KANSAS CLIMATE UPDATE
February 2020 Summary

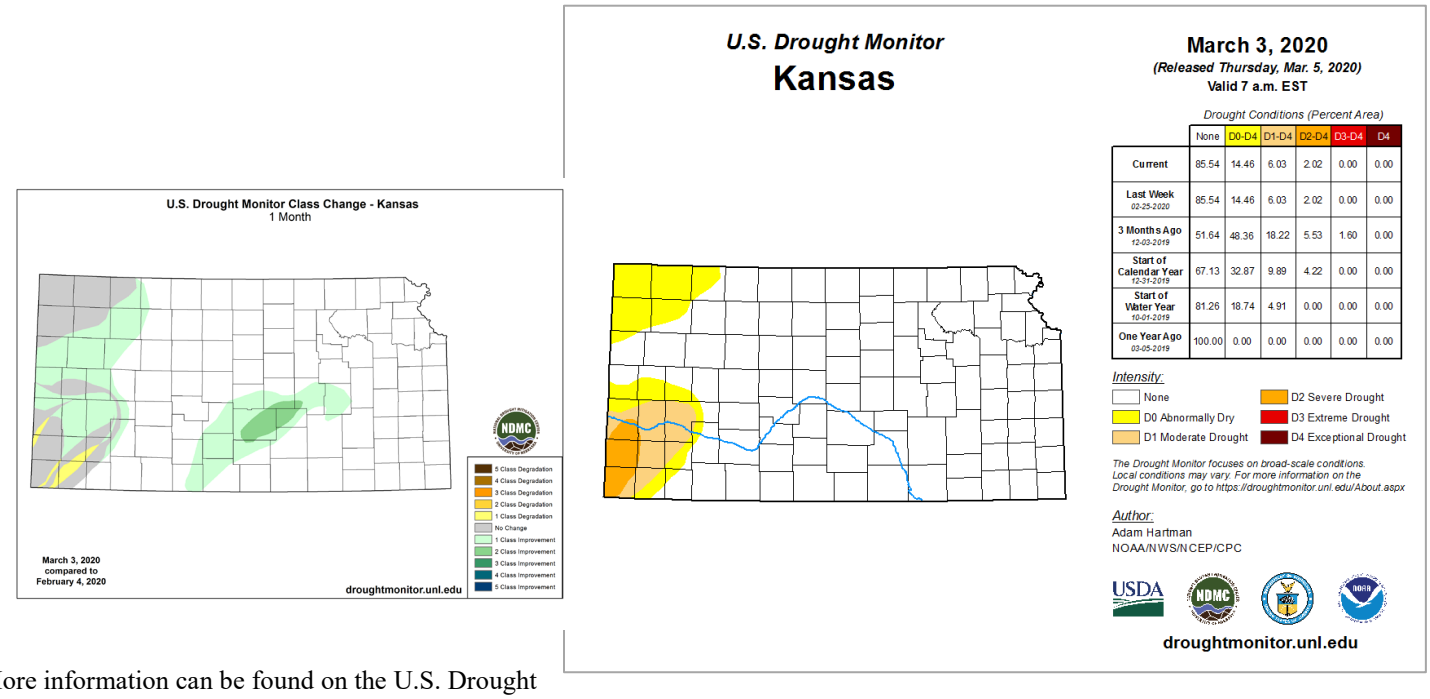
Highlights

- U.S. Drought Monitor indicated continuing areas of abnormally dry (D0), moderate drought (D1), severe drought (D2) and moderate drought (D3) in western and south central Kansas conditions though February although, some drought was removed from central/south central Kansas by the end of February.
- Statewide February precipitation was 1.19 inches, 114 percent of normal, 33rd wettest February.
- Statewide February temperatures averaged 0.9°F cooler than normal, 66th warmest February.
- March outlook: increased chance of above normal temperatures; below normal precipitation in the west.
- Drought Outlook favors drought continuing for the current area of drought in extreme western Kansas.

General Drought Conditions

The U.S. Drought Monitor indicated dry and drought conditions in parts of western and central Kansas at the beginning of the month. All drought was erased from the central and south central parts of the state. However, severe drought remains in the Southwest, and abnormally dry conditions remain in the Northwest. The condition at the end of the month is shown below in Figure 1. Change in drought classification over the month is also shown.

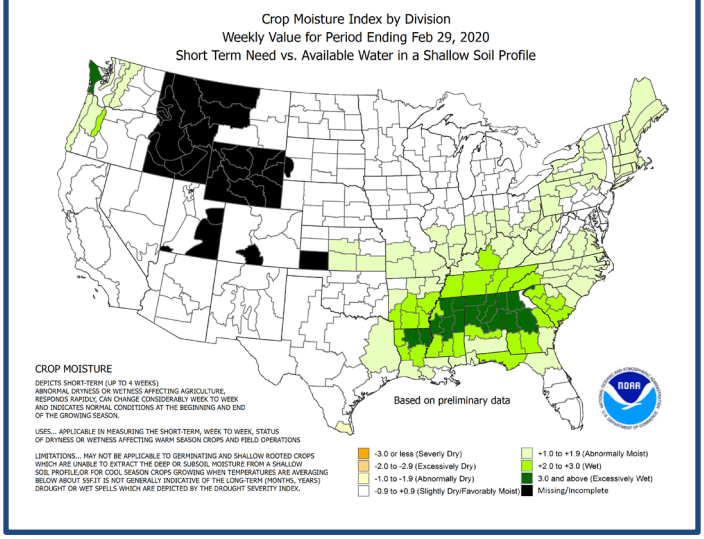
Figure 1. U.S. Drought Monitor Maps of Drought status



More information can be found on the U.S. Drought Monitor web site https://droughtmonitor.unl.edu/ .

