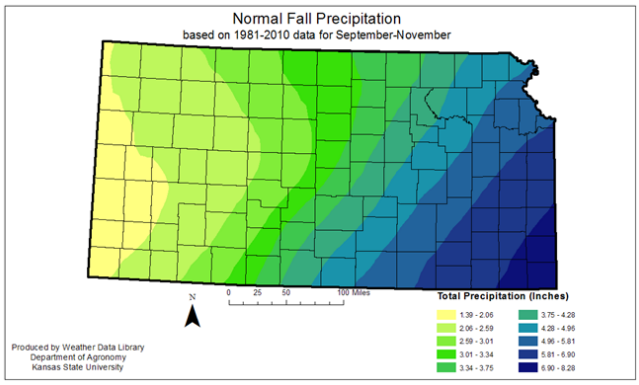


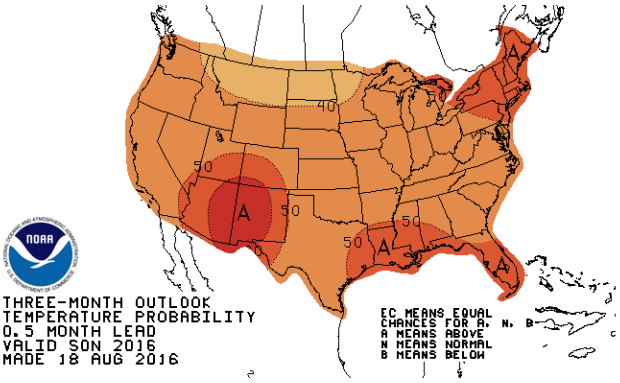


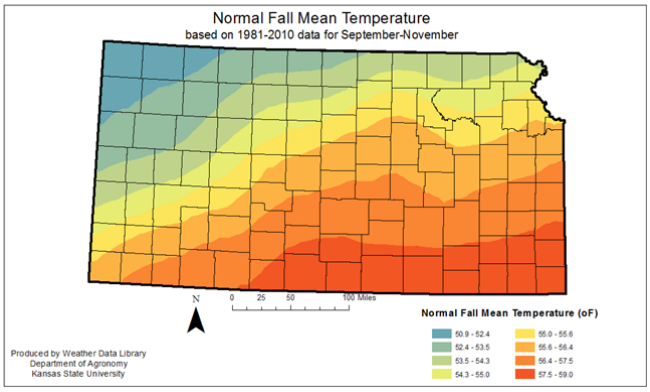


The three-month outlook favors above normal temperatures and normal precipitation for September through November 2016.









Additional outlooks for additional 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.

Known issues:

Stage II water restrictions, under Resolution 03-16 are in place for the **City of Russell,** Russell County water customers as of July 31, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the **City of Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (July 31, 2016, http://victoriaks.com/utilities.htm.)

Surface Water Supply Conditions

Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs began and ended the month with full conservation storage. Inflows were sufficient to maintain storage and streamflow throughout the month of August.

Marais des Cygnes basin: Melvern and Pomona reservoirs maintained storage in excess of conservation throughout the month of August. Hillsdale dropped below normal pool but refilled by the end of the month. Some flood pool storage was evacuated which helped kept flow in the Marais des Cygnes River above median levels.

Cottonwood / Neosho basin: A few precipitation events maintained river flow and storage in August. River flow remained at or above normal throughout the basin, particularly in the middle and lower system.

Verdigris basin: Toronto, Fall River, Big Hill, and Elk City reservoirs maintained healthy storage in August. Verdigris River streamflow remained well above historic median values.

Saline basin: Elevation at Wilson Lake was maintained about 5 feet low throughout August. *Note: Given the timing of this report it should be mentioned that a significant precipitation event in the first week of September has provided enough inflow to fill Wilson conservation storage and more.*

Smoky Hill basin: The middle Smoky Hill basin maintained streamflow but below median values in August. Kanopolis Reservoir pool level steadily declined over the month without significant inflow events and ended the month about two feet below the seasonal target elevation. Discharge continued through the uncontrolled notch spillway. Cedar Bluff Reservoir did not experience any significant inflow and steadily declined in August.

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. During the month, various lakes were in watch or warning status, with one portion of Milford closed entirely for a portion of the month.

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.

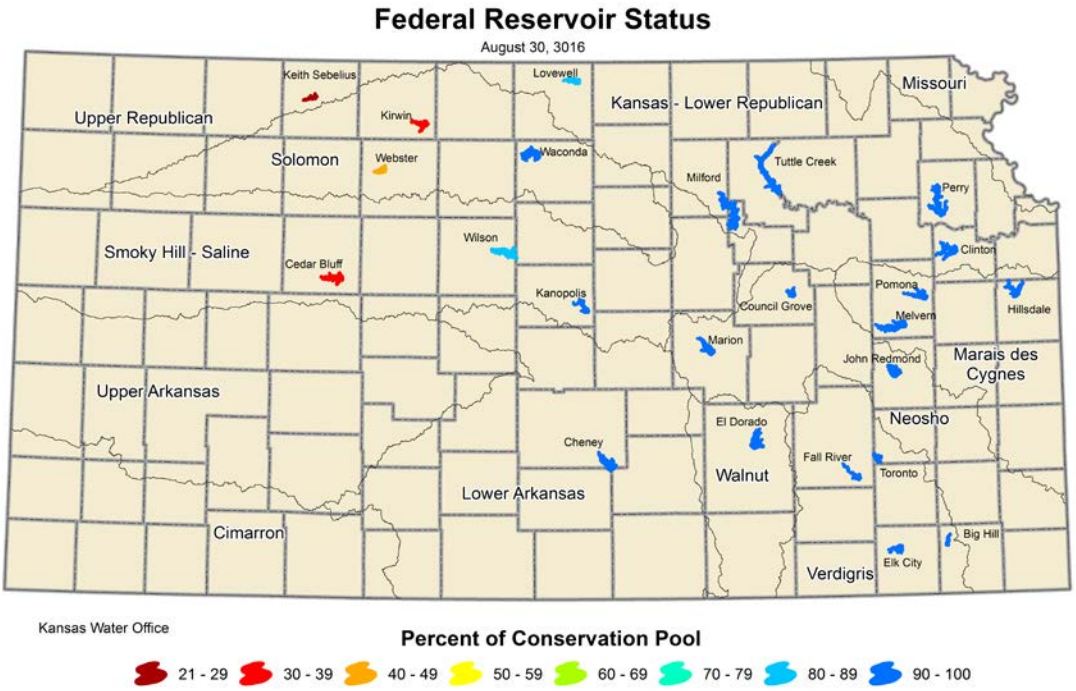
As of September 2, 2016, a public health watch was in place for Atchison County Park Lake, Atchison County; Lake Afton, Sedgwick County; and Milford Lake- Zone A, Geary County.

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.

As of September 2, 2016 lakes on the public health warning list were: Milford Reservoir Zones B & C, Clay and Geary Counties; Overbrook City Lake, Osage County; and South Lake, Johnson County.

General Reservoir Conditions

The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff, Webster, and Kirwin reservoirs remain significantly below conservation pool.



Kansas Federal Reservoir Conservation Pool Levels

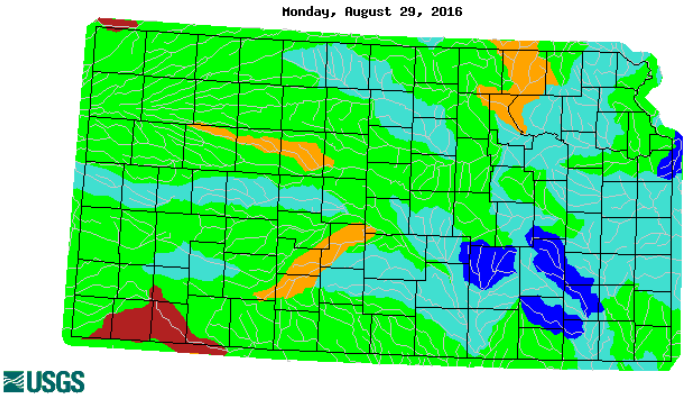
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**08/29/2016 06:00 AM**		
Norton[1]	2304.3	2288.22	-16.08	28.6
Harlan County, NE	1945.73	1935.28	-10.45	60.8
Lovewell[1]	1582.6	1581.02	-1.58	87.2
Milford[1]	1144.4	1145.96	1.56	100.0
Cedar Bluff	2144	2119.99	-24.01	33.5
Kanopolis[1]	1463	1465.87	2.87	100.0
Wilson[1]	1516	1510.75	-5.25	81.7
Webster[1]	1892.5	1876.41	-16.04	38.5
Kirwin[1]	1729.3	1711.14	-18.11	30.9
Waconda[1]	1455.6	1457.04	1.44	100.0
Tuttle Creek[1]	1075	1077.26	2.26	100.0
Perry[1]	891.5	895.21	3.71	100.0
Clinton[1]	875.5	875.64	0.14	100.0
Melvern[1]	1036	1036.45	0.45	100.0
Pomona[1]	974	974.40	0.40	100.0
Hillsdale[1]	917	917.78	0.78	100.0
Arkansas River Basin		**08/30/2016 08:00 AM**		
Cheney	1421.6	1422.18	0.58	100.0
El Dorado	1339	1339.30	0.30	100.0
Toronto[1]	901.5	901.40	-0.10	98.0
Fall River[1]	948.5	949.04	0.54	100.0
Elk City[1]	796	796.66	0.66	100.0
Big Hill	858	857.84	-0.16	100.0
Council Grove[1]	1274	1273.93	-0.07	100.0
Marion[1]	1350.5	1350.78	0.28	100.0
John Redmond[1]	1039	1043.09	2.09	100.0

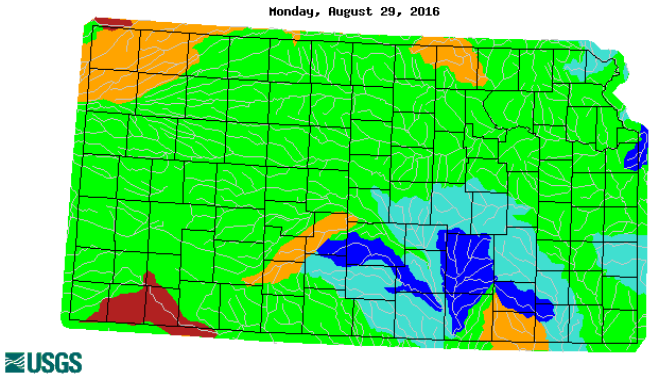
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.

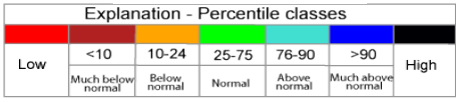
Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the 28 day streamflow compared to historical is shown on the map below, right.

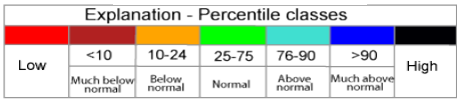




7-day streamflow



Monthly streamflow



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.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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.

Streamflows as of September 1, 2016	**cubic feet per second ((cfs)**			
Gaging Station	**Current Flow**	**August MDS**	**September MDS**	**Comment**
Republican River at Concordia	738	150	80	Admin began April 19, 2016; 71 files. Admin ceased May 13, 2016.
Republican River at Clay Center	1620	200	100	Admin began April 19, 2016; 147 files. Admin ceased May 13, 2016.

Flooding

The table below summarizes recent flood conditions for August 2016 from USGS WaterWatch data. Note: flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor Flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience.

USGS Station Number	USGS Station Name	Drain. Area [mi^2]	NWS Flood Stage [ft]	No. of Days Above Flood Stage	NWS flood class*	Highest peak from 2016-07-01 to 2016-07-25				Historical Peaks	
						Date	Stage [ft]	Streamflow (date) [ft^3/s]	Rank	No. of Yrs	Max. (year) [ft^3/s]
06874000	SF SOLOMON R AT OSBORNE, KS	2012	14	2		2016-08-25	15.84	2160	32	69	81200 (1951)
06893390	INDIAN C AT STATE LINE RD, LEAWOOD, KS	64.17	20	2		2016-08-24	20.98	8420	8	11	18700 (2010)
07145200	SF NINNESCAH R NR MURDOCK, KS	650	8	1		2016-08-08	9.51	4840	34	64	28700 (1979
07145500	NINNESCAH R NR PECK, KS	2129	17	1		2016-08-09	17	13600	34	78	70000 (1923)
07145700	SLATE C AT WELLINGTON, KS	154	19	2		2016-08-20	21.59	4980	26	55	28500 (1975)
07146500	ARKANSAS R AT ARKANSAS CITY, KS	43713	11	2		2016-08-20	12.92	23800	45	97	103000

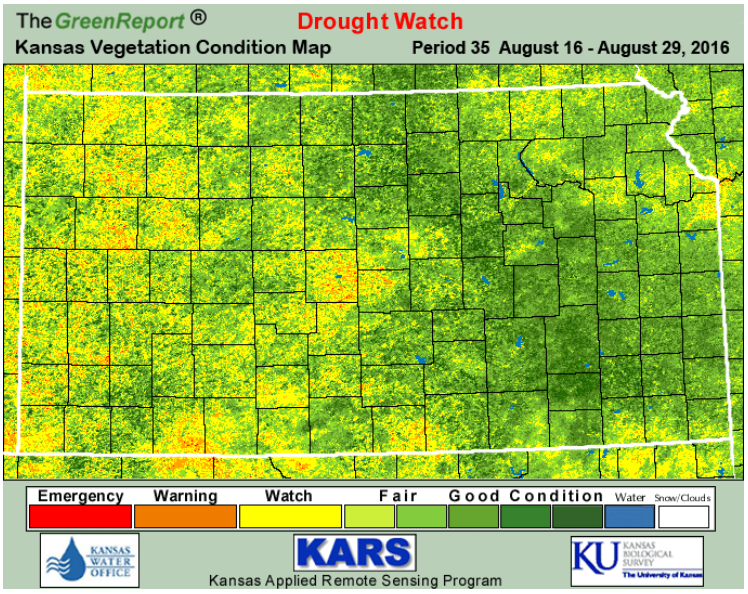
* =Minor Flooding =Moderate Flooding

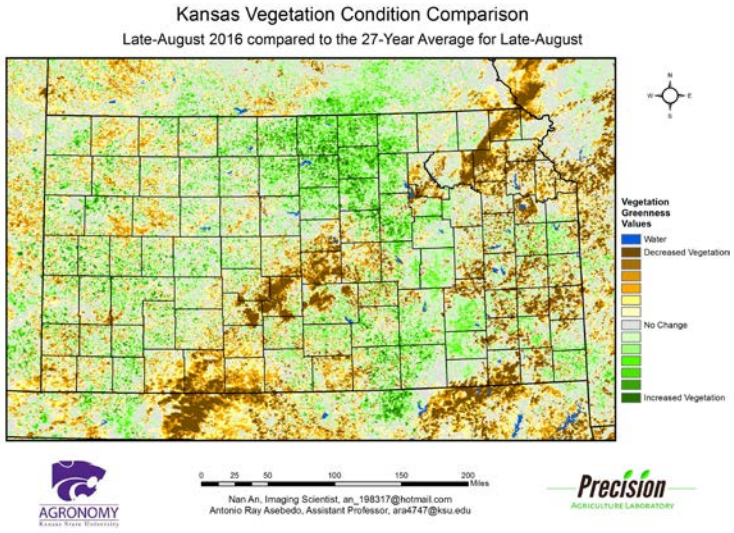
Note: USGS WaterWatch provides streamflow based on USGS monitored stream gages. NWS flood stage is found on the NWS River Conditions Map.

Soil, Crop and Vegetation

Kansas Vegetative Conditions

The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. The west is showing some signs of stress, however corn is beginning to brown-down in these areas. The east remains in great shape.

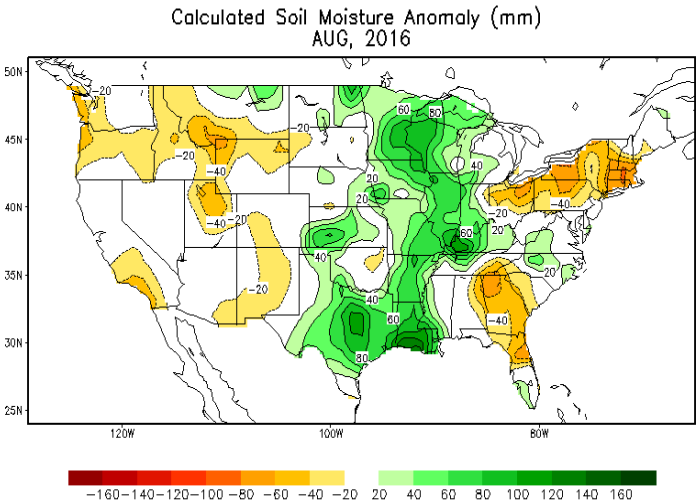




Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for August 23 – August 29, 2016 from K-State's Precision Agriculture Laboratory shows lower vegetative activity in a band from Southwest to Northeast Kansas. That parallels the line of heavy rain and cloud cover that dominated the period. In contrast, the area of decreased vegetative activity in the Northwestern Climate Division has been reduced, thanks to timely rains and favorable temperatures.

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.
http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml



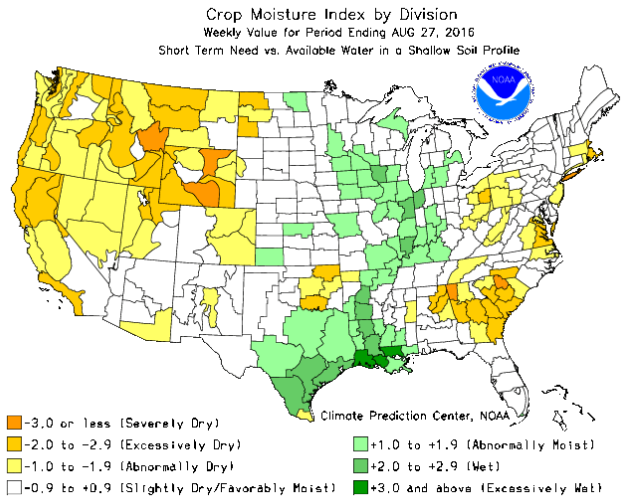
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at:
http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for the week ending August 28, 2016 reported topsoil 4 percent very short, 13 short, 75 adequate, and 8 surplus. Subsoil moisture rated 3 percent very short, 15 short, 78 adequate, and 4 surplus.

Field Crops Condition: Corn condition rated 1 percent very poor, 6 poor, 25 fair, 56 good, and 12 excellent. Soybean condition rated 1 percent very poor, 4 poor, 27 fair, 55 good, and 13 excellent. Sorghum condition rated 1

percent very poor, 3 poor, 22 fair, 59 good, and 15 excellent. Cotton condition rated 1 percent very poor, 2 poor, 29 fair, 64 good, and 4 excellent. Sunflower condition rated 0 percent very poor, 2 poor, 28 fair, 63 good, and 7 excellent. Alfalfa hay condition rated 1 percent very poor, 4 poor, 31 fair, 58 good, and 6 excellent.

Livestock Report: Pasture and range conditions rated 1percent very poor, 4 poor, 24 fair, 61 good, and 10 excellent. Stock water supplies were 1 percent very short, 6 short, 90 adequate, and 3 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

General Federal Disaster Assistance

USDA has financial and technical assistance to immediately help crop and livestock producers in cope with the adverse impacts of drought and other natural disasters. More information on these programs may be found at: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

USDA's Rural Development works with existing individual and community borrowers that have been affected by a natural disaster to help them with their loans. With respect to loans guaranteed by Rural Development, borrowers should initially contact their lender for assistance.

USDA's Farm Service Agency (FSA) provides emergency loans through the Emergency Loan Program to help producers recover from production and physical losses due to natural disasters. Producers were eligible for these loans as soon as their county was declared a Presidential or Secretarial disaster county. More information may be found at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing and http://www.fsa.usda.gov/Internet/FSA_File/disasterfsaprograms.pdf.

USDA's Risk Management Agency aids producers on crop losses, those with questions should contact their crop insurance companies and local USDA Farm Service Agency Service Centers, as applicable, to report damages to crops or livestock loss, and not to destroy or discontinue care for your crops. Livestock producers need to keep thorough records of losses, including additional expenses for such things as food purchased due to lost supplies. USDA Risk Management Agency information on crop insurance and drought damaged crops can be found at: http://www.rma.usda.gov/fields/ks_rso/2011/droughtfaq.pdf.

USDA's NRCS administers the Emergency Watershed Protection Program, which provides assistance to areas that have been damaged by natural disasters, such as floods, windstorms, drought, and wildfires. In partnership and through local government sponsors, NRCS helps local communities recover from natural disasters.

Forms for disaster relief programs are found at: http://www.disasterassistance.gov/federal-agency/2.

Livestock
The 2014 Farm Bill makes the **Livestock Forage Disaster Program (LFP)** a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. More detailed information on eligibility and sign up is available on the FSA fact sheet found at: http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf

An eligibility tool keyed to the U.S. Drought Monitor is available at:
http://droughtmonitor.unl.edu/fsa/FsaEligibilityCounty.aspx

The 2014 Farm Bill makes the **Livestock Indemnity Payments (LIP)** a permanent program and provides retroactive authority to cover eligible livestock losses back to Oct. 1, 2011. LIP provides compensation to eligible livestock producers who have suffered livestock death losses in excess of normal mortality due to adverse weather and attacks by animals reintroduced into the wild by the federal government or protected by federal law, including wolves and avian predators. LIP payments are equal to 75 percent of the market value of the applicable livestock on the day before the date of death of the livestock. Fact sheet is available at http://www.fsa.usda.gov/Internet/FSA_File/lip_pf_022414_1.pdf.

Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish (ELAP): ELAP provides emergency assistance to eligible producers of livestock, honeybees and farm-raised fish for losses due to disease (including cattle tick fever), adverse weather, or other conditions, such as blizzards and wildfires, not covered by LFP and LIP.

Other Federal Disaster Assistance for Producers
Department of Transportation Emergency Exemptions of Federal Operating Requirements: This authority can put more commercial drivers behind the wheel-driving large trucks needed to assist the farmers and ranchers in need. If a qualifying drought emergency has been declared in a state by the Governor or appropriate official, the state automatically gets Hours of Service and other regulatory relief for those providing emergency assistance; no application is needed. If the situation does not qualify for emergency relief, the Federal rules regulating large truck and bus operations may be waived in certain circumstances. DOT can process a request to waive regulations in 7-14 days.

Department of Interior grazing on Federal lands: The Department of the Interior's Bureau of Land Management (BLM) and the USDA Forest Service are providing relief to ranchers who graze on public lands by employing flexibility to accommodate needs and conditions on the ground.

Tree Assistance Program (TAP): TAP provides financial assistance to qualifying orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines damaged by natural disasters through FSA.

Kansas Climate Summary
The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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
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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

August 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	0.53	-1.88	22%	71.8	-0.3	99 (10)	48 (20)
Dodge City	2.88	0.13	105%	76.6	-1.5	100 (1)	52 (21)
Garden City	1.72	-0.73	70%	75.1	-1.6	97 (23,4)	53 (21)
Goodland	2.31	-0.39	86%	72.0	-1.7	97 (10)	47 (21,20)
Guymon, OK	3.07	0.15	105%	77.1	-1.0	101 (4,1)	54 (15)
Hill City	3.73	0.82	128%	74.7	-1.9	99 (1)	46 (21)
Lamar, CO	T	-2.28	0%	75.1	-0.3	102 (10)	48 (27)
McCook, NE	2.70	-0.44	86%	74.1	0.3	102 (1)	44 (21)
Springfield, CO	1.01	-1.83	36%	72.0	-2.2	97 (2)	51 (19)
Central							
Concordia	6.01	2.87	191%	76.2	-0.9	98 (11)	57 (21)
Hebron, NE	6.08	2.35	163%	74.0	-1.2	94 (11)	50 (21)
Medicine Lodge	7.16	4.04	229%	78.5	-1.8	102 (3)	51 (21)
Ponca City, OK	2.75	-0.50	85%	80.8	-0.2	100 (11,3)	54 (21)
Salina	7.84	3.89	198%	79.7	0.1	104 (3)	53 (21)
Wichita (ICT)	8.28	4.57	223%	79.9	-0.1	101 (3)	57 (21)
East							
Bartlesville, OK	1.66	-1.41	54%	80.6	0.4	102 (11)	51 (22, 21)
Chanute	5.75	2.06	156%	78.8	-0.1	98 (11)	54 (21)
Fall City, NE	6.02	1.98	149%	76.2	0.8	98 (11)	53 (21)
Johnson Co. Exec. Apt	8.48	4.76	228%	76.7	-0.9	97 (4)	57 (22,21)
Joplin, MO	4.26	0.91	127%	79.4	-0.3	99 (4)	55 (21)
Kansas City (MCI), MO	9.16	5.27	235%	77.0	-0.1	98 (11)	55 (21)
St. Joseph, MO	6.74	2.76	169%	76.0	0.7	97 (11)	54 (21)
Topeka (TOP	0.53	-1.88	22%	71.8	-0.3	99 (10)	48 (20)

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

KANSAS CLIMATE and DROUGHT UPDATE – September 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

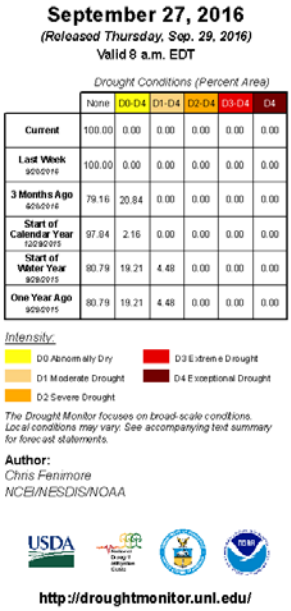
- The US Drought Monitor removed dry and drought conditions from all areas of Kansas during the month.
- Flood stage occurred at thirty-one stream gages during September. (USGS WaterWatch data).

Lakes and Streams

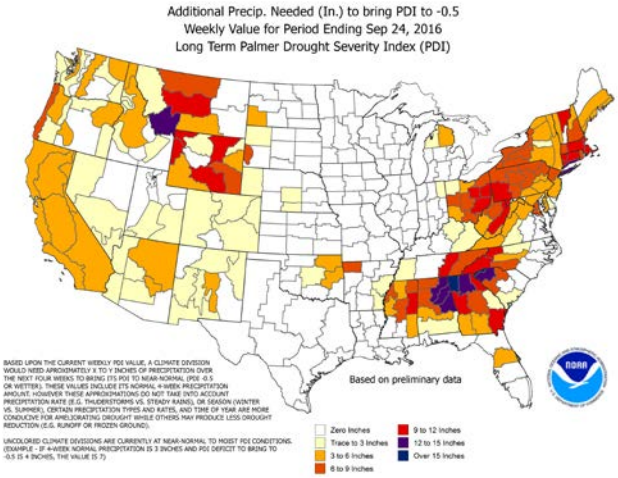
- Norton and Cedar Bluff continued to be significantly below conservation pool throughout September.
- Webster, Wilson and Kirwin reservoirs have been refilling during the month with Wilson's conservation pool completely full by the end of September.
- Lakes on the public health warning list due to blue-green algae blooms: Milford Reservoir Zones B & C, Clay and Geary Counties; Overbrook City Lake, Osage County; and South Lake, Johnson County. (September 29, 2016)
- Lakes on public health watch list due to blue-green algae blooms: Lake Afton, Sedgwick County; Lake Meade, Mead County; and Milford Reservoir Zone A, Clay County. (September 29, 2016)

General Conditions

Above normal precipitation coupled with near normal temperatures allowed for removal of the abnormally dry conditions across the state. On the other hand, the continued below normal rainfall in the western divisions coupled with warmer than normal temperatures increase the likelihood that abnormally dry conditions will return, particularly in the Southwestern Division.



