

An Assessment of the Severe Oklahoma Drought of 2000

October 3, 2000

As of very early October, severe to extreme drought and fire danger conditions exist throughout the vast majority of Oklahoma, with significant economic, agricultural and public safety impacts. As with most summer dry periods, unusually warm temperatures join this year's drought. These conditions continue into early October, and are underscored by well-above-normal temperatures in Oklahoma on October 3rd, 2000, including a maximum of 106 F at Hollis, the warmest reading ever in Oklahoma in October.

The immediate cause of these drought conditions is a virtual (and in several locations, complete) lack of significant rainfall during the months of August and September. However, some locations in Oklahoma may be feeling the effects of long-term drought, which intensify the impact of the current situation.

The purpose of this document is to provide more detailed information about the impact of drought in Oklahoma on both the short term and the long term. The descriptions are organized by Oklahoma's Climate Divisions to facilitate its understanding and use on the local level.

Definitions of *KBDI*, *normal*, *period of record* and *soil moisture category* follow these descriptions.

CD1: Panhandle

Since Aug 1: 0.66" rainfall, 4.09" below normal, 14% of normal
Driest Aug-Sep period on record

This is normally Oklahoma's driest climate division, and typically receives rainfall in brief heavy events during the warm season. CD1's expected rainfall is skewed more toward the warm months than any of Oklahoma's climate divisions: two-thirds of the expected annual total falls in the five months bookended by May and September. During the last four years, fifteen of the twenty months that compose this period saw below normal rainfall. In the short-term, the Aug-Sep 2000 period was the driest, and August 2000 was the warmest, on record for this climate division. The western panhandle stations of Kenton, Boise City and Goodwell are the only stations to collect more than one-half inch of rainfall since July ended. Every single Mesonet soil moisture sensor at every depth (32 total) reports that soil moisture is in the driest category. KBDI values range from 448 at Kenton to 700 at Buffalo. Conditions worsen as one moves eastward in the climate division.

CD2: North Central

Since Aug 1: 0.38" rainfall, 6.16" below normal, 6% of normal
Driest Aug-Sep period on record

Although long-term drought is not a problem in CD2, the last two months have been severely dry and very warm throughout this entire division, as the winter-wheat planting season draws near. With the exception of thundershowers in Woodward County on August 7th and 10th, the vast majority of the climate division has received less than 1/2 inch of rainfall since July ended. Taken individually, both August and September were warmer than 90% of previous Augusts and Septembers recorded in CD2. The two-month period was easily the driest Aug-Sep on record for the division. Of the 52 Mesonet soil moisture sensors (4 depths by 13 stations) deployed in the climate division, all but one observe the soil moisture conditions in the driest category (the remaining sensor reports very limited moisture). KBDI values range from 536 at Woodward to 714 at Lahoma. Twelve of the thirteen stations report KBDI values exceeding 600.

CD3: Northeast

*Since Aug 1: 1.24" rainfall, 7.26" below normal, 15% of normal
Driest Aug-Sep period on record*

Like CD2, the summer drought of 1998 was not as severe in the northeast as elsewhere in the state, but the short-term drought is a major problem. Since August 1st, just over two months ago, the division stands at 7.26" below normal rainfall. All but one of the 30 Mesonet soil moisture sensors installed at 60 cm and 75 cm in CD3 show soil moisture conditions in the driest category. Eleven of the fifteen installed at 25 cm, and eight of the fifteen installed at 5 cm, show soil moisture conditions in the driest category. KBDI values range from 449 at Jay to 711 at Burbank. Eleven of CD3's fifteen stations report KBDI values exceeding 600, primarily in northern and western sections of the climate division.

CD4: West Central

*Since Aug 1: 0.04" rainfall, 6.08" below normal, 1% of normal
Driest Aug-Sep period on record*

According to precipitation data and Mesonet soil moisture observations, it appears that CD4 never fully recovered from the drought of 1998, and it is currently experiencing the most extreme lack of rainfall of any region in Oklahoma this season. Since July ended, CD4 has observed less than one-tenth of an inch of rainfall, the driest Aug-Sep period on record for any of Oklahoma's climate divisions. August 2000 was the 5th warmest August on record for CD4, and September was warmer than 90% of Septembers on record for CD4. During and since the severe drought of summer 1998, CD4 has received little warm season precipitation. More than 60% of CD4's precipitation normally falls in the five months bookended by May and September. During these periods of the last three years, only June 1999 and June 2000 yielded above normal rainfall. Ten of the thirteen below-normal months were more than one inch short of normal. Every single Mesonet soil moisture sensor at every depth indicates conditions in the driest category. All Mesonet-derived KBDI values in the region exceed 600, and range from 644 at Cheyenne to 699 at Bessie. Only a prolonged period of above normal rainfall will fully mitigate the effects of the last 30 months in this climate division.

CD5: Central

*Since Aug 1: 1.15" rainfall, 5.95" below normal, 16% of normal
Second driest Aug-Sep period on record: driest since 1956*

Since the end of July, CD5 has observed just over an inch of rainfall. Almost every drop of that came during a 24-hour period on September 23-24. This year, August was warmer than 90% of those on record for CD5, and September was also well above normal. As winter wheat planting season draws near, all but one of the 40 Mesonet soil moisture sensors installed at 60 cm and 75 cm in CD5 show soil moisture conditions in the driest category. Seventeen of the twenty installed at 25 cm and twelve of the twenty installed at 5 cm, indicate soil moisture conditions in the driest category. The worst conditions are found primarily in western sections of the division, in Oklahoma's "Wheat Belt". KBDI values range from 484 at Norman to 729 at Kingfisher. Just over half of the 20 stations in the division report values exceeding 600.

