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Increasing Community Resilience to Wildfire in the Southern Plains

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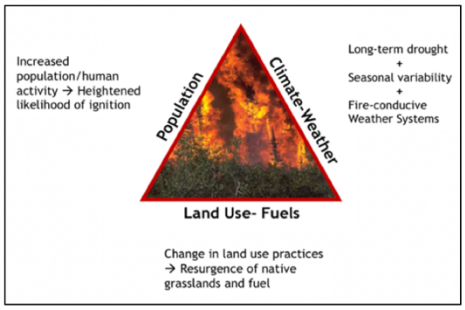
The Southern Great Plains is home to a wide variety of extremes including hot and dry conditions, and when paired with high winds, wildfires commonly form. This region has a long history with wildfires dating back to the Native American's use of fire for land management practices before early settlement (Fowler and Konopik 2007) and the documentation of the first observations and narrow escapes of fire from early explorers (Jackson 1965). The relationship and experiences with fire have become unique characteristics of the Southern Great Plains and is complex as it is both a devastating source of destruction as well as an effective adaptive land management strategy. Additionally, communities in the region are actively working to understand the vulnerability, characteristics and use of wildfire to aid in reducing wildfire risk both now and in the future.

A region's vulnerability to wildfire formation can be summarized by three primary factors highlighted in the figure below: human interaction with the environment (ignition), land-use changes (fuel), and climate and weather conditions. Although these three factors are intertwined and are often times complex, generally the increase of ignition sources and fuel supply, along with the appropriate meteorological environment, lead to the most conducive wildfire conditions.



The three primary factors influencing wildfire formation. Image provided by Lindley (2018).

Oklahoma has high vulnerability in all three of these factors which throughout history has made the region susceptible to fire and undoubtedly shaped the Great Plains. The largest source of wildfire ignition in the region is from the increased human interaction with the environment. Oklahoma has experienced an increased vulnerability from human activity in recent decades due to infrastructure development, notably train tracks, vehicles, and the most common ignitor, power lines.

Landscape photo of Beaver, OK in March 2018. This region was burnt badly from wildfires in 2017 and is still recovering. Regrowth can be seen throughout the area.

As land use changes with human interaction, the management practices of the land also tend to change. Prescribed burns (a controlled, intentional wildfire for land management and risk reduction practices) were performed on Oklahoma lands dating back before early settlement, however, there has been a decrease in performance since the early 1900's. The reduction of these burns has allowed an increase of native vegetation growth and invasive species (such as Eastern Red Cedar which have large diameters and often create high intensity fires) and has in return increased the vegetative fuels available for burning. The final factor, meteorological

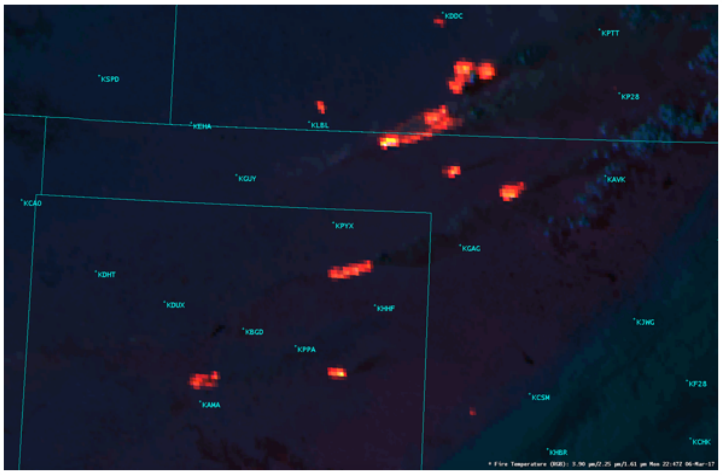
and climatological ingredients, is one of the most important factors that influence the onset, behavior and fate of fires. Among short-term weather ingredients, the most significant indices for wildfire conditions are low relative humidity (dries fuel), wind speed and direction (can drastically impact fire containment), warm temperatures (increases evapotranspiration) and a lack of precipitation (reduces moisture of soil and dead fuel, and influences drought). It is characteristic of the Southern Great Plains to experience a flux of values for each of these indices, and when favorable conditions occur together, this leads to the most at-risk days for wildfire.