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	100.00	0.00	0.00	0.00	0.00	0.00
Last Week 9/20/2016	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago 6/28/2016	79.16	20.84	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00
One Year Ago 9/29/2015	80.79	19.21	4.48	0.00	0.00	0.00



More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.

Palmer Drought Severity Index (PDSI) - The Palmer Index is an indicator used in the U.S. Drought Monitor. The PDI for the period ending August 27, 2016 indicates a trace to three inches of moisture is needed over the next four weeks in the Northwest and Northeast Climate Divisions to bring those areas to their normal moisture conditions.

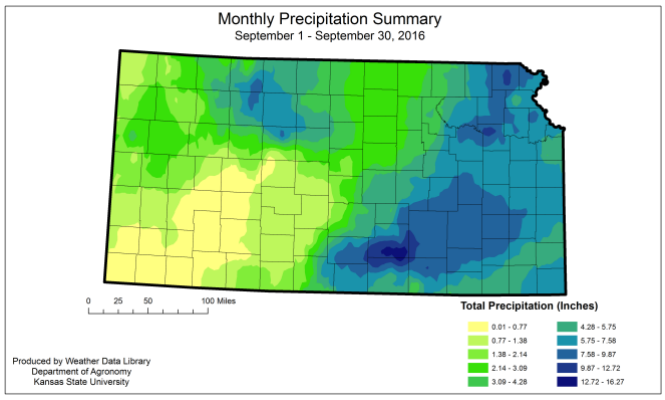
Climate Summary (Temperature and Precipitation)

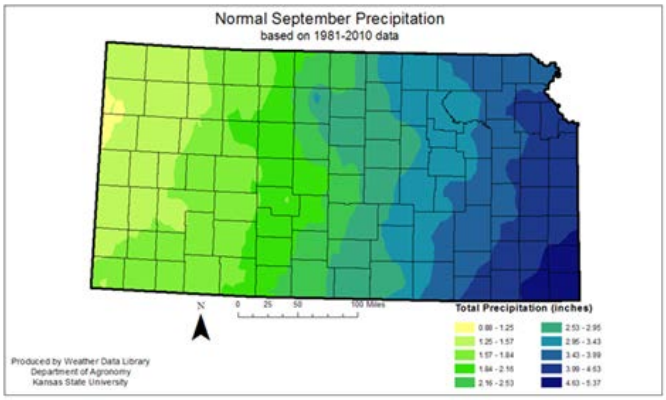
State-wide average rainfall for September was well above normal. The state-wide average was 4.15 inches or 148 percent of normal. However, the distribution was skewed to the Northeastern and South Central Climate Divisions. The Southwest Division missed out on most of the rainfall. The divisional average was just 0.62 inches, or 37 percent of normal. The

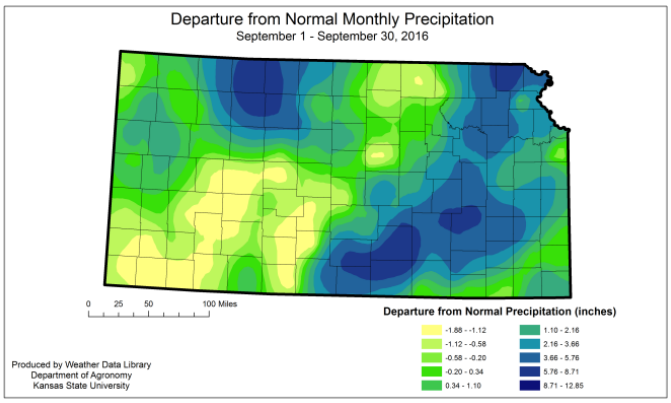
West Central Division was also below normal, although less dramatically. The average for the West Central division was 1.57 inches or 97 percent of normal. In contrast, the South Central Division averaged 5.87 inches or 206 percent of normal. However, this excess moisture was concentrated heavily in the southern Sedgwick County area, where the Haysville and Clearwater areas saw the heaviest totals for the month. September 2016 ranks as the 20th wettest in the 122 years of record. The wettest September on record occurred in 1973, when the statewide average total was 8.32 inches. With the overall wet pattern it is no surprise that there were 138 new record daily rainfall totals. Of those, 11 reports set new monthly records and seven set new all-time records as well. The greatest 24 hour total was at CoCoRaHS station: 9.32 inches at Clearwater 3.9 NNE, Sedgwick County, on the 9th. Highest monthly totals: 15.56 inches at Haysville 3SE, Sedgwick County (NWS) and 16.27 inches at Clearwater 7.0 N, Sedgwick County (CoCoRaHS).

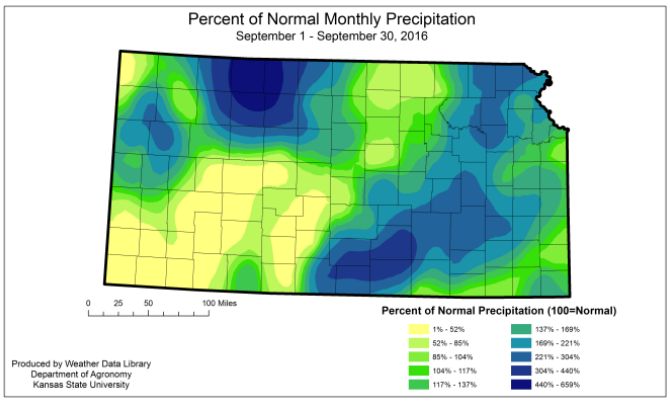
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

Kansas Climate Division Precipitation Summary (inches)												
	September 1-30, 2016			January 1– September 30, 2016			April 1 – September 30, 2016			September 1-30, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	3.25	1.74	205	19.15	0.69	103	17.77	1.67	109	3.25	1.74	205
West Central	1.54	-0.05	97	18.48	0.54	102	17.14	1.75	110	1.54	-0.05	97
Southwest	0.62	-0.99	37	19.79	2.68	115	19.42	4.74	131	0.62	-0.99	37
North Central	3.79	1.18	167	28.73	4.73	120	26.94	6.49	132	3.79	1.18	167
Central	2.94	0.44	113	28.73	3.65	114	26.77	5.73	127	2.94	0.44	113
South Central	5.87	3.27	209	32.69	6.53	123	31.00	9.54	142	5.87	3.27	209
Northeast	6.52	2.92	182	32.39	3.01	109	30.11	5.03	119	6.52	2.92	182
East Central	6.23	2.58	168	33.01	1.63	104	30.53	4.17	114	6.23	2.58	168
Southeast	7.18	3.17	185	37.20	3.65	111	34.32	6.88	125	7.18	3.17	185
STATE	4.15	1.54	148	27.88	3.18	111	26.12	5.34	124	4.15	1.54	148

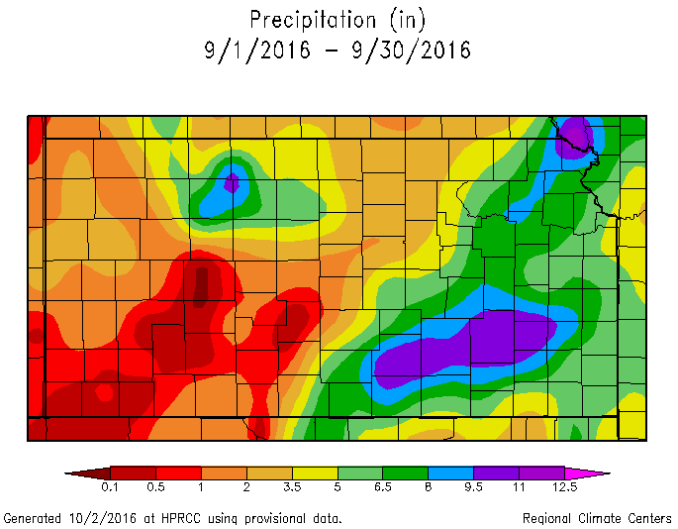


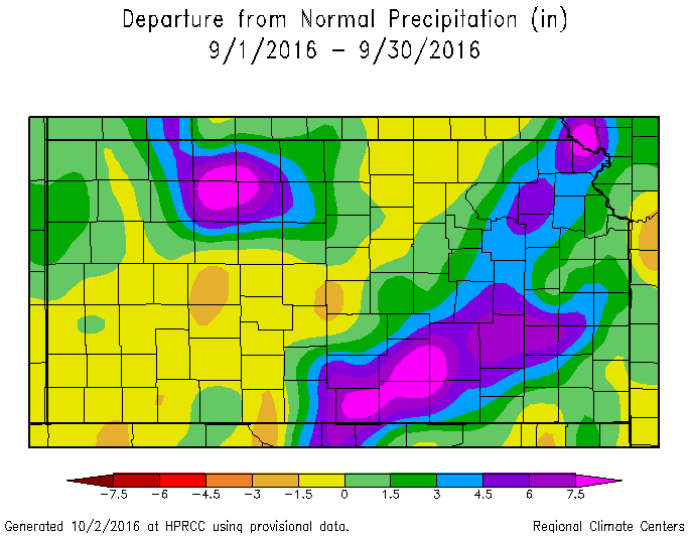






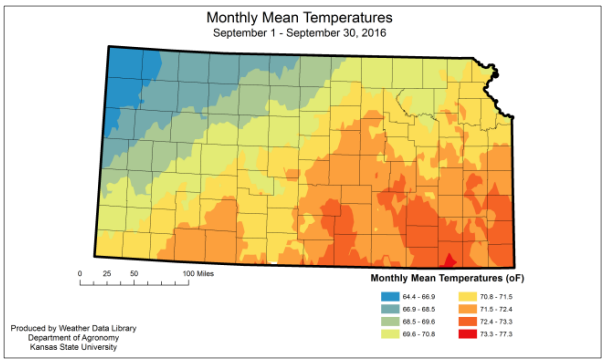
Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

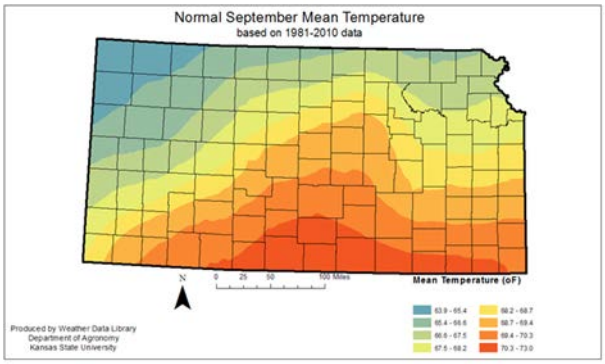


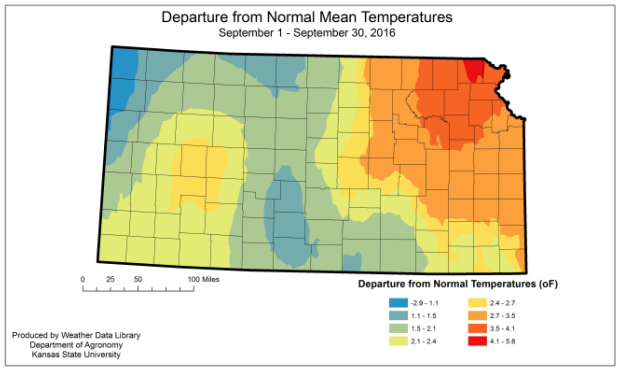


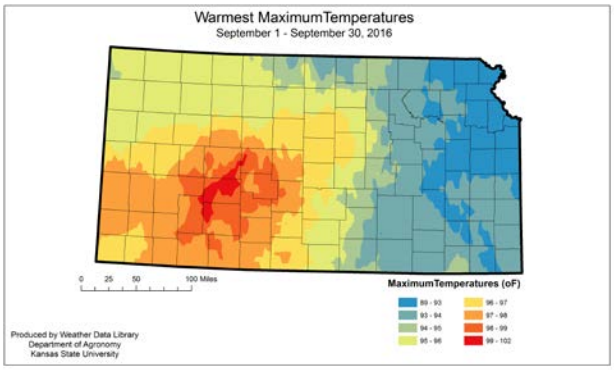
Temperatures were warmer than normal across the state in September. The state-wide average temperature was 70.7° F, or 3.0 degrees warmer than normal. This was the 32nd warmest since 1896, which places it on the warm side of the distribution range. The Northwest Climate Division was closest to normal for the month. Their average was 67.1° F, or 2.3 degrees warmer than normal. The warmest division was the Northeast Division where average temperature was 71.5° F or 4.5 degrees warmer than normal. There were two events that tied the daily record high temperature, when Girard and Pomona Lake reached 90° F on the 20th, breaking their previous records of 89° F set in 1998 and 1986 respectively. In contrast, there were no new record low maximum temperatures or minimum temperatures set. There were 27 new record warm minimum temperatures set. Of those, one set a monthly record. That was the 72° F reported for the low temperature at the Garden City Experiment Station on September 6th. The previous record was 71° F set on September 1, 1964. The highest temperature recorded was 100° F reported at Hudson, Stafford County, on the 19th. The coldest temperature recorded for the month was reported as 31° F at Brewster 4W, Thomas County, on the 27th.

Climate Division	Kansas Climate Division Temperature Summary (°F)							
	September 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	82.0	52.2	67.1	2.3	97	21	31	27
West Central	84.4	53.6	69.0	3.0	99	20	35	26
Southwest	86.2	56.7	71.5	3.3	99	19	37	26
North Central	82.1	58.0	70.0	2.5	96	21	38	26
Central	83.6	58.8	71.2	2.6	98	20	38	30
South Central	84.4	60.2	72.3	2.5	100	19	38	27
Northeast	82.1	60.9	71.5	4.5	95	21	44	26
East Central	81.7	60.8	71.3	3.4	93	21	44	30
Southeast	83.0	61.0	72.0	2.7	95	7	43	26
STATE	83.3	58.0	70.7	3.0	100	19th	31	27th
Data Source: KSU Weather Library								

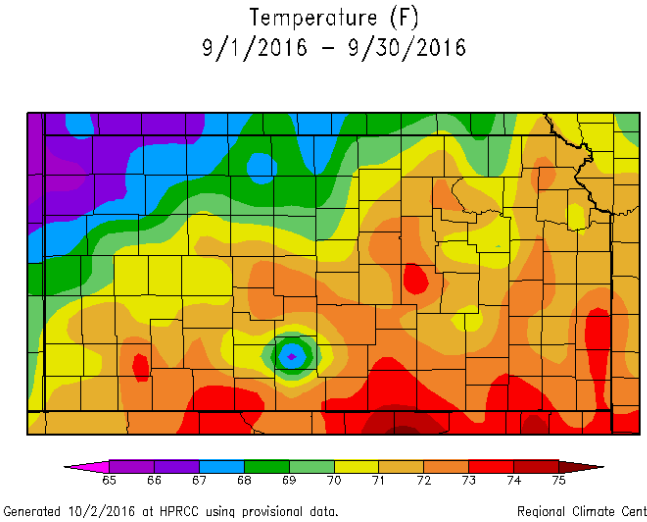


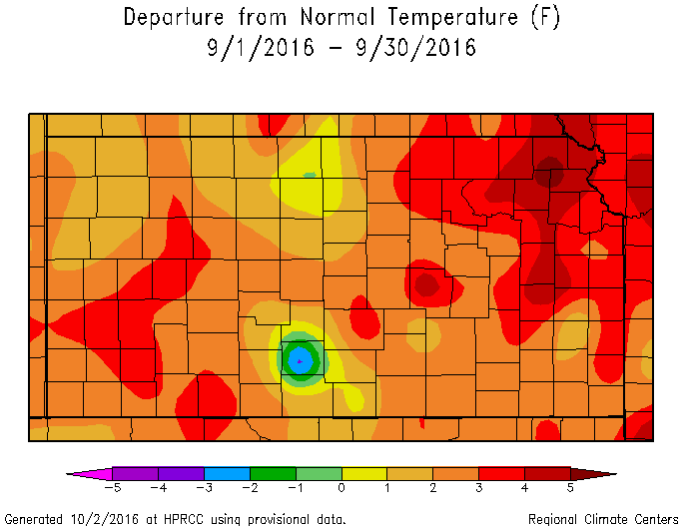






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.

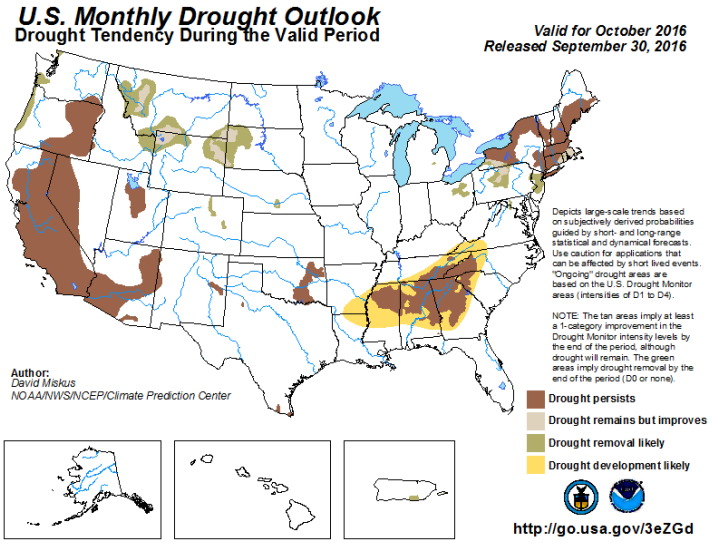


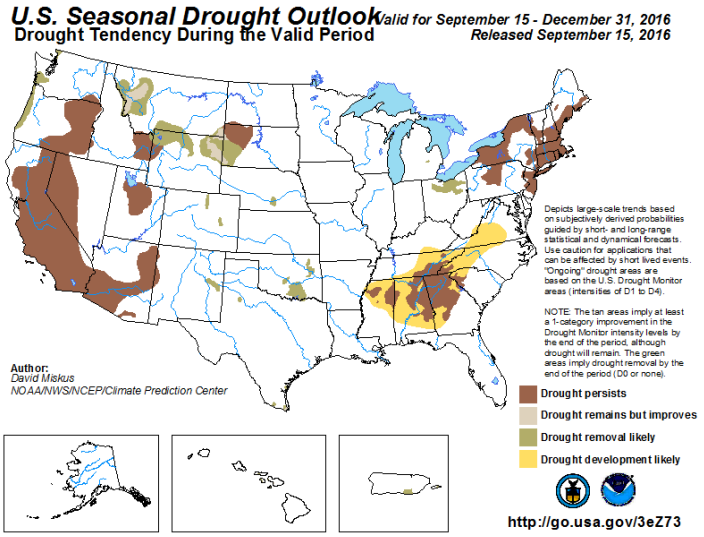


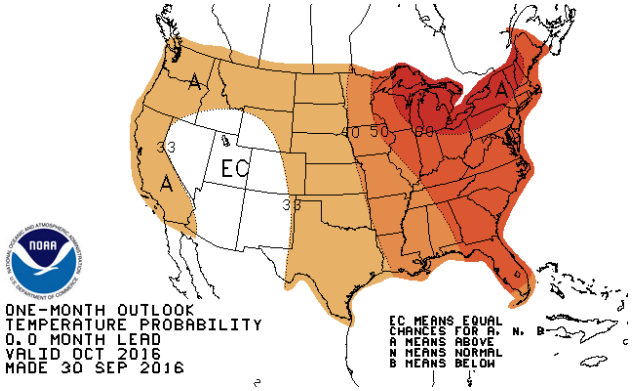
Severe weather was also a factor, although not to the degree that was seen in August. There was one tornado reported in September. The EF0 tornado was reported near Weskan, Wallace County. Fortunately there were no deaths or injuries reported with the events. There were a total of 38 hail reports and 29 damaging wind reports in the month. There were 81 flood/flash flood reports, including several swift water rescues.

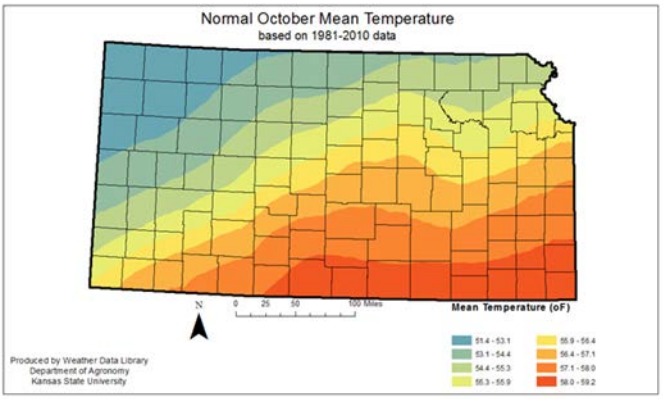
Future Outlook

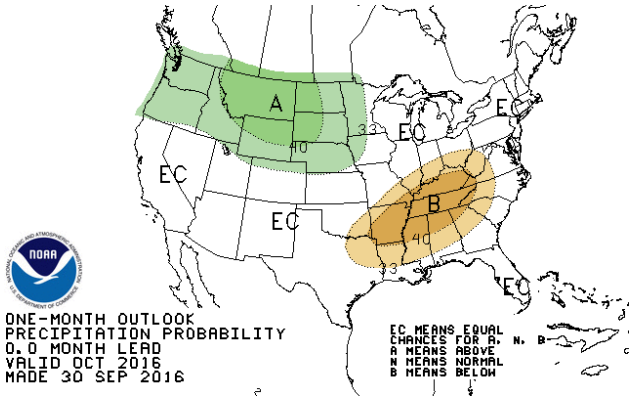
The Monthly outlook for drought does not indicate drought for Kansas. The temperature outlook for October favors above temperatures. The Precipitation outlook is for equal chance of above or below normal precipitation. Both the Drought Outlooks and individual temperature and precipitation outlooks are provided below. Average temperature and precipitation maps are included for reference.

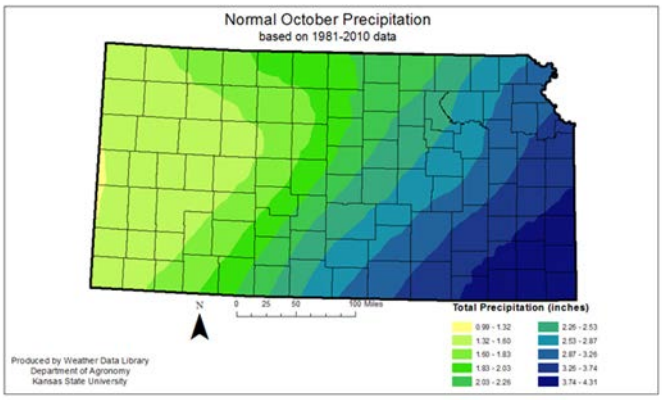




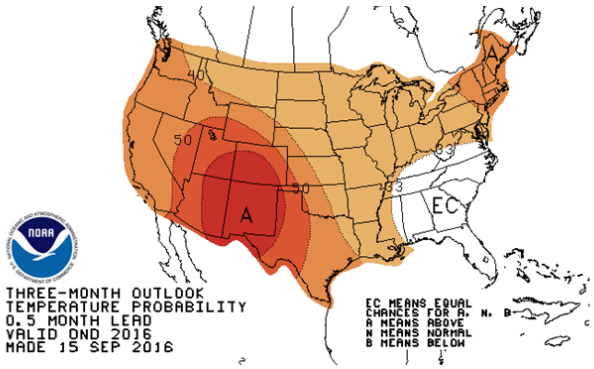


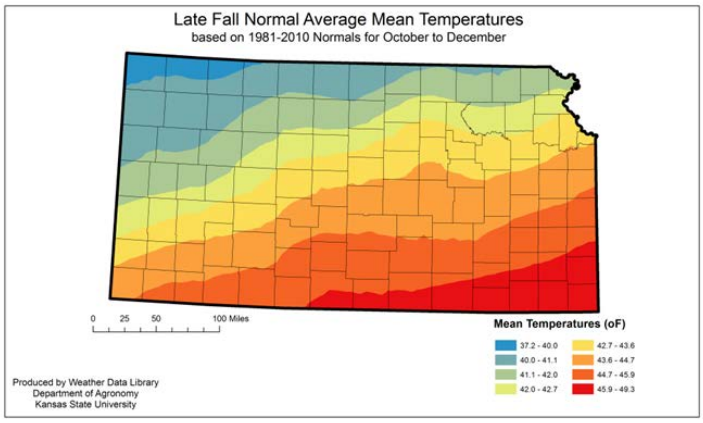


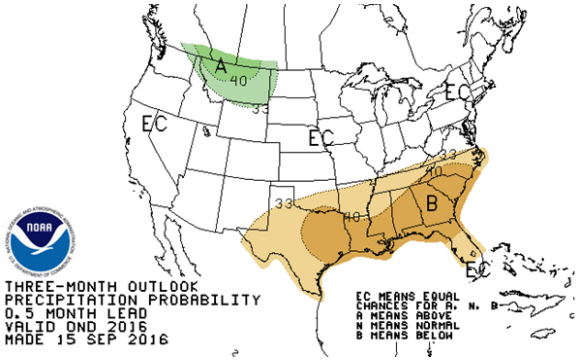


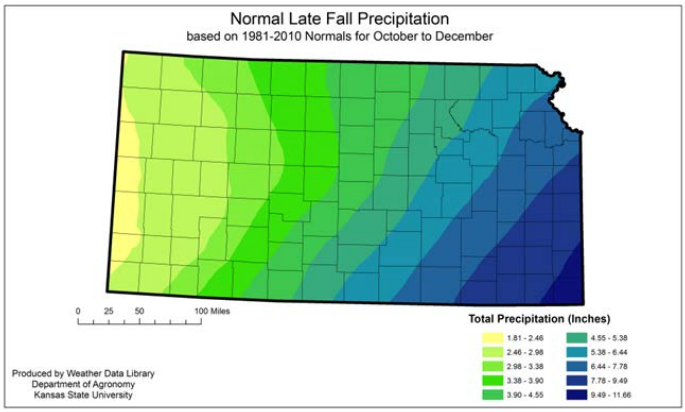


The three-month outlook favors above normal temperatures and normal precipitation for October thru December 2016.









Additional outlooks for additional 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.

Known issues:

Stage II water restrictions, under Resolution 03-16 are in place for the **City of Russell,** Russell County water customers as of September 30, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the **City of Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (September 30, 2016, http://victoriaks.com/utilities.htm.)

Surface Water Supply Conditions

Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs began and ended the month with full conservation storage. Inflows were sufficient to maintain storage in the flood pools and streamflow throughout the month of September.

Marais des Cygnes basin: Melvern, Pomona, and Hillsdale reservoirs maintained storage in excess of conservation throughout the month. Some flood pool storage was evacuated which helped keep flow in the Marais des Cygnes River well above median levels.

Cottonwood / Neosho basin: A few precipitation events maintained river flow and storage in September. River flow remained well above normal throughout the basin, particularly in the middle and lower system.

Verdigris basin: Toronto, Fall River, Big Hill, and Elk City reservoirs were in flood operations for the majority of the month, particularly Fall River and Toronto. Verdigris River streamflow remained well above historic median values.

Saline basin: Elevation at Wilson Lake benefited significantly from a precipitation event early in September. Not only did Wilson fill, it rose more than two feet above normal pool, an elevation not reached since 2008.