Palmer Drought Severity Index (PDSI) - The Palmer Drought Severity Index is an indicator of relative dryness or wetness and is one factor used the U.S. Drought Monitor. The Crop Moisture (Figure 2) component evaluates short term needs and available water. More information on the PDSI and its parts can be found at http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml.

Figure 2.



Climate Summary - Precipitation

A series of storms crossed the state in February, with a southerly track to the systems. Statewide average precipitation for the month was 1.19 inches, 114 percent of normal. This ranks as the 33rd wettest February in the 126-year record. Not all divisions were wet, however. The North Central Division was the driest, with an average of 0.25 inches, 29 percent of normal. The Southeast had the highest average precipitation at 2.32 inches, 129 percent of normal. The highest 24-hour rainfall total for a National Weather Service Cooperative station was 3.50 inches at Garnett 1E, Anderson County, on the 13th. The greatest 24-hour rainfall total for a Community Collaborative Rain, Hail and Snow network station was 3.55 inches at Lyons 4.2 WNW, Rice County, on the 24th. The greatest monthly precipitation totals for January: 6.61 inches at Garnett 1E, Anderson County (NWS); 4.96 inches at Sterling 0.5 NNW (CoCoRaHS). The Garnett daily rainfall for the 13th also set a new February daily record for the location. Snowfall was mixed, with the highest amounts reported in North Central, KS. Thirteen new daily record snowfall amounts were reported during the month. Table 1 summarizes the monthly precipitation (KSU Weather Data Library).

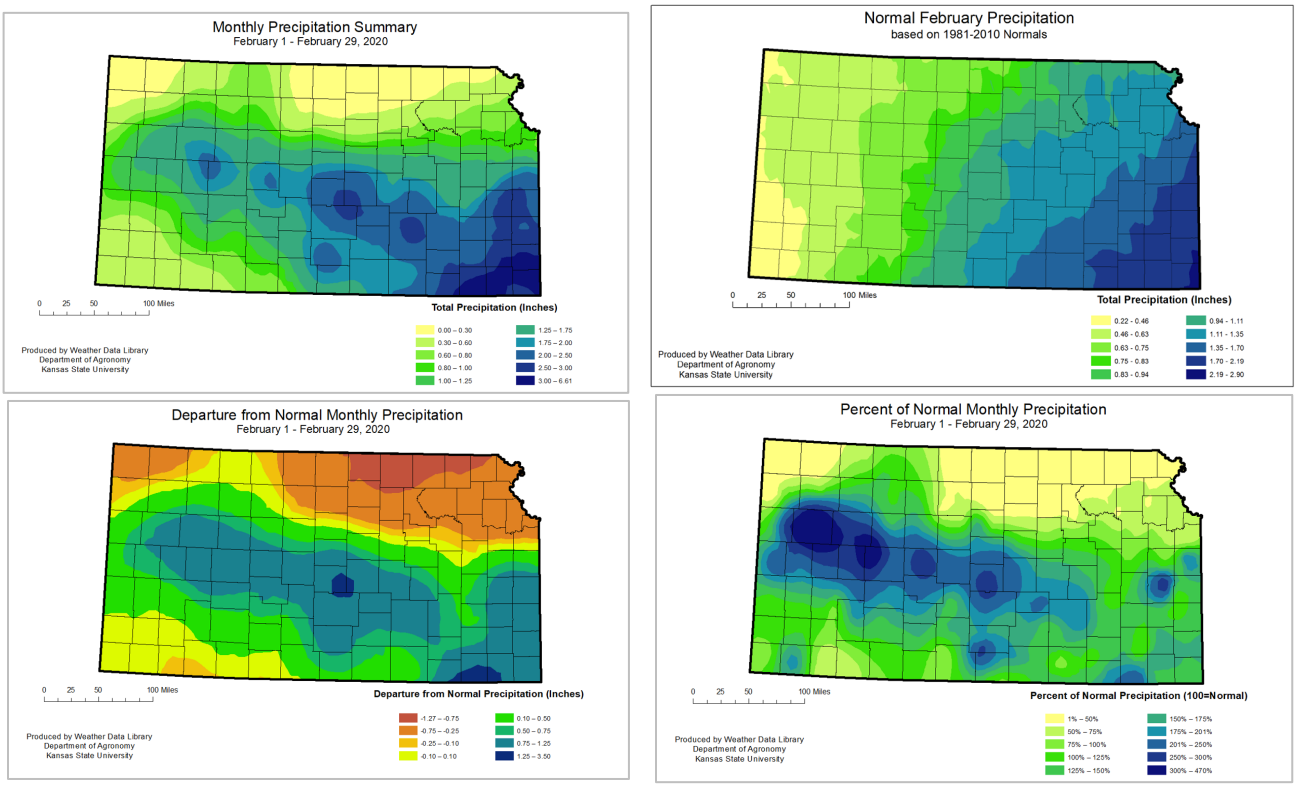
Table 1.

