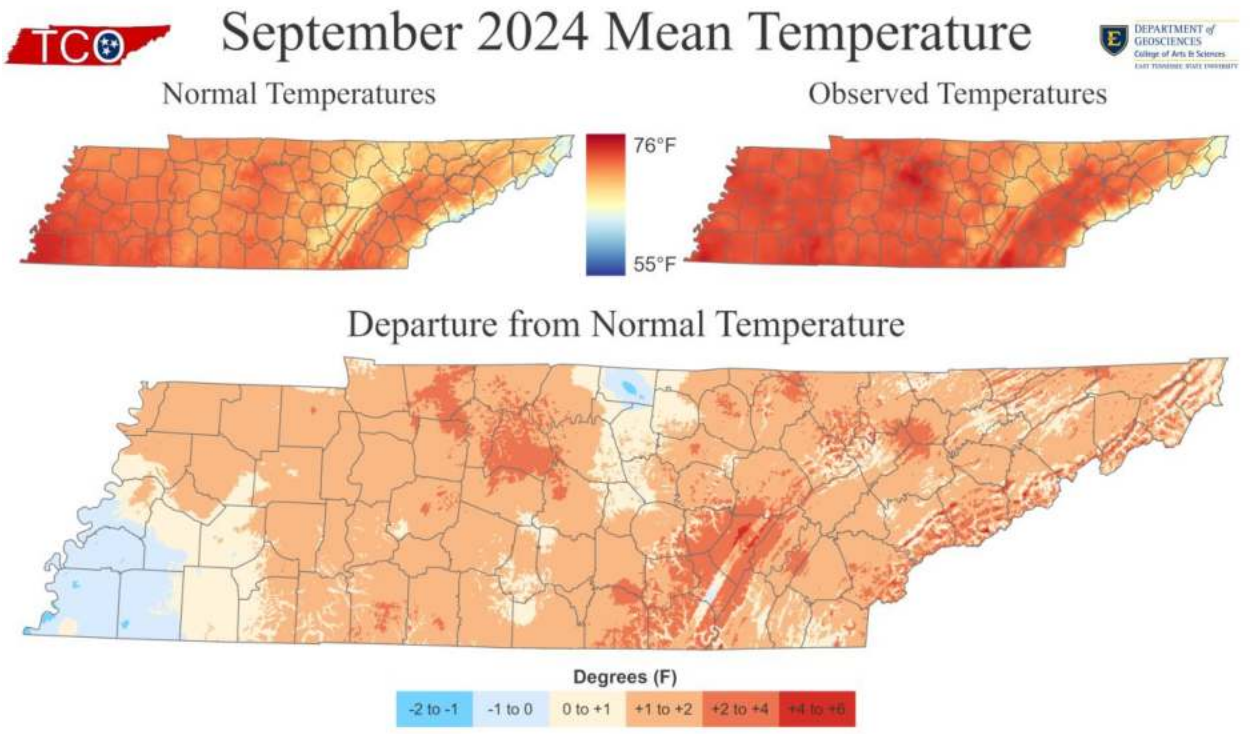
# September 2024 Tennessee State Climate Summary

*Tennessee Climate Office * East Tennessee State University*
*Prepared by William Tollefson and Dr. Andrew Joyner*
*With contributions by Climate Data Representatives across the state*

## Monthly Temperature Summary:

September started warm across the state with some high heat days, but that was followed by a cold front and the remnants of Hurricane Francine impacting the western half of the state in the second week of September. This brought cooler than normal temperatures across the state, with West Tennessee running the most below normal (4-6°F below normal). Heat returned for the third week of September, with high temperatures reaching into the mid-to-upper 90's in the final days before the fall equinox. Warmer than normal temperatures continued into the fourth week of September, with warm, humid air funneling up from the Gulf of Mexico along a stalled frontal boundary and with Hurricane Helene. This led to temperatures 4-6°F above normal for most of the state and 6-10°F above normal in northeast Tennessee. Overall, the southwest corner of the state around Memphis averaged slightly cooler than normal while the rest of the state was warmer than normal, with the Nashville area and southeastern Tennessee being the most above normal, with mean temperatures 2-4°F above normal. With the combination of two warm spells and a strong cold spell during the month, mean temperatures were far from records, with no long-term climate stations having a top 5 warmest or coolest September based on mean temperatures, average highs, or average lows.




Stations with the highest mean temperature

| Station Name | Station Type | Mean Temperature (F) |
|---|---|---|
| CHATTANOOGA AP | WBAN | 75.9 |
| SHILOH NMP TENNESSEE | RAWS | 75.4 |
| MEMPHIS INTERNATIONAL AP | WBAN | 75.2 |
| NASHVILLE INTL AP | WBAN | 75.2 |
| NASHVILLE BERRY FIELD | COOP | 75.1 |

Map Data from PRISM Climate Group, Oregon State University. 1991-2020 Climate Normals Used. Station Data Retrieved From xmACIS2.

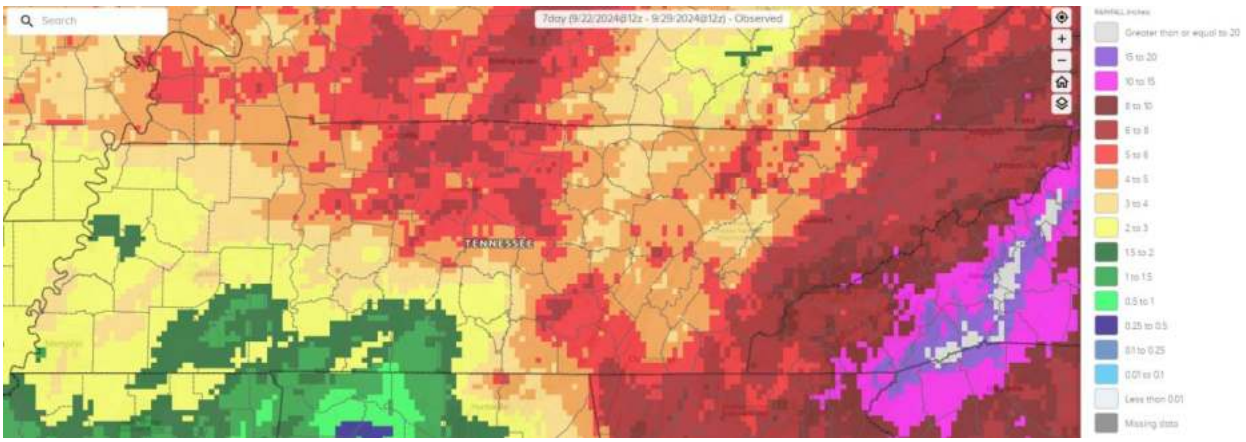
Stations with the lowest mean temperature

| Station Name | Station Type | Mean Temperature (F) |
|---|---|---|
| MT LECONTE | COOP | 53.9 |
| NEWFOUND GAP | COOP | 60.9 |
| ROAN MOUNTAIN 3SW | COOP | 63.5 |
| MOUNTAIN CITY 2 | COOP | 66.3 |
| CHEROKEE TENNESSEE | RAWS | 66.6 |

## Monthly Precipitation Summary:

September started out dry, with scattered storms associated with a cold front bringing a few pockets of above normal precipitation, but an overall drier than normal pattern. In the second week of September, the remnants of Hurricane Francine brought widespread heavy rains to the western half of the state with 2-6-inches of rain across West Tennessee, with higher totals near the Mississippi and Alabama borders. East Tennessee remained dry during this time. In the third week of September rains from potential tropical cyclone eight (which never received a name from the National Hurricane Center due to a disorganized surface area of low pressure not coming together into a clear center of circulation) brought normal to above normal rains to western North Carolina and far northeast Tennessee. A few counties along the Mississippi River also saw normal to above normal rainfall this week, while the rest of the state remained very dry.

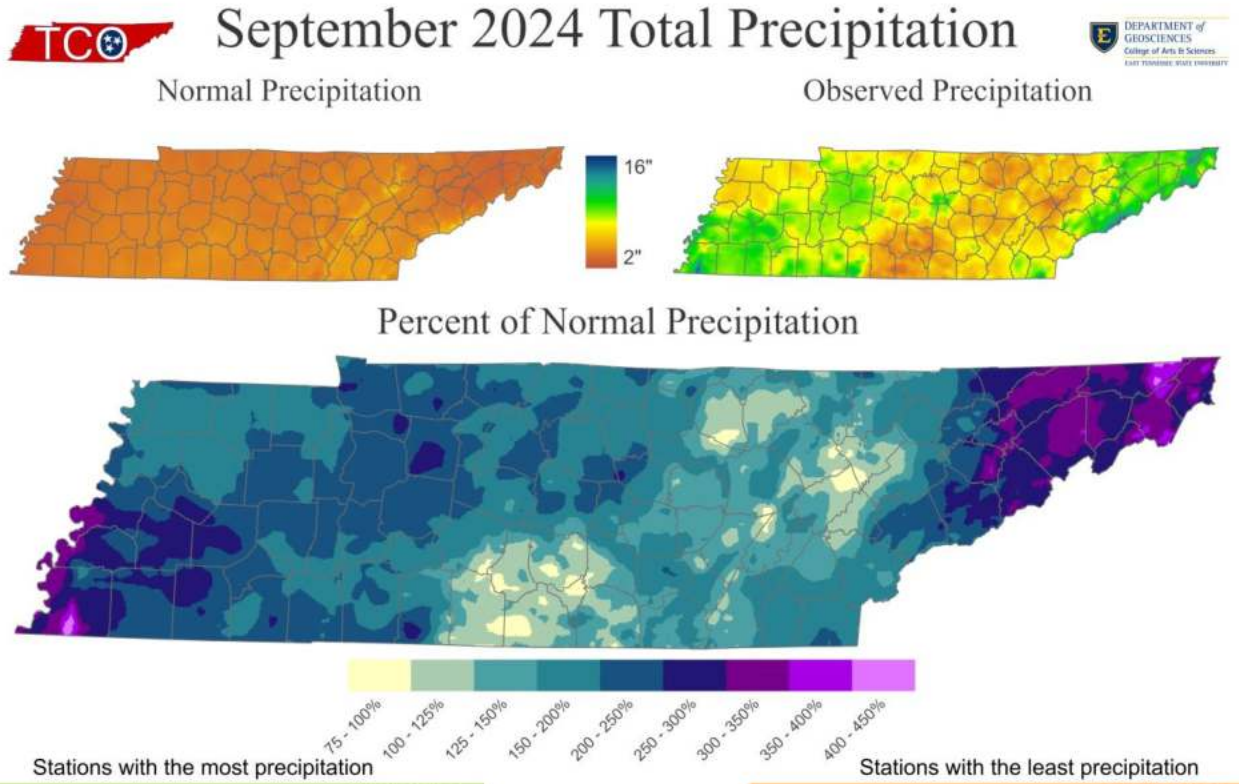
In the fourth week of September, a cold front worked its way across the state with some scattered severe storms that produced spotty heavy rains on Monday and Tuesday. This front then stalled out in the eastern half of the state on Wednesday, with heavy rains along the Appalachians and their foothills in East Tennessee and western North Carolina. Later in the day on Wednesday and into Thursday this frontal rain was supercharged as the outer rain bands from Hurricane Helene in the Gulf of Mexico converged with the stalled front. This heavy rain continued Thursday and Friday morning as Hurricane Helene moved north rapidly becoming a Tropical Storm as it continued its path across the southern Appalachian Mountains into East Tennessee mid-day Friday. On Friday the rain from Helene spread westward into Middle and eventually West Tennessee as the low-pressure center merged with an upper level low over West Tennessee and western Kentucky Friday night and Saturday. The heavy rains from Wednesday to Friday, especially on the North Carolina side of the mountains where several rivers in East Tennessee have their headwaters, led to devastating and deadly flash flooding along rivers in upper East Tennessee. The Pigeon, Upper French Broad, Nolichucky, Doe, and Watauga rivers were the most impacted with flash flood emergencies issued by the National Weather Service for several of these rivers as flood waters rose rapidly and multiple dams faced an imminent risk of failure. Scattered rain showers continued as the remnant low from Helene sat and spun over Tennessee, slowly working its way back east in the final days of September. The map below shows radar-estimated 7-day rainfall totals from 8am EDT Tuesday, September 22 until 8am EDT Tuesday, September 29, identifying the highest rainfall totals in the range of 5-10-inches in East Tennessee, generally east of the I-75 corridor, and in northern Middle Tennessee.