Smoky Hill basin: The middle Smoky Hill basin maintained streamflow and benefited from the same precipitation event that filled Wilson Lake in September. Kanopolis Reservoir maintained pool elevation at or above the seasonal target level, 4 plus feet above conservation. Discharge continued through the uncontrolled notch spillway. Cedar Bluff Reservoir did not experience any significant inflow and steadily declined.

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. During the month, various lakes were in watch or warning status, with one portion of Milford closed entirely for a portion of the month.

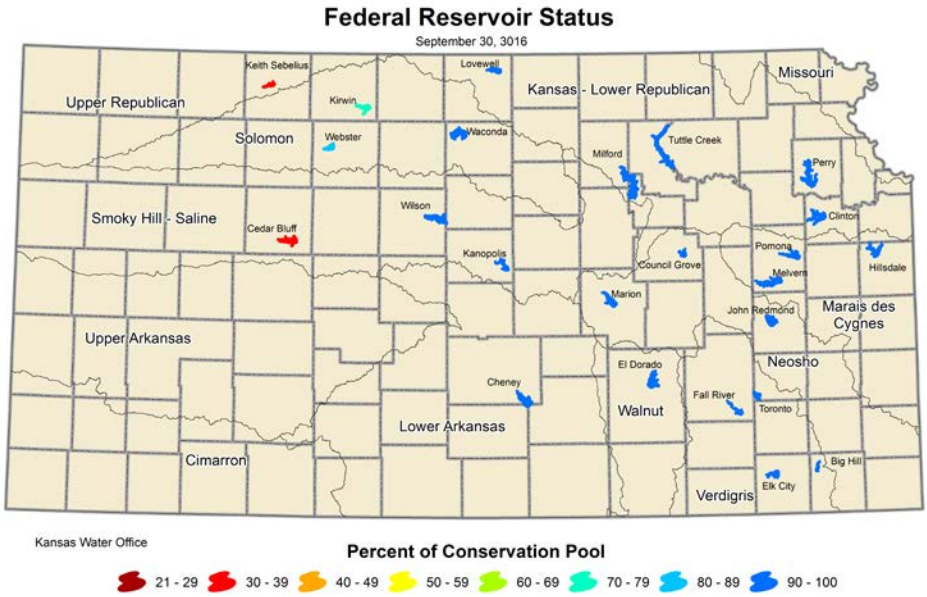
Public Health Watch–Notifies public that a hazardous condition may exist, that the water may be unsafe for humans and animals and contact with the water is discouraged.

As of September 29, 2016, a public health watch was in place for Lake Afton, Sedgwick County; Lake Meade, Meade County: and Milford Reservoir Zone A, Clay County.

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.

As of September 29, 2016 lakes on the public health warning list were: Milford Reservoir Zones B&C, Clay and Geary Counties; Overbrook City Lake, Osage County; and South Lake, Johnson County.

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff reservoirs remain significantly below conservation pool.



Kansas Federal Reservoir Conservation Pool Levels

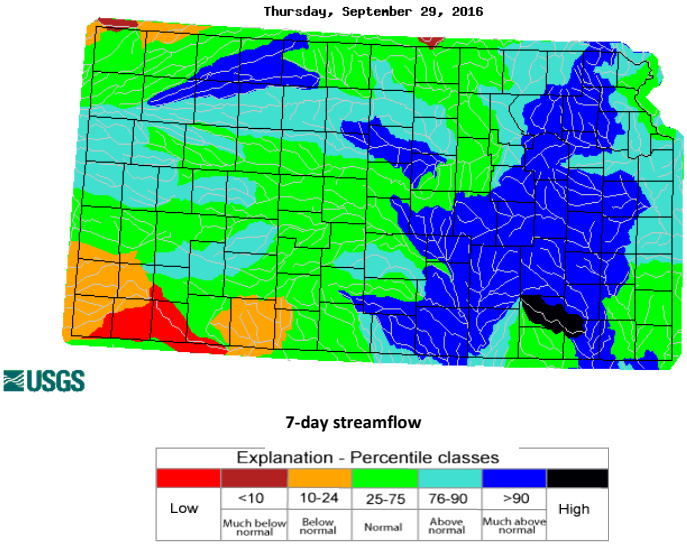
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**09/29/2016 06:00 AM**		
Norton[1]	2304.3	2291.23	-13.07	37.7
Harlan County, NE	1945.73	1935.48	-10.25	61.5
Lovewell[1]	1582.6	1581.89	-0.71	94.2
Milford[1]	1144.4	1147.12	2.72	100.0
Cedar Bluff	2144	2119.55	-24.45	32.8
Kanopolis[1]	1463	1467.37	4.37	100.0
Wilson[1]	1516	1517.63	1.63	100.0
Webster[1]	1892.5	1888.29	-4.16	80.7
Kirwin[1]	1729.3	1723.04	-6.21	71.0
Waconda[1]	1455.6	1456.82	1.22	100.0
Tuttle Creek[1]	1075	1079.91	4.91	100.0
Perry[1]	891.5	899.47	7.97	100.0
Clinton[1]	875.5	877.28	1.78	100.0
Melvern[1]	1036	1039.26	3.26	100.0
Pomona[1]	974	976.67	2.67	100.0
Hillsdale[1]	917	917.56	0.56	100.0
Arkansas River Basin		**09/30/2016 08:00 AM**		
Cheney	1421.6	1422.16	0.55	100.0
El Dorado	1339	1340.68	1.44	100.0
Toronto[1]	901.5	907.06	3.70	100.0
Fall River[1]	948.5	954.29	4.89	100.0
Elk City[1]	796	797.91	1.04	100.0
Big Hill	858	858.07	0.04	100.0
Council Grove[1]	1274	1276.21	1.89	100.0
Marion[1]	1350.5	1351.18	0.53	100.0
John Redmond[1]	1039	1052.48	10.69	100.0

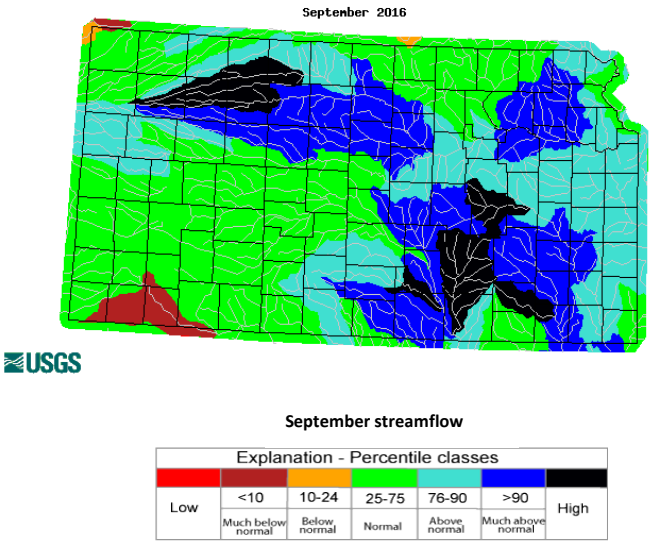
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the 28 day streamflow compared to historical is shown on the map below, right.





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.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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.

Streamflows as of Sept. 29, 2016	**cubic feet per second ((cfs)**			
Gaging Station	**Current Flow**	**September MDS**	**October MDS**	**Comment**
Republican River at Concordia	175	80	65	Admin began April 19, 2016; 71 files. Admin ceased May 13, 2016.
Republican River at Clay Center	293	100	90	Admin began April 19, 2016; 147 files. Admin ceased May 13, 2016.

Flooding and High Flows

The map and table below summarizes recent flood conditions for September 2016 from USGS WaterWatch data. Note: flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience. Moderate flooding is some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary. Major flooding is extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

USGS Station Number	USGS Station Name	Drain. Area [mi^2]	NWS Flood Stage [ft]	No. of Days Above Flood Stage	NWS flood class*	Highest peak from 2016-09-01 to 2016-09-28				Historical Peaks	
						Date	Stage [ft]	Streamflow (date) [ft^3/s]	Rank	No. of Yrs	Max. (year) [ft^3/s]
06847900	PRAIRIE DOG C AB KEITH SEBELIUS LAKE, KS	590	11	2		2016-09-04	14.18	2100	5	53	65500 (1953)
06867000	SALINE R NR RUSSELL, KS	1502	18	2		2016-09-04	22.22	19300	5	64	41500 (1993)
06871000	NF SOLOMON R AT GLADE, KS	849	11	3		2016-09-05	18.65	11000	4	62	23300 (1957
06871500	BOW C NR STOCKTON, KS	341	9	4		2016-09-05	12.44	5230	9	64	12900 (1951)
06873000	SF SOLOMON R AB WEBSTER RE, KS	1040	8.5	3		2016-09-04	12.98	8060	17	72	55200 (1951)
06873460	SF SOLOMON R AT WOODSTON, KS	1502	12	3		2016-09-05	13	1420	11	36	8710 (1993)
06874000	SF SOLOMON R AT OSBORNE, KS	2012	14	1		2016-09-05	14.44	1800	36	69	81200 (1951)
06876700	SALT C NR ADA, KS	384	18	2		2016-09-07	18.21	1470	20	55	16000 (1961)
06889200	SOLDIER C NR DELIA, KS	149	26	1		2016-09-25	26.96	7310	14	57	59600 (2005)
06890100	DELAWARE R NR MUSCOTAH, KS	431	27	1		2016-09-14	29.66	23000	5	46	35600 (2013)
06891850	STRANGER C AT EASTON, KS	216	17	2		2016-09-15	21.19	7590	--	--	--
06910800	MARAIS DES CYGNES R NR READING, KS	177	19	1		2016-09-25	22.51	5060	26	46	67400 (1982)
06914100	POTTAWATOMIE C NR SCIPIO, KS	343	23	2		2016-09-10	25.66	8860	5	13	141000 (2007)
06915800	MARAIS DES CYGNES R AT LA CYGNE, KS	2669	25	1		2016-09-11	25.04	15100 (2016-09-10)	21	30	131000 (2007)
06917000	L OSAGE R AT FULTON, KS	314	22	2		2016-09-10	23.18	6380	46	66	62800 (1986)
07144480	COWSKIN C AT 119TH ST AT WICHITA, KS	86	18	2		2016-09-09	19.56	3000	6	14	5870 (2009)
07144550	ARKANSAS R AT DERBY, KS	40830	12	2		2016-09-10	14.54	35000	8	46	58300 (1998)
07145200	SF NINNESCAH R NR MURDOCK, KS	650	8	2		2016-09-09	10.33	9050	20	64	28700 (1979)
07145500	NINNESCAH R NR PECK, KS	2129	17	3		2016-09-10	22.84	41700	2	78	70000 (1923)
07145700	SLATE C AT WELLINGTON, KS	154	19	5		2016-09-10	22.96	8620 (2016-09-09)	9	55	28500 (1975)

USGS Station Number	USGS Station Name	Drain. Area [mi^2]	NWS Flood Stage [ft]	No. of Days Above Flood Stage	NWS flood class*	Highest peak from 2016-09-01 to 2016-09-28				Historical Peaks	
						Date	Stage [ft]	Streamflow (date) [ft^3/s]	Rank	No. of Yrs	Max. (year) [ft^3/s]
07146500	ARKANSAS R AT ARKANSAS CITY, KS	43713	11	8	▲	2016-09-11	19.19	58500	10	97	103000 (1923)
07147190	WHITEWATER R AT AUGUSTA, KS	456.00	21	2	▲	2016-09-10	26.27	--	--	--	--
07147800	WALNUT R AT WINFIELD, KS	1880	18	5	▲	2016-09-11	29.37	36100	23	96	105000 (1944)
07147900	WALNUT R AT ARKANSAS CITY, KS	1952	18	4	▲	2016-09-11	23.04	--	--	--	--
07151500	CHIKASKIA R NR CORBIN, KS	794	10	3	▲	2016-09-10	16.77	18500	15	56	60000 (1923)
07166500	VERDIGRIS R NR ALTOONA, KS	1094	19	2	▲	2016-09-10	19.13	12900	36	76	71000 (1951)
07169500	FALL R AT FREDONIA, KS	827	17	4	▲	2016-09-10	20.78	12000	41	80	77800 (2007)
07182250	COTTONWOOD R NR PLYMOUTH, KS	1740	32	2	▲	2016-09-10	33.08	16000	26	52	92900 (1998)
07182260	COTTONWOOD R AT EMPORIA, KS	1845	20	3	▲	2016-09-11	23.72	16200	1	1	9570 (2014)
07182390	NEOSHO R AT NEOSHO RAPIDS, KS	2753	22	1	▲	2016-09-26	22.4	16200 (2016-09-29)	3	5	24900 (2010)
07183000	NEOSHO R NR IOLA, KS	3723	15	3	▲	2016-09-10	17.57	23300	56	108	436000 (1951)
07183500	NEOSHO R NR PARSONS, KS	4905	21	4	▲	2016-09-13	25.17	28500	43	93	410000 (1951)

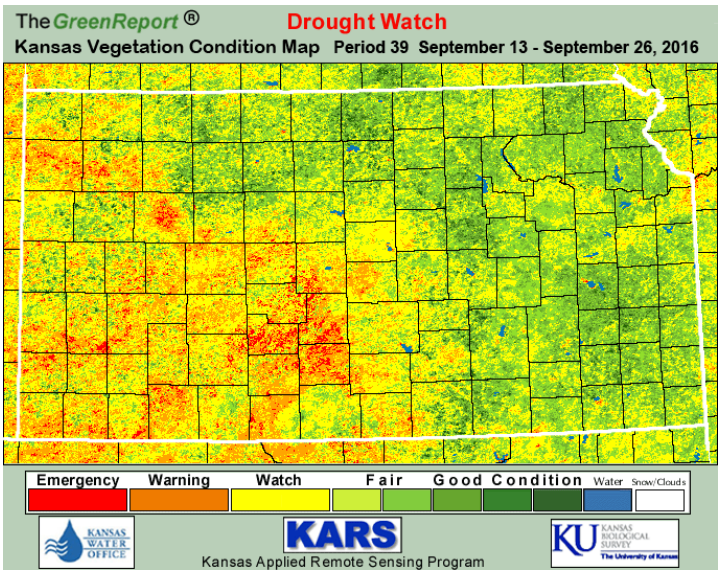
* ▲=Minor Flooding ▲=Moderate Flooding ▲=Major Flooding

Note: USGS WaterWatch provides streamflow based on USGS monitored stream gages. NWS flood stage is found on the NWS River Conditions Map.

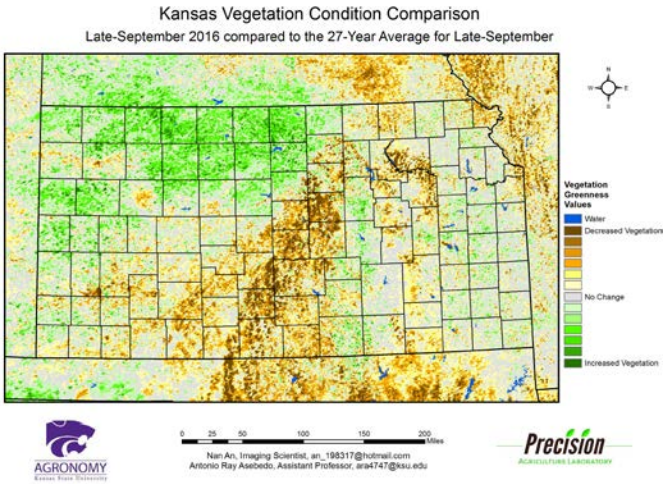
Soil, Crop and Vegetation

Kansas Vegetative Conditions

The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Areas showing stress are mostly due to corn beginning to mature and loosing greenness.

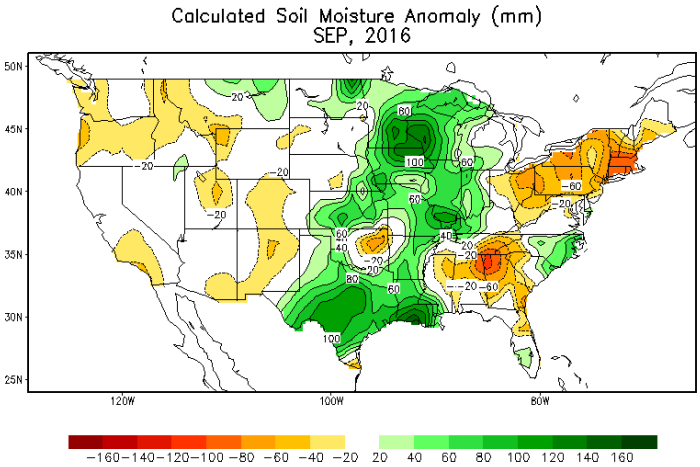


Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for late September from K-State's Precision Agriculture Laboratory shows lower vegetative activity is concentrated in the center parts of the state. These low NDVI values are the result of heavy rains and cloud cover in this area. Warm temperatures and seasonal rainfall have favored plant growth across most of the state.



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.
http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

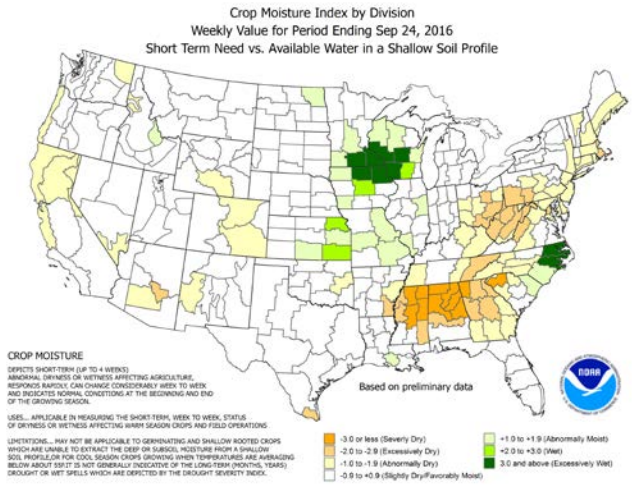


Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for the week ending September 25 reported topsoil 3 percent very short, 10 short, 75 adequate, and 12 surplus. Subsoil moisture rated 2 percent very short, 11 short, 77 adequate, and 10 surplus.

Field Crops Condition: Corn condition rated 2 percent very poor, 7 poor, 26 fair, 54 good, and 11 excellent. Soybean condition rated 1 percent very poor, 4 poor, 24 fair, 56 good, and 15 excellent. Sorghum condition rated 1 percent very poor, 3 poor, 21 fair, 59 good, and 16 excellent. Cotton condition rated 1 percent very poor, 2 poor, 29 fair, 64 good, and 4 excellent. Sunflower condition rated 1 percent very poor, 3 poor, 28 fair, 63 good, and 5 excellent.

Livestock Report: Pasture and range conditions rated 1 percent very poor, 4 poor, 23 fair, 59 good, and 13 excellent. Stock water supplies were 1 percent very short, 4 short, 80 adequate, and 15 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

September 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	3.75	2.61	329%	66.4	3.1	94 (11,5)	40 (26)
Dodge City	0.31	-1.36	19%	72.0	2.8	99 (19)	39 (29,26)
Garden City	0.19	-1.28	13%	71.1	2.9	99 (20)	38 (26)
Goodland	2.49	1.27	204%	66.9	2.3	95 (5)	38 (26)
Guymon, OK	0.01	-1.78	1%	73.2	2.8	99 (20)	41 (26)
Hill City	8.75	6.87	465%	69.1	1.7	95 (20)	39 (29,206)
Lamar, CO	0.16	-1.09	13%	67.9	3.2	100 (5)	34 (26)
McCook, NE	5.63	4.19	391%	67.1	2.7	95 (20)	35 (26)
Springfield, CO	0.02	-1.31	2%	66.9	0.8	93 (11)	35 (26)
Central							
Concordia	2.00	-0.91	69%	70.8	2.8	95 (20)	41 (30)
Hebron, NE	1.84	-1.08	63%	68.7	2.8	93 (20)	39 (30)
Medicine Lodge	7.18	5.08	342%	72.6	1.4	97 (20)	44 (30,29)
Ponca City, OK	1.00	-2.29	30%	76.1	4.0	99 (19)	46 (30,29)
Salina	1.20	-1.50	44%	73.1	2.9	98 (19)	44 (26)
Wichita (ICT)	11.30	8.16	360%	73.6	2.6	95 (20)	48 (30,29)
East							
Bartlesville, OK	3.12	-0.72	81%	73.5	2.2	98 (6)	43 (30)
Chanute	6.91	3.24	188%	73.1	3.2	94 (7,6)	49 (30,29)
Fall City, NE	6.03	2.48	170%	71.2	4.5	92 (19)	45 (26)
Johnson Co. Exec. Apt	3.37	-1.14	75%	70.6	2.0	89 (20,6)	48 (29)
Joplin, MO	2.74	-2.21	55%	73.0	2.2	94 (6)	45 (29)
Kansas City (MCI), MO	4.94	0.32	107%	71.4	3.2	91 (20)	47 (29)
St. Joseph, MO	8.66	5.24	253%	71.3	4.7	93 (21,20)	44 (30)
Topeka (TOP	7.78	4.12	213%	72.3	4.0	93 (20,19)	47 (30)

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

KANSAS CLIMATE and DROUGHT UPDATE – October 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

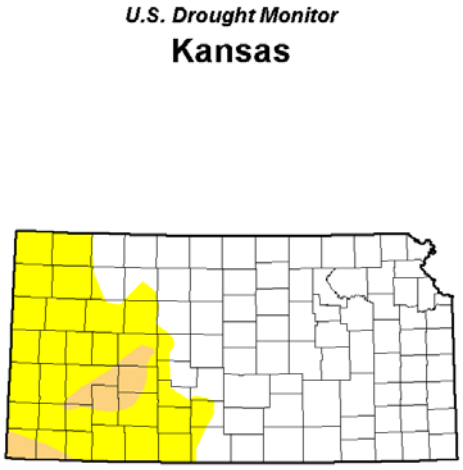
- The US Drought Monitor has dry and drought conditions developing in western Kansas in October.
- October 2016 was the eight warmest October since 1896, state-wide.

Lakes and Streams

- Norton and Cedar Bluff continued to be significantly below conservation pool throughout October.
- There was no administration of water appropriations due to minimum desirable streamflows (MDS) in October.
- Minor or moderate flooding occurred at six locations in October.
- Lakes on the public health **warning** at the end of the sampling season list due to blue-green algae blooms are South Lake, Johnson County and Vineyard Park Pond, Ellis County. (November 3, 2016)
- Lakes on public health **watch** list due to blue-green algae blooms: Milford Reservoir Zone C, Clay and Geary Counties; and Lake Shawnee, Shawnee County. (November 3, 2016)

General Conditions

Above normal temperatures coupled with below normal precipitation resulted in the return of moderate drought in southwestern Kansas, with an expansion of abnormally dry conditions across much of the western divisions. The continued dry pattern, coupled with the outlook for warmer than normal conditions in November, is likely to result in further expansion of both categories.



November 1, 2016
(Released Thursday, Nov. 3, 2016)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	66.04	33.96	4.19	0.00	0.00	0.00
Last Week 10/25/2016	68.75	31.25	4.19	0.00	0.00	0.00
3 Months Ago 8/2/2016	86.67	13.33	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/27/2016	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 11/3/2015	26.86	73.14	15.10	0.00	0.00	0.00

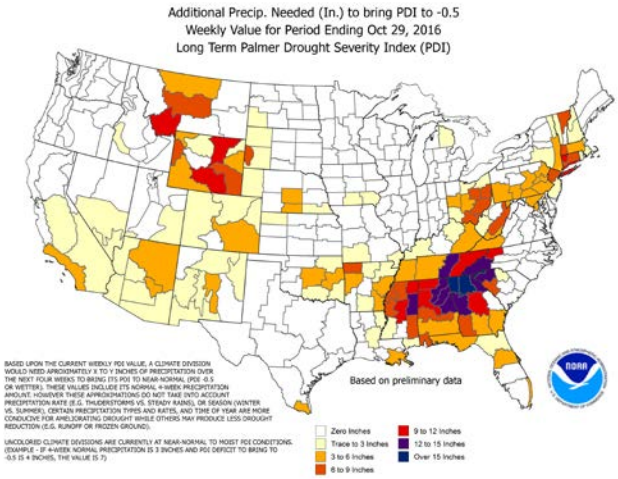
Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Deborah Bathke
National Drought Mitigation Center

http://droughtmonitor.unl.edu/



More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.

Palmer Drought Severity Index (PDSI) - The Palmer Index is an indicator used in the U.S. Drought Monitor. The PDI for the period ending August 27, 2016 indicates a trace to three inches of moisture is needed over the next four weeks in the Northwest and Northeast Climate Divisions to bring those areas to their normal moisture conditions.

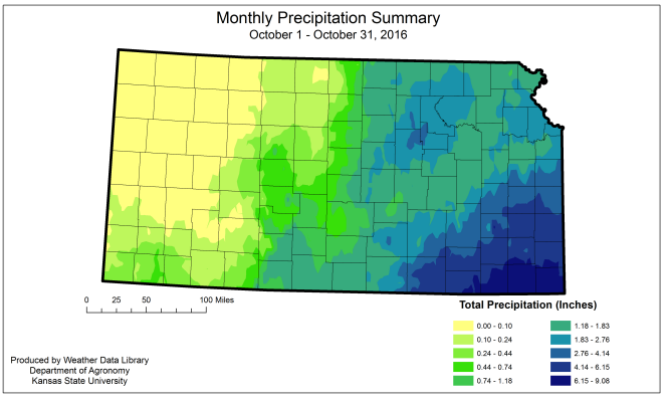
Climate Summary (Temperature and Precipitation)

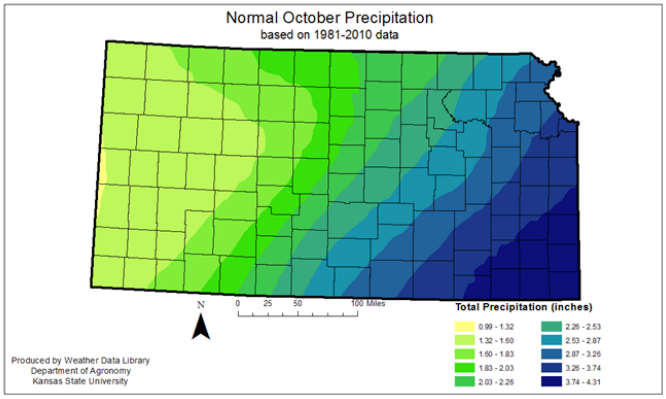
State-wide average rainfall for October was well below normal; however the distribution was quite skewed. The state-wide average was 1.35 inches or 45 percent of normal. The western three divisions all averaged less than 10 percent of the normal October precipitation. The Northwest Climate Division missed out on most of the rainfall. The divisional average was just 0.02 inches, or one percent of normal. The Southwest Division was the wettest of the western areas, and averaged

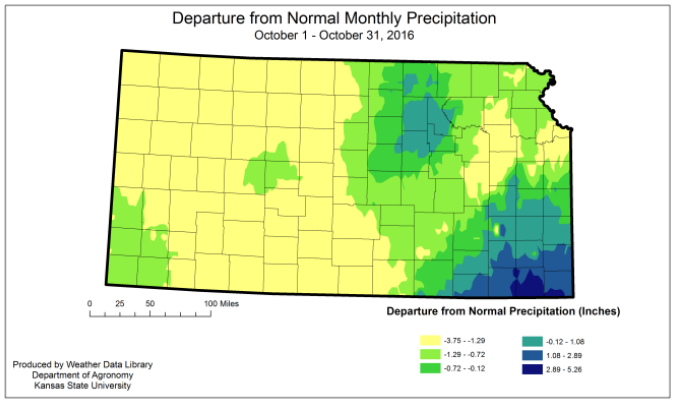
just 0.14 inches of precipitation. That is just 9 percent of normal. In contrast, the Southeastern Division averaged 4.50 inches or 120 percent of normal. This October ranks as the 34th driest in the 122 years of record. The wettest October on record occurred in 1941, when the statewide average total was 5.99 inches. The driest October occurred in 1973 when the state-wide average was just 0.02 inches. Despite the dry pattern there were 35 new record daily rainfall totals. The greatest 24 hour total recorded at a CoCoRaHS station was 6.69 inches at Beaumont 6.6 SSW, Butler County, on the 7th. The greatest 24 hour report for a National Weather Service station was 6.44 inches at Parsons Tri City AP, Labette County, on the 6th. The greatest monthly totals: 9.91 inches at Independence, Montgomery County (NWS) and 7.27 inches at Beaumont 6.6 SSW Butler County (CoCoRaHS).