Kansas Climate Division Precipitation Summary (inches)

Climate Division	February 1 - 29, 2020			Jan. 1 – Feb. 29, 2020			April 1, 2019 – Feb. 29, 2020			Sept 1, 2019 – Feb. 29, 2020		
	Actual	Depart Normal*	% of Normal	Actual	Depart Normal*	% of Normal	Actual	Depart Normal*	% of Normal	Actual	Depart Normal*	% of Normal
Northwest	0.34	-0.22	61	0.74	-0.26	74	24.38	4.19	121	3.93	-1.58	71
West Central	1.34	0.72	216	1.83	0.72	165	21.2	1.82	109	4.94	-0.64	89
Southwest	0.73	0.16	128	1.74	0.71	169	18.44	-0.11	99	4.24	-1.25	77
North Central	0.25	-0.62	29	1.20	-0.28	81	33.19	7.15	127	7.66	-0.55	93
Central	1.57	0.52	150	2.84	1.11	164	34.94	7.87	129	8.06	-0.48	94
South Central	1.78	0.56	146	3.46	1.43	170	39.85	11.13	139	10.98	1.10	111
Northeast	0.48	-0.69	41	1.55	-0.40	79	43.12	10.38	132	9.92	-1.37	88
East Central	1.43	0.03	102	3.45	1.14	149	49.18	13.87	139	11.93	-0.69	95
Southeast	2.32	0.52	129	4.67	1.66	155	57.99	19.48	151	15.95	0.86	106
STATE	1.19	0.15	114	2.49	0.74	142	35.74	8.44	131	8.72	-0.42	95

The maps of Figure 3 below summarize precipitation for the month. (State maps by KSU are based on data from the Cooperative Observer and Kansas Mesonet, and provided by KSU Weather Data Library. State weekly maps of precipitation information can be accessed at http://climate.k-state.edu/maps/weekly/.)

Figure 3. Monthly Precipitation maps



Climate Summary-Temperature

Temperatures for February were slightly cooler than normal. Statewide average temperature for the month was 33.5 oF, which is 0.6 degrees cooler than normal. This ranks as the 66th warmest February on record, right in the middle of the distribution. The North Central Division had the warmest departure with an average of 32.9 oF, 0.6 degrees warmer than normal. The West Central Division had the coldest departure, with an average of 31.2 oF, 2.0 degrees cooler than normal. The coldest readings were in the eastern divisions, with subzero readings in all three divisions. The remaining divisions all had lowest minimums below zero or in the single digits. The warmest maximum temperature was 84 oF Atwood, Rawlins County, on the 3rd. The coldest minimum temperature was -5 oF at Horton, Brown County, on the 15th and at Osage City, Osage County on the 14th. There were 48 daily record high maximum temperatures, all on the 2nd or 3rd of the month. There were 27 new record low maximums. On the low temperature side of the scale, there were 8 record high minimum temperatures and 21 record low minimums. Table 2 summarizes the monthly temperatures (KSU Weather Data Library).

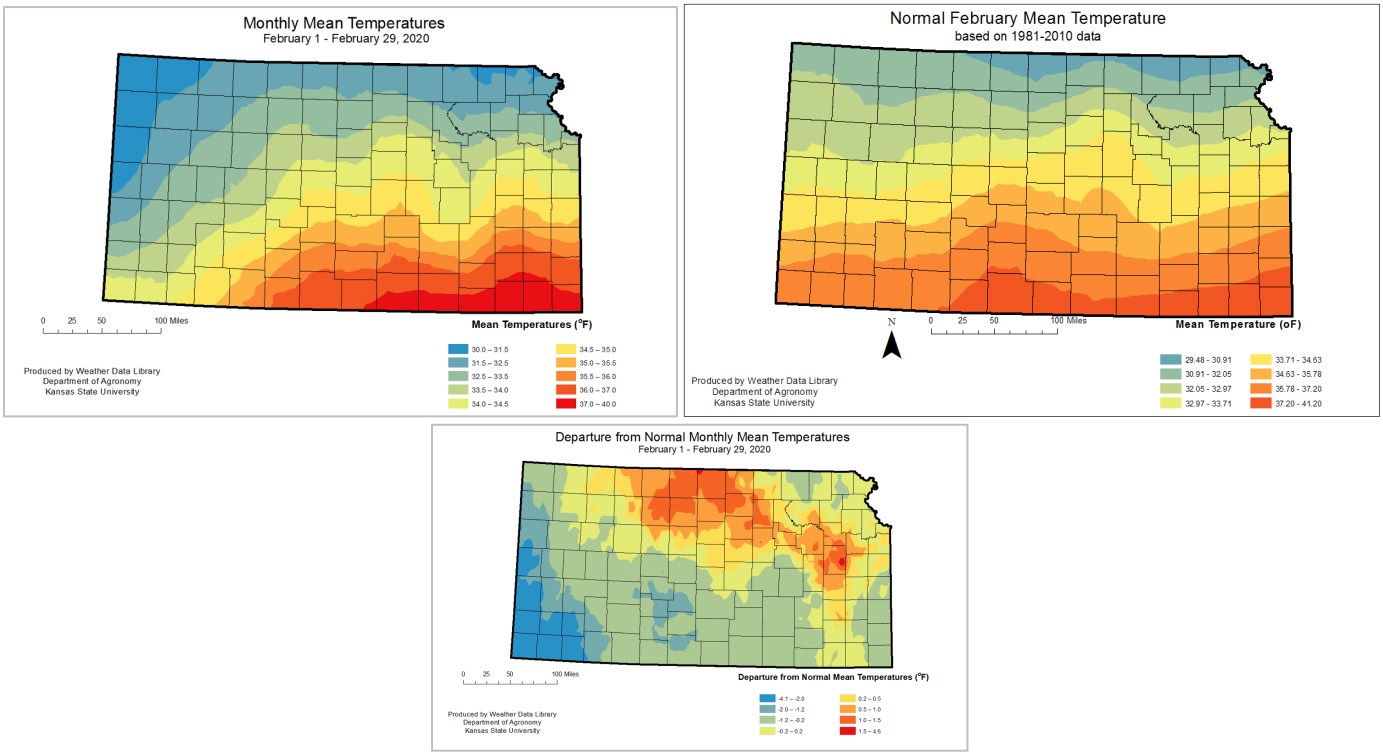
Table 2.
Kansas Climate Division Temperature Summary (ºF)
February 2020