Thanks in large part to rains from Hurricane Francine, potential tropical cyclone eight, and Hurricane Helene, September 2024 was the wettest September on record for Bristol/Tri-Cities (with an 85-year history), 3rd wettest for Memphis (146-year history) and the Jackson airport (75-year history), and 5th wettest for Nashville (151-year history).

Amazingly looking at monthly rainfall anomalies, there were a few small areas that recorded below normal rainfall this month, mostly in southern Middle Tennessee and in the northern half of the Cumberland Plateau. Most areas of the state recorded between 150-250% of their normal September rainfall, while the northeastern and southeastern corners of the state recorded over 250% of their normal September rainfall, with a few areas seeing over 400% of their normal September rainfall!

Due to conditions in Asheville, NC (the location of NOAA's primary data facility), many NOAA NCEI datasets and tools are offline, so the number of daily, monthly, or all-time precipitation records set this month is unknown at this point, but looking at stations with at least 15-years of weather data, there were at least 34 stations with a daily rainfall record set the week of September 23-28 in the state of Tennessee.




Stations with the most precipitation

| Station Name | Station Type | Total Precipitation (in) |
|---|---|---|
| MT LECONTE | COOP | 14.41 |
| GATLINBURG 2 SW | COOP | 12.34 |
| JACKSON EXP STA | COOP | 11.67 |
| NEWFOUND GAP | COOP | 11.66 |
| MONTEREY | COOP | 11.62 |

Map Data from PRISM Climate Group, Oregon State University. 1991-2020 Climate Normals Used. Station Data Retrieved From xmACIS2

Stations with the least precipitation

| Station Name | Station Type | Total Precipitation (in) |
|---|---|---|
| LEWISBURG EXP STA | COOP | 3.74 |
| PULASKI WASTEWATER PLANT | COOP | 4.35 |
| SPARTA WASTEWATER PLANT | COOP | 4.38 |
| SHELBYVILLE MUNI. AIRPORT | COOP | 4.38 |
| OAK RIDGE ASOS | WBAN | 4.44 |

## Station Data and Top Tenn. (warmest/wettest, coldest/driest stations of the month):

Station data for airports across the state using WBAN weather stations, compared to 1991-2020 30-year climate normals for departure from mean temperature and total precipitation:

| Station Name | Temperatures (˚F) | | | | | | | | Precipitation (inches) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Averages | | | | Extremes | | | | Totals | | |
| | Max | Min | Mean | Depart | High | Date | Low | Date | Obs | Depart | %Norm |
| **Memphis** | 83.4 | 67.0 | 75.2 | **-0.8** | 92 | 9/22 | 56 | 9/9 | 9.89 | **+6.86** | **326%** |
| **Jackson** | 83.7 | 63.8 | 73.7 | **+2.0** | 94 | 9/22 | 48 | 9/9 | 11.37 | **+7.79** | **318%** |
| **Clarksville** | 84.5 | 61.7 | 73.1 | **+2.5** | 95 | 9/6 | 46 | 9/9 | 5.89 | **+2.42** | **170%** |
| **Nashville** | 85.0 | 65.4 | 75.2 | **+2.1** | 96 | 9/20 | 52 | 9/9 | 8.78 | **+4.98** | **231%** |
| **Chattanooga** | 85.5 | 66.4 | 75.9 | **+2.0** | 97 | 9/21 | 57 | 9/9 | 5.76 | **+1.53** | **136%** |
| **Crossville** | 78.1 | 58.7 | 68.4 | **+1.4** | 89 | 9/20 | 44 | 9/8 | 5.35 | **+1.21** | **129%** |
| **Knoxville** | 82.7 | 62.8 | 72.8 | **+1.0** | 93 | 9/22 | 51 | 9/10 | 6.33 | **+2.84** | **181%** |
| **Bristol** | 81.6 | 59.1 | 70.4 | **+1.8** | 90 | 9/22 | 42 | 9/8 | 7.66 | **+4.82** | **270%** |

Departures and %Norm Key: **Warmer than Normal**, **Cooler than Normal**; **Wetter than Normal**, **Drier than Normal**

**Hottest Stations (highest maximum temperature)**

| Station Name | Station Type | Highest Temperature (F) | Date |
|---|---|---|---|
| WINCHESTER 5SE | COOP | 100 | 3 |
| GAINESBORO | COOP | 99 | 2 |
| LEBANON | COOP | 98 | 1 |
| LEXINGTON | COOP | 97 | 3 |
| CHARLOTTE | COOP | 97 | 3 |
| CHATTANOOGA AP | WBAN | 97 | 21 |
| COOKEVILLE | COOP | 96 | 21 |
| MORRISTOWN RADIO WCRK | COOP | 96 | 3 |
| CLARKSVILLE WWTP | COOP | 96 | 6 |
| NASHVILLE BERRY FIELD | COOP | 96 | 21 |
| NASHVILLE INTL AP | WBAN | 96 | 20 |

*Five stations tied for the 7th hottest temperature (96°F)*

**Coldest Stations (lowest minimum temperature)**

| Station Name | Station Type | Lowest Temperature (F) | Date |
|---|---|---|---|
| MT LECONTE | COOP | 30 | 8 |
| MOUNTAIN CITY 2 | COOP | 38 | 10 |
| LEWISBURG EXP STA | COOP | 40 | 7 |
| KINGSTON SPRINGS | COOP | 40 | 10 |
| COALMONT | COOP | 41 | 8 |
| PICKETT STATE PARK | COOP | 41 | 8 |
| NEWFOUND GAP | COOP | 41 | 8 |
| ONEIDA | COOP | 42 | 10 |
| ROAN MOUNTAIN 3SW | COOP | 42 | 10 |
| BLEDSOE SF TENNESSEE | RAWS | 42 | 8 |
| CROSSVILLE AREA OFFICE TN | RAWS | 42 | 9 |
| BRISTOL AP | WBAN | 42 | 8 |

*Five stations tied for the 8th coldest temperature (42°F)*

**Warmest Stations (highest mean temperatures)**

| Station Name | Station Type | Mean Temperature (F) |
|---|---|---|
| CHATTANOOGA AP | WBAN | 75.9 |
| SHILOH NMP TENNESSEE | RAWS | 75.4 |
| MEMPHIS INTERNATIONAL AP | WBAN | 75.2 |
| NASHVILLE INTL AP | WBAN | 75.2 |
| NASHVILLE BERRY FIELD | COOP | 75.1 |
| CAMDEN TOWER TENNESSEE | RAWS | 74.8 |
| LEWISBURG TOWER TN | RAWS | 74.6 |
| LENOIR CITY TENNESSEE | RAWS | 74.1 |
| MEMPHIS WFO | WBAN | 74.1 |
| FRANKLIN SEWAGE PLANT | COOP | 74 |

**Coolest Stations (lowest mean temperatures)**

| Station Name | Station Type | Mean Temperature (F) |
|---|---|---|
| MT LECONTE | COOP | 53.9 |
| NEWFOUND GAP | COOP | 60.9 |
| ROAN MOUNTAIN 3SW | COOP | 63.5 |
| MOUNTAIN CITY 2 | COOP | 66.3 |
| CHEROKEE TENNESSEE | RAWS | 66.6 |
| PICKETT STATE PARK | COOP | 67.2 |
| GATLINBURG 2 SW | COOP | 67.3 |
| TOWNSEND 5S | COOP | 68.1 |
| ONEIDA | COOP | 68.3 |
| CROSSVILLE MEMORIAL AP | WBAN | 68.4 |

**Wettest Stations (highest precipitation totals):**

| Station Name | Station Type | Total Precipitation (in) |
|---|---|---|
| MT LECONTE | COOP | 14.41 |
| GATLINBURG 2 SW | COOP | 12.34 |
| JACKSON EXP STA | COOP | 11.67 |
| NEWFOUND GAP | COOP | 11.66 |
| MONTEREY | COOP | 11.62 |
| JACKSON MCKELLAR- SIPES AP | WBAN | 11.37 |
| AMES PLANTATION | COOP | 10.65 |
| MOUNTAIN CITY 2 | COOP | 10.64 |
| MEMPHIS WFO | WBAN | 10.28 |
| ALAMO 1 N | COOP | 10.16 |

*Several COOP and CoCoRaHS stations in the wettest areas during Helene were missing data so some locations likely had more rainfall this month.*