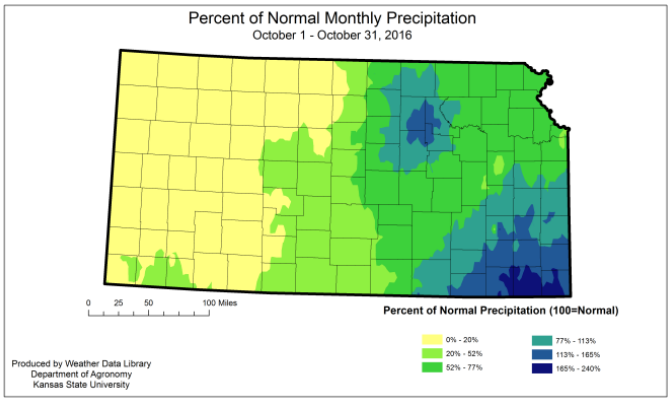
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

Kansas Climate Division Precipitation Summary (inches)												
	October 1-31, 2016			January 1– October 31, 2016			April 1 – October 31, 2016			October 1- October 31, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	0.02	-1.52	1	19.39	-0.61	96	18.00	0.35	101	3.49	0.44	111
West Central	0.09	-1.35	5	18.73	-0.66	95	17.40	0.56	102	1.80	-1.23	60
Southwest	0.14	-1.35	9	19.93	1.32	106	19.55	3.37	120	0.76	-2.34	23
North Central	0.92	-1.03	43	29.81	3.86	115	28.02	5.62	125	4.88	0.32	113
Central	1.38	-0.72	62	30.13	2.95	110	28.16	5.02	121	4.33	-0.27	90
South Central	1.30	-1.30	48	34.20	5.43	117	32.50	8.44	133	7.37	2.16	132
Northeast	1.55	-1.14	57	33.89	1.82	105	31.61	3.84	112	8.01	1.72	126
East Central	1.91	-1.15	61	35.03	0.59	100	32.56	3.15	109	8.25	1.54	121
Southeast	4.50	0.87	120	41.74	4.56	112	38.87	7.79	125	11.72	4.07	154
STATE	1.35	-0.94	45	29.32	2.33	106	27.56	4.49	117	5.59	0.69	101

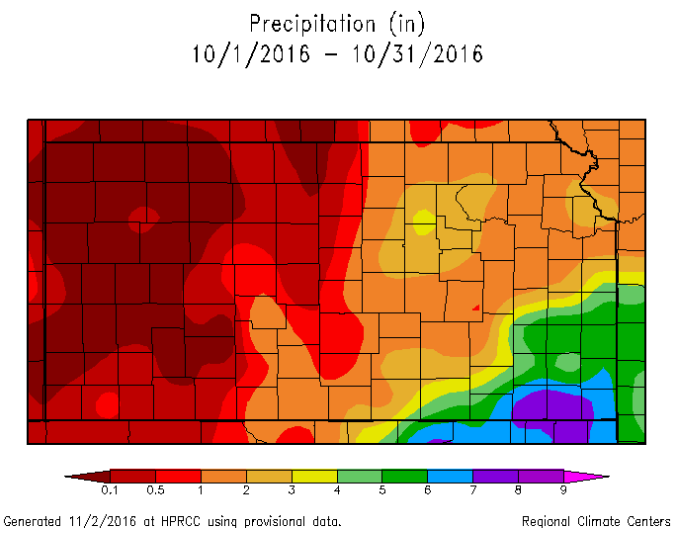


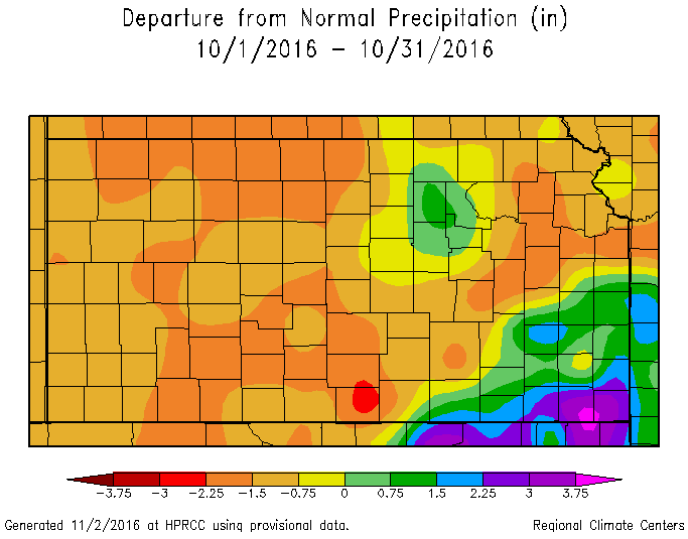






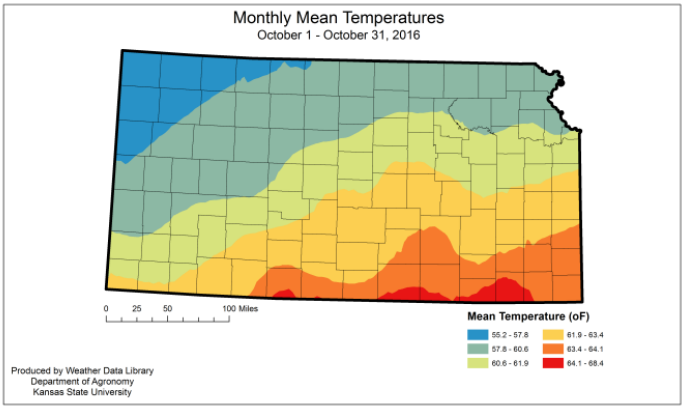
Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

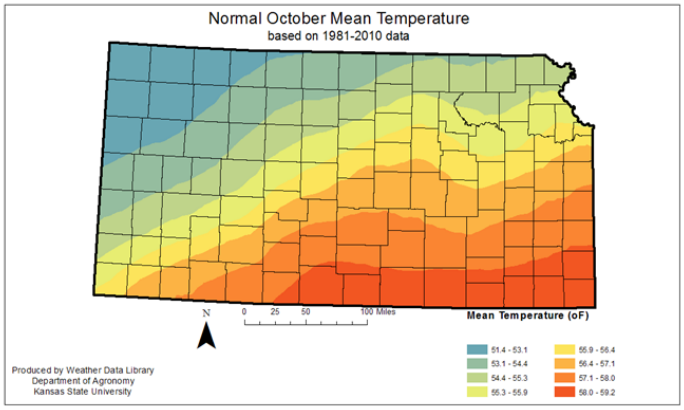


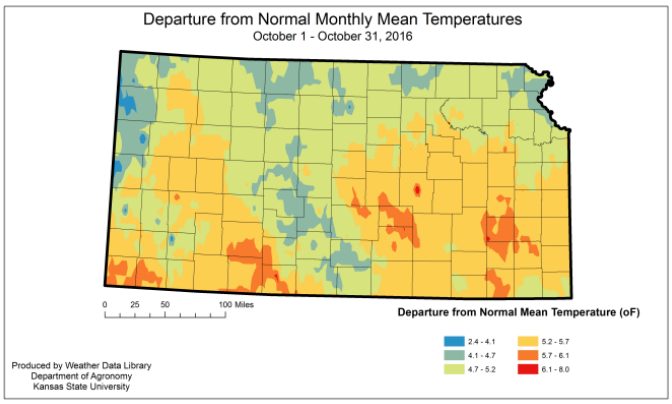


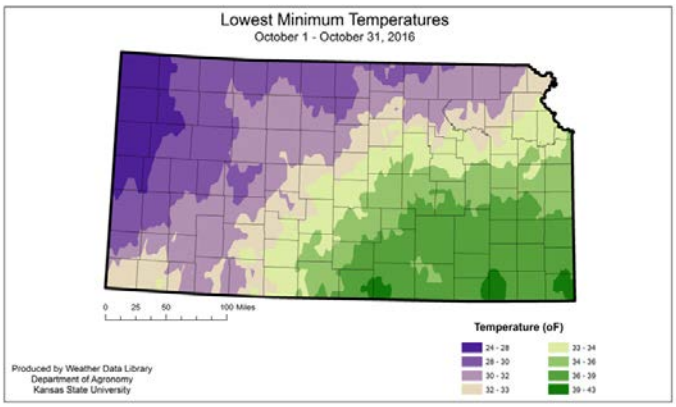
Temperatures continued the warmer than normal pattern through much of October. The state-wide average temperature was 60.9° F, or 5.6 degrees warmer than normal. This was the 8th warmest since 1896. The Northeast Climate Division was closest to normal for the month. Their average was 59.8° F, or 4.8 degrees warmer than normal. The division with the greatest departure was the Southwest Division where the average temperature was 62.3° F or 6.7 degrees warmer than normal. There were 102 new daily record high temperatures set in the month, of those 12 set new record highs for October. Ashland, in Clark County, had the highest reading for the month, with 102° F reported on both the 17th and the 18th. In contrast, there were no new record low maximum temperatures or minimum temperatures set. There were 58 new record warm minimum temperatures set. The coldest temperature recorded for the month was 25° F at Brewster 4W, Thomas County, on the 8th and Tribune 1W, Greeley County, on the 7th.

Climate Division	Kansas Climate Division Temperature Summary (°F)							
	October 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	75.3	39.7	57.5	5.7	94	17	25	8
West Central	77.7	40.5	59.1	5.9	98	17	25	7
Southwest	80.4	44.2	62.3	6.7	102	17	27	8
North Central	74.5	45.2	59.8	5.1	91	18	26	13
Central	76.4	46.8	61.6	5.6	95	17	30	7
South Central	77.4	49.5	63.4	6.2	100	16	28	8
Northeast	72.4	47.3	59.8	4.8	90	18	30	13
East Central	73.0	49.7	61.3	5.3	89	18	32	22
Southeast	75.0	51.5	63.2	5.8	89	18	34	22
STATE	75.8	46.0	60.9	5.7	102	17th	25	7th
Data Source: KSU Weather Library								

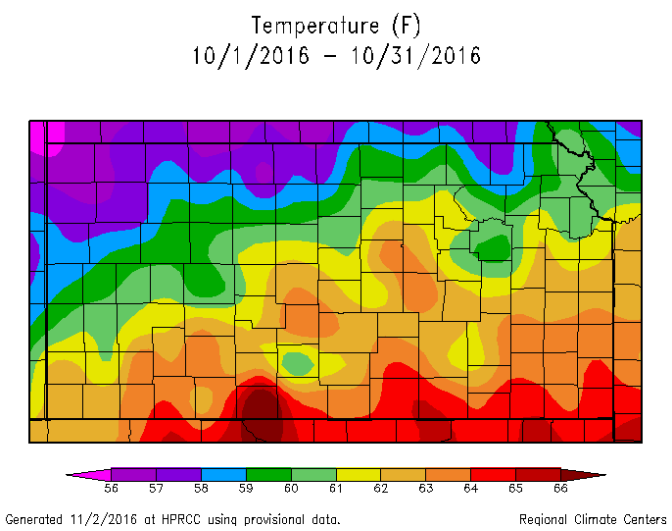


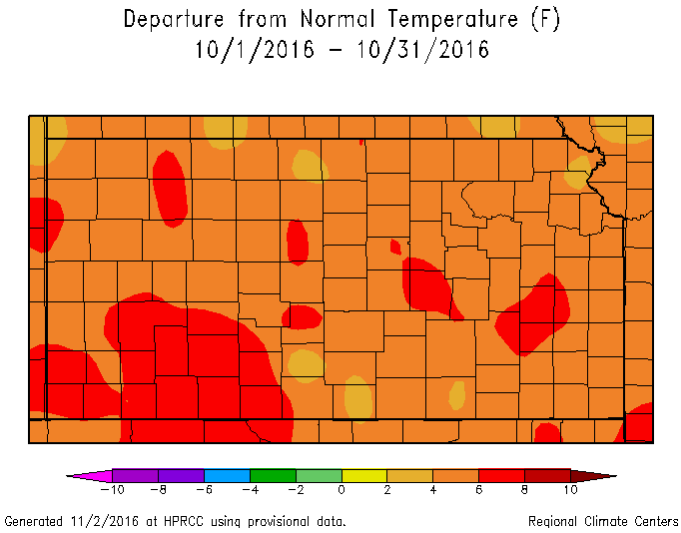






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.

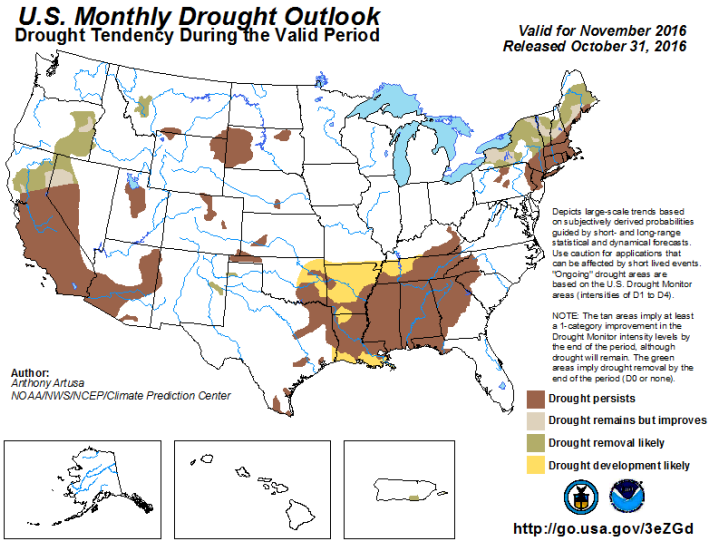


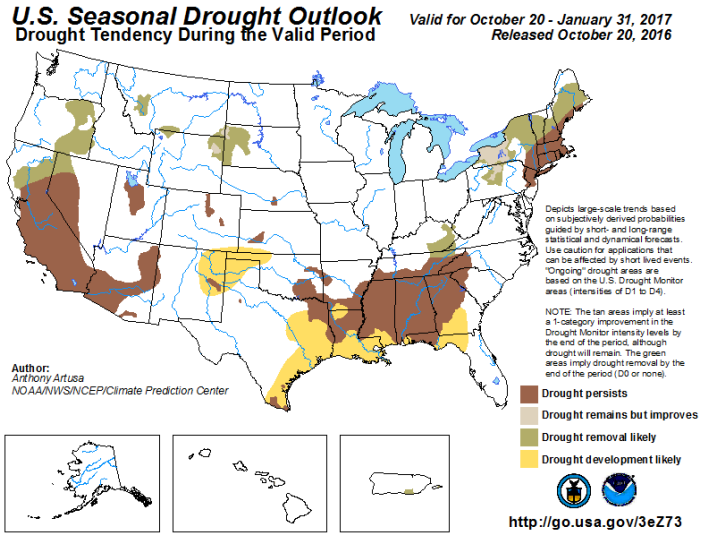


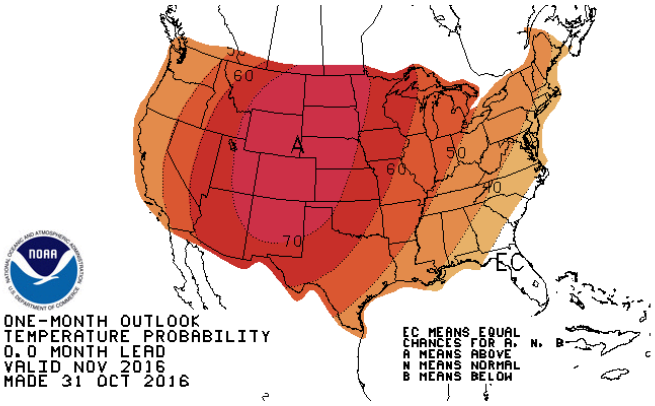
Severe weather was also a factor with an unusual tornado outbreak on the 7th of October. There were 16 tornadoes reported during the event, with storms in Allen, Clay, Cowley, Dickinson and Labette counties. Fortunately there were no deaths or injuries reported with the storms. There were a total of 33 hail reports and 17 damaging wind reports in the month.

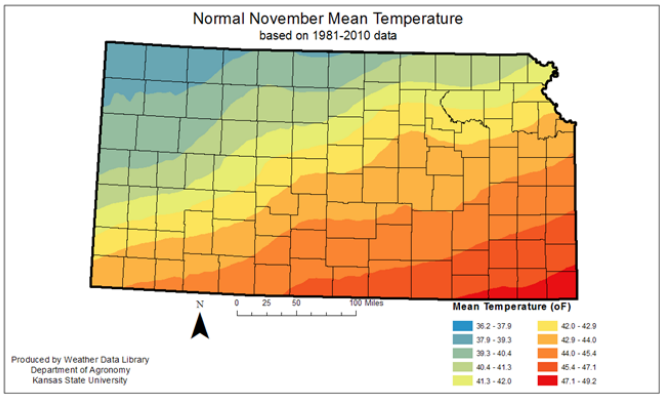
Future Outlook

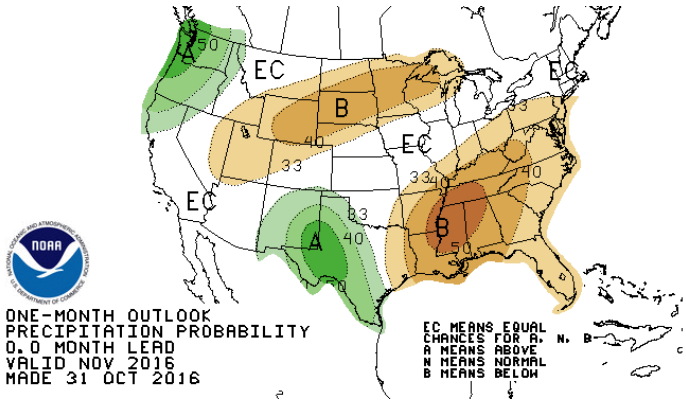
The Monthly outlook for drought indicates drought to persist in small areas of south west Kansas. The temperature outlook for November favors above temperatures. The Precipitation outlook is for equal chance of above or below normal precipitation. Both the Drought Outlooks and individual temperature and precipitation outlooks are provided below. Average temperature and precipitation maps are included for reference.

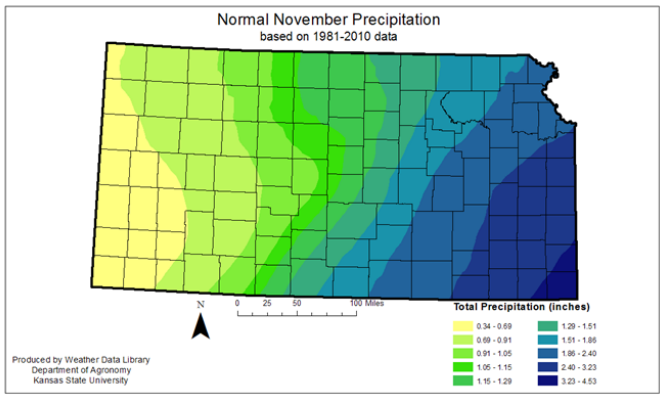




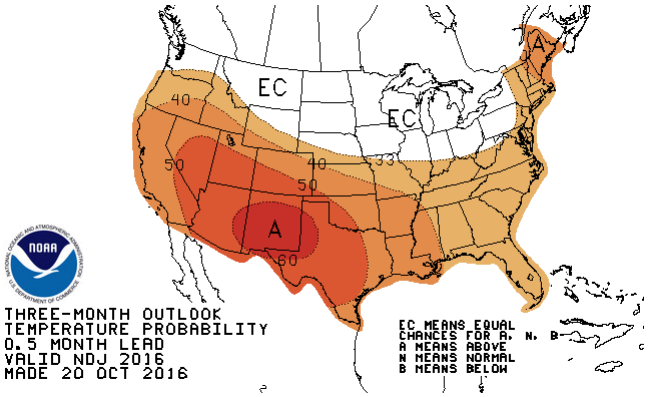


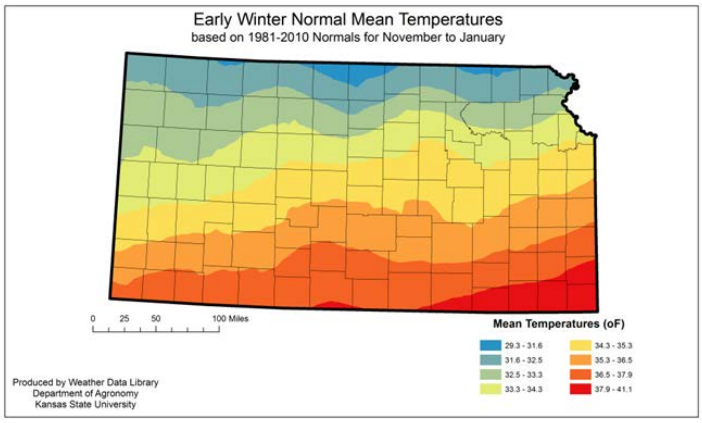


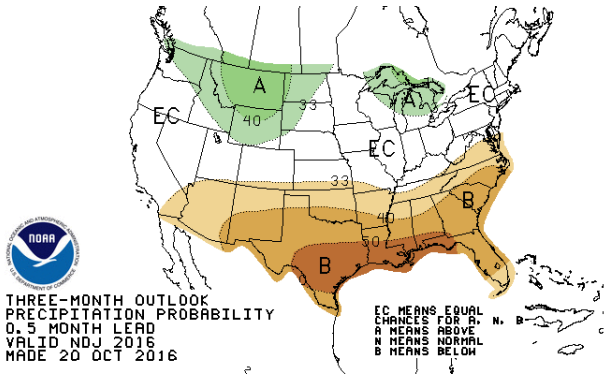


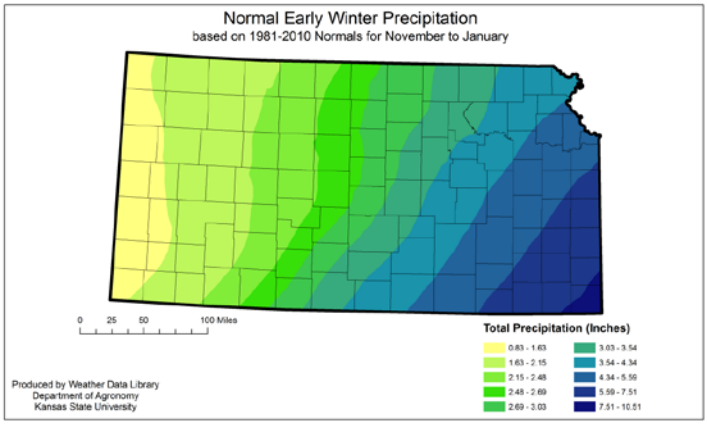


The three-month outlook favors above normal temperatures November 2016 thru January 2017. Normal precipitation for most of Kansas with the exception of the southern anticipating below normal is predicted for the November thru January period.









Additional outlooks for additional 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.

Known issues:

Stage II water restrictions, under Resolution 03-16 are in place for the **City of Russell,** Russell County water customers as of October 27, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the **City of Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (October 27, 2016, http://victoriaks.com/utilities.htm.)

Surface Water Supply Conditions

Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs began and ended the month with full conservation storage. Inflows were sufficient to maintain storage in the flood pools near the fall target elevations and above historical median flows in the Kansas River throughout the month of October.

Marais des Cygnes basin: Melvern, Pomona, and Hillsdale reservoirs maintained storage in excess of conservation in October. Flow in the Marais des Cygnes River declined over the month but maintained above median levels.

Cottonwood / Neosho basin: Streamflow and storage was maintained at healthy levels throughout the basin in October, particularly in the lower system.

Verdigris basin: Toronto, Fall River, Big Hill, and Elk City reservoirs were in flood operations in October. Verdigris River streamflow remained well above historic median values.

Saline basin: Elevation at Wilson Lake was maintained at or above the seasonal lake level target of 1,517 feet, one foot above normal multipurpose pool.

Smoky Hill basin: The middle Smoky Hill basin maintained streamflow in October. Kanopolis discharge continued through the uncontrolled notch spillway and reservoir level declined throughout the month. Cedar Bluff Reservoir did not experience any significant inflow and steadily declined.

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. During the month, various lakes were in watch or warning status, with one portion of Milford closed entirely for a portion of the month.

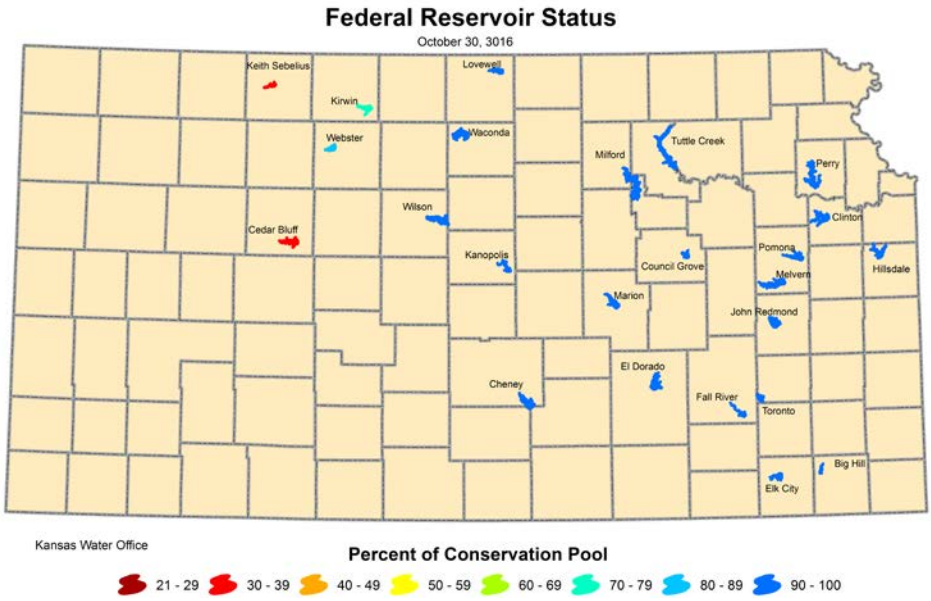
Public Health Watch–Notifies public that a hazardous condition may exist, that the water may be unsafe for humans and animals and contact with the water is discouraged.

Through much of late October, a public health watch was in place for Lake Meade, Meade County; Milford Reservoir Zones A&B, Clay County; and South Lake, Johnson County. But ending the season **the following lakes will remain on the list until the beginning of the 2017 HAB season. The following lakes will remain on the list until the beginning of the 2017 HAB season, Milford Reservoir Zone C, Clay and Geary counties and Lake Shawnee, Shawnee County.**

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.