CD6: East Central

*Since Aug 1: 2.43" rainfall, 5.44" below normal, 31% of normal
Fourth driest Aug-Sep period on record: driest since 1956*

East Central Oklahoma experienced hot August and a warmer than normal September in CD6, combined with below normal rainfall for the period. While conditions are quite dry in late summer 2000, and short-term conditions are poor, they are not as extreme as the rest of Oklahoma, and this climate division was able to recover from the drought conditions of summer 1998. Mesonet soil moisture sensors show conditions in the driest category throughout the division at 60 cm and 75 cm, and across about half of the division at 25 cm. Sensors at 5 cm depict mostly adequate soil moisture conditions. KBDI values range from 473 at Tahlequah to 735 at Calvin. Three of the division's thirteen stations report KBDI values exceeding 600.

CD7: Southwest

*Since Aug 1: 0.84" rainfall, 5.36" below normal, 14% of normal
Second driest Aug-Sep period on record: driest since 1952*

Southwest Oklahoma is in a position of long-term drought, dating from the onset of the drought of summer 1998, exacerbated by severe conditions in August and September 2000. No rainfall was observed in the division in August and less than one inch in September (almost every drop coming on the night of September 23-34), making this the second-driest such period on record (next to 1958) for the region. Perhaps the hardest-hit of Oklahoma's climate divisions during the 1998 drought, the region has received only slightly above normal rainfall since, and much of this came during the cold season. Mesonet soil moisture data indicates that CD7 never recovered from the drought of 1998 at depths greater than one-foot. Currently, soil moisture is in the driest category throughout the region at depths greater than 25 cm, and six of the division's eleven sensors at 5 cm indicate dry conditions. KBDI values at eight of the division's eleven stations exceed 600, ranging from 509 at Apache to 756 at Grandfield. The worst conditions are found in the southern and western portions of the division. Only a prolonged period of above normal rainfall will fully mitigate the effects of the last 30 months in this climate division.

CD8: South Central

*Since Aug 1: 0.90" rainfall, 6.46" below normal, 12% of normal
Third driest Aug-Sep period on record: driest since 1948*

In addition to extreme short-term conditions, CD8 is in a period of long-term drought, dating from the onset of the widespread drought of summer 1998, and possibly to the winter drought of 1995-96. Less than one inch of rainfall has fallen on the division, on average, since the end of July, and three of the state's four most extreme KBDI values (Ringling, Waurika and Burneyville) are located in CD8. Mesonet soil moisture observations indicate conditions are in the driest category at and below 25 cm throughout the region and predominantly dry at 5 cm as well. All but two of the division's 15 stations report KBDI values exceeding 600, and range from 561 at Durant to 777 at Ringling. The value of 777 at Ringling is the most extreme KBDI value indicated since the commissioning of the Oklahoma Mesonet in 1994. Mesonet soil moisture sensors indicate that most of CD8 did not recover from the drought of 1998, and the division has received below normal rainfall in eleven of the fifteen months since July 1999. In CD8, half of the annual rainfall normally comes in the five month period bookended by May and September, and in the last four years, only four of the twenty months in this category have seen above normal rainfall. Only a prolonged period of above normal rainfall will fully mitigate the effects of the last 30-60 months in this climate division.

CD9: Southeast

*Since Aug 1: 2.66" rainfall, 5.43" below normal, 33% of normal
Third driest Aug-Sep period on record: driest since 1963*

While short-term conditions aren't quite as extreme as much of southern and western Oklahoma, CD9 is in a period of substantial long-term drought, dating to the onset of the widespread drought of summer 1998. CD9 has received below-normal rainfall for 20 of the 30 months since April 1998. Seventeen of those months had a deficit of one inch or more. Thirteen of the last 15 months have yielded below-normal rainfall. Soil moisture sensors indicate mostly adequate moisture at shallow depths and predominantly dry conditions at 60 cm and 75 cm. KBDI values at five of the division's nine stations exceed 600. Values range from 501 at Wister to 709 at Antlers. Only a prolonged period of above normal rainfall will fully mitigate the effects of the last 30 months in this climate division.

Terms and Definitions

KBDI: Keetch-Byram Drought Index. The KBDI is an indicator of the amount of moisture available in the upper eight inches of soil at a given location. It has value both as a drought indicator and as a fire danger index. Values range from 0-800, with 0 indicating no moisture deficit, and 800 indicating the maximum drought possible. Values over 400 are considered significant to drought and fire danger. Values over 600 indicate “Severe Drought” and the incorporation of organic material in the soil itself as fuel for wildfire.

Normal Rainfall/Temperature: Normal values are derived from a 30-year period, from 1961-1990.

Driest/Hottest on Record: Oklahoma’s climate records per climate division date to 1895.

Mesonet Soil Moisture Sensors: The Oklahoma Mesonet operates an array of up to four soil moisture sensors at 102 stations across the state. The sensors are placed at depths of 5 cm, 25 cm, 60 cm and 75 cm below the surface. Data from a sensor is used to determine a matric potential category of one to four. Matric potential can be considered as a measure of how difficult it is for a plant to extract water from the soil. Values in the driest category suggest a complete lack of available water to roots at that depth.