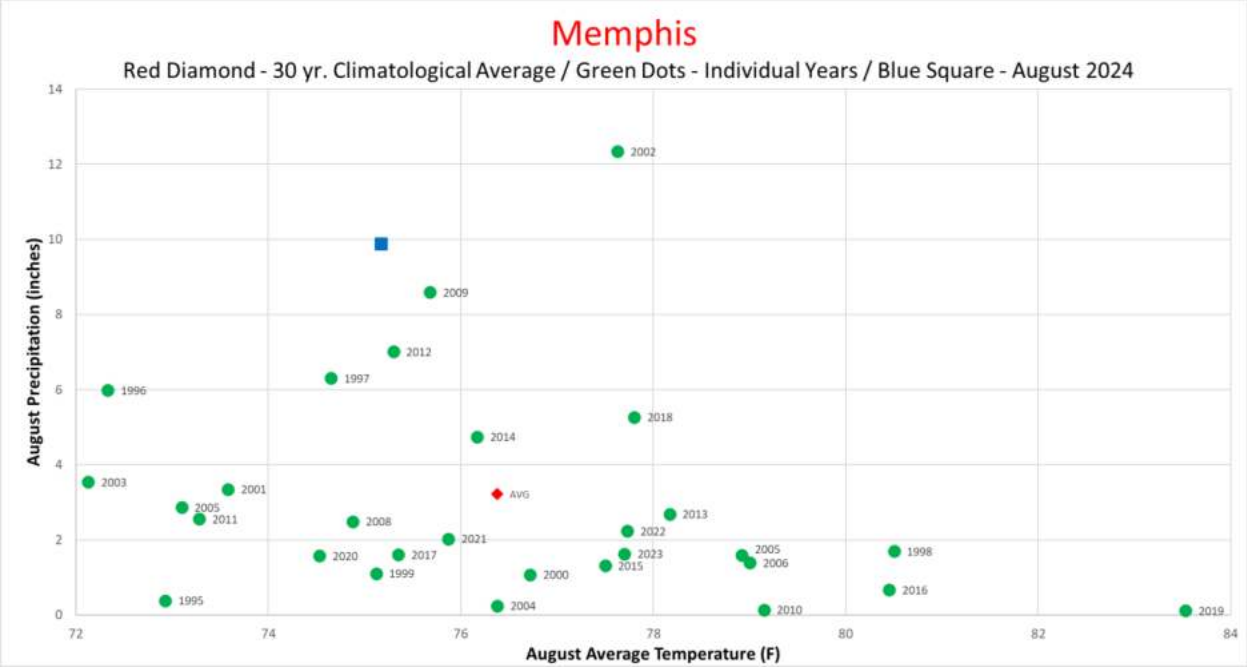
**Driest Stations (lowest precipitation totals):**

| Station Name | Station Type | Total Precipitation (in) |
|---|---|---|
| LEWISBURG EXP STA | COOP | 3.74 |
| PULASKI WASTEWATER PLANT | COOP | 4.35 |
| SPARTA WASTEWATER PLANT | COOP | 4.38 |
| SHELBYVILLE MUNI. AIRPORT | COOP | 4.38 |
| OAK RIDGE ASOS | WBAN | 4.44 |
| BYRDSTOWN | COOP | 4.58 |
| LYNCHBURG | COOP | 4.72 |
| PIKEVILLE | COOP | 4.83 |
| ONEIDA | COOP | 5 |
| CROSSVILLE MEMORIAL AP | WBAN | 5.35 |

*Several COOP and CoCoRaHS stations reported lower precipitation totals, but were missing multiple days, this table shows the driest stations with no missing day during September 2024.*

## The Month in Comparison:

Comparing the mean temperature and total precipitation for September 2024 to the conditions of September for the past 30 years, select airport weather stations across the state show that September 2024 was wetter than average for all stations, and warmer than normal at all stations except Memphis. Rainfall this month was the highest of the past 30 years for Bristol/Tri-Cities with almost 2" more than the second wettest September of the past 30 years! Additionally, 2024 had the 2nd highest rainfall total of the past 30 years at Memphis and Nashville, and 3rd highest of the past 30 years for Jackson and Knoxville. Looking at the longer record for these stations, September 2024 was the wettest September on record for Bristol/Tri-Cities (with an 85-year history), 3rd wettest for Memphis (146-year history) and the Jackson airport (75-year history), and 5th wettest for Nashville (151-year history).