Climate Division	Maximum	Minimum	Average	Departure*	High	Date	Low	Date
Northwest	44.8	17.1	31.0	-0.8	84	3	-3	20
West Central	44.4	18.0	31.2	-2.0	82	3	-1	5
Southwest	47.3	21.9	34.6	-1.2	78	3	5	13
North Central	45.4	20.4	32.9	0.6	77	3	0	14
Central	46.5	22.2	34.4	0.1	81	3	0	14
South Central	47.6	24.3	35.9	-0.7	80	2	7	14
Northeast	43.4	19.9	31.7	-0.8	69	3	-5	14
East Central	45.2	22.4	33.8	-0.1	73	3	-5	14
Southeast	46.8	25.3	36.0	-0.7	79	3	-1	14
STATE	45.7	21.3	33.5	-0.6	84	3rd	-5	14th

*Departure from normal is departure from the base period of 1981-2010, KSU Weather Data Library.

The maps in Figure 4 below summarize temperature for the month. (State maps based on data from the Cooperative Observer and Kansas Mesonet, and provided by KSU Weather Data Library. State weekly maps of precipitation information can be accessed at http://climate.k-state.edu/maps/weekly/.) Some maps obtained from the High Plains Regional Climate Center, ACIS system.

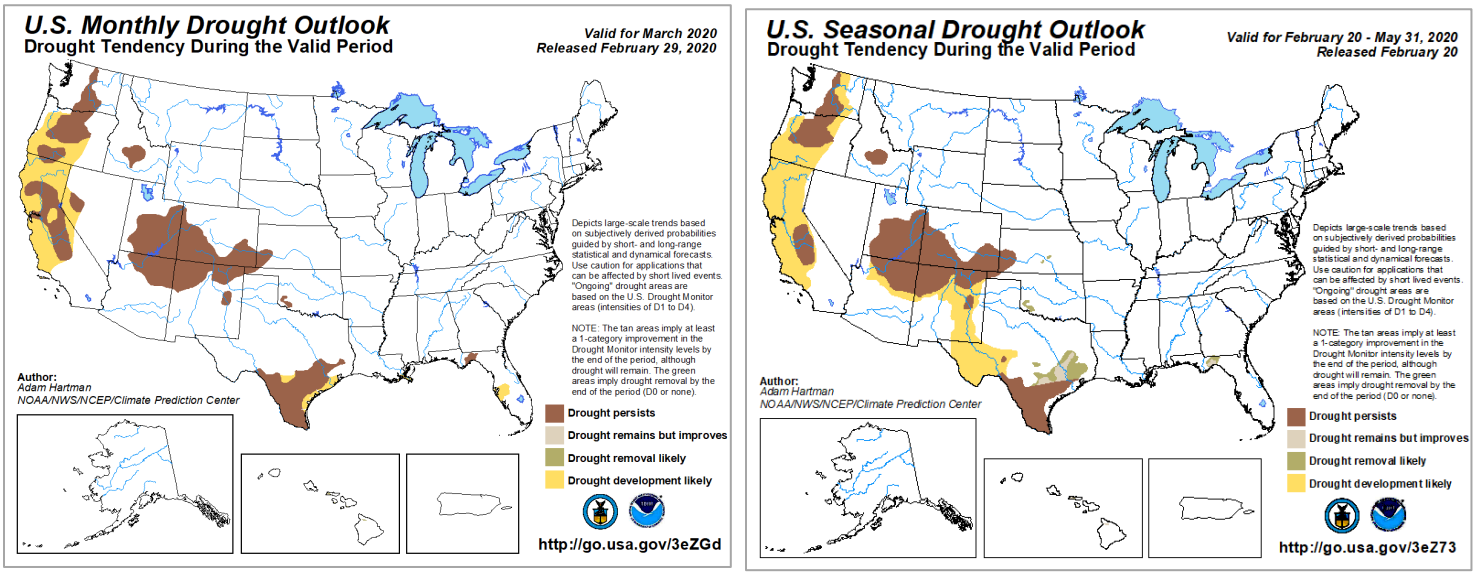
Figure 4. Monthly Temperature Maps



Outlooks

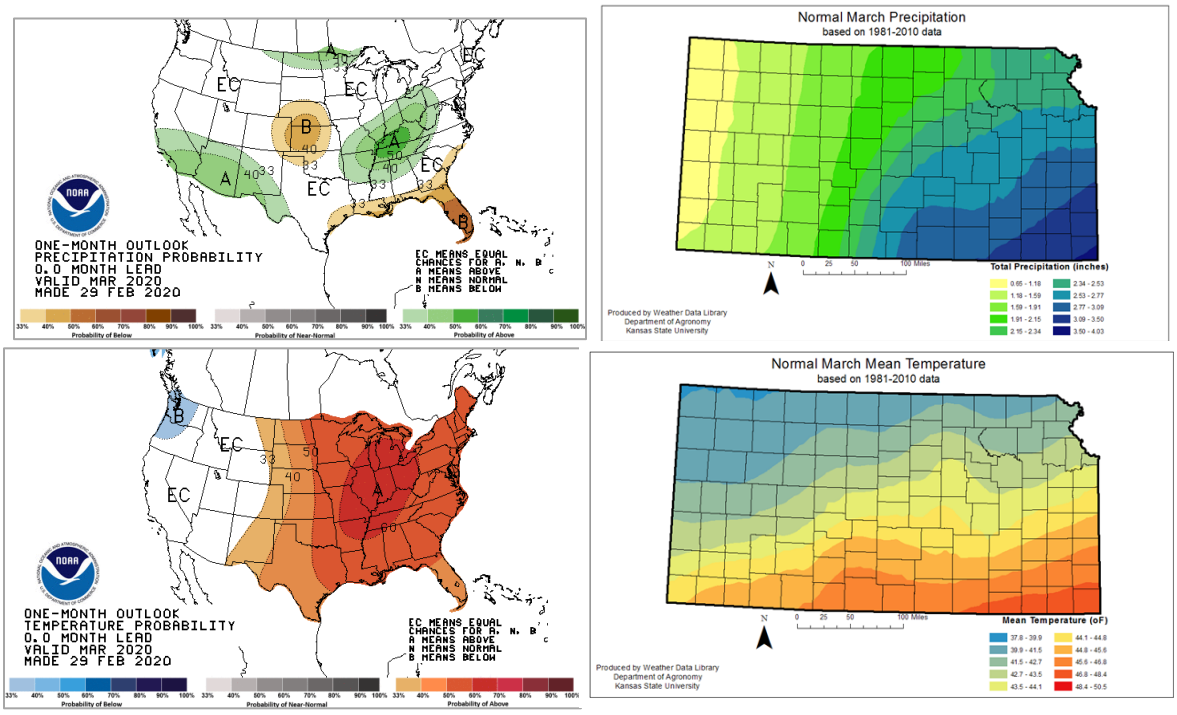