Wildfire intensity throughout the Southern Great Plains varies based on these factors and leads to altering intensities of wildfire seasons, with the highest number of wildfires occurring between January and April and the highest total acres burned occurring in March and April. One of the most devastating recent Southern Great Plains wildfire outbreaks occurred on March 6, 2017 across portions of western Kansas and the Panhandles of Oklahoma and Texas. Following the event in 2017, the National Weather Service (NWS) revealed that 32 major fires occurred and nearly 1.3 million acres burned. Further, a case study by Lindley (2018) explained that the ingredients of this outbreak followed high intensities of the three factors listed above and was described as "the perfect fire storm".

Firefighters from across Kansas and Oklahoma battle a wildfire near Protection, Kansas, Monday, March 6, 2017. *(Bo Rader/The Wichita Eagle via AP)*

Lindley further explained that this storm was unique in that it was an occurrence of multiple megafires, defined as fires burning over 100,000 acres (NWS 2017), and resulted in many high intensity, high damaging fires. There have only been 10 megafires documented over the Southern Great Plains in the modern era, which makes the 32 megafires during this event unprecedented. The most known megafire, the Starbuck fire, occurred on the border of Oklahoma and Kansas and burned over 660,000 acres (NWS 2017). The outbreak of these megafires drastically impacted individuals, property and livestock, and exhausted resources from across the region. Strong local support was prevalent across the communities and bordering states, and various neighboring response personnel including firefighters, emergency managers, and burn associations offered their assistance in combating the events.

This local support was developed throughout the years of reoccurring wildfire events and has transformed into a camaraderie between the various response personnel and local individuals, most often consisting of volunteered time. They identify the need to increase wildfire preparedness and continue to improve resiliency by such things as hosting meetings and improving planning efforts. One example of these ongoing efforts



GOES-16 satellite image March 6, 2017

was a Regional Taskforce Meeting held on the one-year anniversary of the March 2017 outbreak. It is often at meetings such as this that community members, fire-fighters, and emergency respondents join together to discuss experiences, lessons learned, and what preparations need to be made to address future risk. Recognizing the opportunity to build upon these experiences, impacts and lessons learned from the recent 2017 wildfires, SCIPP collaborated with the USDA Southern Plains Climate Hub and the Redlands Community College to host the 2018 Southern Plains Wildfire Forum. This event was held in the panhandle of Oklahoma in Beaver, OK (a location impacted by the March 6, 2017 wildfires) on February 13, 2018, and drew over 100 local participants across western Oklahoma, western Kansas and the panhandle of Texas.

This meeting facilitated the collaboration of participants and aimed to increase awareness and preparation of wildfire resiliency efforts. Focusing on the recent wildfire events in 2016 and 2017, the event consisted of both presentations and panel discussions covering topics such as common weather conditions associated with wildfire and future implications, impacts and recovery perspectives, and management strategies to reduce future wildfire risk. Conversations also included discussing the benefits and safe practices of using prescribed burns as a management strategy, the importance and benefits of joining a local burn association, and the need to increase transparency and communication across various local entities. Additionally, a panel consisting of federal program representatives encouraged open dialogue of sharing perspectives on funding topics between the local and federal levels.

Over 100 participants across OK, KS and TX participated in the 2018 Wildfire Forum in Beaver, OK on February 13, 2018.

The discussion and information shared at this workshop is especially important to facilitate as changing climate conditions favor a warmer and drier environment, and the trend for the Southern Great Plains to experience wildfires is projected to continue into the future. However, it was noted that wildfire trends are not necessarily increasing in quantity (trends actually show a decrease in the frequency of fires) but are increasing in size and severity. This is likely due to an increase in fuel sources, despite the advancement in tools and increase in management strategies.

As the trend for larger and more intense wildfire events continue, this event was one way to assist locals in their planning efforts to reduce risk for future wildfire events. Furthermore, it is a very timely topic as the current 2018 wildfire season is turning historic as factors such as fuel source (from an abundance of dormant grasses) and dry, warm and windy meteorological conditions continue to occur. Most recently, conditions during the week of April 9th and April 16th have resulted in the worst wildfire conditions of the season thus far, with large and intense wildfires damaging over 373,000 acres across southwestern Kansas and the OK and TX Panhandles, especially in regions participants represented at the forum. Actions such as sharing information, improving collaborations and adapting management strategies through avenues like local meetings and increased planning efforts is critical for increasing resiliency to wildfire events as they continue to impact the region now and in the future.