Memphis
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - August 2024
August Precipitation (inches)
August Average Temperature (F)
AVG
2002
2009
2012
1997
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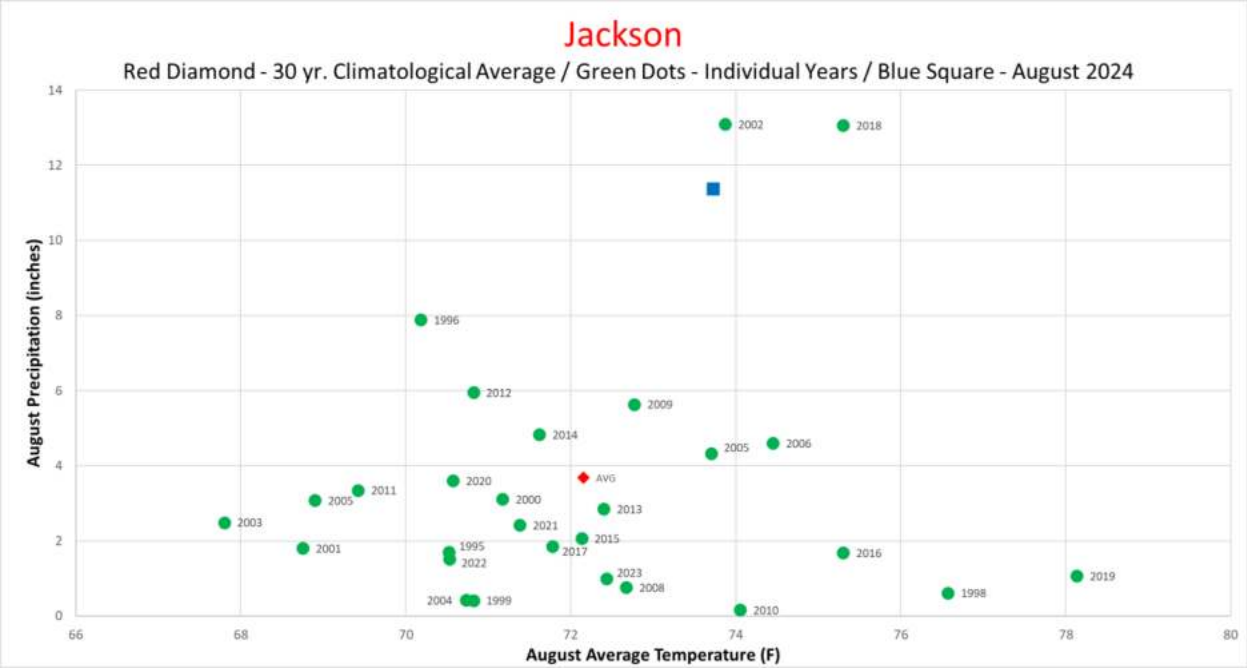
Jackson
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - August 2024
August Precipitation (inches)
August Average Temperature (F)
AVG
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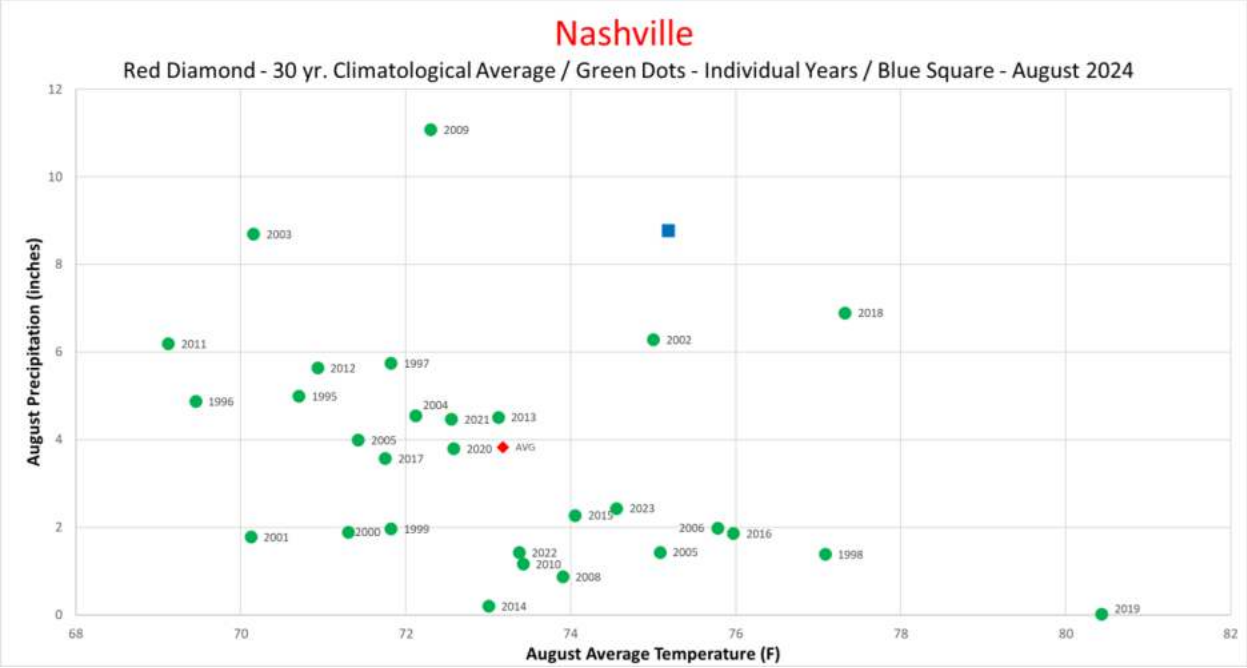
Nashville
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - August 2024
August Precipitation (inches)
August Average Temperature (F)
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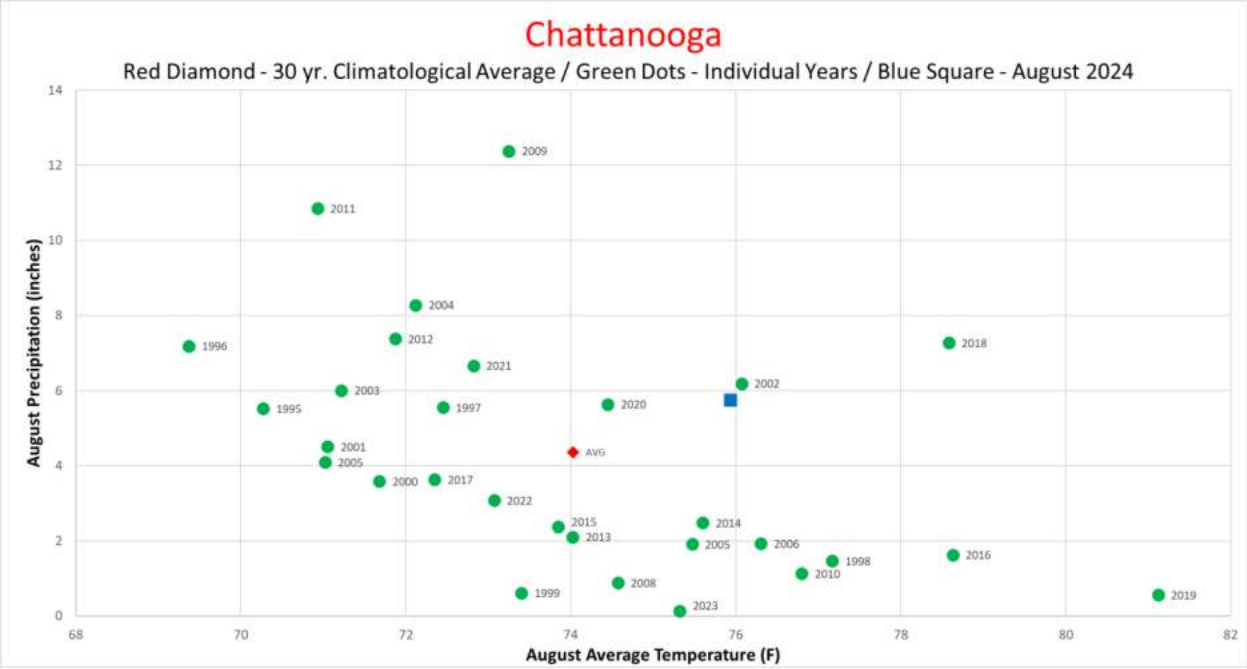
Chattanooga
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - August 2024
August Precipitation (inches)
August Average Temperature (F)
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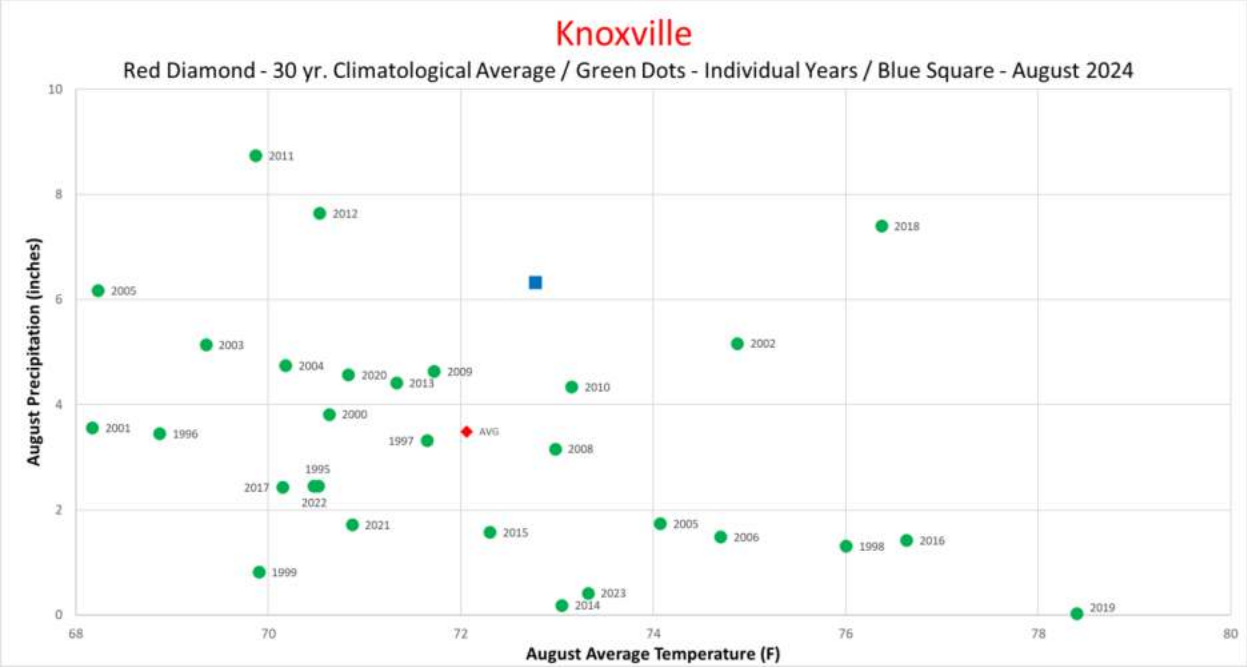
Knoxville
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - August 2024
August Precipitation (inches)
August Average Temperature (F)
AVG
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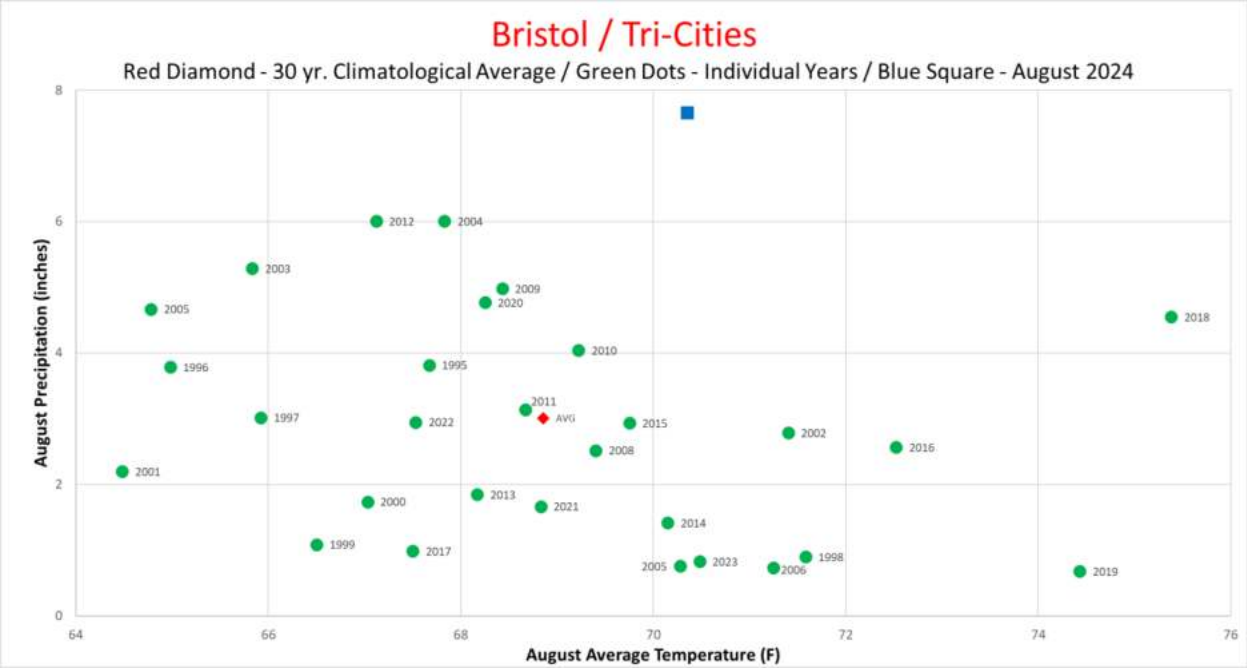
Bristol / Tri-Cities
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - August 2024
August Precipitation (inches)
August Average Temperature (F)
AVG
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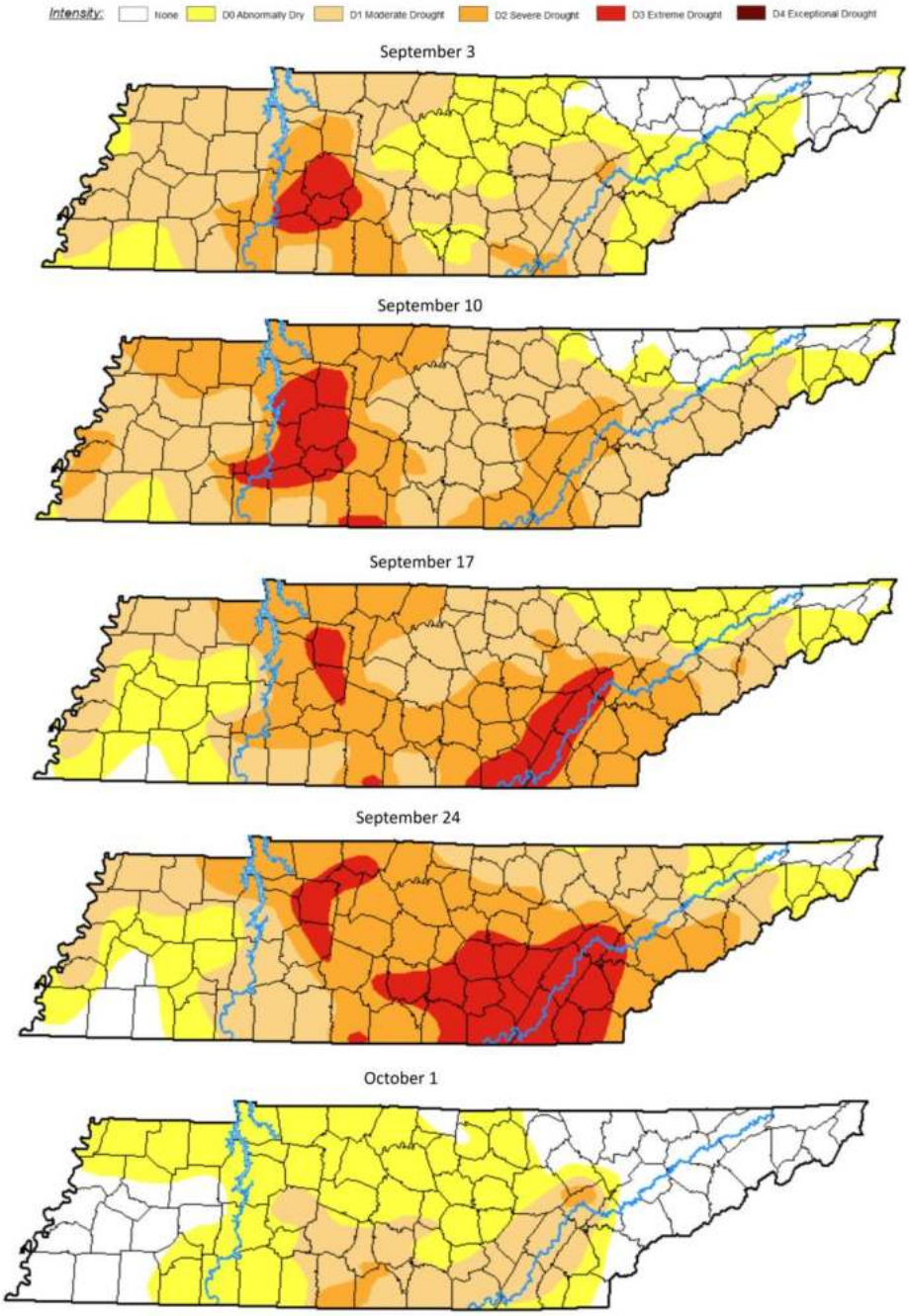
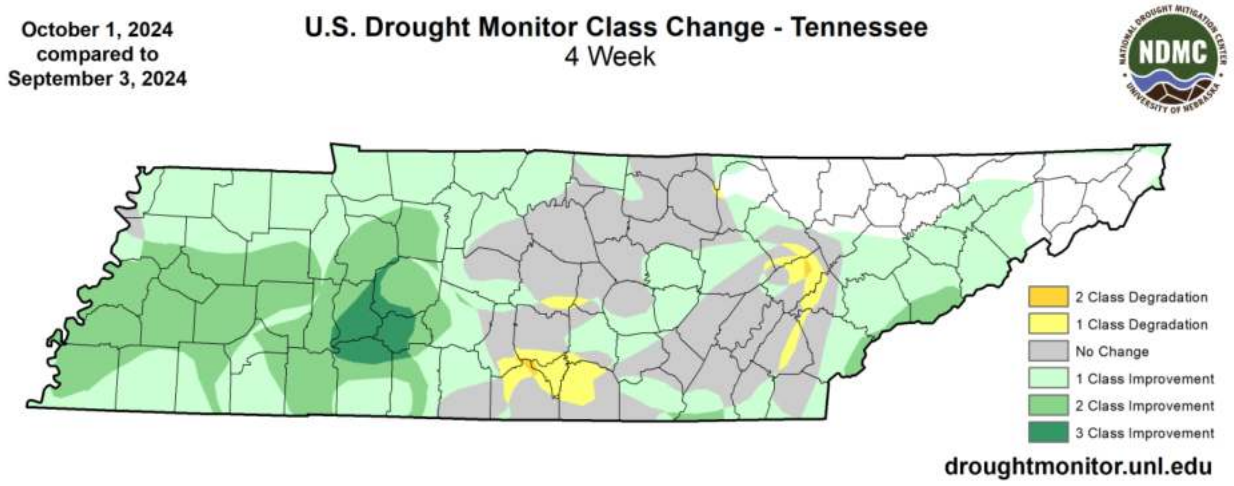
## Drought Monitor:

Drought conditions went on a bit of a roller-coaster ride with expansion of Moderate, Severe, and Extreme Drought (D1-D3) conditions in the eastern half of the state through the month, with some improvement in the western half of Tennessee following the rains from Francine. Then the U.S. Drought Monitor for October 1 showed major improvements following the widespread heavy rains from Helene. Large areas of Abnormally Dry and Moderate drought persist in southeastern portions of West Tennessee, southern Middle Tennessee, most of the Cumberland Plateau, and southwestern portions of East Tennessee where rainfall deficits of 5-8" continue from the beginning of June through October 1. Impacts continue to be felt, especially in the agriculture and utilities sectors, because of the intensity of the summer drought and sustained overall dry pattern in these locations.



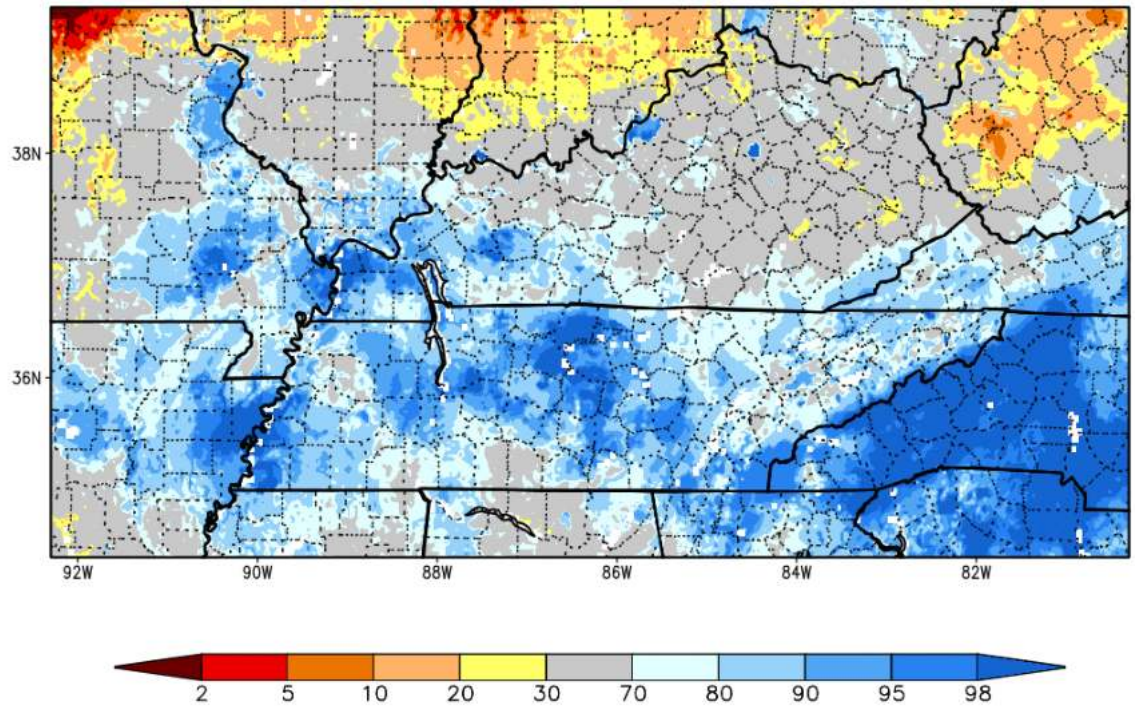
In the October 1 US Drought Monitor, 36.23% of Tennessee's area was free from any drought or abnormally dry conditions compared to 11.24% on the September 3 edition of the US Drought Monitor. As of October 1, no part of the state was shown with Extreme Drought (D3), down from 3.68% on September 3 and down from the maximum coverage of 19.12% on the September 24 Drought Monitor map. As of October 1, only 1.78% of the state was shown with Severe Drought (D2) compared to 14.91% of the state on September 3, and down from the maximum extent of 50.44% on September 24. As of October 1, 17% of the state was shown in Moderate Drought (D1), down from 44.83% on September 3, and from the peak extent of 47.26% on September 10.




## Soil Moisture:

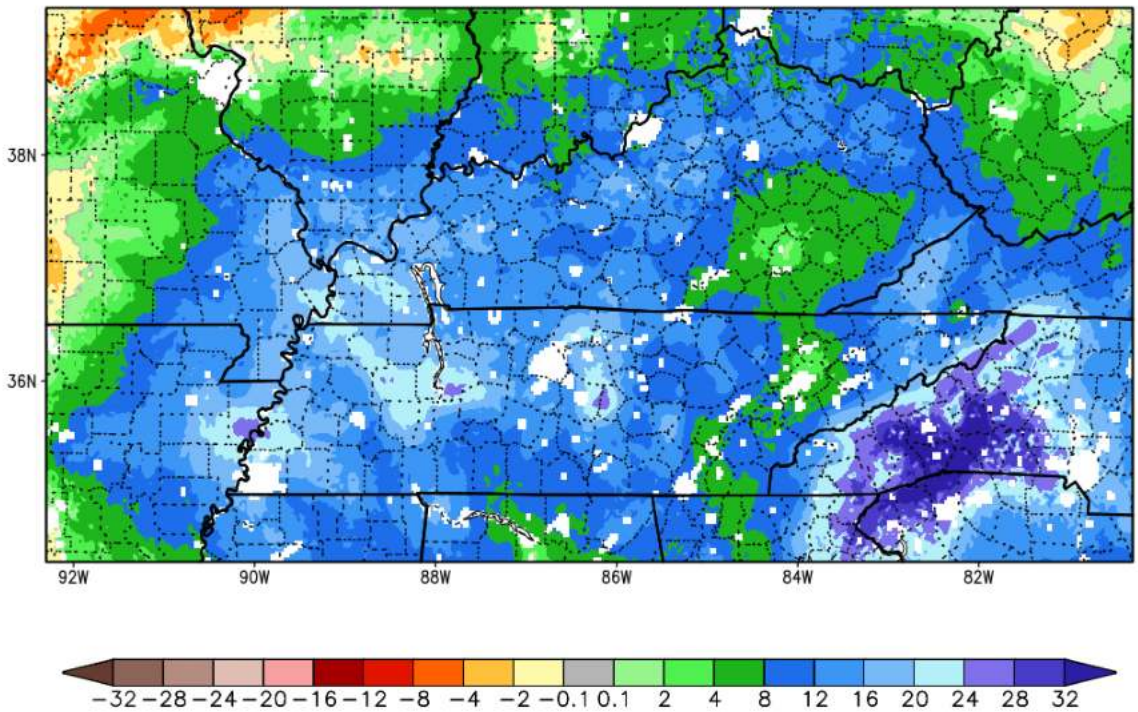
Soil moisture followed a similar pattern to drought conditions across the state, with soil moisture levels dropping in the first week of September followed by improvement in the western half of the state starting mid-month with rainfall from Francine, while the eastern half of the state continued to show lowering soil moisture levels until the last week of the month after the rainfall from Helene. By September 30, the NASA SPoRT Land Information System showed that virtually all of Tennessee had above normal levels of soil moisture for the top two meters of the ground. Looking at the 1-month change in soil moisture levels there were increases in soil moisture percentiles in the range of 2-4 percentile points in areas of East Tennessee and southern Middle Tennessee that saw the most drying out earlier in the month and least rain from Helene. But most areas of the state saw increases in soil moisture percentiles in the range of 8-20 percentile points, with a few areas seeing improvements up to 24-28 percentile points. For the week ending September 29, the USDA crop weather report rated topsoil moisture as 7% very short, 9% short, 51% adequate, and 33% surplus. Subsoil moisture was rated 9% very short, 15% short, 61% adequate, and 15% surplus.