The Monthly Drought Outlook issued February 29, 2020 indicates drought conditions in southwest Kansas to persist. The Seasonal Outlook (3-month) favors the area of drought in southwest Kansas through May with the removal of the remaining small central area of drought. The individual temperature and precipitation outlooks that contribute to these outlooks are available below.

Figure 5. Drought Outlooks



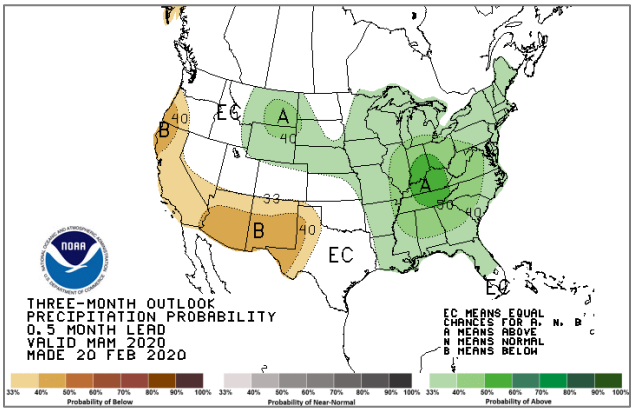
The March precipitation outlook is shows an increased chance of below normal precipitation across all but the eastern areas of the state, where equal chances prevail. The temperature outlook favors above normal temperatures across the state. One month outlooks are provided in Figure 6.

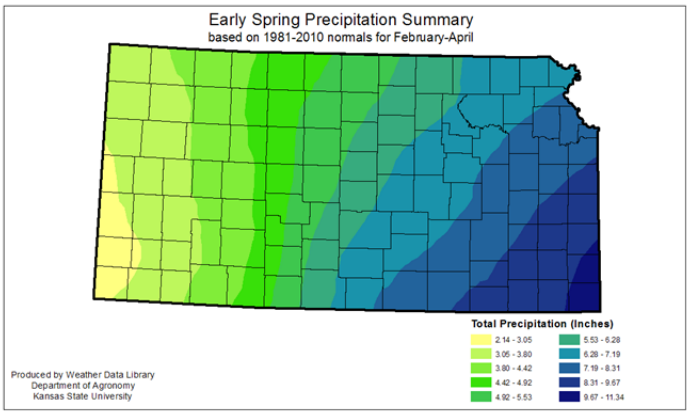
Figure 6. Next Month Precipitation and Temperature Outlooks

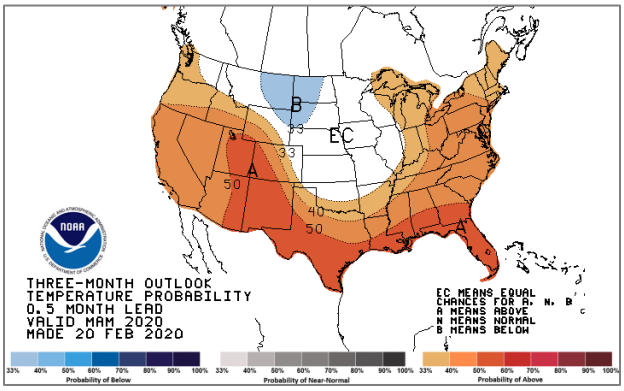


The U.S. three month outlook for February through April suggests equal chances of above, normal or below -average precipitation and temperatures for the state.

Figure 7. Three Month Precipitation and Temperature Outlooks







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

Reservoir Storage

Table 3 provides conservation pool status for each federal reservoir.