References:

Fowler, C., and E. Konopik, 2007: The History of Fire in the Southern United States, Human Ecology Review, 14 (2), 165-176, http://www.humanecologyreview.org/pastissues/her142/fowlerandkonopik.pdf

Jackson, A.S., 1965: Wildfires in the Great Plains Grasslands, Proceedings: 4th Tall Timbers Fire Ecology Conference, 4, 241-259, http://talltimbers.org/wpcontent/uploads/2014/03/Jackson1965_op.pdf

Lindley, T., cited 2018: personal communication, National Weather Service Norman Forecast Office.

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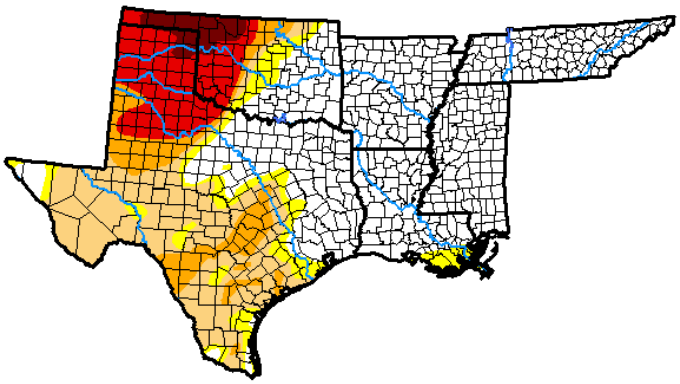
Drought Update

Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

In March, the exceptional drought classification appeared in northwestern Oklahoma and northern Texas. The severe drought classification was expanded through parts of central Texas and drought conditions worsened to moderate in southern Texas. The moderate drought classification was expanded throughout parts of western Texas. Drought conditions improved from moderate to no official drought designation in central Oklahoma and north central Arkansas. Conditions also improved from abnormally dry to normal or wetter than normal conditions in central Mississippi, southeastern Tennessee and northwestern Arkansas.

In March, there were 12 days with severe weather reports throughout the region. There were 459 severe weather events (29 tornadoes, 288 hail, and 142 wind events) reported throughout the Southern Region. Sixteen of the tornado events and 75 of the wind events occurred throughout Texas, Louisiana, and Mississippi on March 28. On March 10, there were 93 hail events reported throughout Texas, Arkansas, and Mississippi.

On March 18, 2018, two tornadoes were reported in Texas. Baseball sized hail was reported in Caldwell, Burleson and Bosque, Texas.



Released Thursday, March 29, 2018
Chris Fenimore, NCEI/NESDIS/NOAA

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	53.85	46.15	38.78	19.92	12.26	2.58
Last Week *03-20-2018*	53.15	46.85	37.34	18.70	12.26	1.09
3 Months Ago *12-26-2017*	34.14	65.86	41.30	8.42	0.30	0.00
Start of Calendar Year *01-02-2018*	31.09	68.91	42.64	15.33	0.30	0.00
Start of Water Year *09-26-2017*	72.17	27.83	2.38	0.02	0.00	0.00
One Year Ago *03-28-2017*	42.89	57.11	20.12	5.60	0.40	0.00

Intensity:

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

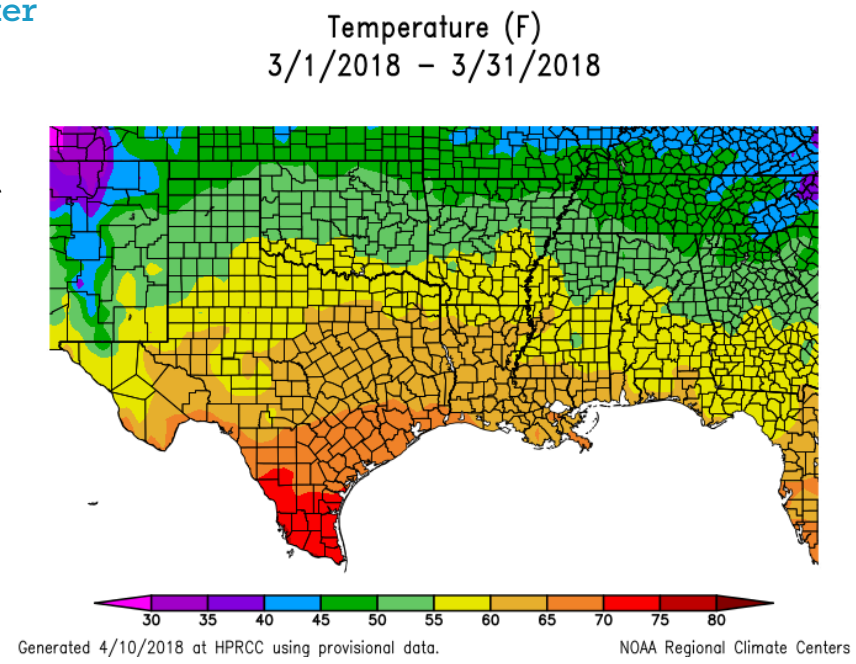
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Above: Drought Conditions in the Southern Region. Map is valid for March 27, 2018. Image is courtesy of the National Drought Mitigation Center.