Through much of late October lakes on the public health warning list were: Milford Reservoir Zones C, Clay and Geary Counties. But ending the season **the following lakes will remain on the list until the beginning of the 2017 HAB season. The following lakes will remain on the list until the beginning of the 2017 HAB season, South Lake, Johnson County and Vineyard Park Pond, Ellis County.**

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton, Cedar Bluff reservoirs remain significantly below conservation pool.



Kansas Federal Reservoir Conservation Pool Levels

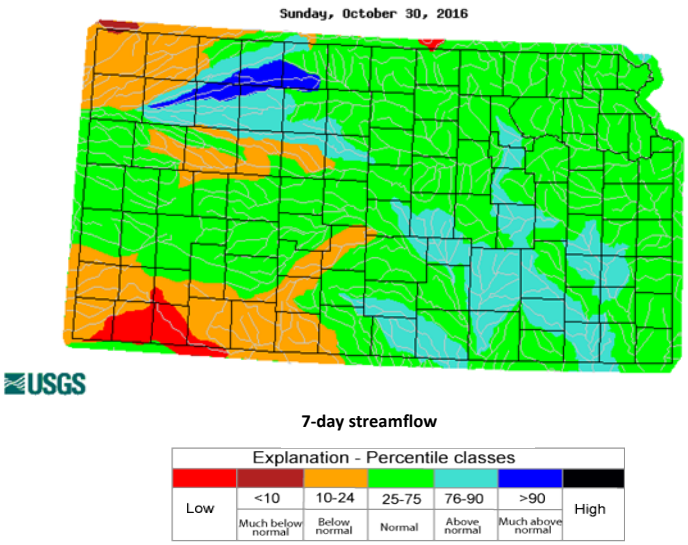
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**10/30/2016 6:00 AM**		
Norton[1]	2304.3	2291.02*	-13.28*	37.0*
Harlan County, NE	1945.73	1935.26	-10.47	60.8
Lovewell[1]	1582.6	1581.96	-0.64	94.8
Milford[1]	1144.4	1146.78	2.38	100.0
Cedar Bluff	2144	2119.10*	-24.90*	32.1*
Kanopolis[1]	1463	1465.81	2.81	100.0
Wilson[1]	1516	1517.17	1.17	100.0
Webster[1]	1892.5	1888.90	-3.55	83.3
Kirwin[1]	1729.3	1723.73	-5.52	74.0
Waconda[1]	1455.6	1456.50	0.90	100.0
Tuttle Creek[1]	1075	1079.64	4.64	100.0
Perry[1]	891.5	893.89	2.39	100.0
Clinton[1]	875.5	877.29	1.79	100.0
Melvern[1]	1036	1037.34	1.34	100.0
Pomona[1]	974	976.44	2.44	100.0
Hillsdale[1]	917	917.44	0.44	100.0
Arkansas River Basin		**10/28/2016 8:00 AM**		
Cheney	1421.6	1421.93	0.33	100.0
El Dorado	1339	1339.26	0.26	100.0
Toronto[1]	901.5	901.66	0.16	100.0
Fall River[1]	948.5	951.21	2.71	100.0
Elk City[1]	796	797.04	1.04	100.0
Big Hill	858	858.10	0.10	100.0
Council Grove[1]	1274	1274.12	0.12	100.0
Marion[1]	1350.5	1350.49	-0.01	100.0
John Redmond[1]	1039	1041.30	0.30	100.0

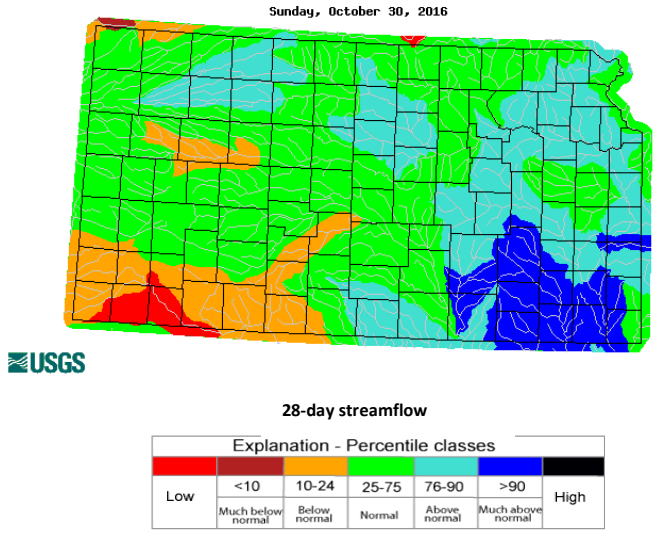
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.
* data not available 10/30/16 this data for 11/2/16.

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the 28 day streamflow compared to historical is shown on the map below, right.





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.

Flooding and High Flows

The map and table below summarizes recent flood conditions for September 2016 from USGS WaterWatch data. Note: flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience. Moderate flooding is some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary. Major flooding is extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations may occur.

USGS Station Number	USGS Station Name	Drain. Area [mi^2]	NWS Flood Stage [ft]	No. of Days Above Flood Stage	NWS flood class*	Highest peak from 2016-10-01 to 2016-10-31				Historical Peaks	
						Date	Stage [ft]	Streamflow (date) [ft^3/s]	Rank	No. of Yrs	Max. (year) [ft^3/s]
06917000	L OSAGE R AT FULTON, KS	314	22	3	▲	2016-10-07	27.69	10100	26	66	62800 (1986)
07166500	VERDIGRIS R NR ALTOONA, KS	1094	19	2	▲	2016-10-08	20.57	20600	17	76	71000 (1951)
07169500	FALL R AT FREDONIA, KS	827	17	2	▲	2016-10-07	23.13	13700	29	80	77800 (2007)
07183000	NEOSHO R NR IOLA, KS	3723	15	3	▲	2016-10-07	18.09	24100	54	108	436000 (1951)
07183500	NEOSHO R NR PARSONS, KS	4905	21	4	▲	2016-10-09	24.96	27900	46	93	410000 (1951)
07184000	LIGHTNING C NR MCCUNE, KS	197	12	3	▲	2016-10-08	16.6	8730	27	64	67500 (1993)

* ▲=Minor Flooding ▲=Moderate Flooding ▲=Major Flooding

Note: USGS WaterWatch provides streamflow based on USGS monitored stream gages. NWS flood stage is found on the NWS River Conditions Map.

Water Right Administration/Minimum Desirable Streamflow (MDS)
Minimum Desirable Streamflow (MDS) is 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.

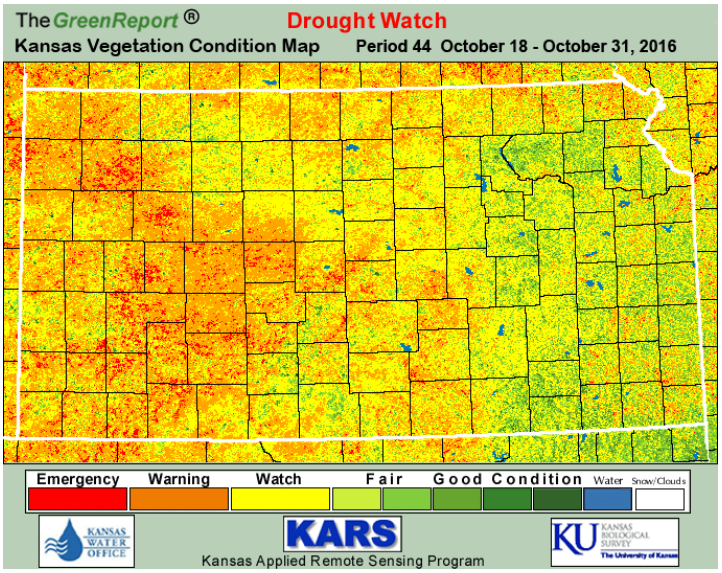
Streamflows as of Oct. 27, 2016	**cubic feet per second ((cfs)**			
Gaging Station	**Current Flow**	**October MDS**	**November MDS**	**Comment**
Republican River at Concordia	137	65	80	Admin began April 19, 2016; 71 files. Admin ceased May 13, 2016.
Republican River at Clay Center	216	90	100	Admin began April 19, 2016; 147 files. Admin ceased May 13, 2016.

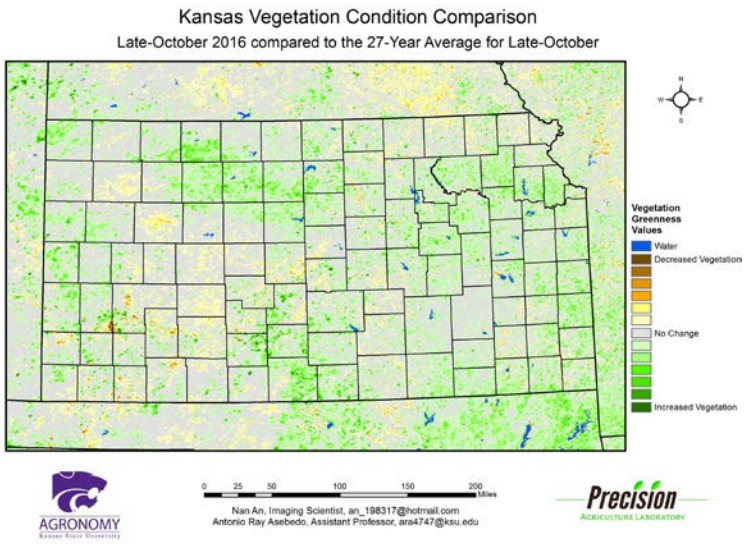
Flooding and High Flows
USGS WaterWatch data indicate no flood conditions for October 2016 in Kansas. USGS WaterWatch provides streamflow based on USGS monitored stream gages. NWS flood stage is found on the NWS River Conditions Map.

Please note: flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience. Moderate flooding is some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary. Major flooding is extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

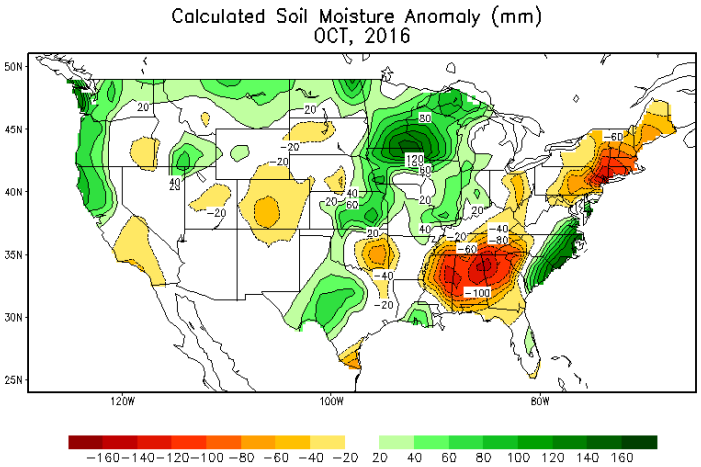
Soil, Crop and Vegetation

Kansas Vegetative Conditions
The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Most vegetation is turning at this time. Emerging winter wheat can be seen in the Central and Southwest areas of the state. Greenness in the east is some wheat but mostly grasses.





Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for October 25 – October 31, 2016 from K-State's Precision Agriculture Laboratory shows much of the state is close to average vegetative activity. Lower values are visible in western Kansas, as abnormally dry conditions continue to expand eastward. The very low NDVI values in extreme eastern Kansas, however, are due to persistent cloud cover in the region.



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.
http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

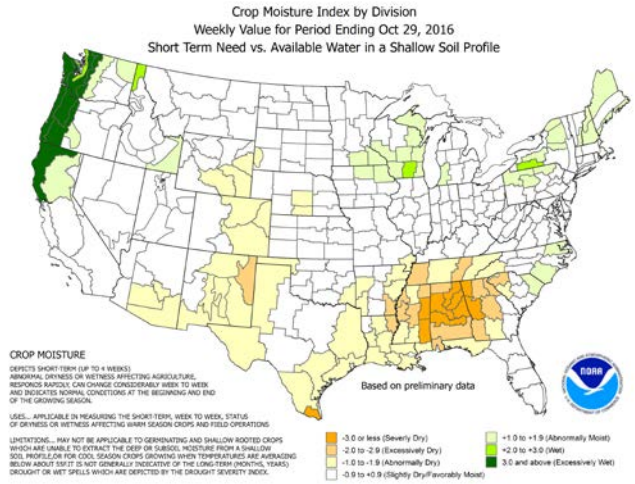
Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at:
http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for the week ending October 30 reported topsoil rated 7 percent very short, 25 short, 65 adequate, and 3 surplus. Subsoil moisture rated 5 percent very short, 20 short, 72 adequate, and 3 surplus.

Field Crops Condition/Status: Corn harvested was 93 percent, equal to last year, and near 90 average. Soybeans harvested was 75 percent, near 80 last year and 77 average. Sorghum harvested was 71 percent, near 74 last year, but ahead of 60 average.

Winter wheat condition rated 2 percent very poor, 7 poor, 34 fair, 48 good, and 9 excellent. Cotton condition rated 1 percent very poor, 3 poor, 28 fair, 64 good, and 4 excellent. Sunflower condition rated 1 percent very poor, 3 poor, 28 fair, 62 good, and 6 excellent.

Livestock Report: Pasture and range conditions rated 1 percent very poor, 5 poor, 27 fair, 56 good, and 11 excellent. Stock water supplies were 2 percent very short, 7 short, 87 adequate, and 4 surplus.
(http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	0.03	-1.12	3%	58.9	8.0	89 (16)	29 (7)
Dodge City	0.09	-1.65	5%	63.6	7.0	101 (17)	32 (7)
Garden City	T	-1.28	0%	62.3	6.9	100 (17)	32 (7)
Goodland	0.04	-1.33	3%	58.7	6.8	92 (16)	29 (24)
Guymon, OK	0.65	-0.92	41%	64.8	7.5	98(18,17)	33 (21,7)
Hill City	0.08	-1.44	5%	59.5	5.5	92 (16)	31 (13,12)
Lamar, CO	T	-0.80	0%	59.5	6.6	95 (16)	25 (7)
McCook, NE	0.14	-1.65	8%	57.8	6.5	88 (28)	28 (7)
Springfield, CO	0.01	-1.38	1%	59.6	5.7	95 (17)	24 (7)
Central							
Concordia	1.00	-0.92	52%	60.5	5.1	89 (17)	29 (13)
Hebron, NE	1.22	-0.99	55%	58.4	5.1	83 (28,17)	28 (13)2.28
Medicine Lodge	1.34	-1.50	47%	63.8	5.2	92 (17,6)	34 (21)
Ponca City, OK	5.59	2.21	165%	67.4	7.3	92 (17)	37 (21)
Salina	2.28	0.01	100%	63.3	5.8	91 (17)	37 (13)
Wichita (ICT)	2.04	-0.74	73%	65.2	6.9	91 (17)	36 (21)
East							
Bartlesville, OK	6.39	2.92	184%	65.1	5.6	89 (17)	35 (21)
Chanute	3.51	-0.15	96%	64.6	6.3	88 (17)	37 (21)
Fall City, NE	1.76	-0.88	67%	59.4	4.7	87 (17)	31 (13)
Johnson Co. Exec. Apt	1.92	-1.52	56%	61.7	4.7	85 (17)	37 (13)
Joplin, MO	5.25	1.22	130%	65.5	5.7	87 (17,16)	38 (21)
Kansas City (MCI), MO	2.58	-0.58	82%	61.8	5.4	87 (17)	35 (13)
St. Joseph, MO	1.66	-1.55	52%	60.8	6.1	89 (17)	31 (13)
Topeka (TOP	1.32	-1.71	44%	62.1	5.5	89 (17)	36 (21,13)

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

KANSAS CLIMATE and DROUGHT UPDATE – November 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

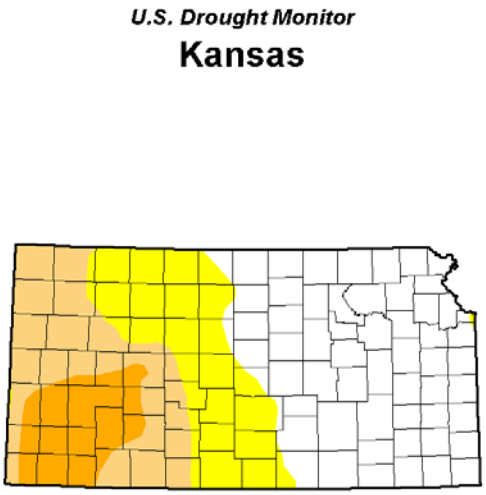
- The U.S. Drought Monitor had dry and drought conditions continuing and expanding in western Kansas in November, affecting over half of Kansas by the end of the month.

Lakes and Streams

- Norton and Cedar Bluff continued to be significantly below conservation pool throughout the month.

General Conditions

Above normal temperatures coupled with below normal precipitation resulted in expansion of moderate drought in western Kansas, with an area of severe drought in southwestern Kansas. As we move into the drier part of the year, even above normal precipitation is not likely to result in significant improvement. By the same token, the rate of deterioration is likely to slow.



November 29, 2016
(Released Thursday, Dec. 1, 2016)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	47.46	52.54	30.50	10.50	0.00	0.00
Last Week 11/22/2016	61.91	38.09	26.69	0.00	0.00	0.00
3 Months Ago 8/30/2016	94.79	5.21	0.97	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/27/2016	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 12/1/2015	46.33	53.67	4.51	0.00	0.00	0.00

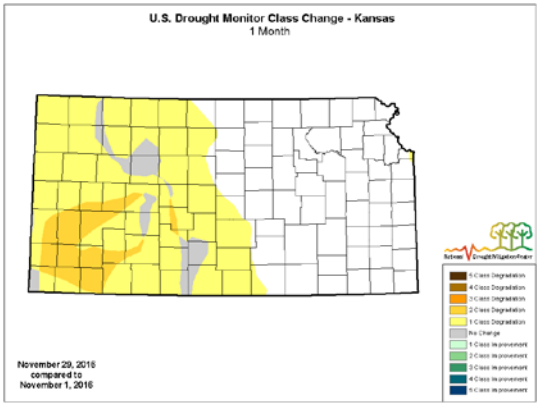
Intensity

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

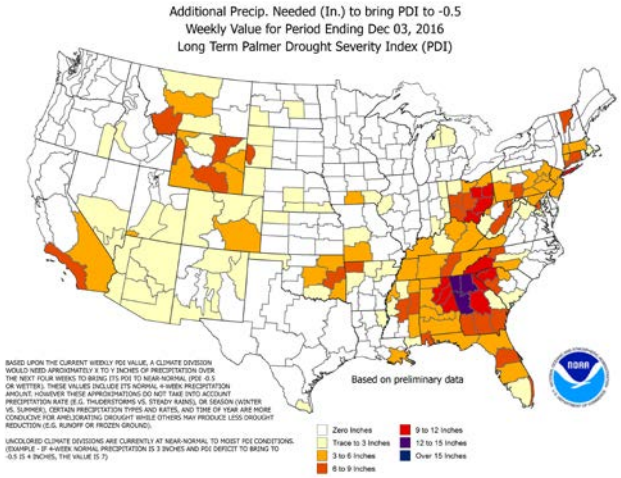
Author:
Richard Heim
NCEI/NOAA

http://droughtmonitor.unl.edu/



http://droughtmonitor.unl.edu

More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.



Palmer Drought Severity Index (PDSI) - The Palmer Index is an indicator used in the U.S. Drought Monitor. The PDI for the period ending December 3, 2016 indicates a trace to three inches of moisture is needed over the next four weeks in the Northwest Climate Division to bring that area to their normal moisture conditions.

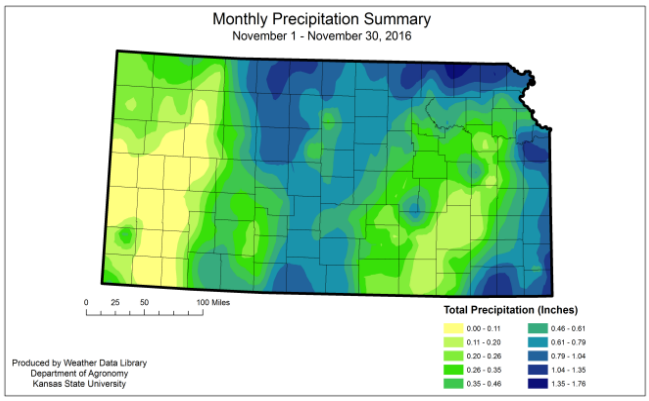
Climate Summary (Temperature and Precipitation)

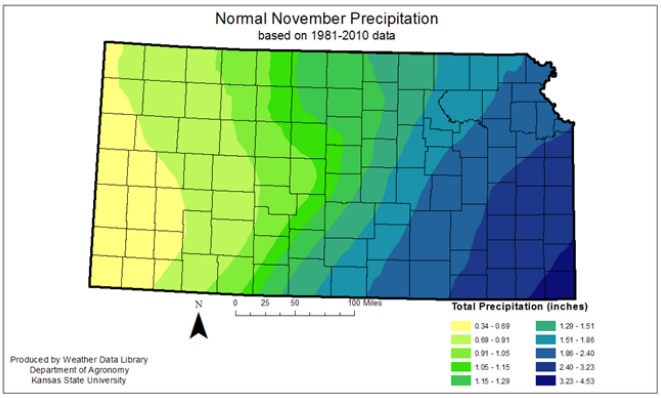
State-wide average rainfall for November continued the trend of the dry fall and was well below normal. The state-wide average was 0.42 inches or 32 percent of normal. The West Central and East Central Climate Divisions vied for lowest percent of normal: the West Central Division had 0.10 inches or 12 percent of normal; the East Central Division had 0.30 inches or 13 percent of normal. The North Central Division came closest to normal with an average of 0.73 inches or 59

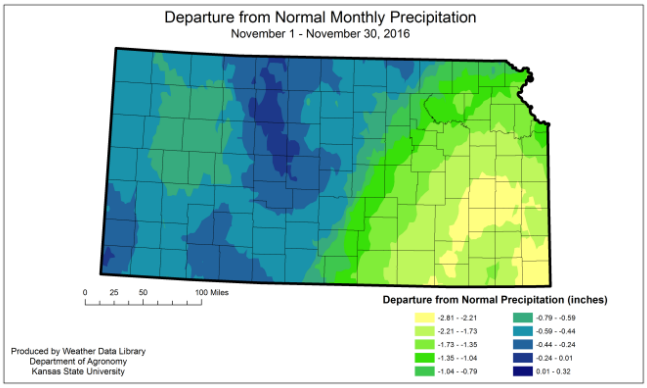
percent of normal. This November ranks as the 30th driest in the 122 years of record. The wettest November on record occurred in 1909, when the statewide average total was 4.68 inches. The driest November occurred in 1989 when the state-wide average was zero inches. Despite the dry pattern there were 26 new record daily rainfall totals. The greatest 24 hour total recorded at a CoCoRaHS station was 1.58 inches at Seneca 0.5 N, Nemaha County, on the 23rd. The greatest 24 hour report for a National Weather Service station was 0.43 inches at Olathe Johnson Co Exec Ap, Johnson County, on the 2nd. The greatest monthly totals: 2.25 inches at Fostoria 7 NW, Pottawatomie County (NWS) and 1.61 inches at Seneca 9.0 N, Nemaha County (CoCoRaHS.

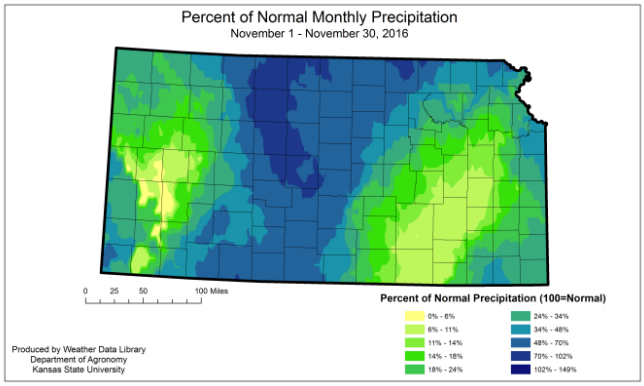
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

Kansas Climate Division Precipitation Summary (inches)												
	November 1-30, 2016			January 1– November 30, 2016			April 1 – November 30, 2016			September 1- November 30, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	0.24	-0.57	27	19.55	-1.26	93	18.17	-0.28	98	3.66	-0.20	92
West Central	0.10	-0.67	12	18.80	-1.36	92	17.46	-0.14	98	1.87	-1.93	50
Southwest	0.21	-0.44	31	20.13	0.88	103	19.76	2.94	116	0.96	-2.79	24
North Central	0.73	-0.49	59	30.55	3.39	112	28.76	5.14	122	5.61	-0.17	101
Central	0.60	-0.62	53	30.72	2.32	108	28.76	4.40	117	4.93	-0.89	82
South Central	0.44	-1.04	32	34.67	4.43	113	32.97	7.43	127	7.84	1.16	110
Northeast	0.89	-0.86	52	34.82	0.99	102	32.55	3.03	109	8.95	0.91	111
East Central	0.30	-1.84	13	35.31	-1.27	95	32.83	1.28	103	8.53	-0.32	95
Southeast	0.50	-2.07	18	42.27	2.52	106	39.39	5.75	117	12.25	2.04	120
STATE	0.43	-0.97	32	29.75	1.36	103	27.99	3.53	113	6.02	-0.28	85

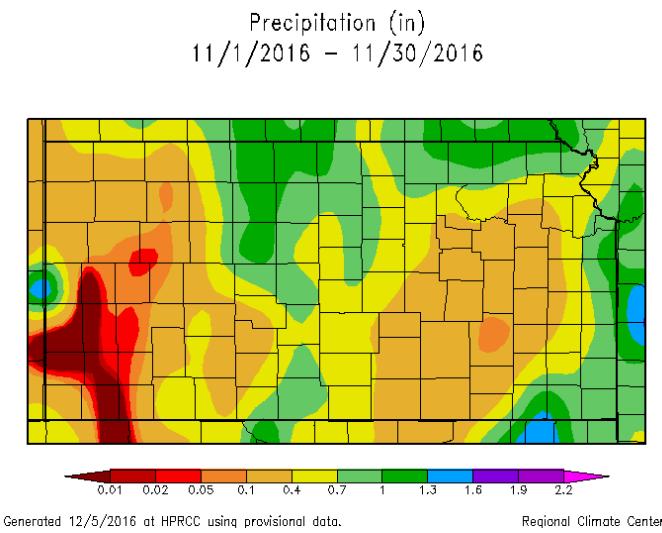


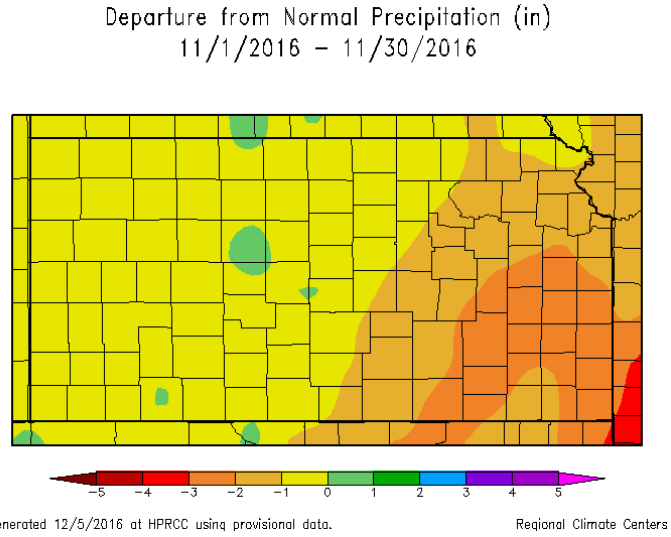






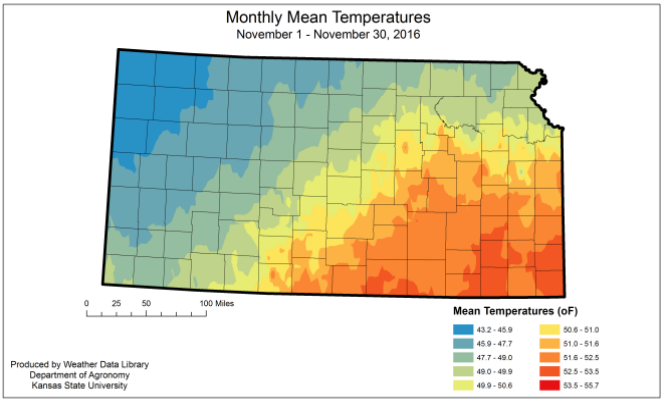
Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

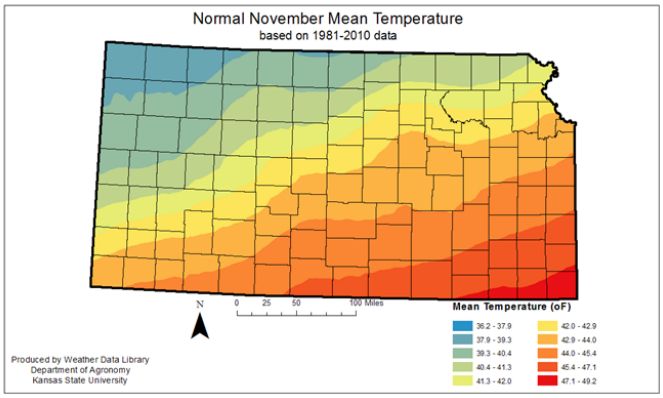


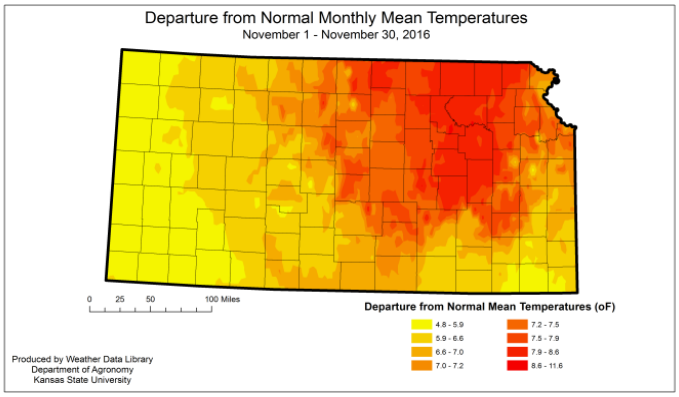


November temperatures continued the warmer than normal pattern. The state-wide average temperature was 49.4 °F, or 7.3 degrees warmer than normal. This was the 2nd warmest since 1896. The Southwest Climate Division was closest to normal for the month. Their average was 48.9 °F, or 6.5 degrees warmer than normal. The division with the greatest departure was the Northeast Division where the average temperature was 49.7 °F or 8.0 degrees warmer than normal. There were 170 new daily record high temperatures set in the month, of those 13 set new record highs for November. Ashland, in Clark County, had the highest reading for the month, with 93 °F reported on the first of the month. Despite the record warmth, there were two new record low minimum temperatures set. There were 74 new record warm minimum temperatures set, of which 6 were records for the month. The coldest temperature recorded for the month was 8 °F at Oakley 19 SSW, Logan County, on the 20th.

