

**Annual Report to the
North Carolina General Assembly**

***NC Drought Management Advisory
Council Annual Report***

(July 1, 2016 – June 30, 2017)

DIVISION OF WATER RESOURCES



**NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL QUALITY**

<http://portal.ncdenr.org>

**N.C. Department of Environmental Quality
Division of Water Resources**

**N.C. Drought Management Advisory Council Annual Report
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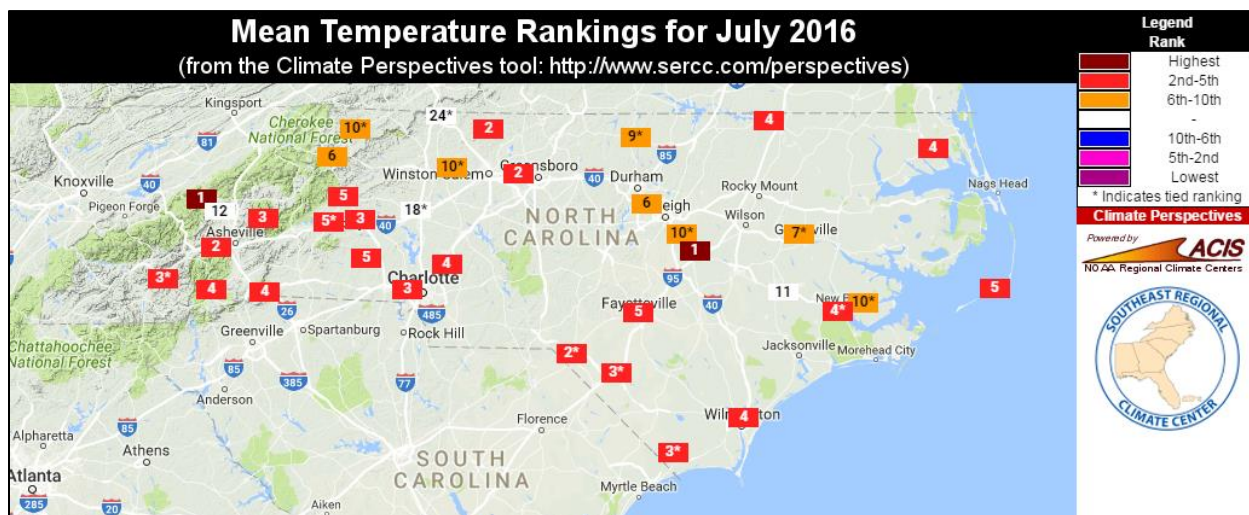
Introduction

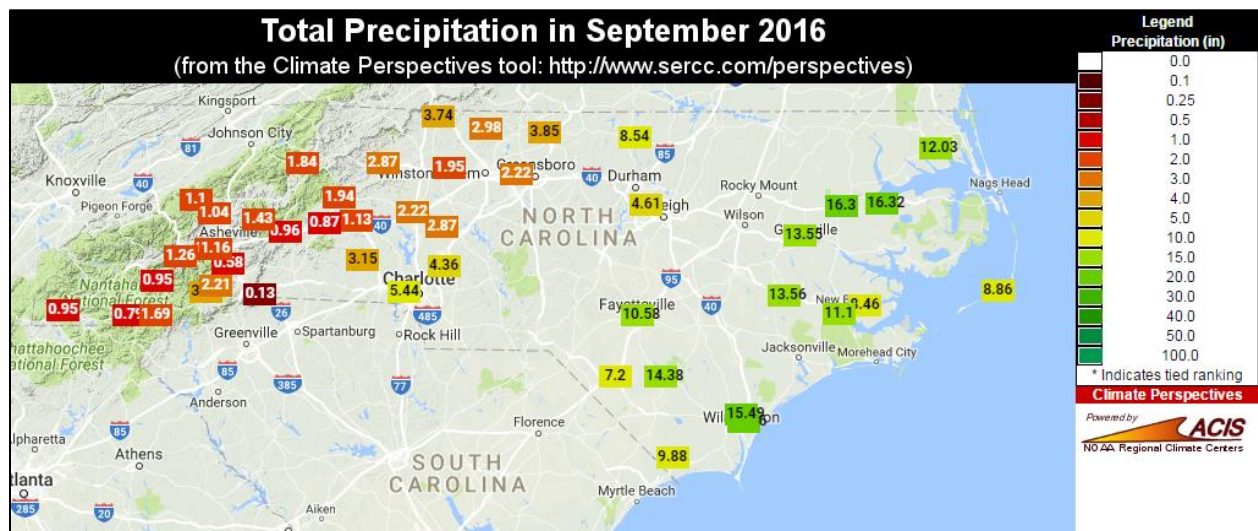
The N.C. Drought Management Advisory Council (DMAC), created as required by North Carolina General Statute 143-355.1, coordinates drought monitoring, assessment and response activities between state and federal agencies, public water systems and water users. The objective of the DMAC is to provide consistent and accurate information on drought conditions to these entities, the U.S. Drought Monitor, the Environmental Management Commission, the secretary of the N.C. Department of Environmental Quality, the N.C. Environmental Review Commission, and the public to manage and mitigate the harmful effects of drought. In accordance with statutory requirements, the council must submit an annual report to the secretary of the N.C. Department of Environmental Quality, the governor and the N.C. Environmental Review Commission by Oct. 1 each year.