SPoRT–LIS 0–200 cm Soil Moisture percentile valid 30 Sep 2024




**NOTE**
**Experimental**

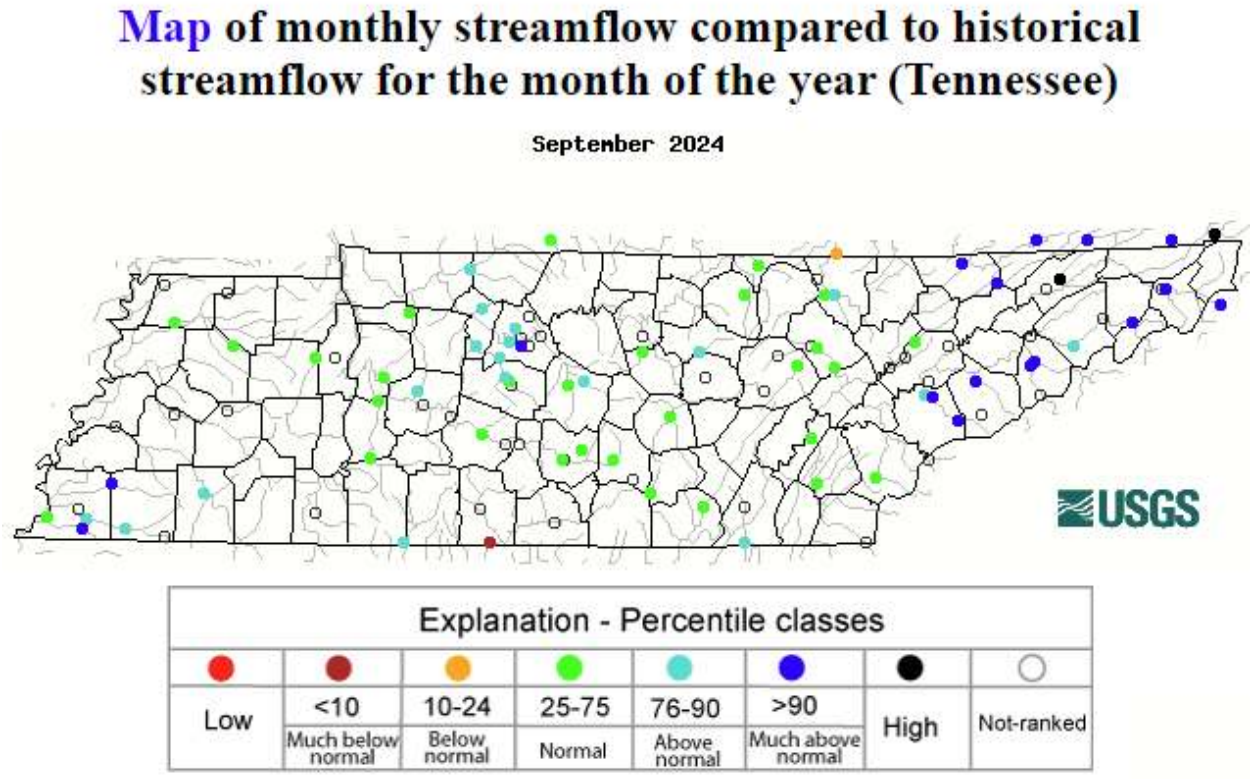
1–Month Difference in Column Relative Soil Moisture (%) valid 12z 30 Sep 2024




**NOTE**
**Experimental**

## Streamflow:

Streamflow's averaged out to be much above normal in northeast Tennessee, where record-setting stream flows occurred after Helene. Some stream gauges in northern Middle Tennessee that also saw very heavy rains from Helene averaged in the above normal category, with one in the much above normal category. A few stream gauges in southern West Tennessee also averaged in above to much-above normal streamflow categories based on rainfall from Francine and Helene. Otherwise, stream gauges that were in areas most affected by the drought for the first three weeks of September ended in the normal range with much below normal flow followed by much above normal flow after Helene.




## Miscellaneous:

**Crop Conditions from USDA:** September started with a continuation of hot and dry weather that was common throughout the summer of 2024. Livestock producers were hit the hardest, having to feed hay and haul water for their herds as most pastures across the state were in poor or very poor conditions at the end of the first week in September. Corn and soybean harvest started in September, with early yield estimates below average due to drought stress during the growing season. By the middle of the month, cotton and tobacco harvests also got underway. West Tennessee and parts of Middle Tennessee did get rains from the remnants of Hurricane Francine, which paused field work during the week. Hot and dry weather returned for the third week of the month with harvests continuing. Winter wheat planting started, but dry soils slowed progress a bit behind average. Heavy rains across most areas of the state returned in the last week of September with a frontal boundary followed by the remnants of Hurricane Helene. East and Middle Tennessee farms delt with flooding from all the rain, and producers across the state had to pause harvests due to soggy fields. Some producers along rivers, especially in northeast Tennessee, experienced significant crop losses from flooding in addition to potential long-term impacts from the depositing of silt and river debris, some of which may contain toxins that could make the land un-useable for a period of time. By the end of the month, 80% of tobacco had been cut, 70% of corn had been harvested, 42% of soybeans had been harvested, and 10% of cotton had been harvested.

| CROP PROGRESS | | | | | CONDITION | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Item | This Week | Last Week | 2023 | 5 Year Avg. | Item | Very Poor | Poor | Fair | Good | Excellent |
| | Percent | | | | | Percent | | | | |
| Corn – Dented | 100 | 99 | 99 | 100 | Corn | 11 | 15 | 32 | 30 | 12 |
| Corn – Mature | 96 | 92 | 95 | 94 | Cotton | 12 | 16 | 27 | 38 | 7 |
| Corn – Harvested | 70 | 58 | 55 | 56 | Soybeans | 9 | 17 | 32 | 32 | 10 |
| Cotton – Bolls Opening | 85 | 78 | 74 | 67 | Pasture | 19 | 29 | 32 | 19 | 1 |
| Cotton – Harvested | 10 | 3 | 4 | 5 | | | | | | |
| Soybeans – Dropping Leaves | 78 | 70 | 70 | 64 | | | | | | |
| Soybeans – Harvested | 42 | 32 | 26 | 19 | | | | | | |
| Tobacco – Cut | 80 | 72 | 81 | 86 | | | | | | |
| Winter Wheat – Planted | 10 | 4 | 8 | 10 | | | | | | |

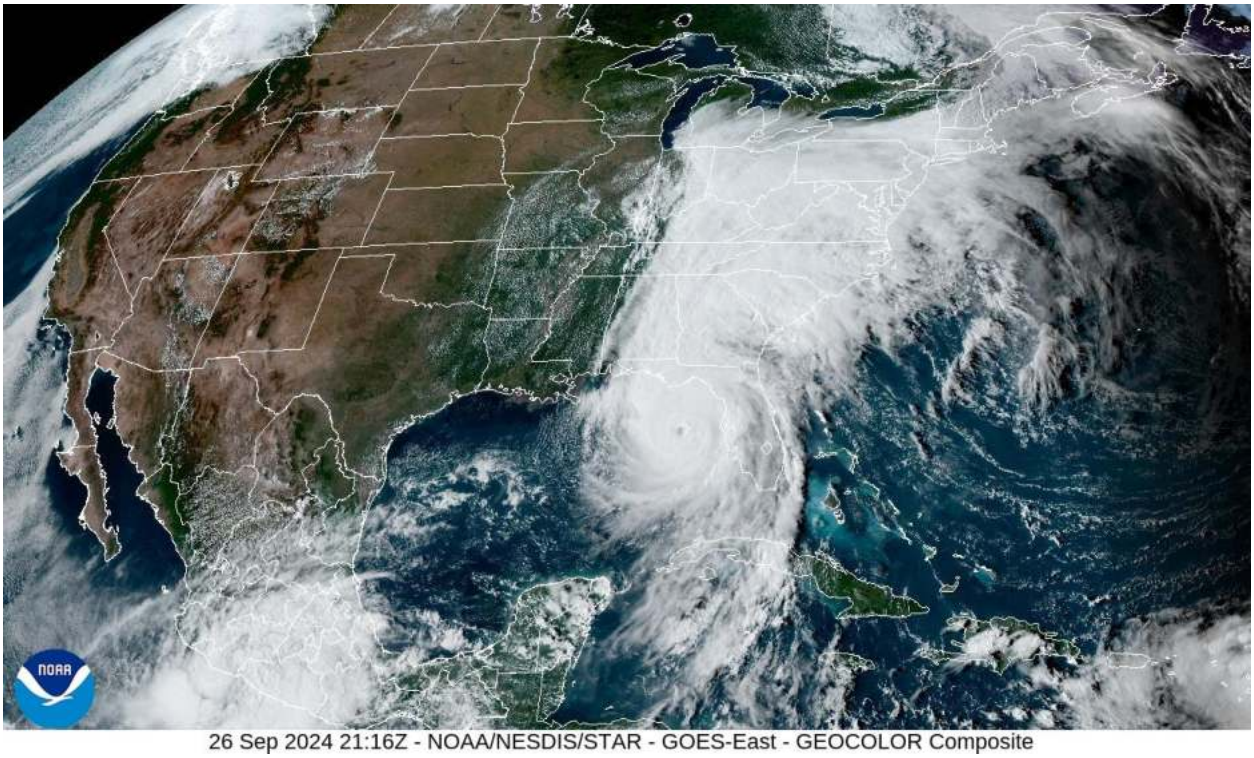
**Fire Danger**: The Interagency Fire Center significant wildland fire outlook for October shows that all of Tennessee and surrounding regions of neighboring states will have a normal chance for significant wildland fires. While recent rains have improved drought conditions as we head into the peak fire risk season in the fall (October-November), flood debris and downed trees/limbs from winds associated with Helene could provide more fuel if fires do start later this fall.


**Fall Foliage:** Drought stress earlier in August and September was a concern for the fall foliage season in Tennessee with some trees dropping leaves early due to hot and dry conditions. A cool spell early in September triggered some color in trees, but a return of summer-like heat in the third week of the month put a bit of a pause on any more color developing. The remnants of Hurricane Francine brought well-timed rain to some areas of West Tennessee earlier in September which may have alleviated some drought stress. Hurricane Helene brought widespread heavy rains and strong winds to East Tennessee and the Cumberland Plateau, which may have caused some trees to drop more leaves.

## Stories of the Month:

The impacts of flooding and high winds from Hurricane Helene were the biggest story of the month. Other stories of note included the expanding drought conditions during the first three weeks of the month, and the first recorded September tornado in East Tennessee on September 24.

**Hurricane Helene:** As Hurricane Helene formed in the Caribbean Sea/Gulf of Mexico the National Hurricane Center forecast showed it traveling northward through Florida, Georgia, western portions of the Carolinas, and into Tennessee. In the days prior to the storm moving through Tennessee, a cold front stalled in East Tennessee and produced several inches of rainfall across East Tennessee and Western North Carolina. As seen in the satellite imagery below from the afternoon of Thursday, September 26, the clouds from these two weather systems covered the entire eastern US, from Florida north to the Great Lakes and New England. The convergence of this frontal boundary from the west and rain bands from Helene from the east led to record-setting rains along the Appalachian Mountains from Tuesday-Friday (September 24-27) with totals above 15-inches in several areas of Western North Carolina, while totals in Tennessee were generally in the range of 5-9-inches due to the rain shadow effect of the Appalachian Mountains.