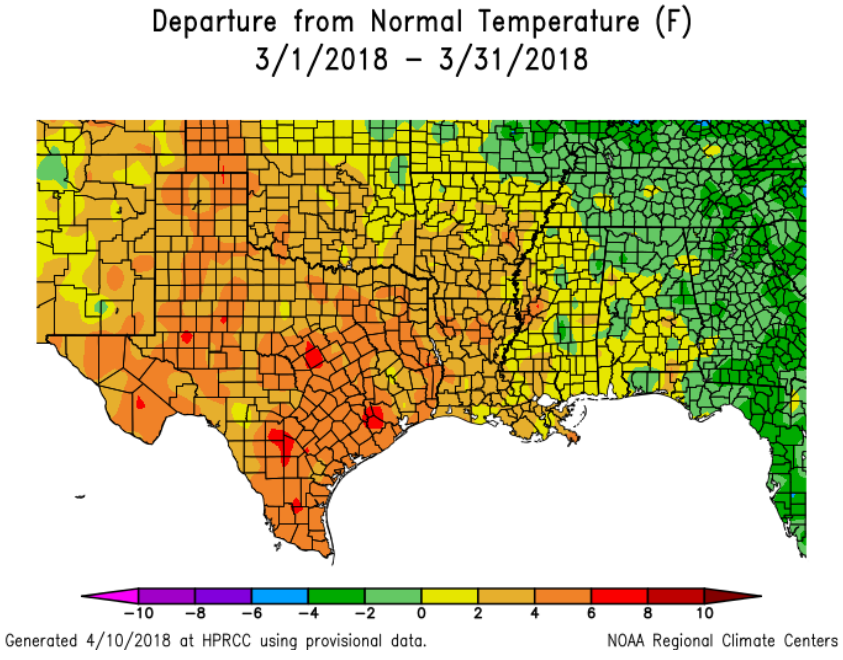
Temperature Summary

Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

March temperatures had a defined gradient throughout the Southern Region. In western Oklahoma, central and northern Louisiana, and most of Texas temperatures were 4 to 6 degrees F (2.22 to 3.33 degrees C) above normal. Parts of central and southern Texas experienced 6 to 8 degrees F (3.33 to 4.44 degrees C) above normal. In contrast, parts of central Mississippi and eastern Tennessee were 2 to 4 degrees F (1.11 to 2.22 degrees C) below normal. The statewide monthly average temperatures were as follows: Arkansas – 53.70 degrees F (12.06 degrees C), Louisiana – 62.10 degrees F (16.72 degrees C), Mississippi – 57.00 degrees F (13.89 degrees C), Oklahoma – 52.90 degrees F (11.61 degrees C), Tennessee – 48.20 degrees F (9.00 degrees C), and Texas – 61.60 degrees F (16.44 degrees C). The statewide temperature rankings for March were as follows: Arkansas (thirty-eighth warmest), Louisiana (twenty-seventh warmest), Mississippi (forty-sixth warmest), Oklahoma (twenty-eighth warmest), Tennessee (fifty-seventh coldest), and Texas (thirteenth warmest). All state rankings are based on the period spanning 1895-2018.