Drought Overview 2016–2017

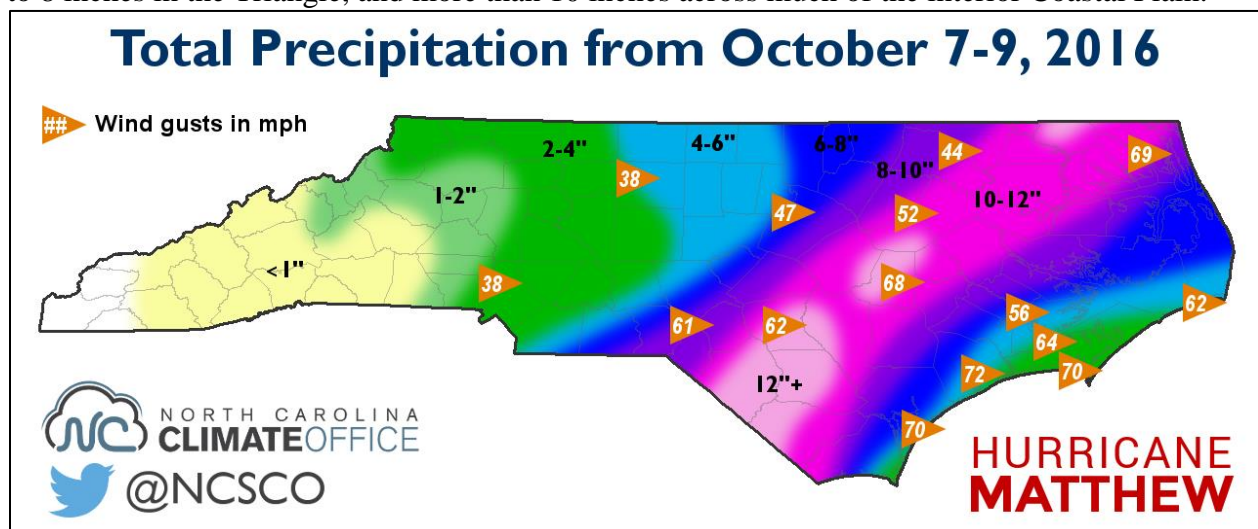
Climate Summary

July 2016 was one of North Carolina's warmest Julys on record, tying for 3rd warmest with many stations individually reporting one of their top 5 warmest Julys on record. Unlike temperatures, which were consistently warm, July's precipitation was varied across the state, though it averaged close to normal.