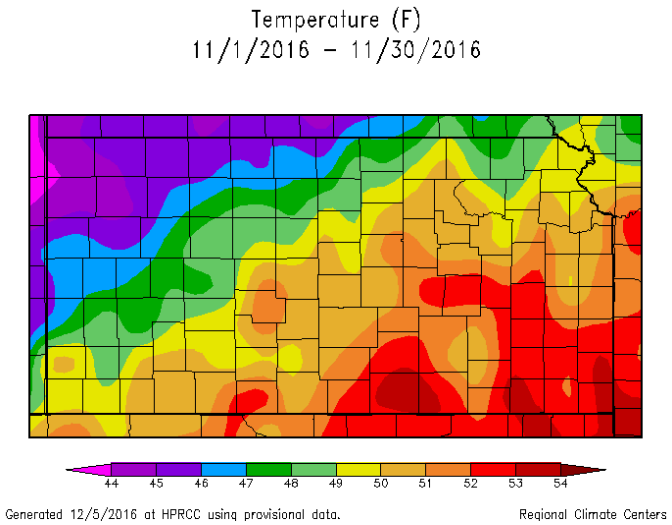
Climate Division	Kansas Climate Division Temperature Summary (°F)							
	November 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	61.5	29.6	45.6	7.0	91	1	8	19
West Central	64.4	29.9	47.1	7.1	92	1	9	19
Southwest	65.2	32.6	48.9	6.5	93	1	9	19
North Central	62.1	35.0	48.6	7.9	88	1	18	19
Central	63.6	36.0	49.8	7.5	92	1	15	19
South Central	65.3	37.2	51.2	7.2	88	1	15	19
Northeast	62.1	37.3	49.7	8.0	83	17	23	21
East Central	63.0	38.5	50.8	7.7	84	1	22	19
Southeast	65.0	40.0	52.5	7.2	85	17	20	19
STATE	63.6	35.1	49.4	7.3	93	1st	8	19th
Data Source: KSU Weather Library								

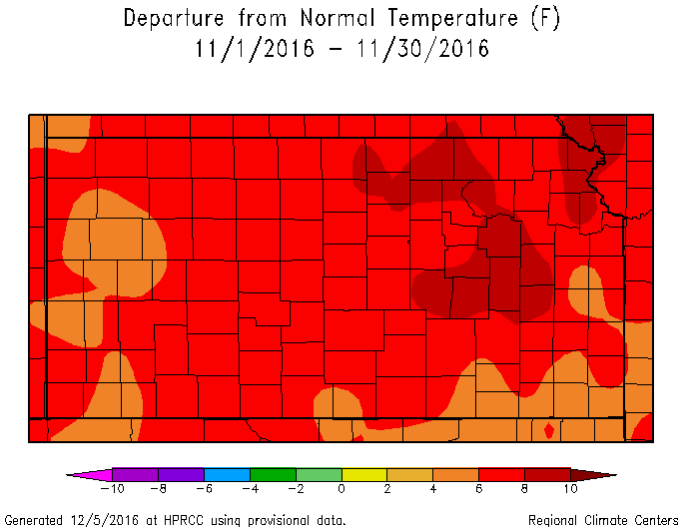






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.

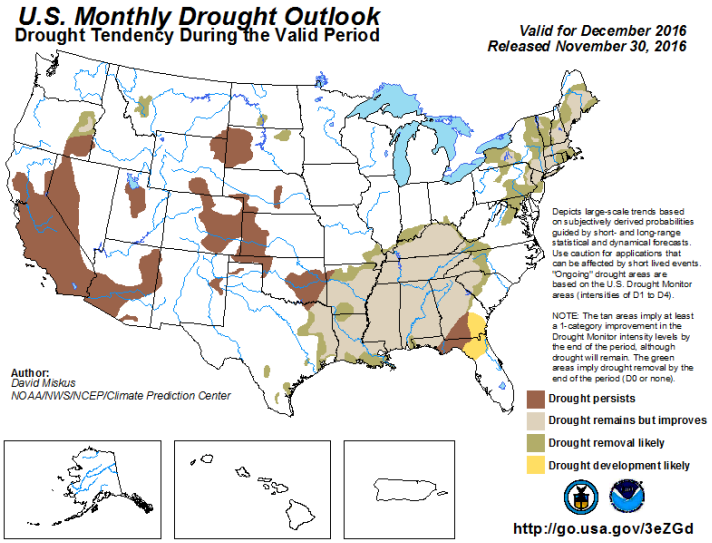


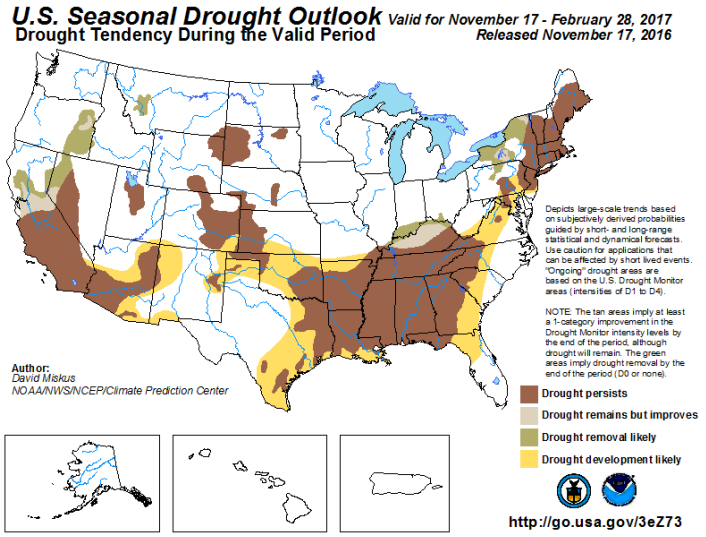


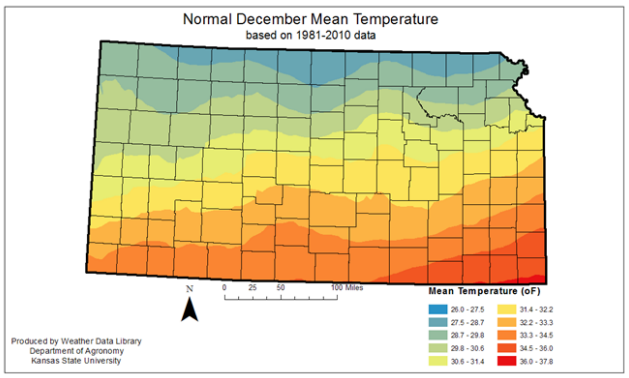
Severe weather wasn't as much of a factor as last month, although there was one tornado reported in Riley County, just north of the Manhattan airport. Fortunately there were no deaths or injuries reported with the storm. There were no hail reports and only four damaging wind reports in the month.

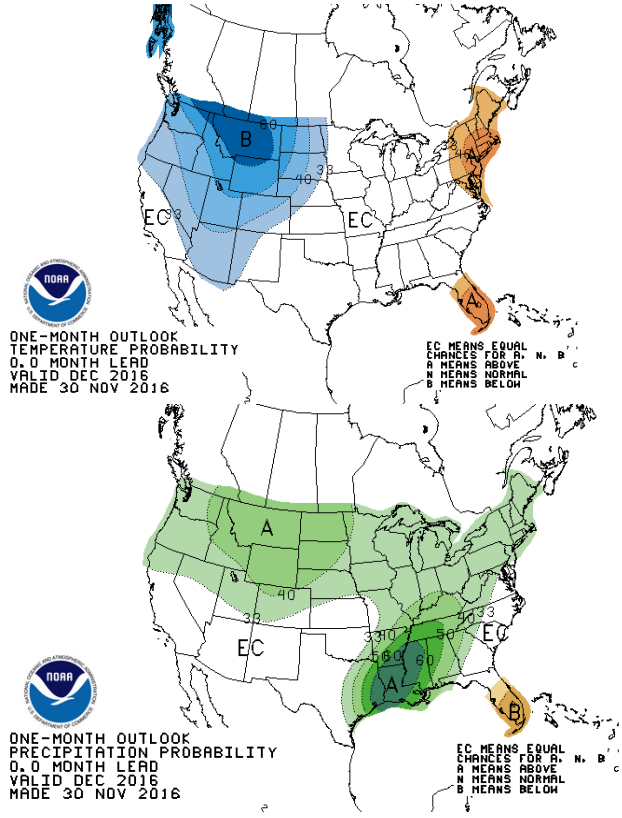
Future Outlook

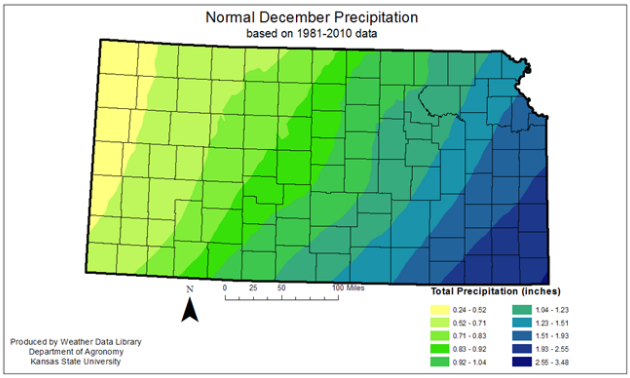
The U.S. Monthly and Seasonal Drought Outlooks indicate drought to persist in western Kansas. The temperature outlook for December is for equal chance of above or below normal temperatures. The precipitation outlook is for equal chance of above or below normal precipitation. Both the Drought Outlooks and individual temperature and precipitation outlooks are provided below.



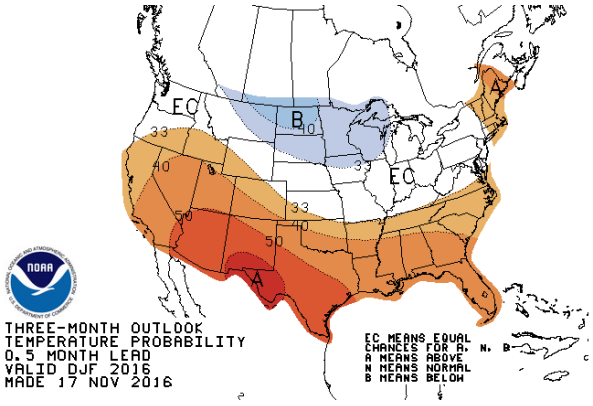


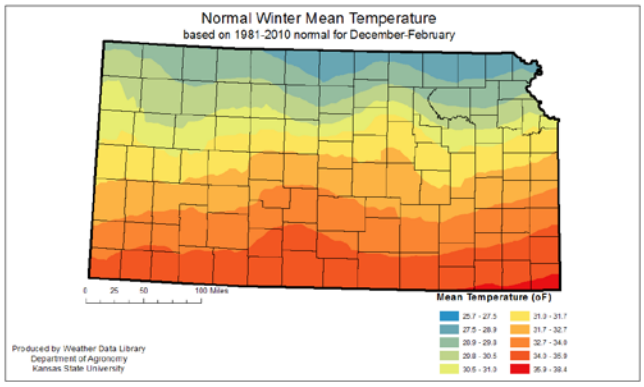


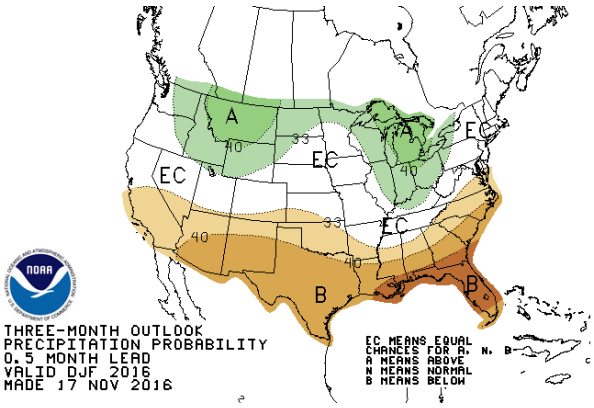


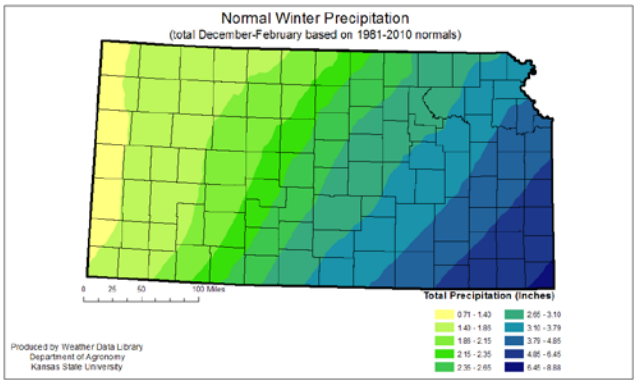


The three-month outlook favors above normal temperatures December 2016 thru February 2017, for southwest Kansas, but equal chances of above or below normal for the majority of the state. Equal chances of above or below normal precipitation for most of Kansas are anticipated with the exception of the southwest area favored to be below normal.









Additional outlooks for additional 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.

Known issues:
Stage II water restrictions, under Resolution 03-16 are in place for the **City of Russell,** Russell County water customers as of December 7, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the **City of Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (December 7, 2016, http://victoriaks.com/utilities.htm.)

Surface Water Supply Conditions
Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs began and ended the month with full conservation storage. Inflows were sufficient to maintain storage in the flood pools near the fall target elevations and historical median flows in the Kansas River were maintained throughout the month of November.

Marais des Cygnes basin: Melvern, Pomona, and Hillsdale reservoirs maintained storage in excess of conservation in November. Flow in the Marais des Cygnes River declined over the month and dropped below median values.

Cottonwood / Neosho basin: Streamflow and storage was maintained at healthy levels throughout the basin in November, particularly in the lower system.

Verdigris basin: Toronto, Fall River, Big Hill, and Elk City reservoirs all declined in a relatively dry November but storage is healthy. Streamflow declined over the month but some additional releases over the Thanksgiving weekend gave some discharge spikes to gages along the Verdigris. The additional releases were in response to dilution needs from a chemical spill in Neodesha, Kansas.

Saline basin: Elevation at Wilson Lake was maintained at or above the seasonal lake level target of 1,517 feet, one foot above normal multipurpose pool.

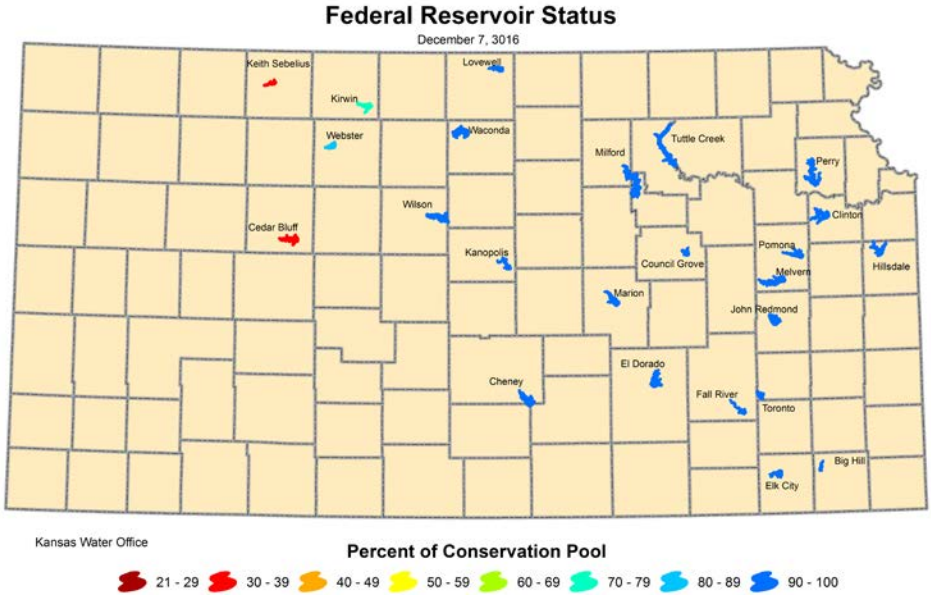
Smoky Hill basin: The middle Smoky Hill basin maintained some streamflow in November. Kanopolis discharge continued through the uncontrolled notch spillway and reservoir level declined throughout the month. Cedar Bluff Reservoir did not experience any significant inflow and steadily declined.

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.

The following lakes remain on the watch list until the beginning of the 2017 HAB season. The following lakes will remain on the list until the beginning of the 2017 HAB season, Milford Reservoir Zone C, Clay and Geary counties and Lake Shawnee, Shawnee County.

The following lakes will remain on the warning list until the beginning of the 2017 HAB season. The following lakes will remain on the list until the beginning of the 2017 HAB season, South Lake, Johnson County and Vineyard Park Pond, Ellis County.

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton and Cedar Bluff reservoirs remain significantly below conservation pool.



Kansas Federal Reservoir Conservation Pool Levels

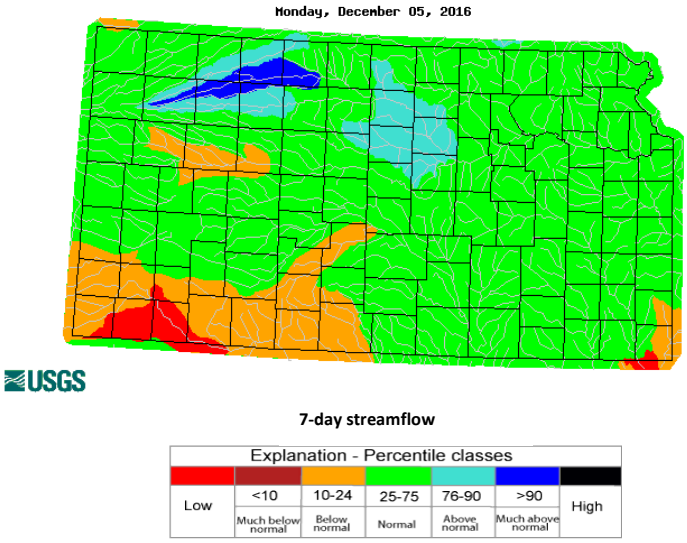
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**12/06/2016 06:00 AM**		
Norton[1]	2304.3	2291.07	-13.23	37.2
Harlan County, NE	1945.73	1935.46	-10.27	61.4
Lovewell[1]	1582.6	1582.19	-0.41	96.7
Milford[1]	1144.4	1146.88	2.48	100.0
Cedar Bluff	2144	2118.86	-25.14	31.7
Kanopolis[1]	1463	1464.95	1.95	100.0
Wilson[1]	1516	1517.20	1.20	100.0
Webster[1]	1892.5	1889.64	-2.81	86.7
Kirwin[1]	1729.3	1724.41	-4.84	76.9
Waconda[1]	1455.6	1456.36	0.76	100.0
Tuttle Creek[1]	1075	1080.22	5.22	100.0
Perry[1]	891.5	893.66	2.16	100.0
Clinton[1]	875.5	876.86	1.36	100.0
Melvern[1]	1036	1036.93	0.93	100.0
Pomona[1]	974	976.07	2.07	100.0
Hillsdale[1]	917	917.27	0.27	100.0
Arkansas River Basin		**12/07/2016 08:00 AM**		
Cheney	1421.6	1421.88	0.28	100.0
El Dorado	1339	1339.01	0.01	100.0
Toronto[1]	901.5	901.64	0.14	100.0
Fall River[1]	948.5	948.94	0.44	100.0
Elk City[1]	796	795.88	-0.12	99.0
Big Hill	858	857.79	-0.21	100.0
Council Grove[1]	1274	1274.16	0.16	100.0
Marion[1]	1350.5	1350.34	-0.16	99.0
John Redmond[1]	1039	1041.11	0.11	100.0

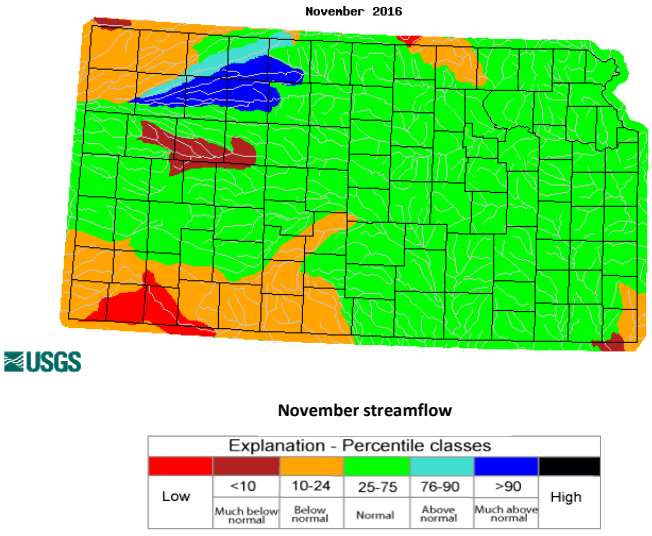
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.
* data not available 10/30/16 this data for 11/2/16.

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the monthly streamflow compared to historical is shown on the map below, right.





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.

Water Right Administration/Minimum Desirable Streamflow (MDS)

Minimum Desirable Streamflow (MDS) is 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.

Streamflows as of Dec. 1, 2016	**cubic feet per second ((cfs)**			
Gaging Station	**Current Flow**	**November MDS**	**December MDS**	**Comment**
Republican River at Concordia	157	80	100	Admin began April 19, 2016; 71 files. Admin ceased May 13, 2016.
Republican River at Clay Center	219	100	125	Admin began April 19, 2016; 147 files. Admin ceased May 13, 2016.

Flooding and High Flows

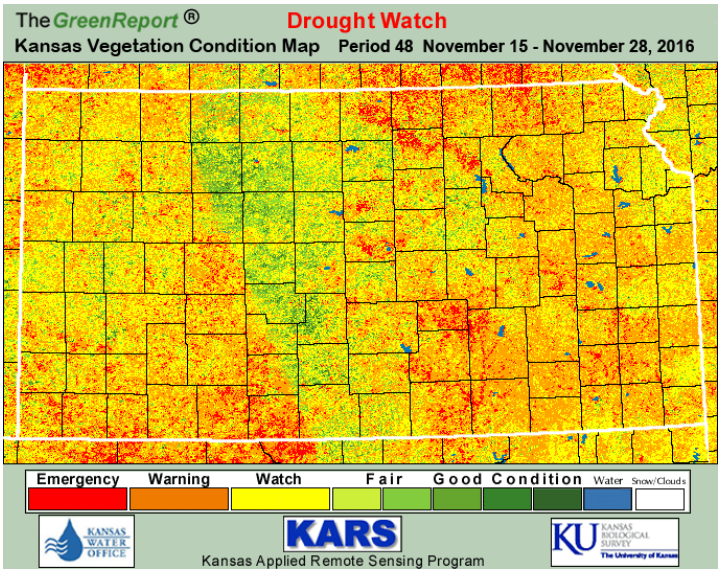
USGS WaterWatch data Based on USGS monitored stream gages, USGS WaterWatch indicates no flood conditions in Kansas in November.

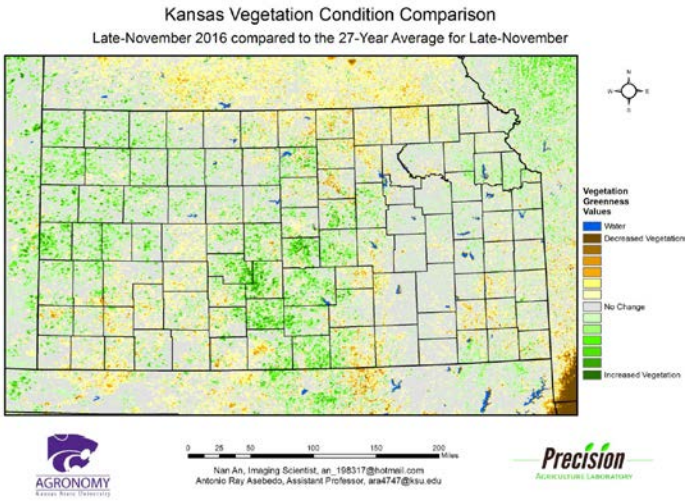
Please note: flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience. Moderate flooding is some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary. Major flooding is extensive inundation of structures and roads, and significant evacuations of people and/or transfer of property to higher elevations. NWS flood stage is found on the NWS River Conditions Map.