Average March 2018 Temperature across the South

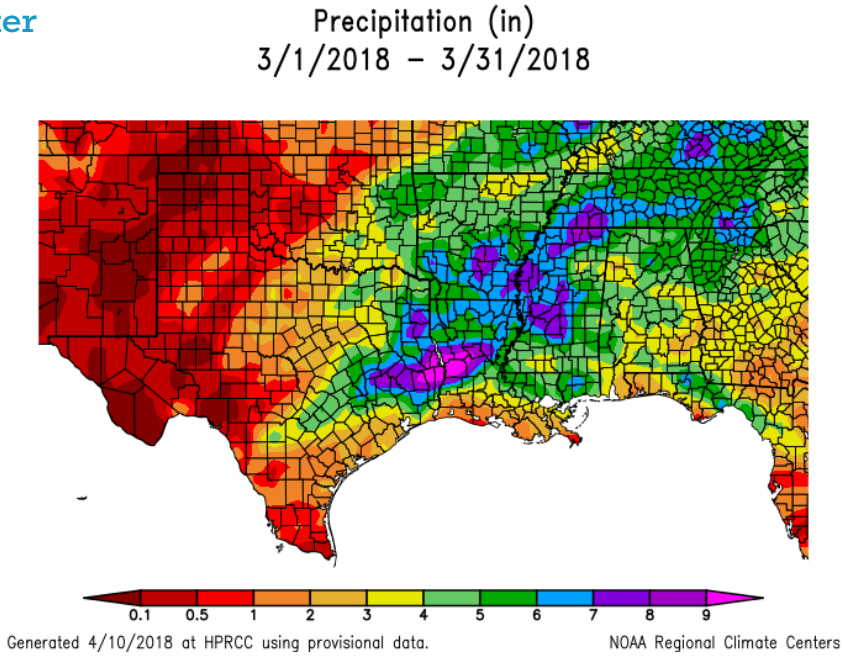


Average Temperature Departures from 1981-2010 for March 2018 across the South

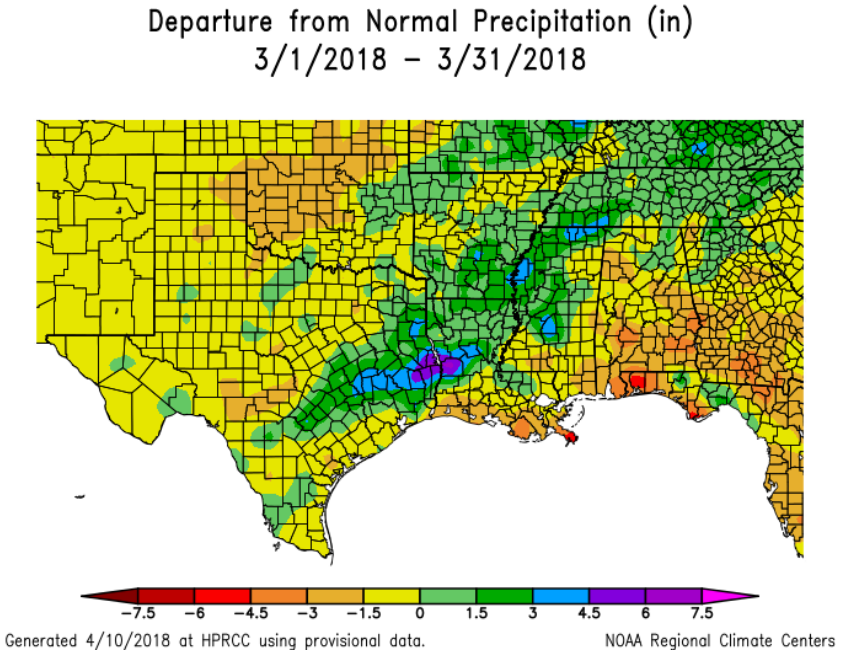
Precipitation Summary

Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

Precipitation values for the month of March varied spatially throughout the Southern Region. Parts of western and eastern Texas and west central Louisiana received 200 – 300 percent of normal precipitation. Southwestern Tennessee, northwestern and central Mississippi, southern Arkansas, western Louisiana and parts of central Texas received 150 – 200 percent of normal precipitation. In contrast, western Oklahoma and northern and western Texas received 5 percent or less of normal precipitation. Areas of extreme southern Louisiana and southern, west central, and northern Texas received 50 percent or less of normal precipitation. The state-wide precipitation totals for the month were as follows: Arkansas – 5.45 inches (138.43 mm), Louisiana – 4.82 inches (122.43 mm), Mississippi – 5.68 inches (144.27 mm), Oklahoma – 1.97 inches (50.04 mm), Tennessee – 5.56 inches (141.22 mm), and Texas – 1.98 inches (50.29 mm). The state precipitation rankings for the month were as follows: Arkansas (forty-seventh wettest), Louisiana (sixty-first wettest), Mississippi (sixtieth driest), Oklahoma (forty-seventh driest), Tennessee (fifty-second wettest), and Texas (forty-fifth wettest). All state rankings are based on the period spanning 1895-2018.