Hurricane Matthew grazed the North Carolina coast in early October, but with heavy precipitation extending far westward from the eye of the storm, it brought widespread rainfall and flooding to central and eastern portions of the state. Rain from Matthew moved over North Carolina beginning early on Oct. 8, and for the next 24 hours, there were few breaks in the rain across the eastern half of the state. Totals amounted to 2 to 4 inches in the Triad and Charlotte, 6 to 8 inches in the Triangle, and more than 10 inches across much of the interior Coastal Plain.



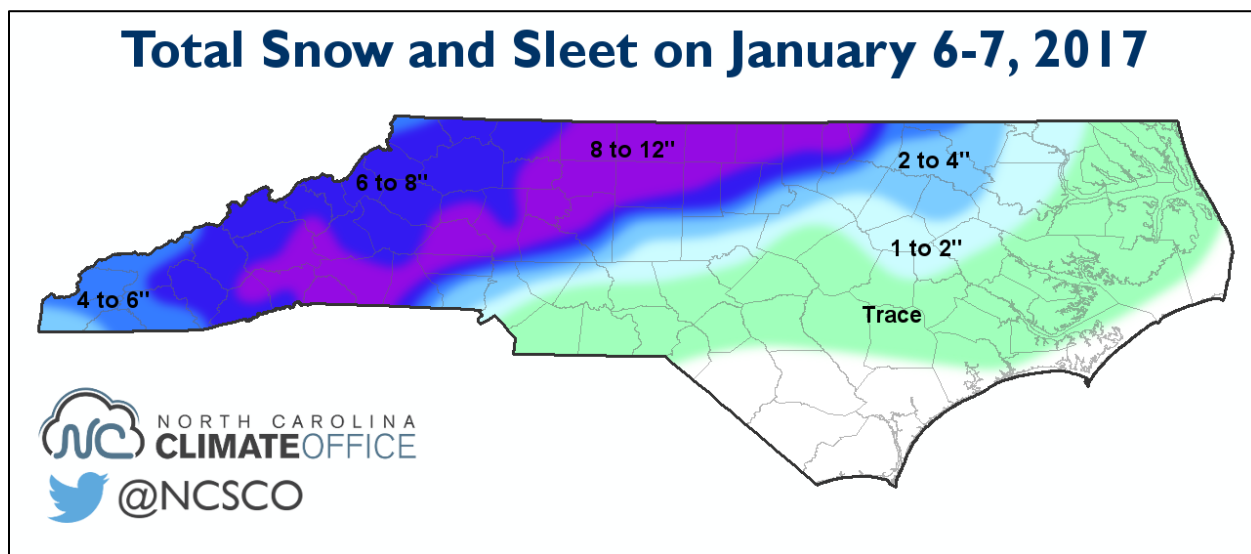
The highest totals came in Wayne County, including 15.24 inches at the Seymour Johnson Air Force Base, and Cumberland County, with CoCoRaHS reports of 14.32 inches near Godwin and 14.71 inches near Hope Mills. Tropical storm-force wind gusts were reported across the Coastal Plain and eastern Piedmont. Along the immediate coastline, gusts as high as 70 mph in Wilmington and Beaufort and 72 mph in Jacksonville were observed.

The heavy rain falling on already saturated ground meant water spilling onto roads, out of rivers and tributaries, and breaching dams, especially near Fayetteville, which had just received up to 10 inches of rain only one week before Matthew.

The remainder of October saw barely an inch of rainfall across the state. The mountains, which had missed out on the tropical rains in September and October, saw ongoing dryness exacerbated by above-normal temperatures. This led to expanding and degrading drought conditions in the North Carolina mountains. By the time October ended, many western areas had seen one of their top five driest falls on record while eastern areas had experienced one of their top five wettest. September 2016 ranked as the 5th warmest on record and October as the 10th.

Though temperatures were closer to normal in November, the month continued the trend of warm and dry weather. In fact, most of the state saw less than one inch of rainfall for the entire month. While this was a relief for the east, it continued to compound dryness in the west. The worsening drought combined with the recently fallen leaves made conditions on the ground and in the vegetation like a powder keg, ready to ignite with just a spark. Nineteen large wildfires were burning in western North Carolina during November 2016, including 11 that covered more than 1,000 acres. The smoke from these fires also led to poor air quality across much of the mountains and even as far east as the Triangle.