Soil, Crop and Vegetation

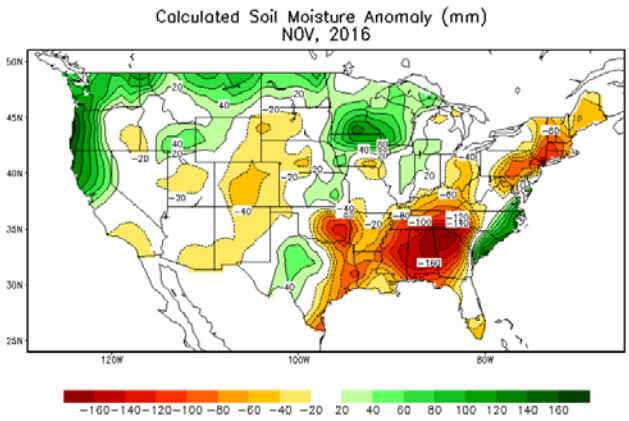
Kansas Vegetative Conditions

The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Winter wheat can be seen in the central and western areas of the state, and have lost a little vigor from the previous week due to dryness.





Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for November 22 – November, 2016 from K-State's Precision Agriculture Laboratory shows much of the state is close to average vegetative activity. Lower values are visible in western Kansas, as drought conditions continue to expand eastward.



Soil Moisture

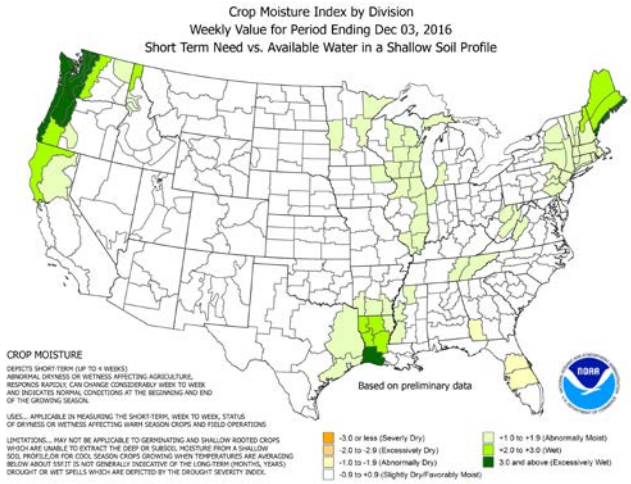
The Climate Prediction Center (CPC), also monitors soil moisture and predicts future soil moisture. Anomalies are defined as deviations from the 1971-2000 monthly climatology. http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for the week ending November 27 reported topsoil rated 14 percent very short, 31 short, 53 adequate, and 2 surplus. Subsoil moisture rated 8 percent very short, 27 short, 64 adequate, and 1 surplus.

Field Crops Report: Winter wheat condition rated 3 percent very poor, 10 poor, 35 fair, 45 good, and 7 excellent. Winter wheat emerged was 96 percent, near 98 both last year and the five-year average. Cotton harvested was 69 percent, near 67 last year, but behind 74 average. Sunflower harvested was 95 percent, near 94 both last year and average.

Livestock, Pasture, and Range Report: Pasture and range conditions rated 2 percent very poor, 6 poor, 30 fair, 53 good, and 9 excellent. Stock water supplies were 2 percent very short, 13 short, 83 adequate, and 2 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

November 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	0.26	-0.33	44%	45.2	7.0	80 (6)	13 (18)
Dodge City	0.37	-0.39	49%	49.8	6.7	87 (16)	14 (19)
Garden City	0.07	-0.48	13%	47.5	5.8	87 (16)	12 (19)
Goodland	0.21	-0.50	30%	45.5	6.5	82 (16)	13 (19)
Guymon, OK	0.02	-0.51	4%	50.6	5.0	87 (16)	14 (19)
Hill City	0.45	-0.50	47%	47.2	6.5	85 (16)	15 (19)
Lamar, CO	0.38	0.00	100%	45.6	5.6	80 (15)	10 (30,19)
McCook, NE	0.49	-0.46	52%	44.7	6.5	79 (10)	11 (19)
Springfield, CO	0.03	-0.55	5%	45.3	3.6	83 (16)	10 (18)
Central							
Concordia	0.57	-0.54	51%	48.6	7.0	80 (16)	20 (19)
Hebron, NE	0.54	-0.90	38%	46.3	6.9	82 (16)	20 (19)
Medicine Lodge	0.69	-0.24	74%	51.3	5.9	85 (16)	20 (19)
Ponca City, OK	0.14	-1.67	8%	55.0	7.3	87 (16)	24 (26)
Salina	0.60	-0.65	48%	51.2	7.3	82 (16)	20 (19)
Wichita (ICT)	0.26	-1.17	18%	53.0	7.6	85 (16)	24 (30,19)
East							
Bartlesville, OK	1.10	-1.58	41%	52.6	4.6	83 (2,1)	21 (26)
Chanute	0.47	-2.03	19%	52.8	6.5	81 (2)	25 (20)
Fall City, NE	0.89	-1.07	45%	48.4	7.4	78 (1)	23 (20,19)
Johnson Co. Exec. Apt	1.67	-0.82	67%	51.0	7.0	78 (1)	26 (19)
Joplin, MO	0.87	-2.91	23%	53.9	5.5	83 (1)	26 (19)
Kansas City (MCI), MO	0.51	-1.64	24%	51.2	7.6	78 (1)	27 (19)
St. Joseph, MO	0.54	-1.01	35%	49.1	7.2	79 (1)	20 (20)
Topeka (TOP	0.19	-1.66	10%	51.2	7.4	80 (16,1)	25 (20)

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

KANSAS CLIMATE and DROUGHT UPDATE – December 2016 Summary

Climate, Drought and Flood Conditions and Responses for Kansas

General

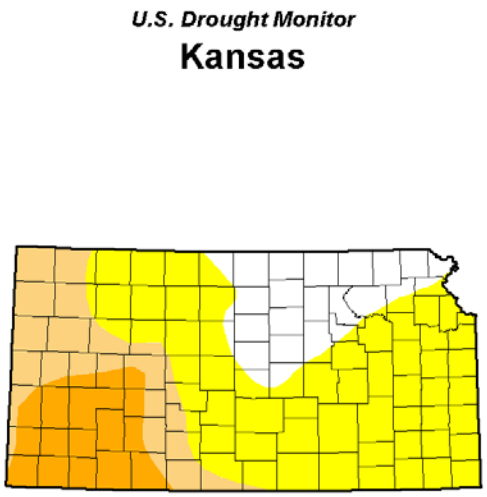
- U.S. Drought Monitor: Dry and drought conditions continued and expanded in western Kansas in December, affecting over half of Kansas. Severe drought classification for southwestern Kansas included all or part of 18 counties.

Lakes and Streams

- Norton and Cedar Bluff continued to be significantly below conservation pool throughout the month.

General Conditions

The lack of precipitation has taken its toll, and abnormal dry conditions expanded during December. As we move into the drier part of the year, even above normal precipitation is not likely to result in significant improvement. By the same token, the rate of deterioration is likely to slow, especially in the western half of the state.



December 27, 2016
(Released Thursday, Dec. 29, 2016)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

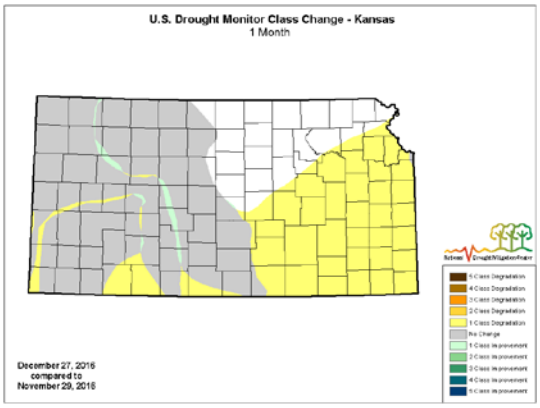
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	17.31	82.69	30.71	13.59	0.00	0.00
Last Week 12/20/2016	47.18	52.82	30.71	13.59	0.00	0.00
3 Months Ago 9/27/2016	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/27/2016	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Brad Rippey
U.S. Department of Agriculture

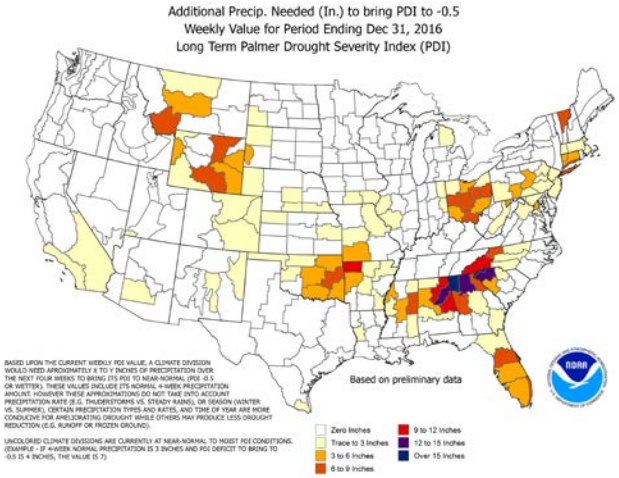
http://droughtmonitor.unl.edu/



http://droughtmonitor.unl.edu

More information on the Drought Monitor categories can be found in a separate document under useful links on the KWO drought page.

Palmer Drought Severity Index (PDSI) - The Palmer Index is an indicator used in the U.S. Drought Monitor. The PDI for the period ending December 31, 2016 indicates a trace to three inches of moisture is needed over the next four weeks in the Northwest and East Central Climate Divisions to bring those areas to their normal moisture conditions.

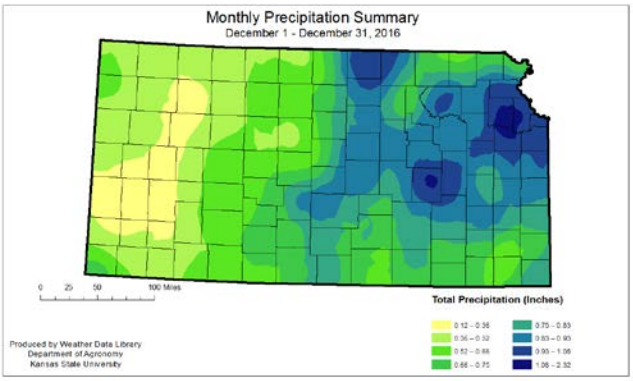


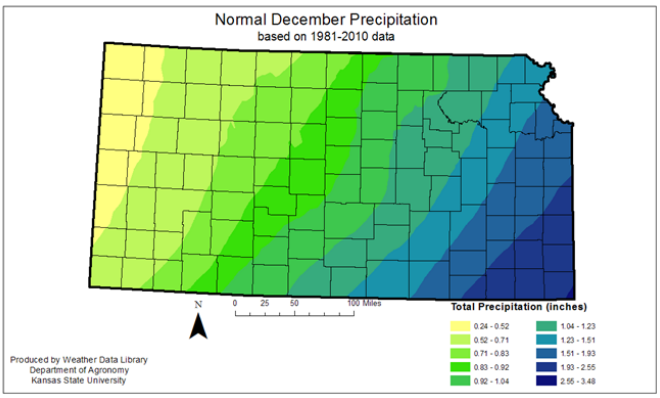
Climate Summary (Temperature and Precipitation)

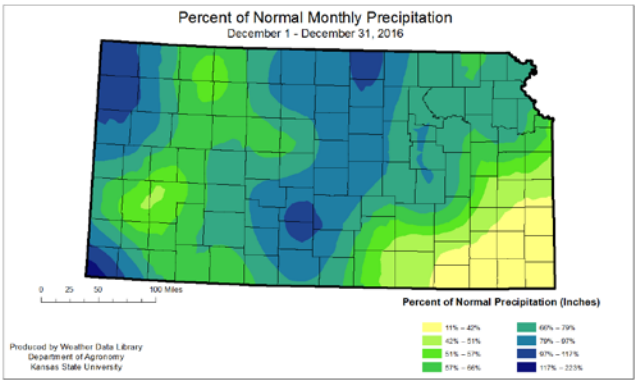
State-wide average rainfall for December continued the trend of the dry fall and was well below normal. The state-wide average was 0.56 inches or 57 percent of normal. The Northwest Climate Division fared the worst with an average of 0.18 inches or 34 percent of normal. The North Central Division came closest to normal with an average of 0.70 inches or 82 percent of normal. This December ranks as the 50th driest in the 122 years of record. The wettest December on record occurred in 1913, when the statewide average total was 3.15 inches. The driest December occurred in 1976 when the state-wide average was 0.05 inches. Despite the dry pattern there were 43 new record daily precipitation totals. The greatest 24-hour total recorded at a CoCoRaHS station was 0.94 inches at St. Francis 8.6 NNE, Cheyenne County, on the 26th. The greatest 24-hour report for a National Weather Service station was 1.15 inches at Eskridge, Wabaunsee County, on the 25th. The greatest monthly totals: 1.88 inches at Lawrence, Douglas County (NWS) and 1.58 inches at Olathe 3.3 ENE, Johnson County (CoCoRaHS).

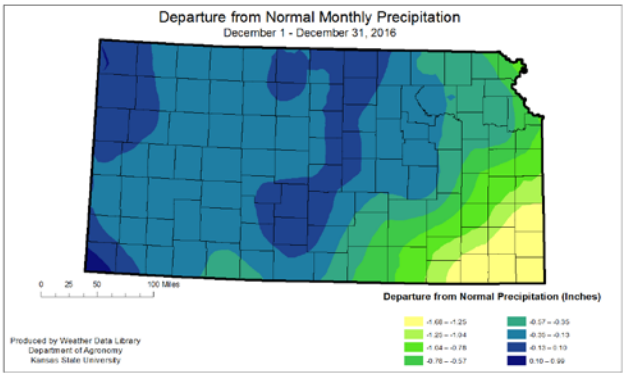
Precipitation summary for the month is provided in the table and maps below from the KSU Weather Library.

Kansas Climate Division Precipitation Summary (inches)												
	December 1-31, 2016			January 1– December 31, 2016			April 1 – December 31, 2016			September 1- December 31, 2016		
Climate Division	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal	Actual	Depart Normal	Percent Normal
Northwest	0.18	-0.37	34	19.73	-1.63	92	18.34	19.00	96	3.84	-0.57	84
West Central	0.32	-0.29	54	19.12	-1.65	91	17.78	18.21	97	2.19	-2.22	50
Southwest	0.37	-0.28	57	20.50	0.60	102	20.13	17.47	114	1.33	-3.07	29
North Central	0.70	-0.15	82	31.25	3.24	111	29.46	24.47	120	6.31	-0.32	98
Central	0.72	-0.17	78	31.44	2.15	107	29.48	25.26	116	5.64	-1.08	81
South Central	0.64	-0.43	59	35.31	3.99	111	33.61	26.61	125	8.48	0.72	103
Northeast	0.70	-0.47	61	35.53	0.53	101	33.25	30.69	107	9.66	0.45	104
East Central	0.72	-0.62	54	36.03	-1.89	94	33.55	32.89	101	9.25	-0.94	90
Southeast	0.68	-1.07	40	42.94	1.45	104	40.07	35.39	113	12.92	0.96	108
STATE	0.56	-0.43	57	30.31	0.93	102	28.55	25.46	110	6.58	-0.71	81

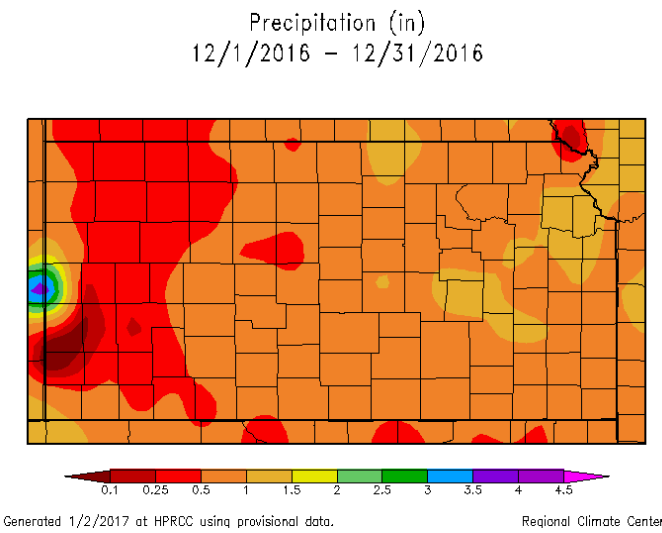


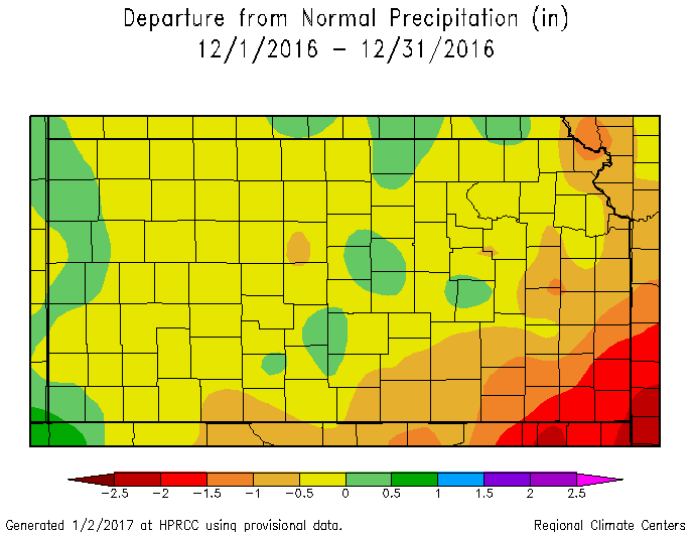






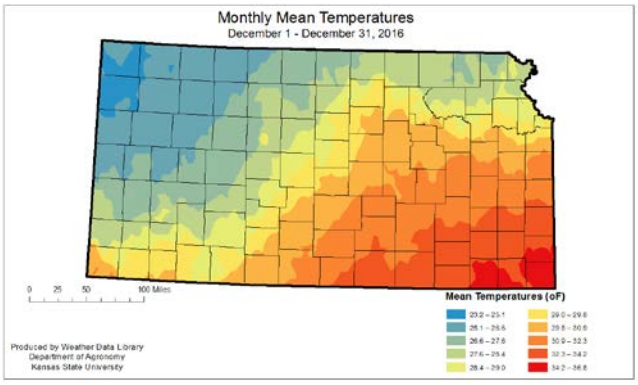
Precipitation summary for the month is provided in the maps below from the High Plains Regional Climate Center. The Climate Center information is provided also as a comparison to the K-State data. Various time intervals can be accessed at the climate center http://www.hprcc.unl.edu/maps.php?map=ACISClimateMaps .

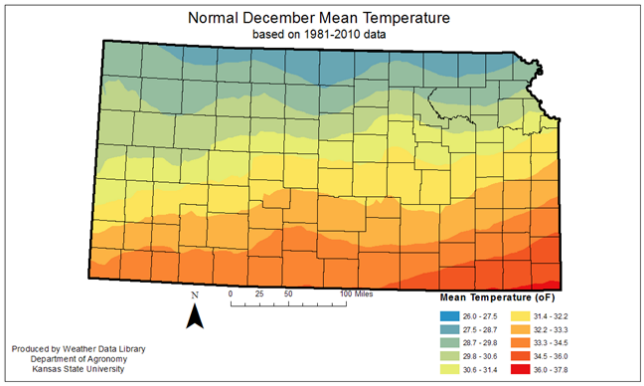


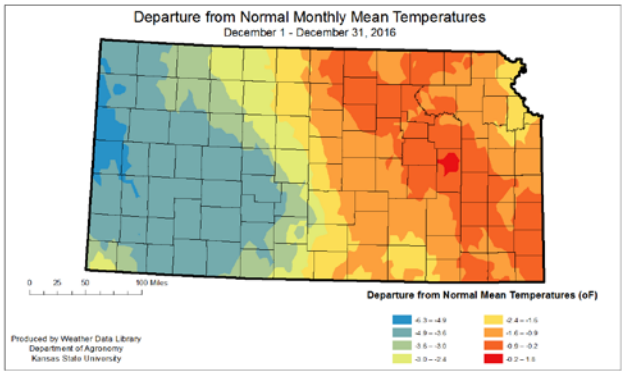


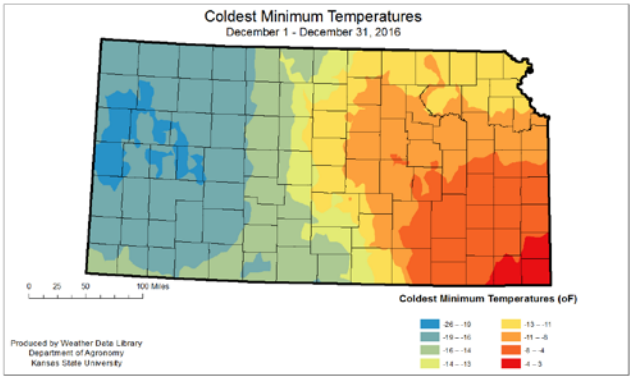
December marked a shift in the warm pattern that dominated much of the Fall. The state-wide average temperature was 29.0 ^{o}F, or -2.3 degrees colder than normal. This was the 25th coldest since 1896. The Southeast Climate Division was closest to normal for the month. Their average temperature was 33.4 ^{o}F, or -0.4 degrees colder than normal. The division with the greatest departure was the West Central Division where the average temperature was 26.7 ^{o}F or -3.7 degrees colder than normal. Even with the cold, there were 28 new daily record high temperatures set in the month, although none of those set monthly records. There were also twelve new daily record high minimum temperatures set. On the cold side, there were17 new record daily low maximum temperatures and 93 new record daily low minimum temperatures reported. Of those record low minimum temperatures, 11 set new record lows for December. The coldest minimum temperature reported was -24 ^{o}F reported at Oakley 19 SSW, Logan County, on the 20th. The highest temperature reported was 74 ^{o}F reported at Elkhart, Morton County, on the 17th.

Climate Division	Kansas Climate Division Temperature Summary (^{o}F)							
	December 2016							
	Maximum	Minimum	Average	Departure	High	Date	Low	Date
Northwest	40.2	11.8	26.0	-2.9	72	31	-24	20
West Central	41.3	12.1	26.7	-3.7	71	6	-20	19
Southwest	44.4	14.4	29.4	-3.2	74	17	-21	19
North Central	39.4	16.5	27.9	-1.3	66	26	-18	18
Central	41.4	16.9	29.1	-2.1	68	25	-16	18
South Central	43.1	18.0	30.6	-2.5	67	25	-15	19
Northeast	39.2	17.0	28.1	-1.5	66	26	-12	18
East Central	40.7	19.5	30.1	-1.3	69	26	-11	18
Southeast	44.2	22.6	33.4	-0.4	71	26	-12	19
STATE	41.5	16.5	29.0	-2.1	74	17th	-24	20th
Data Source: KSU Weather Library								

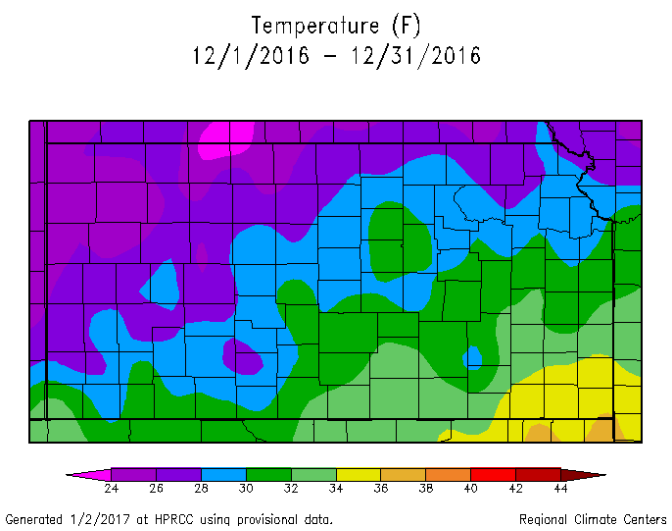


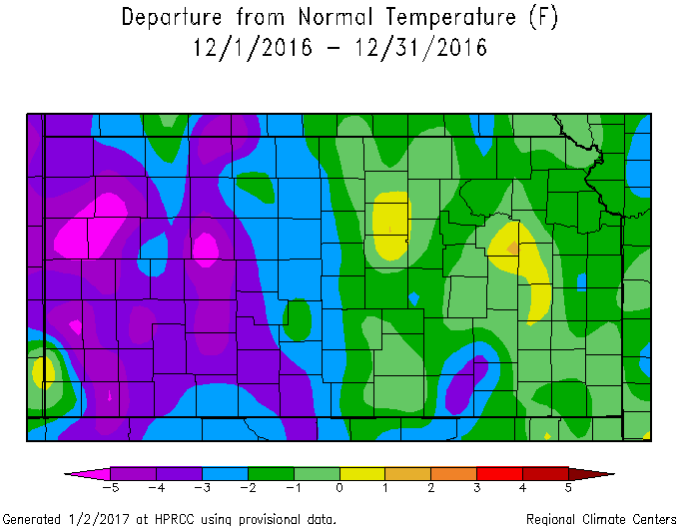






Temperature summary by the High Plains Regional Climate Center for the month is provided in the maps below.



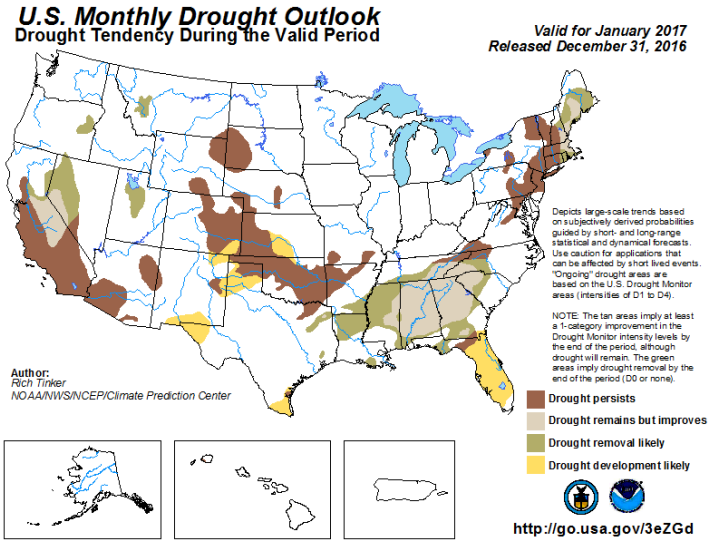


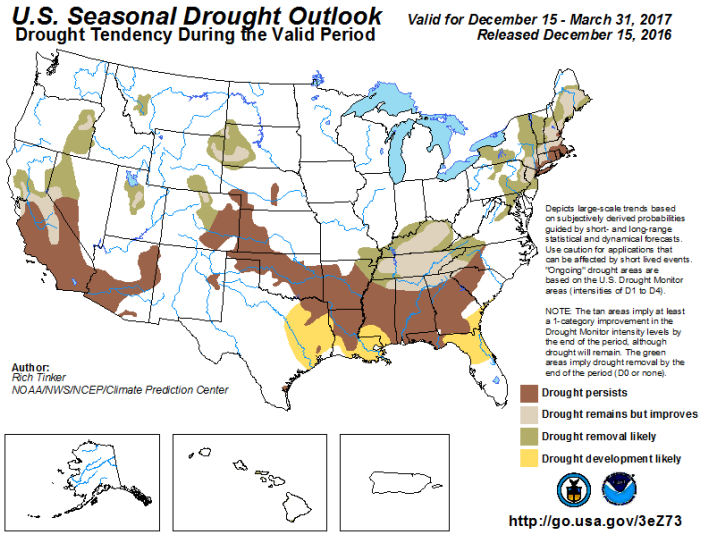
The cold air mass of December 18th through the 20th was displaced by a warm front. The clashing systems triggered a rare Christmas tornado outbreak in southwest Kansas. Brief touchdowns were reported in Ford, Kiowa and Rush counties. There were reports of damage to a cattle building and a horse shed in Kiowa County, but no reports of deaths or injuries. In addition to the tornadoes, there were 11 reports of wind damage during the month.