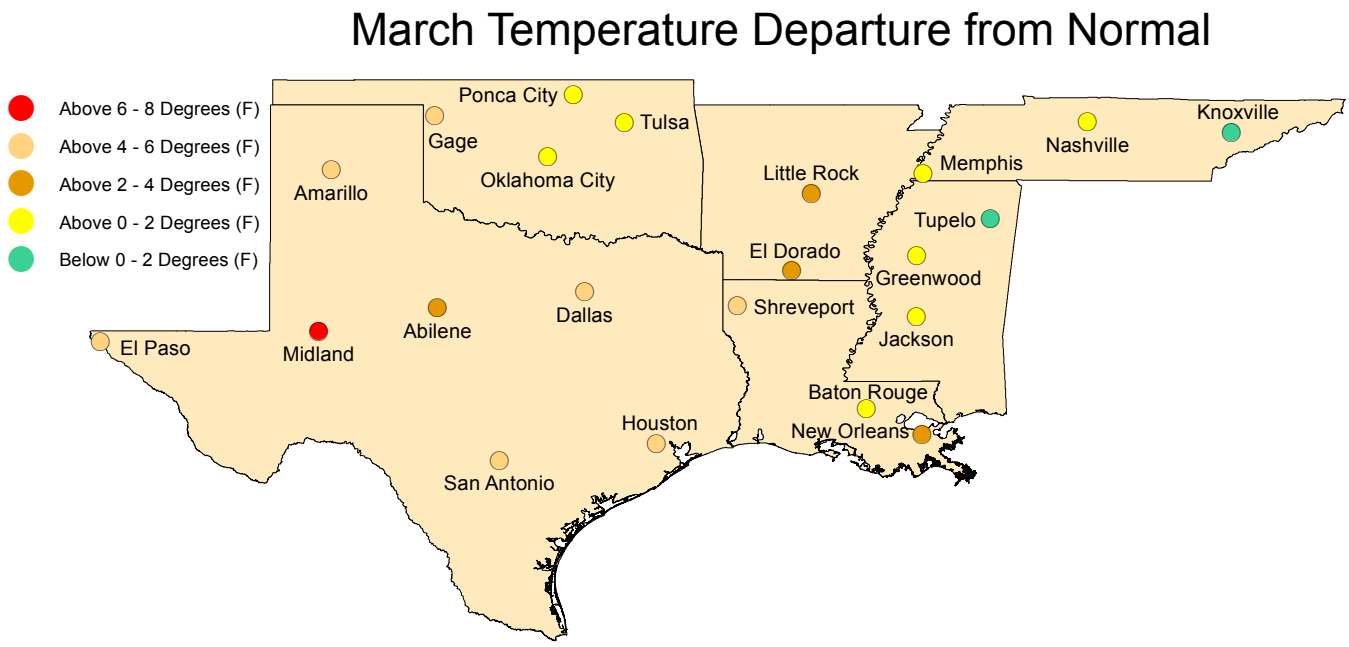


March 2018 Total Precipitation across the South

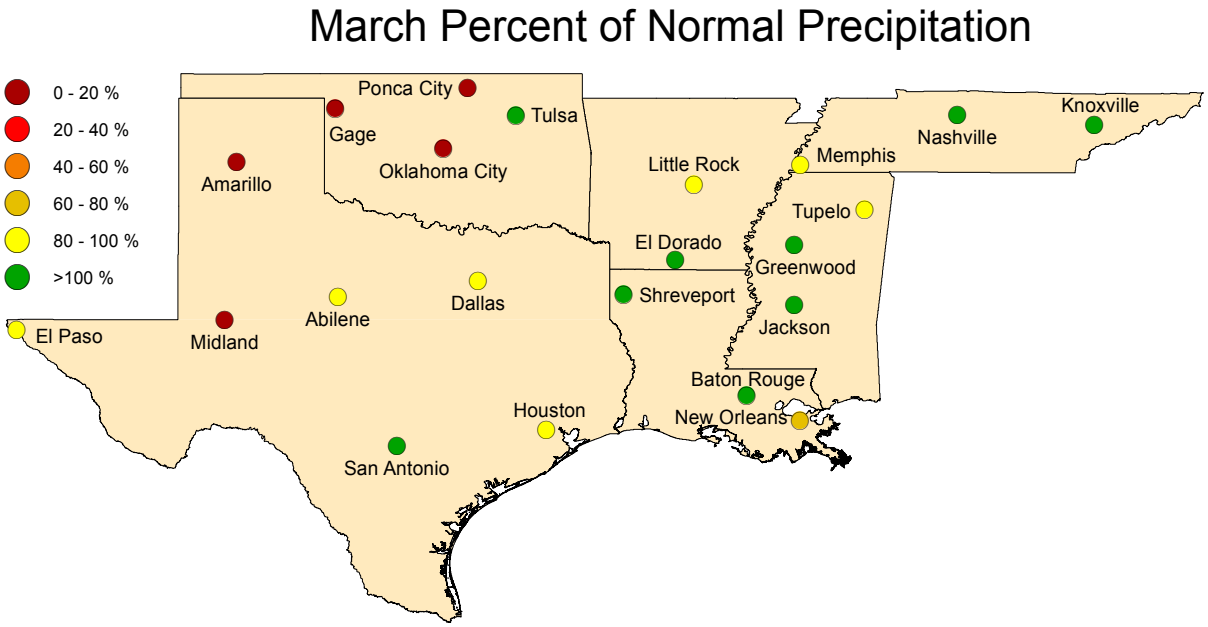


Percent of 1981-2010 normal precipitation totals for March 2018 across the South

Regional Climate Perspective in Pictures



March 2018 Temperature Departure from Normal from 1981-2010 for SCIPP Regional Cities



March 2018 Percent of 1981-2010 Normal Precipitation Totals for SCIPP Regional Cities

Climate Perspective

State	Temperature	Rank (1895-2018)	Precipitation	Rank (1895-2018)
Arkansas	53.7	38th Warmest	5.45	47th Wettest
Louisiana	62.1	27th Warmest	4.82	61st Wettest
Mississippi	57.0	46th Warmest	5.68	60th Driest
Oklahoma	52.9	28th Warmest	1.97	47th Driest
Tennessee	48.2	57th Coldest	5.56	52nd Wettest
Texas	61.6	13th Warmest	1.98	45th Wettest

State temperature and precipitation values and rankings for March 2018. Ranks are based on the National Climatic Data Center's Statewide, Regional, and National Dataset over the period 1895-2018.

Station Summaries Across the South

Station Summaries Across the South

Station Name	Temperatures								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	%Norm
El Dorado, AR	70.4	45.8	58.1	2.3	84	03/27+	29	03/08	6.59	1.84	139
Little Rock, AR	67.9	43.9	55.9	2.5	83	03/27	31	03/08+	3.85	-0.83	82