Regular rainfall returned in December along with a mix of warm and cooler days that, on average, was slightly warmer than normal. An early January winter storm brought widely varied impacts across the state, with more than 10 inches of snow in the Triad, a wintry mix in the Triangle and Charlotte, and a run-of-the-mill rain event along the coast. That was followed by the coldest air of the season as temperatures plunged into the low teens and single digits.



Temperatures warmed up after the early-month cold snap, however, and January 2017 finished a bit warmer than normal. January also finished slightly wetter than normal and helped abate some of the persistent drought in western North Carolina.

February 2017 was the warmest February on record for the state. In fact, February was 0.8 degrees warmer than March, which saw overall more normal temperatures. February was also a dry month, ranking 5th driest on record with a statewide average of only 1.19 inches, or more than 2.5 inches below normal.

The first part of March continued February's warm trend, but a mid-month cold snap brought light snow and freezing temperatures that caused damage to some crops that had started to emerge during the preceding warmth. Precipitation for March was also on the dry side, though not quite as dry as the previous month.

The spigot finally turned on in April with a statewide average of 6.5 inches, the 3rd wettest April on record. The wet pattern alleviated much of the dryness in the state. Temperatures, however, continued the above-normal pattern with at least a dozen days with temperatures at or above 80 degrees across much of the Piedmont and Coastal Plain. April ranked as the warmest on record.

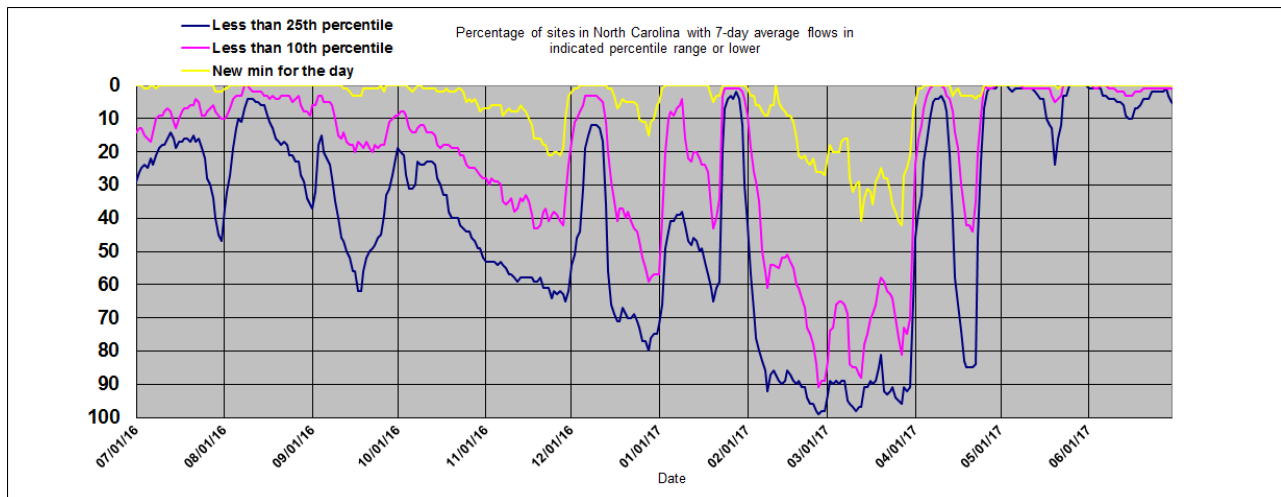
May was also wet (ranked 11th wettest) and brought an end to the dryness in the western part of the state. June saw the start of summer but temperatures for many places stayed closer to normal or were even on the cooler side. The month also saw few days with temperatures reaching 90 degrees or higher. Precipitation patterns, while transitioning to the summertime pattern of afternoon showers and storms, managed to stay near-normal across the state as well.