Table 3. Kansas Federal Reservoir Conservation Pool Levels-March 4, 2020

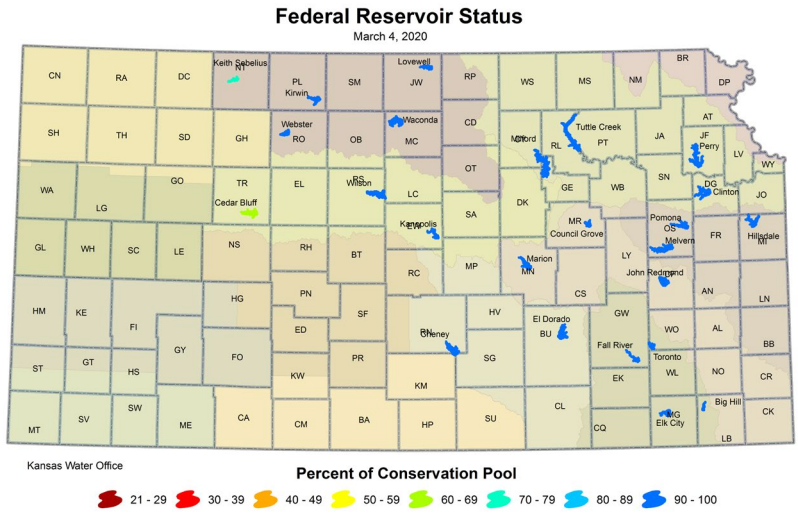
	Current Conditions		Multipurpose /Conservation Pool			
Reservoir	Pool Elevation (Feet MSL)	Storage (Acre-Feet)	Top of Pool (Feet MSL)	Conservation Storage (Acre-Feet)	Change from Top of Pool (Feet)	Percent of Pool Full
Kansas River Basin						
Keith Sebelius Lake	2300.53	26,910	2304.3	34,510	-3.77	78.0%
Harlan County Lake NE	1945.93	316,760	1945.73	314,112	0.20	100.0%
Lovewell Reservoir	1581.34	32,039	1582.6	35,666	-1.26	89.8%
Webster Reservoir	1892.50	76,360	1892.45	76,171	0.05	100.0%
Kirwin Reservoir	1729.11	97,453	1729.25	98,169	-0.14	99.3%
Waconda Lake	1454.60	207,090	1455.6	219,469	-1.00	94.4%
Cedar Bluff Reservoir	2134.31	114,024	2144	172,452	-9.69	66.1%
Kanopolis Lake	1462.42	46,667	1463	48,378	-0.58	96.5%
Wilson Lake	1515.23	235,641	1516	242,528	-0.77	97.2%
Milford Lake	1141.49	330,190	1144.4	373,152	-2.91	88.5%
Tuttle Creek Lake	1077.98	291,430	1075	257,014	2.98	100.0%
Perry Lake	889.93	184,267	891.5	200,004	-1.57	92.1%
Clinton Lake	875.72	120,302	875.5	118,699	0.22	100.0%
Melvern Lake	1034.35	136,967	1036	147,972	-1.65	92.6%
Pomona Lake	972.94	51,382	974	55,514	-1.06	92.6%
Hillsdale Lake	915.46	70,290	917	77,415	-1.54	90.8%
Arkansas River Basin						
Marion Reservoir	1350.64	81,557	1350.5	80,659	0.14	100.0%
Council Grove Lake	1272.73	40,433	1274	43,984	-1.27	91.9%
John Redmond Reservoir	1042.46	74,955	1041	62,611	1.46	100.0%
Toronto Lake	902.18	18,063	901.5	16,528	0.68	100.0%
Fall River Lake	951.89	28,412	948.5	20,690	3.39	100.0%
Elk City Lake	797.72	43,842	796	37,422	1.72	100.0%
Big Hill Lake	858.12	23,496	858	23,361	0.12	100.0%
Cheney Reservoir	1421.75	168,499	1421.6	167,074	0.15	100.0%
El Dorado Lake	1339.12	159,601	1339	158,630	0.12	100.0%

[1]Source: U.S. Army Corps of Engineers, U.S. Bureau of Reclamation and U.S. Geological Survey

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.

In Figure 8 illustrates status of Conservation Pool storage at the federal reservoirs.