Baton Rouge, LA	74.4	52	63.2	1.7	85	03/28+	37	03/15+	5.08	0.67	115
New Orleans, LA	74.2	56.5	65.3	2.7	84	03/25+	41	03/15	3	-1.55	66
Shreveport, LA	73.7	50.5	62.1	4.2	85	03/27+	33	03/08	6.67	2.53	161
Greenwood, MS	67.5	46	56.8	1.3	82	03/19	31	03/14	5.74	1.43	133
Jackson, MS	70.3	46.9	58.6	1.7	84	03/19+	30	03/15	9.19	4.15	182
Tupelo, MS	64.8	43	53.9	-0.1	79	03/19+	29	03/09	3.89	-0.93	81
Gage, OK	68.5	34.7	51.6	4.3	91	03/23	17	03/12	0.06	-1.82	3
Oklahoma City, OK	65.7	41.4	53.5	1.3	79	03/23+	28	03/14	0.61	-2.45	20
Ponca City, OK	64.6	36.5	50.6	1.8	79	03/22+	21	03/14+	0.4	-2.31	15
Tulsa, OK	64.9	41.1	53	1.7	78	03/16	26	03/13+	3.31	0.02	101
Knoxville, TN	57.5	39.5	48.5	-1.8	78	03/29	24	03/09	5.14	0.8	118
Memphis, TN	63.6	44.6	54.1	0.1	78	03/27	31	03/13	4.44	-0.72	86
Nashville, TN	60.5	40.4	50.5	0.5	80	03/17	26	03/09	4.83	0.72	118
Abilene, TX	72.2	46.5	59.4	3	88	03/25	29	03/07	1.47	-0.27	84
Amarillo, TX	68.9	36.3	52.6	4.7	91	03/23	22	03/07+	0.24	-1.15	17
El Paso, TX	74.6	48.4	61.5	4.9	88	03/22	34	03/01	0.21	-0.05	81
Dallas, TX	74.7	51.9	63.3	5.7	89	03/24	37	03/14	2.9	-0.57	84
Houston, TX	77.7	57.4	67.6	4.9	85	03/25+	44	03/14+	2.97	-0.44	87
Midland, TX	76.8	47.6	62.2	6.6	91	03/22	32	03/06	0.11	-0.49	18
San Antonio, TX	77.2	56.8	67	4.8	89	03/10	45	03/21	4.02	1.71	174