Note: All statewide temperature and precipitation amounts, departures and rankings were obtained from the [National Centers for Environmental Information](#) and are based on the period from 1895 to present.

Streamflow and Groundwater

At the beginning of the annual period (July 1, 2016 through June 30, 2017), [USGS WaterWatch](#) streamflow maps depicted a mix of conditions consisting of normal and above-normal ranges across central and eastern North Carolina coupled with below-normal conditions across western North Carolina (particularly across the southern mountains in southwest corner of the state). The below-normal conditions remained entrenched across the southern mountains from the summer through early spring season. Across eastern parts of North Carolina, normal, above-normal and record-high streamflows occurred following a very wet September and the passage of Hurricane Matthew in early October. By late February, much below-normal conditions were depicted across all parts of the state with widespread "less than 10th percentile" flows in effect through late March. The early spring season saw the passage of several large storm systems across the state that produced beneficial rainfalls, which resulted in much above-normal streamflow conditions through May. Lower overall precipitation totals during June allowed streams to recede, but conditions remained in the normal and above-normal ranges through the end of the annual period.

The graph shown below indicates the percentage of USGS streamgages in North Carolina with 7-day flows less than the 25th, 10th and 1st percentiles (or record-low for the calendar date) during the annual period.



Below-normal streamflow conditions gradually expanded during the summer and early fall seasons with the percentages of USGS streamgages across North Carolina having 7-day average streamflow percentiles below the 25th and 10th percentiles reaching 99 percent and 91 percent, respectively, in late February. These percentages are higher than the maximum values (84 and 55 percent, respectively) observed during the previous annual period and were also the highest since late 2012. The heavy rainfalls during late September and early October (Hurricane Matthew) were generally confined to the eastern third of the state, meaning streamflow conditions in western and much of central North Carolina remained in the normal and below-normal ranges. During February and March 2017, the percentage of sites with 7-day conditions below the 25th percentile was 85 percent or higher during much of these two months. Following the passage of several large storm systems across the state during late March and again from April into May, the 7-day flows quickly increased across the state with the percentage of sites in the “less than 25th percentile” range improving to less than 10 percent during May and June 2017.

Examination of provisional daily discharges indicates no new period of record minimum daily mean discharges were set at the USGS streamgages across North Carolina during the annual period. However, provisional new period of record minimum monthly average discharge were set during October 2016 at four streamgages in southwest North Carolina when extreme (D3) and exceptional (D4) U.S. Drought Monitor conditions were in effect. Also, provisional new record minimum monthly average discharges were set at 39 streamgages across western North Carolina during the period from September 2016 through March 2017.

Groundwater levels at 16 USGS observation wells within the [N.C. Climate Response Network](#) varied widely during July 1, 2016 through June 30, 2017. Water levels in the wells reflect the

climate conditions (occurrence of precipitation), but the temporal changes are also affected by individual well characteristics (e.g. well depth, surrounding material through which the water moves).

Water levels at the four Blue Ridge observation wells in this network were generally sustained in the below-normal and much-below normal ranges from summer 2016 through early spring 2017. With extreme (D3) and exceptional (D4) U.S. Drought Monitor conditions in effect across southwest North Carolina during November 2016, the water levels at these four sites were at or near record minimums for the periods of record. At the USGS well at Marble in Cherokee County, a new provisional period of record minimum water level of 15.16 ft below land surface was observed on Nov. 28, 2016. Beneficial rainfalls from March into May 2017 resulted in rising water levels at all four Blue Ridge sites, with levels generally remaining sustained in the normal ranges through the end of June 2017.