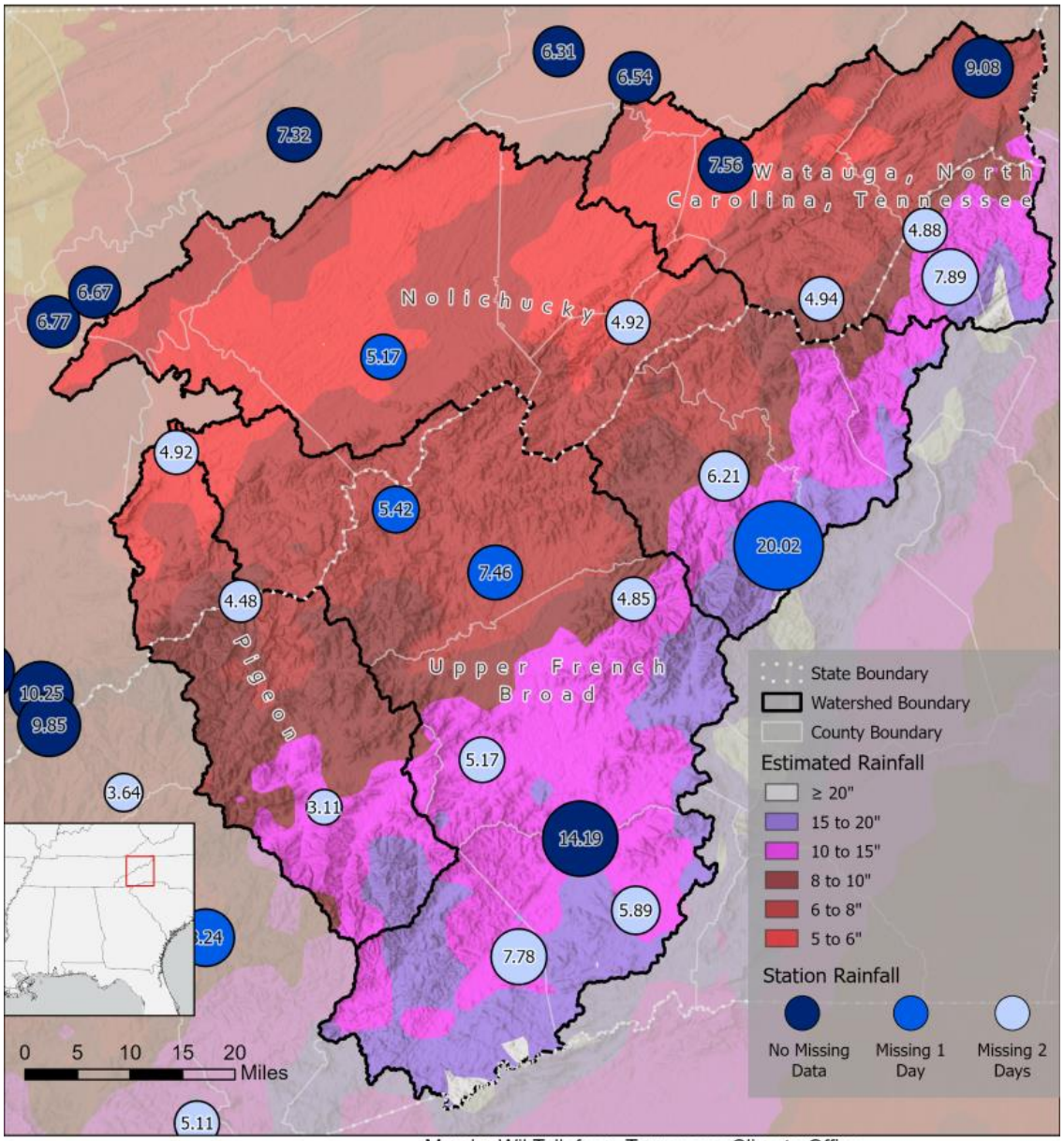



*Satellite imagery showing the clouds from Hurricane Helene and the stalled frontal boundary across the eastern U.S. on Thursday evening, Sep 26.*

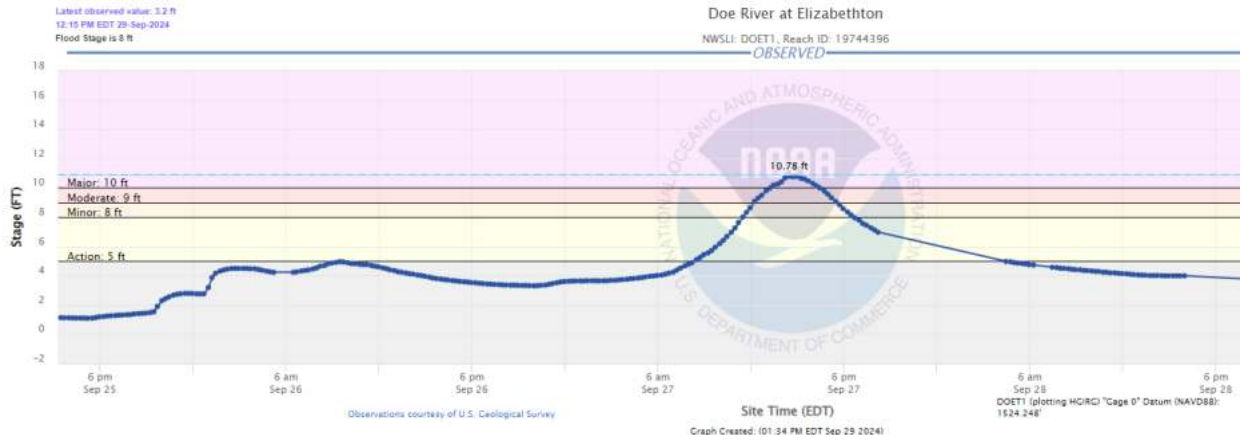
This extreme rainfall primarily impacted areas of Western North Carolina. However, several rivers in upper East Tennessee have their headwaters in this area and deadly and devastating flash flooding occurred as rain rapidly drained into and through these rivers. The most impacted watersheds in Tennessee (from North to South) were the Watauga/Doe Rivers, Nolichucky River, Upper French Broad River, and Pigeon River, all of which entered Major flood stage or set record stream heights. The Doe River at Elizabethton crested at 10.76-feet, just about 1.7-inches below the record flood stage set in 1998. Watauga Lake, behind the Watauga Dam set record water levels, about 3-feet above the previous record lake level. The Nolichucky River gauge at Embreeville reported a stage of 19.56-feet, just short of Major flood stage, at

11:30am before the gauge stopped reporting due to an equipment malfunction. This was several hours before peak water levels along the river occurred, with estimates of the river reaching a peak of 30-feet in that location. The French Broad River near Newport, reported a peak of 23.34-feet, just 8-inches short of the record flood height from March 1867. The Pigeon River at Newport peaked at 28.90-feet, well above the previous record flood stage of 23.4-feet set in February 1902.

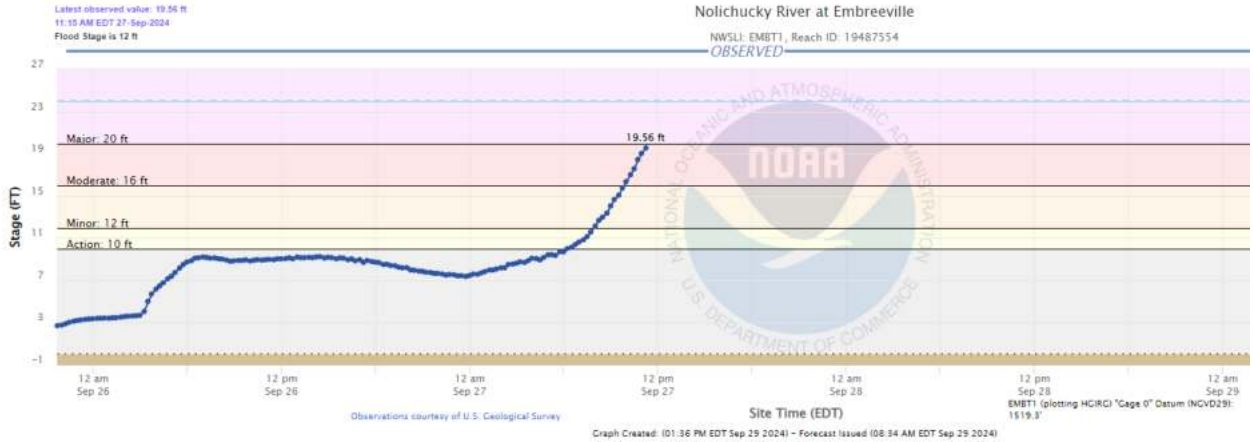
**Frontal + Helene, Storm Total Rainfall**
**Radar Estimated Rainfall (8am EDT Sep 24 - 8am EDT Sep 29)**
**Station Rainfall (7am EDT Sep24 - 7am EDT Sep 28)**



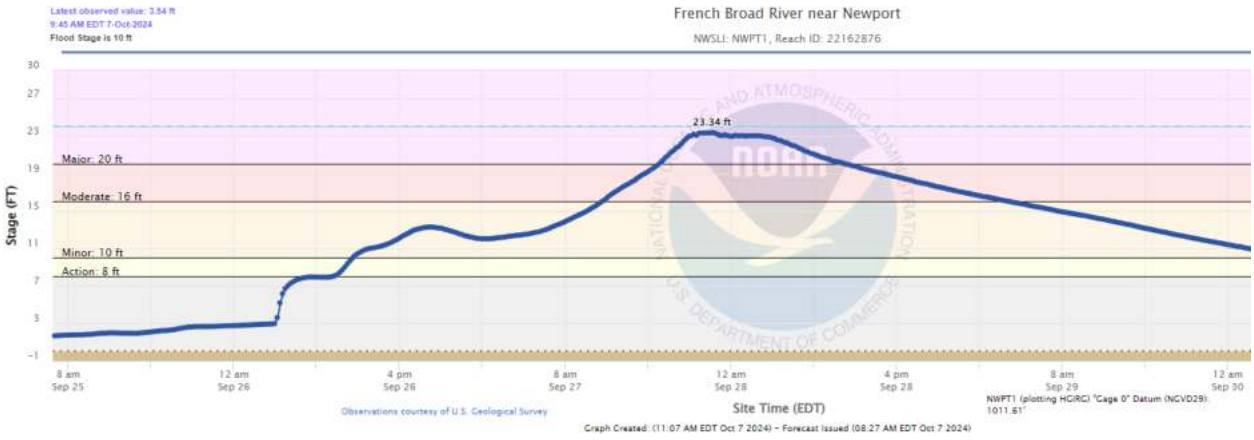

Map by Wil Tollefson, Tennessee Climate Office
Data from: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, Esri, NASA, NGA, USGS, National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Office of Dissemination (ODIS), and XM-ACIS