Summary of temperature and precipitation information from around the region for March 2018. Data provided by the Applied Climate Information System. On this chart, "depart" is the average's departure from the normal average, and "% norm" is the percentage of rainfall received compared with normal amounts of rainfall. Plus signs in the dates column denote that the extremes were reached on multiple days. Blueshaded boxes represent cooler than normal temperatures; redshaded boxes denote warmer than normal temperatures; tan shades represent drier than normal conditions; and green shades denote wetter than normal conditions.

Divergent Trends of Open-Surface Water Body Area in the Contiguous United States from 1984-2016

Xiangming Xiao, University of Oklahoma

Researchers from the University of Oklahoma recently published a new study titled "Divergent trends of open-surface water body area in the contiguous United States from 1984 to 2016" in the Proceedings of the National Academy of Sciences of the United States.

Surface water is a vital resource for agriculture, public water supply, and ecosystems. Climate change models indicate that a greater degree of water stress is possible over the next 30 years, especially across the Southwest, due to warmer temperatures and drier conditions. It is also evident over the past few years how severe drought events reduce the water body surface area, and how that reduction affects water resources and ecosystems. While the current and future impacts on surface water are more distinct, the goal of this research is to understand the interannual variability and trends of open-surface water body areas across the contiguous United States over the past 30 years, and how human development and climate change affect the surface water body area in each state.

Researchers analyzed nearly 370,000 Landsat images to generate 30-m annual surface water body frequency maps over the time period of 1984 to 2016. From these images, interannual variations and trends of annual surface water body area were studied. Likewise, impacts on surface water body area dynamics due to climate change drivers were explored, along with the dynamics between water body area and land water storage.

Analysis showed the western half of the United States has less surface water body area, and experiences large interannual variability. Therefore, the region exhibits more water stress. The divergent trends, driven by climate, showed that regions of less water surface body area were seeing even less surface area (mainly in the Southwest and Northwest) and regions of more surface water body area (Northern Great Plains and Southeast), were seeing even more surface area. This is indicative of large water-resource gaps and is likely to continue according to climate projections. The land water shortage can be described by surface water body area change in 58% of the contiguous United States. These findings can provide valuable information to water resource managers as they manage and plan for future conditions.

If you are interested in reading this publication, the manuscript can be found online at the following link: http://www.pnas.org/content/115/15/3810

Funding for this research was provided by the National Science Foundation EPSCoR program, the U.S. Department of Agriculture's National Institute of Food and Agriculture, and the U.S. Geological Survey. For more information about this research, contact xiangming.xiao@ou.edu or visit http://www.eomf.ou.edu.

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From Our Partners

South Central Climate Science Center: Early Career Researcher Development Training

February 19, 2018: We are pleased to announce our third Early Career Researcher Professional Development Training designed for graduate students, postdocs, and early career researchers (i.e., graduated within the last five years) from any discipline conducting climate-related research with relevance to the south-central U.S. (i.e., New Mexico, Texas, Oklahoma, Louisiana, or Texas/Louisiana coast). This immersive five-day training will include a series of lectures, team activities, and field trips exploring Louisiana's water and climate challenges. Participants will have the unique opportunity to converse with scientists, communicators, stakeholders, and decision-makers dealing with 'on the ground' environmental and climate impacts. Participants will learn effective communication strategies for sharing their research, how to develop multi-disciplinary research proposals, engaging in actionable science, and team-building.

If you have any questions, please do not hesitate to contact us by emailing info@southcentralclimate.org.

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For any questions pertaining to historical climate data across the states of Oklahoma, Texas, Arkansas, Louisiana, Mississippi, or Tennessee, please contact the Southern Regional Climate Center at (225)578-5021.

For questions or inquiries regarding research, experimental tool development, and engagement activities at the Southern Climate Impacts Planning Program, please contact us at (405)325-7809 or (225)578-8374.

Monthly Comic Relief