Across the Piedmont and Coastal Plain, water levels among the 12 wells in the network were in the normal and above-normal ranges throughout much of the annual period. No period of record minimums were observed among these wells, but period of record maximums were observed at the USGS well near Marston in Scotland County as well as the six wells in the Coastal Plain. Much above-normal rainfalls in September 2016 across eastern North Carolina followed by the heavy rainfall associated with the passage of Hurricane Matthew during early October resulted in water levels sustained in the above-normal and normal ranges through January 2017. At the Marston well, a provisional new period of record maximum water level of 28.16 feet below land surface was observed on Nov. 3, 2016, with water levels at this site remaining much above-normal range through mid-February 2017. Water levels in the Piedmont and Coastal Plain region descended into the below-normal ranges from February into early April. But with the passage of several strong storms producing large totals of rainfall through May, the water levels at these wells (many with shallow depths) quickly rose again in late April and remained in the normal and above-normal ranges through the end of June 2017.

Agriculture

The 2016–17 period was a difficult year for the agriculture industry. A hurricane in the east combined with drought and wildfires in the west challenged local, state and federal resources, and threatened the long-term well-being of many agricultural enterprises.

By late August, the western third of North Carolina was dry entering the fall of 2016. Many row crops died off, pastures were dried up and forest land was dry enough to provide extensive fuel for wildfire. In the driest counties, producers were selling cattle for which they would otherwise have to begin buying hay. Amid the drought in the west, harvest of corn, tobacco and hay continued normally throughout the central and eastern portions of the state.

In October, Hurricane Mathew spun off a rain event that filled the heads of five river basins that penetrate some of North Carolina's most productive agricultural soils. Thousands of acres of soybeans, cotton and forages were lost to floods. While poultry and livestock losses were substantial, advancements in building location and design following Hurricane Floyd in 1999 limited livestock losses in 2016.

The spring of 2017 saw adequate rains in much of the state, including the west and excessive rain in specific locations in the east. Due to substantial rain in the east, some corn and soybeans were planted late. Frequent rains throughout the spring and summer resulted in shallow root systems in various crops in the central and eastern parts of the state. These crops, particularly in the central Piedmont, suffered when dryness set in. While most of the state received adequate rain throughout much of the summer, spotty dryness did have modest impact on pastures and hay production.

Forest Resources

Drought impacts had a modest effect on forestry operations across the state during the past year, but a tremendous impact on wildfire. From July 1, 2016 to June 30, 2017, the N.C. Forest Service responded to 4,605 wildfires across the state that burned approximately 71,767 acres on state and private lands. The number of fires increased by nearly 50 percent, while the number of acres burned increased by nearly 350 percent from the previous year. The increase in acreage can be attributed to the extreme fall drought in the mountains. Nearly 82 percent of the acreage that burned in the state burned during October and November with the vast majority being in the mountains and foothills.

Hurricane Matthew destroyed the bare root seedling crop at the North Carolina Forest Service's nursery in Goldsboro and damaged other nurseries in North Carolina and South Carolina. This led to a shortage of trees for planting during the winter. Matthew also impacted timber harvesting operations for several weeks in the Coastal Plain during the late summer and fall. Prescribed burning and other forestry activities were not impacted by weather.

As the hurricane recovery process progressed, wildfires in the far west, challenged human and infrastructure resources that were already stressed from time spent addressing flooding in the east. More than 30 states responded with firefighting crews and helped limit the damage inflicted on North Carolina forests.

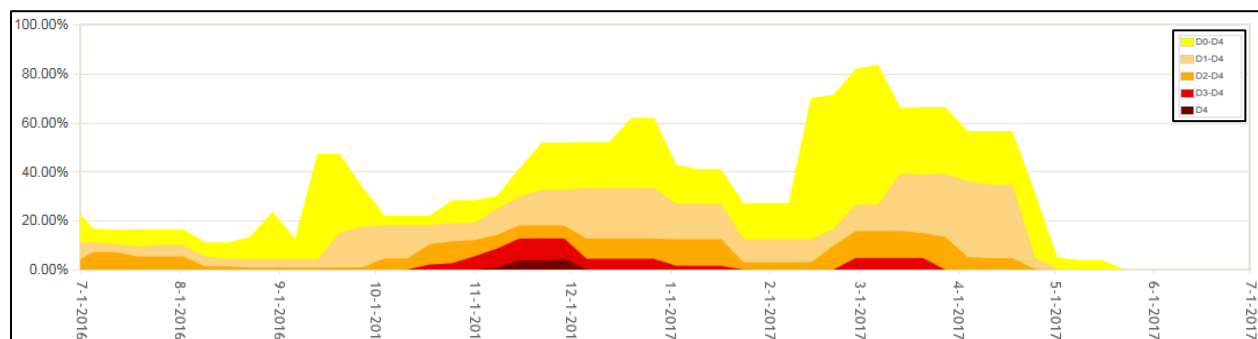
The number of fires was approximately 17 percent less than the 10-year average. However, the total number of acres burned was 263 percent higher than the 10-year average. Again, this was due to the drought and several large fires that burned in the mountains including Party Rock