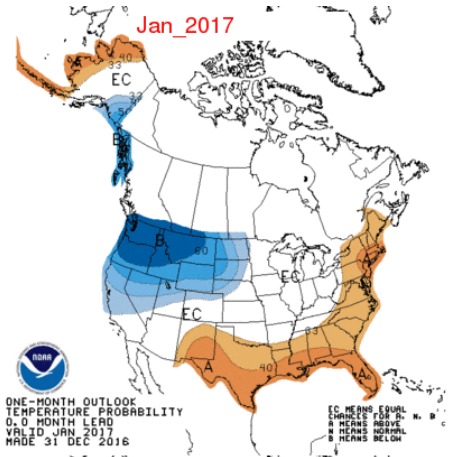
Future Outlook

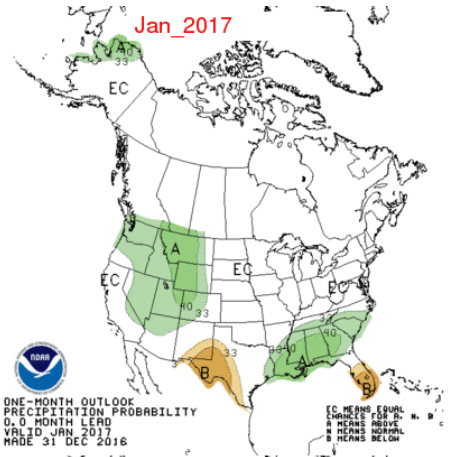
The U.S. Monthly and Seasonal Drought Outlooks indicate drought to persist in western Kansas with some expansion eastward into south central Kansas likely. The temperature and precipitation outlooks for January are for equal chance of above or below normal. The three-month outlook favors above normal temperatures January 2017 thru March 2017, for southwest Kansas, but equal chances of above or below normal for the majority of the state. Equal chances of above or below normal precipitation for most of Kansas are anticipated with the exception of the southwest area favored to be below normal.

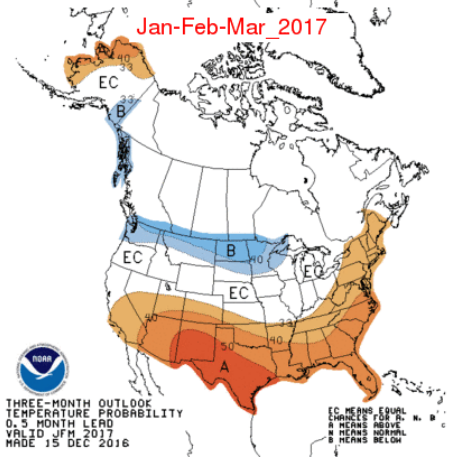
Both the Drought Outlooks and individual temperature and precipitation outlooks are provided below.

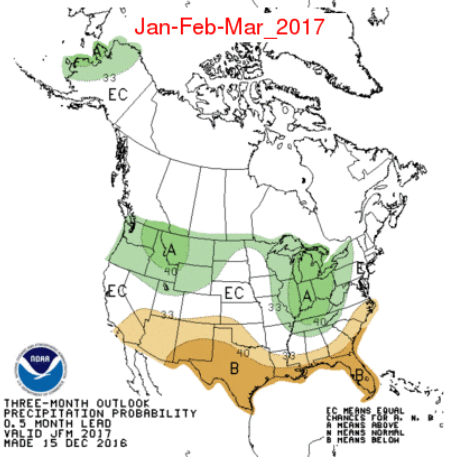


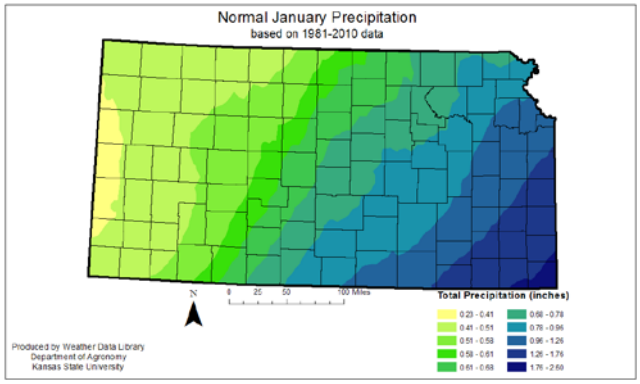


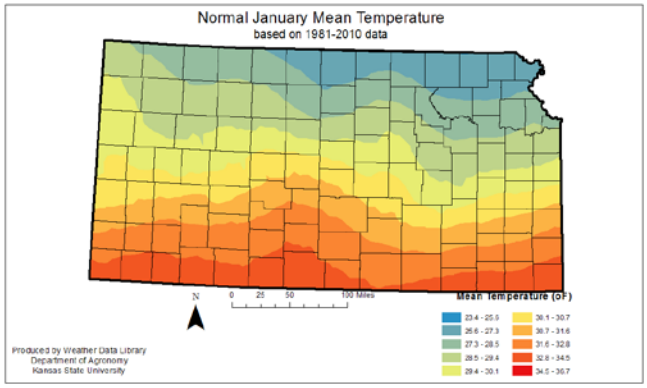


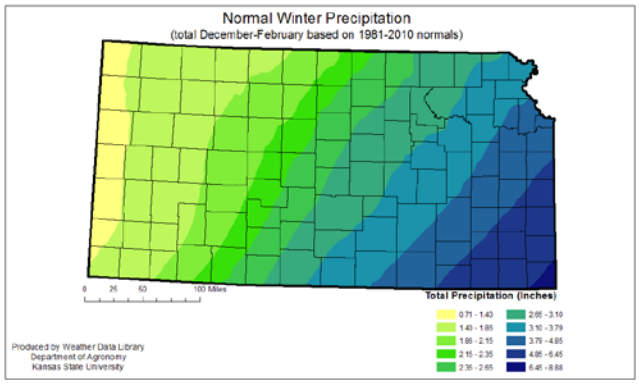


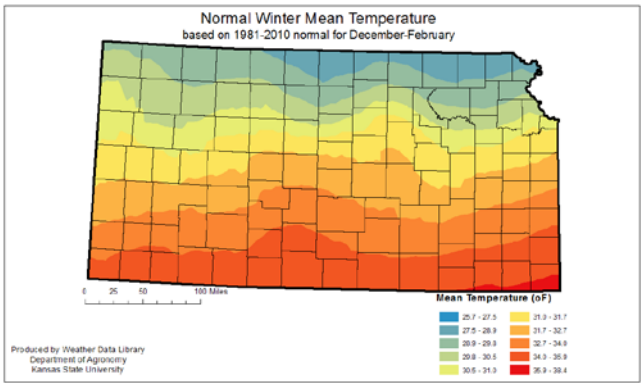












Additional outlooks for additional timeframes are available from the national CPC for up to 13 months. (http://www.cpc.ncep.noaa.gov/products/predictions/90day/)

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.

Known issues:

Stage II water restrictions, under Resolution 03-16 are in place for the **City of Russell,** Russell County water customers as of December 27, 2016 (www.russellcity.org/148/Current-Water-Status). The water restrictions include a prohibition on outdoor watering from 10:00 am to 7:00 pm. It also prohibits the waste of water.

Stage III water restrictions have been in place for the **City of Victoria**, Ellis County since January 2014. No outdoor watering, washing of cars or filling of private swimming pools is allowed. (December 27, 2016, http://victoriaks.com/utilities.htm.)

Surface Water Supply Conditions

Kansas River basin: Tuttle Creek, Perry, Milford, and Clinton reservoirs received sufficient inflow to maintain storage but a significant amount of water was released to lower lake levels to winter target elevations. Flows in the Kansas River were well above historical median values for the majority of December due to these releases.

Marais des Cygnes basin: Melvern, Pomona, and Hillsdale reservoirs maintained storage in excess of conservation for much of December but releases to reach lower winter target elevations began mid-month. Flow in the Marais des Cygnes River was healthy and rose above median values with reservoir storage evacuation.

Cottonwood/Neosho basin: Streamflow and storage was maintained at healthy levels throughout the basin in December, however releases were made from Marion Reservoir to reach the winter target elevation.

Verdigris basin: Toronto, Fall River, Big Hill, and Elk City reservoirs maintained storage around normal pool elevation. Streamflow was relatively low but well above low-flow targets.

Saline basin: Elevation at Wilson Lake slowly declined over the month from the fall target elevation of 1,517 feet but ended the year above normal pool of 1,516 for the first time in seven years.

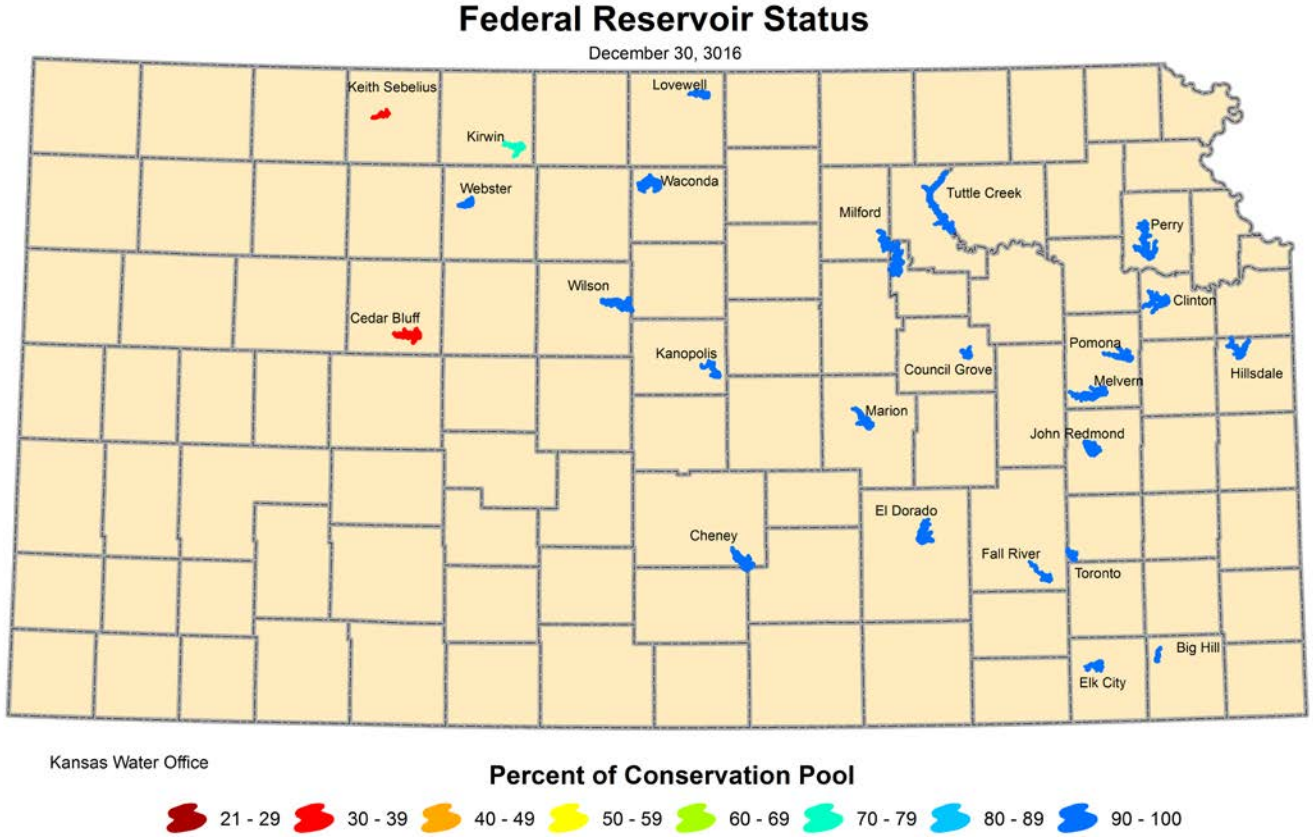
Smoky Hill basin: The middle Smoky Hill basin maintained some streamflow in December. Kanopolis Reservoir inflow was low but continued to discharge through the uncontrolled notch spillway and reservoir level declined throughout the month. Cedar Bluff Reservoir did not experience any significant inflow and steadily declined.

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.

The following lakes will remain on the watch list until the beginning of the 2017 HAB season, Milford Reservoir Zone C, Clay and Geary counties and Lake Shawnee, Shawnee County.

The following lakes will remain on the warning list until the beginning of the 2017 HAB season, South Lake, Johnson County and Vineyard Park Pond, Ellis County.

General Reservoir Conditions
The conservation pools at the water supply reservoirs in eastern Kansas are full. Norton and Cedar Bluff reservoirs remain significantly below full conservation pool.



Kansas Federal Reservoir Conservation Pool Levels

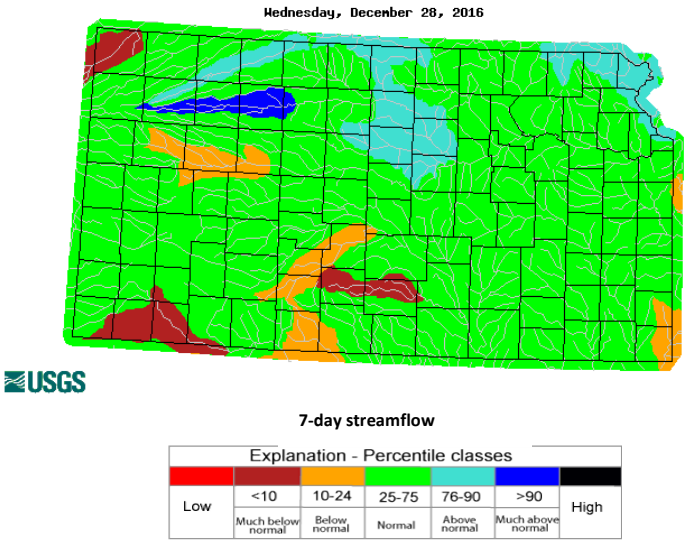
Reservoir	Top of Multipurpose / Conservation Pool (Feet MSL)	Multipurpose/Conservation Pool Elevation (Feet MSL)	Change from Top of Pool (Feet)	Percent of Conservation Pool Full
Kansas River Basin		**12/30/2016 06:00 AM**		
Norton[1]	2304.3	2291.25	-13.05	37.8
Harlan County, NE	1945.73	1935.57	-10.16	61.8
Lovewell[1]	1582.6	1582.49	-0.11	99.1
Milford[1]	1144.4	1144.11	-0.29	98.8
Cedar Bluff	2144	2118.81	-25.19	31.6
Kanopolis[1]	1463	1464.45	1.45	100.0
Wilson[1]	1516	1516.92	0.92	100.0
Webster[1]	1892.5	1890.14	-2.31	89.0
Kirwin[1]	1729.3	1724.76	-4.49	78.4
Waconda[1]	1455.6	1455.40	-0.20	98.9
Tuttle Creek[1]	1075	1072.90	-2.10	91.4
Perry[1]	891.5	889.48	-2.02	90.0
Clinton[1]	875.5	874.74	-0.76	95.5
Melvern[1]	1036	1035.80	-0.20	99.1
Pomona[1]	974	975.16	1.16	100.0
Hillsdale[1]	917	917.16	0.16	100.0
Arkansas River Basin		**12/30/2016 08:00 AM**		
Cheney	1421.6	1421.98	0.38	100.0
El Dorado	1339	1338.90	-0.10	100.0
Toronto[1]	901.5	902.14	0.64	100.0
Fall River[1]	948.5	949.23	0.73	100.0
Elk City[1]	796	796.14	0.14	100.0
Big Hill	858	857.66	-0.34	99.0
Council Grove[1]	1274	1274.13	0.13	100.0
Marion[1]	1350.5	1349.38	-1.12	92.0
John Redmond[1]	1039	1042.36	1.36	100.0

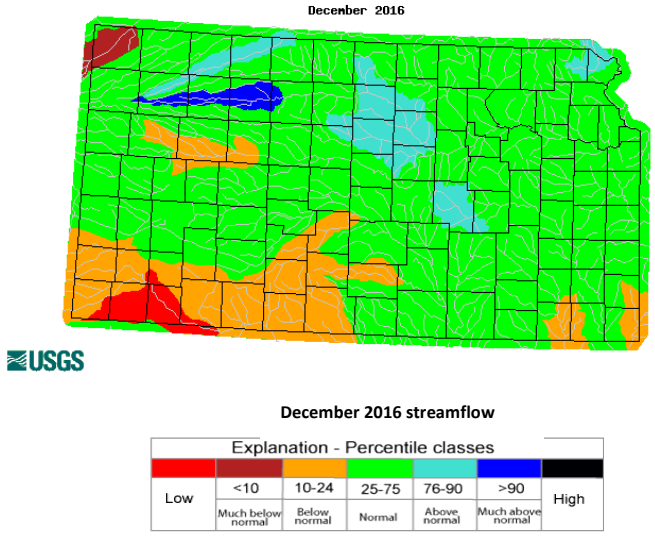
[1]Lake level management plan in place — Source: U.S. Army Corps of Engineers

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.
* data not available 10/30/16 this data for 11/2/16.

Streamflow Conditions

The comparison of present **7-day** streamflow to historical is shown on the map below left and the monthly streamflow compared to historical is shown on the map below, right.





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.

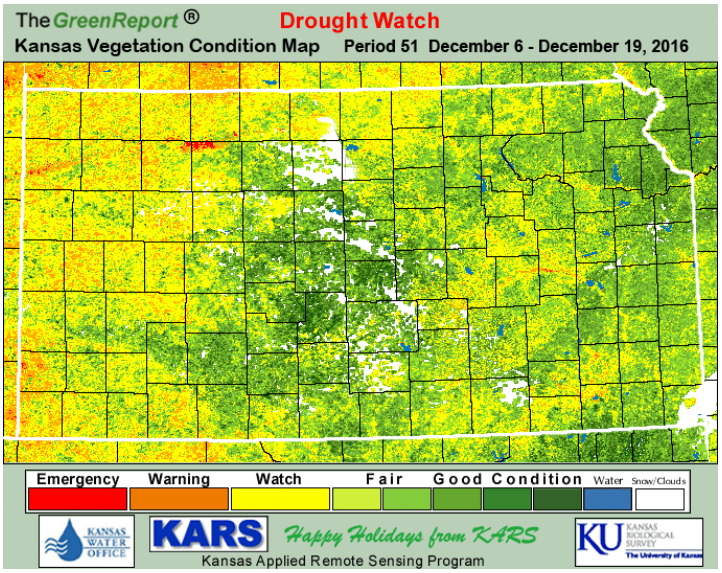
Water Right Administration/Minimum Desirable Streamflow (MDS)
Minimum Desirable Streamflow (MDS) is not being administered in Kansas. MDS administration requires water rights junior to MDS, usually with priority dates after April 12, 1984, to stop diverting water. Administration is ordered when streamflow drops below MDS for more than seven days.

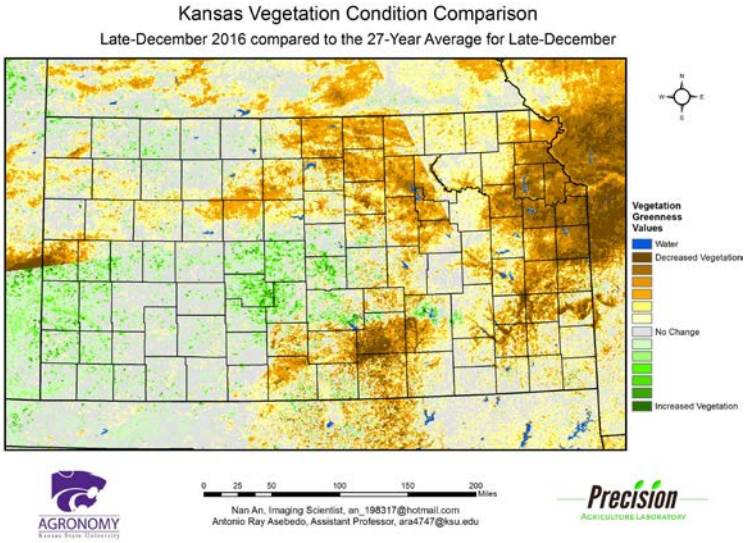
Flooding and High Flows
USGS WaterWatch data Based on USGS monitored stream gages, USGS WaterWatch indicates no flood conditions in Kansas in December.

Please note: flood classification is National Weather Service (NWS) flood classes which are based on property damage and public threat. Minor flooding is defined as minimal or no property damage, but possibly some public threat or inconvenience. Moderate flooding is some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary. Major flooding is extensive inundation of structures and roads, and significant evacuations of people and/or transfer of property to higher elevations. NWS flood stage is found on the NWS River Conditions Map.

Soil, Crop and Vegetation

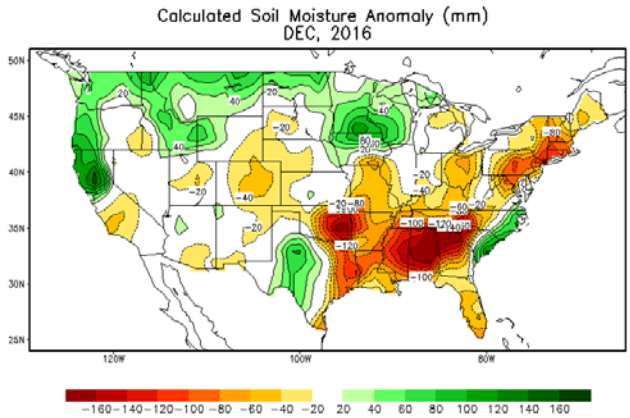
Kansas Vegetative Conditions
The Kansas Vegetative Condition map (on right) is produced by Kansas Applied Remote Sensing Program using satellite data. Areas in yellow, orange and red indicate areas of vegetative stress. Winter wheat can be seen in the central area of the state.





Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for late December from K-State's Precision Agriculture Laboratory is provded on the left.

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. http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

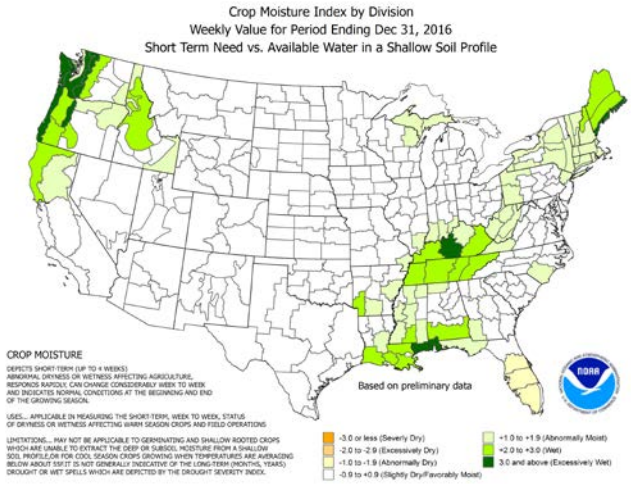


Soil erosion from winds is increased when vegetation is sparse and soils dry as in drought. K-State Research and Extension has publications on mitigating wind erosion which may be found at: http://www.ksre.ksu.edu/p.aspx?tabid=255.

USDA Crop Progress and Condition provide some indication of the climatic effects on soil, and livestock feed and water supplies. The Kansas report for the state as a whole for December published January 3, 2017 reported topsoil moisture rated 23 percent very short, 34 short, 42 adequate, and 1 surplus. Subsoil moisture rated 16 percent very short, 28 short, 55 adequate, and 1 surplus.

Field Crops Report: Winter wheat condition rated 5 percent very poor, 14 poor, 37 fair, 42 good, and 2 excellent.

Livestock, Pasture, and Range Report: Hay and roughage supplies rated 0 percent very short, 3 short, 83 adequate, 14 surplus. Stock water supplies were 2 percent very short, 8 short, 89 adequate, and 1 surplus. (http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Crop_Progress_and_Condition/current.pdf)



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/JAWF Weekly Weather and Crop Bulletin.

Kansas Climate Summary

The Kansas Weekly Climate Summary and Drought Report is 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, KWO Drought, 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

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 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.

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.org.

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 Seasonal Drought Outlook, developed by the NOAA Climate Prediction Center, assesses the likelihood for improvement, persistence or deterioration in drought conditions for areas currently experiencing drought as identified by the U.S. Drought Monitor. Also see: http://www.ncdc.noaa.gov/oa/climate/research/dm/weekly-dm-animations.html

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.

USDA has programs for agricultural producers and businesses for drought affected areas. In some cases a eligibility is dependent on a federal disaster declaration but other programs are triggered by specific conditions.

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

December 2016 Summary	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
Station[1]	Total	Departure	Percent Normal	Mean	Departure	Highest	Lowest
West							
Burlington, CO	0.23	-0.20	53%	26.8	-2.1	66 (30)	-15 (17)
Dodge City	0.62	-0.22	74%	30.1	-2.7	61 (25)	-16 (18)
Garden City	0.30	-0.21	59%	27.7	-4.0	60 (30)	-19 (18)
Goodland	0.60	0.14	130%	25.9	-4.0	67 (30)	-15 (17)
Guymon, OK	0.44	-0.20	69%	34.0	-1.1	76 (16)	-11 (18)
Hill City	0.42	-0.27	61%	27.9	-2.4	61 (3)	-16 (18)
Lamar, CO	0.23	-0.17	58%	26.2	-3.4	69 (5)	-23 (18)
McCook, NE	0.43	-0.21	67%	26.8	-1.2	62 (30)	-16 (18)
Springfield, CO	0.07	-0.44	14%	29.5	-2.8	73 (16)	-14 (18)
Central							
Concordia	0.93	0.08	109%	29.1	-0.9	64 (25)	-12 (18)
Hebron, NE				26.8	-1.1	61 (25)	-14 (18)
Medicine Lodge	0.70	-0.22	76%	31.8	-2.9	63 (25)	-11 (18)
Ponca City, OK	0.28	-1.14	20%	35.1	-1.5	71 (25)	-3 (18)
Salina	0.85	-0.09	90%	31.6	-0.7	68 (25)	-10 (18)
Wichita (ICT)	0.66	-0.54	55%	32.9	-0.9	67 (25)	-10 (18)
East							
Bartlesville, OK	0.42	-1.79	19%	35.4	-1.1	69 (25)	-2 (19)
Chanute	0.78	-0.97	45%	34.4	-0.4	70 (25)	-6 (18)
Fall City, NE	0.88	-0.10	90%	28.4	-0.6	63 (25)	-12 (18)
Johnson Co. Exec. Apt	0.90	-0.74	55%	30.4	-2.0	65 (25)	-8 (18)
Joplin, MO	0.59	-2.23	21%	36.5	-0.7	72 (25)	-4 (18)
Kansas City (MCI), MO	1.19	-0.34	78%	30.1	-1.4	65 (25)	-9 (18)
St. Joseph, MO	1.10	-0.42	72%	27.8	-1.6	64 (25)	-11 (18)
Topeka (TOP	1.05	-0.30	78%	30.6	-1.4	68 (25)	-9 (18)

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