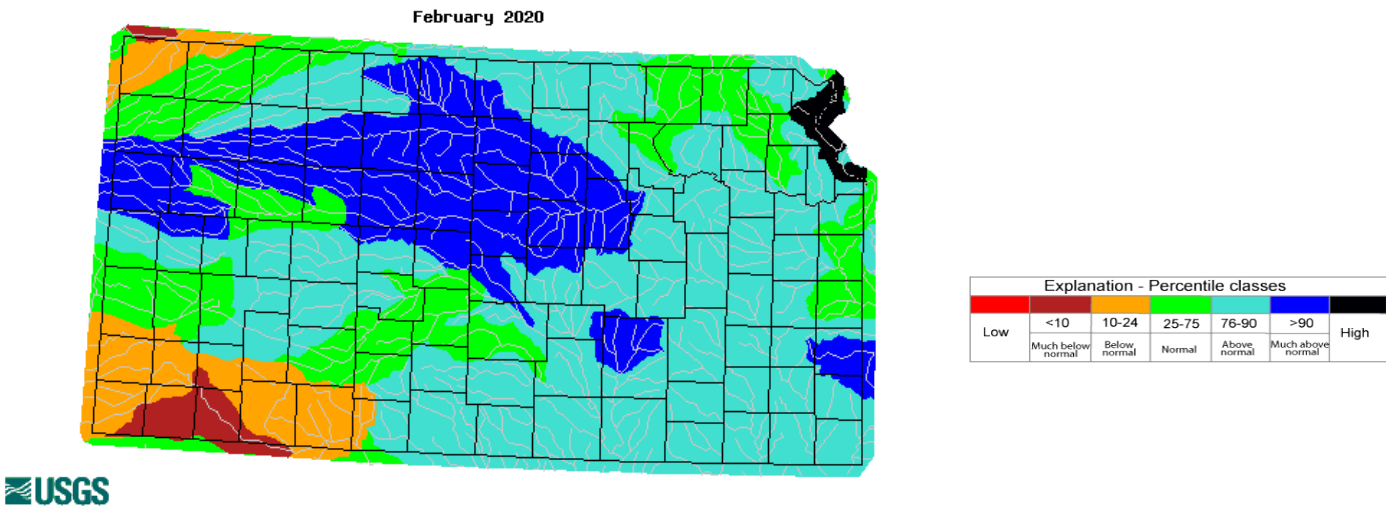
Figure 8. Reservoir Storage



Streamflow Conditions

WaterWatch summarizes streamflow conditions in a region (state or hydrologic unit) in terms of the long-term typical condition at stream gages in the region. In general, a streamflow which is greater than the 75 percentile is considered *above normal*, a streamflow which is between 25 and 75 percentiles is considered *normal* and a streamflow which is less than the 25 percentile is considered *below normal*. Color codes are for basins with streamflow averages less than 25 percent of historic values. This comparison aids in evaluating water resources conditions for a time period. A summary of flooding in is found later in this report. Figure 9 summarizes streamflow.

Figure 9. Monthly streamflow compared to historical streamflow



Minimum Desirable Streamflow: Low flows may be reflected at gage locations when the flow does not reach Minimum Desirable Streamflow (MDS). MDS requirements are in place to ensure base flows in certain streams to protect existing water rights and to meet in-stream water uses related to water quality, fish and wildlife and recreation. The Kansas Department of Agriculture, Division of Water Resources monitors 23 streams and rivers at 33 locations for minimum desirable streamflow. When flows drop below an established threshold, pumping restrictions are imposed on permits or water rights granted after the minimum desirable streamflow provision was made into law in 1984.

Although no water right administration was in effect in this month, the table below notes locations of concern including those below MDS.

Table 4.
Streamflows of Note

Gaging Station	Feb 3 Flow	Feb 10 Flow	Feb 18 Flow	Feb 24 Flow	Feb MDS	Comment
Rattlesnake Creek near Macksville	7	6.5	6	9	5	No surface water diversions junior to MDS above gage
Rattlesnake Creek near Zenith	30	27	Eqp	42	15	
South Fork Ninnescah River near Pratt	13	13	13	21	10	No surface water diversions junior to MDS above gage

Vegetation, Soil Moisture and Crops

Vegetative Conditions

The Vegetative Condition map depicts vegetation stress. It is produced using satellite data by the National Drought Mitigation Center https://vegdri.unl.edu/Home.aspx and often customized for Kansas by the Kansas Biological Survey in the GreenReport. December is out of season for the vegetative conditions, so is not part of this report.

Soil Moisture and Rangeland

The Climate Prediction Center (CPC), monitors soil moisture and predicts future soil moisture. Anomalies are defined as deviations from the 1971-2000 monthly climatology. The monthly soil anomaly is shown in Figure 10. (.http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml).

Within Kansas soil moisture is now being measured through the Kansas Mesonet and Kansas State University the percent of soil saturation (representative of grassland vegetation) is shown in Figure 10. (http://mesonet.k-state.edu/agriculture/soilmoist/)

Figure 10.

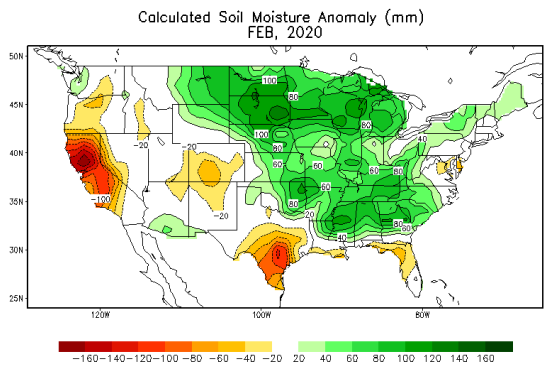
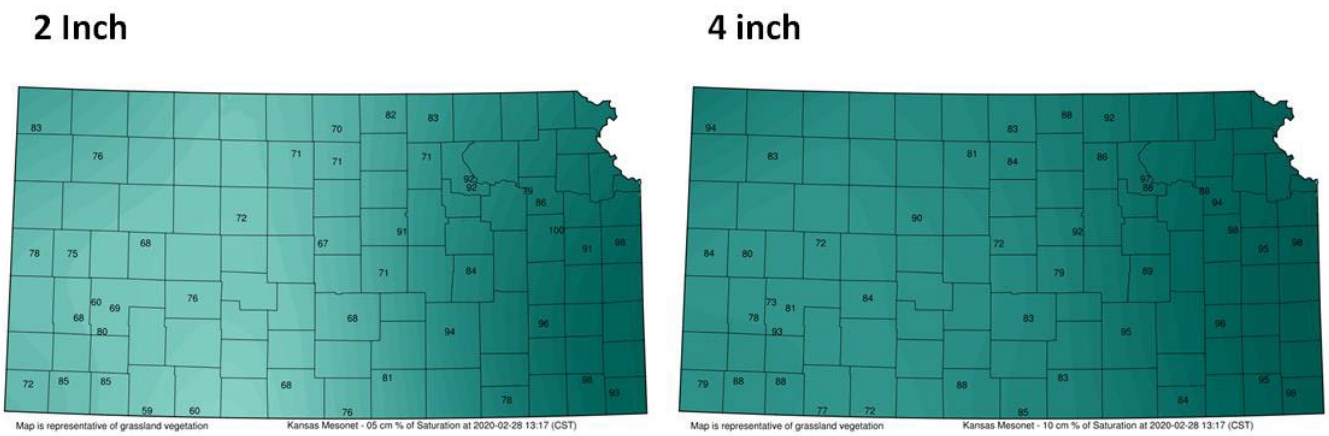