(6,530 acres), Chestnut Knob (6,431 acres) and Horton (1,378 acres). There were 79,280 acres on state and private lands that were treated with prescribed fire during the past fiscal year, a 5 percent increase from the previous year.

Most effects of the past droughts for much of the state have subsided and all trees except for the most frail have fully recovered. Fall drought conditions in parts of western North Carolina left many trees stressed. There has been increased activities related to opportunistic pine bark beetles attacking vulnerable pines. This has been observed from Atlanta, east to South Carolina and north to extreme western North Carolina. Forests originally showed signs of recovery from infestations in the early Spring, but activity picked back up in the heat of the Summer. North Carolina Forest Service field personnel are ground checking and monitoring outbreaks.

Drought Condition Summary

During the past year, the worst drought conditions in North Carolina occurred in the fall and winter. The July 1, 2016-to-June 30, 2017 period began with approximately 20 percent of the state in abnormally dry (D0) to moderate drought (D2) conditions. These dry conditions were focused in the western part of the state.



Rainfall continued to be below normal and by the end of December, about half of the state was experiencing at least abnormally dry conditions with a small part of the state reaching the worst drought level, Exceptional Drought (D4). The dry conditions continued to be focused in the western part of the state but spread eastward throughout the fall. Rainfall during the second week of January provided a brief respite from the drought. Precipitation was below normal in much of the state from mid-January through March. Drought conditions quickly reemerged and expanded during this period with nearly 85 percent of the state in abnormally dry (D40) to Extreme Drought (D3) conditions. More typical rainfall occurred starting in mid-March causing a gradual decrease in the drought-impacted area. Heavy rainfall across the state in late April quickly addressed the rainfall shortfalls, removing almost all areas in the state from the drought map. Cherokee County, the first area to enter the drought, was the last area to fully recover in late May 2017.

During the worst period of the drought, the number of water systems that were affected by the drought conditions were as follows:

- 63 water systems were under abnormally dry conditions (approximately 1 million residents)
- 35 water systems were under moderate drought conditions (approximately 1.1 million residents)
- 23 water systems were under severe drought conditions (approximately 32,000 residents)
- 34 water systems were under extreme drought conditions (approximately 371,000 residents)
- Nine water systems were under exceptional drought conditions (approximately 31,000 residents)

Conditions began to improve in April 2017 with no drought designations statewide by late May 2017.

Council Meetings

Drought conditions in North Carolina are updated weekly through an audio-video telecom with a Technical Drought Advisory Team, which is a sub-group of the North Carolina Drought management Advisory Council. The team consists of experts on climate, weather, hydrology, water supply, forestry and agriculture that report each week on streams flows, groundwater levels, reservoirs levels, wildfire activity, water supplies and crop conditions. Based on this information, the team makes a recommendation to the U.S. Drought Monitor author on the state's drought conditions for that week. Those recommendations are used to draw the national drought map each Thursday. To see or download a copy of the current drought map, go to the state's official drought website at: www.ncdrought.org.

The DMAC is required by law to meet in person at least once each calendar year. The annual council meeting was held at 10 a.m. April 6, 2017 with 37 representatives and associates of the council in attendance. Items discussed at the meeting included current conditions on stream flow and ground water levels, lake and reservoir levels, agriculture, forestry and public water systems.