Figure 11. Percent of Soil Saturation as of February 28, 2020



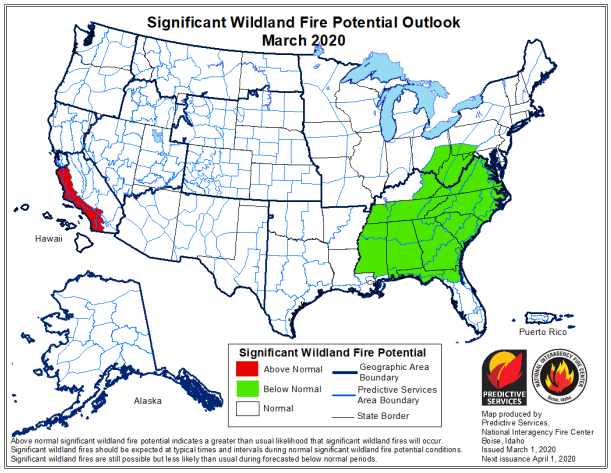
The National Agricultural Statistics Service, USDA Crop Progress and Condition provides a summary of the climatic effects on soil and crops. For the week ending March 2, 2020, topsoil moisture supplies rated 5 percent very short, 15 short, 64 adequate, and 16 surplus, according to the USDA's National Agricultural Statistics Service. Subsoil moisture supplies rated 7 percent very short, 13 short, 69 adequate, and 11 surplus.

Field Crops Report:
Winter wheat condition rated 3 percent very poor, 17 poor, 37 fair, 37 good, and 6 excellent.

Fire

The National Weather Service issues Red Flag Warnings when conditions favoring wildfire are at an increased risk. These are issued daily when needed. A Significant Wildland Fire Potential Outlook is issued monthly for the United States. Figure 12 is the most recent outlook for possible wildfires tor the next month. Additional forecasts can be found at https://www.predictiveservices.nifc.gov/outlooks/monthly_seasonal_outlook.pdf .

Figure 12. Wildfire Outlook



Disaster Designations 2020

A total of 70 Kansas counties were identified in Federal Emergency Declarations in 2019, due to storms, winds, tornadoes, flooding, landslides and mudslides. The President's action makes federal funding available to state, eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and repair or replacement of facilities in those counties. At the beginning of 2020 many Kansas communities have applied for assistance are waiting for their funds. Additional designations for 2019 storms have been made in 2020.

Federal funding is also available on a cost-sharing basis for hazard mitigation measures statewide. Some additional counties may be eligible for federal declaration and aid in the future once damage assessment is completed by FEMA.

Kansas Climate Summary

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

RESOURCES and REFERENCES

Kansas climate data is provided by Kansas State University, Weather Data Library through the Kansas Mesonet. (http://www.ksre.k-state.edu/wdl/). Soil moisture data was added in 2018 (http://mesonet.k-state.edu/agriculture/soilmoist)

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

The High Plains Regional Climate Center (https://hprcc.unl.edu/) has precipitation and temperature summary maps available for the state, region and nation.

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

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

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

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

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

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

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

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

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

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

APPENDIX A
Monthly Weather Summary

February 2020
Summary

Station[1]	Precipitation (inches)			Temperature °F			
						Extreme (Date)	
	Total	Departure[2]	Percent Normal	Mean	Departure[2]	Highest	Lowest
West							
Burlington, CO	0.06	-0.36	14%	31.6	0.0	77 (2)	-3 (5)
Dodge City	0.95	0.27	140%	36.2	0.3	74 (2)	8 (13)
Garden City	0.38	-0.16	70%	34.2	-0.6	77 (2)	7 (13)
Goodland	0.40	-0.09	82%	32.7	0.4	79 (2)	1 (20)
Guymon, OK	0.30	-0.17	64%	37.8	-0.8	80 (2)	14 (21)
Hill City	0.68	0.16	131%	34.7	1.8	83 (2)	4 (20)
Lamar, CO	0.20	-0.17	54%	32.7	-0.9	83 (2)	-1 (5)
McCook, NE	0.07	-0.55	11%	32.7	1.8	77 (2)	-3 (20)
Springfield, CO	2.93	2.23	419%	16.2	-1.9	46 (2)	-18 (5)
Central							
Concordia	0.18	-0.61	23%	36.1	3.4	71 (2)	4 (13)
Hebron, NE				33.3	3.7	69 (29)	1 (13)
Medicine Lodge	1.57	0.53	151%	37.7	-0.5	78 (2)	10 (21)
Ponca City, OK	1.12	-0.22	84%	40.5	0.8	77 (2)	13 (21,14)
Salina	1.39	0.22	119%	35.7	0.2	73 (2)	2 (14)
Wichita (ICT)	1.94	0.76	164%	37.4	0.2	76 (2)	9 (13)
East							
Bartlesville, OK	2.83	0.86	144%	39.9	0.1	77 (2)	12 (21,14)
Chanute	2.35	0.45	124%	39.0	1.5	74 (2)	9 (13)
Falls City, NE	0.08	-0.86	9%	31.8	0.9	64 (29)	0 (13)
Johnson Co. Exec. Apt	0.81	-0.76	52%	34.8	0.0	66 (2)	0 (14)
Joplin, MO	0.65	0.36	224%	51.5	7.2	66 (1)	33 (3)
Kansas City (MCI), MO	0.68	-0.78	47%	35.4	1.9	65 (2)	0 (14)
St. Joseph, MO	0.52	-0.41	56%	32.9	0.9	63 (29)	-5 (13)
Topeka (TOP)	0.82	-0.50	62%	35.1	0.7	72 (2)	1 (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