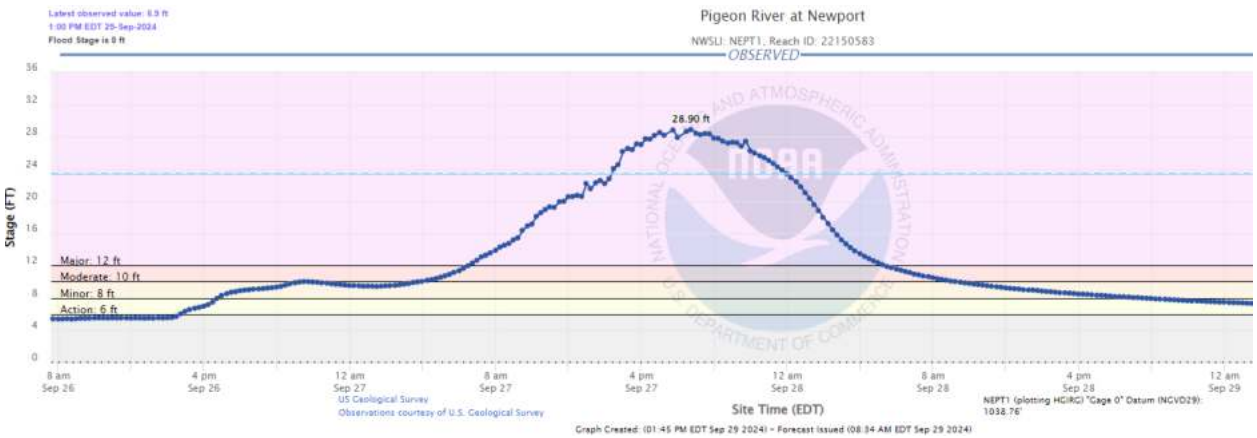

*Doe River at Elizabethton, with a peak flood stage just about 1.7-inches below the record flood stage of 10.92-feet, set in January 1998*




*The Nolichucky River at Embreeville recorded a peak stage of 19.56-feet before a malfunction caused the gauge to stop reporting data just below major flood stage, at 11:30am on Friday, September 27, several hours before the peak of the river flood.*

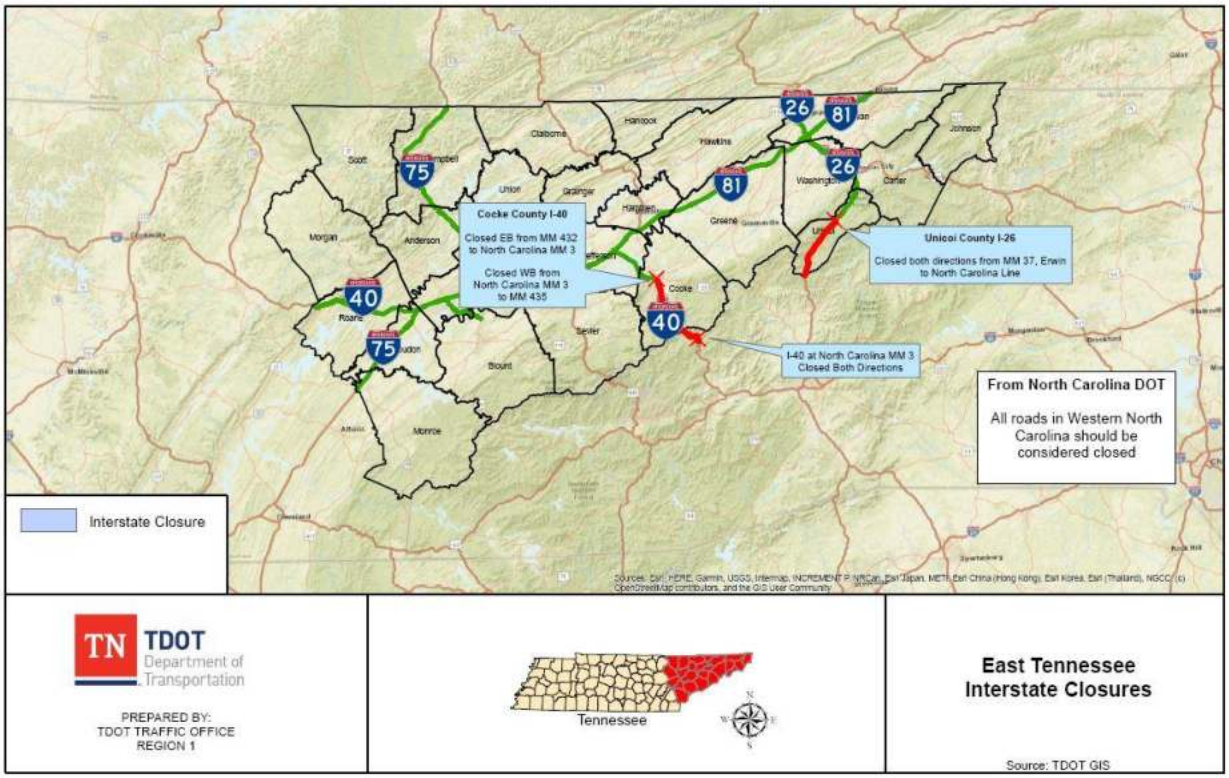



*French Broad River Near Newport reached a flood crest of 23.34ft, about 8-inches below the record flood stage set in March 1867*

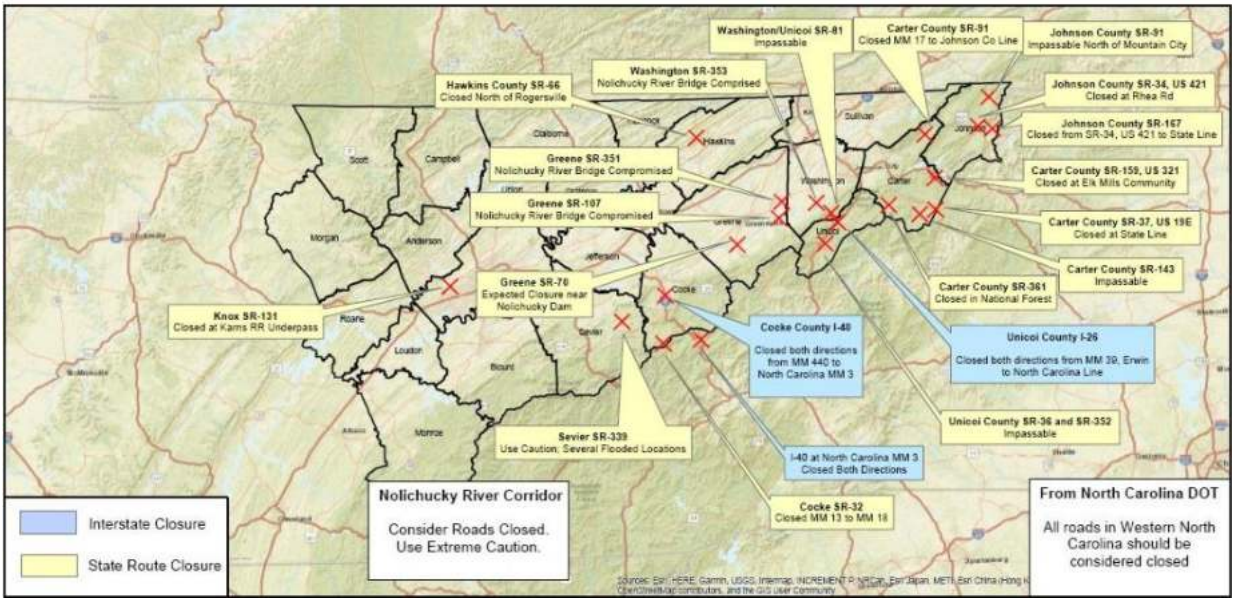



*Pigeon River at Newport reached a new peak flood stage of 28.9-feet, surpassing the previous record flood stage of 23.4-feet set in February 1902.*

Flooding on the Nolichucky washed out bridges on I-26 in Erwin, TN, and flooding on the Pigeon River eroded the road-bed causing portions of I-40 to collapse into the river. Both interstates are closed between Tennessee and North Carolina. In addition to the interstates, several other state and US highways were closed due to flooding and many bridges over the Nolichucky were washed away in Washington and Greene Counties.




*TDOT map showing I-40 and I-26 closed from Tennessee into North Carolina*




*TDOT Map of closed roads in the East Tennessee region from Saturday, Sep 28*

*Doe River flooding on Hwy 19E in Hampton, TN. Source: Facebook, Elizabethton/Carter County Priority News & Alerts*

*Debris near what was Taylors Bridge on State Route 81 in Washington County, TN*
*Source: Facebook*

*Remains of the Kinser Bridge on Hwy 107 over the Nolichucky River in Greene County.*
*Source: Facebook*

As it became clear that life-threatening flash flooding was occurring, the National Weather Service office in Morristown issued flash flood emergencies for Unicoi, Washington, Greene, and Cocke counites. In addition to flash flooding, it appeared that the Walters Dam on the Pigeon River (in North Carolina, 11 miles upstream from the TN-NC border) and the Nolichucky Dam in Greene County were at significant risk of failure. Luckily the dams did not fail, but devastating flooding still occurred downstream. Along the Nolichucky River, southern sections of Erwin, TN were flooded, as the river quickly rose out of its banks and swept away several bridges. Unicoi County Hospital was evacuating when rising waters cut off escape routes before the evacuation was finished. The water was moving so fast and filled with so much debris

that boats could not be used to safely ferry people to high ground, so over 50 people were moved to the roof of the hospital to await airlift rescue. This was also the area where the I-26 bridges were taken out by debris in the river, along with the Chestoa Pike bridge that served as the Nolichucky River crossing for the Appalachian Trail. Several other businesses, homes, and churches were destroyed by the flooding as waters rushed out of the Nolichucky Gorge into the broader Unicoi Valley.


*People waiting on the roof of Unicoi County Hospital, after the Nolichucky River inundated the building. Source: NewsNation*

*Area around the I-26 Jackson-Love Exit in Erwin, TN after the flood including the Unicoi County Hospital on the right side of the image. Source: Johnson City Aerial Photography*

The Nolichucky River then cuts through another mountain ridge into Washington County and out onto the broader Tennessee Valley flowing south into Greene County, where at the Nolichucky Dam the TVA reported that peak discharge occurred around 11pm on September 27, with around 1.3 million gallons of water flowing over the dam each second! That is about twice the average flow rate of Niagara Falls, which averages 700,000 gallons of water per second.

*Nolichucky Dam, Greene County, near the peak of the flood. Source: Facebook*

Reports that a dam had failed upstream in North Carolina on the Pigeon River led to an emergency evacuation notice for Newport, TN. That dam did survive, but flooding on the Pigeon River enveloped all of downtown Newport Friday afternoon and evening.

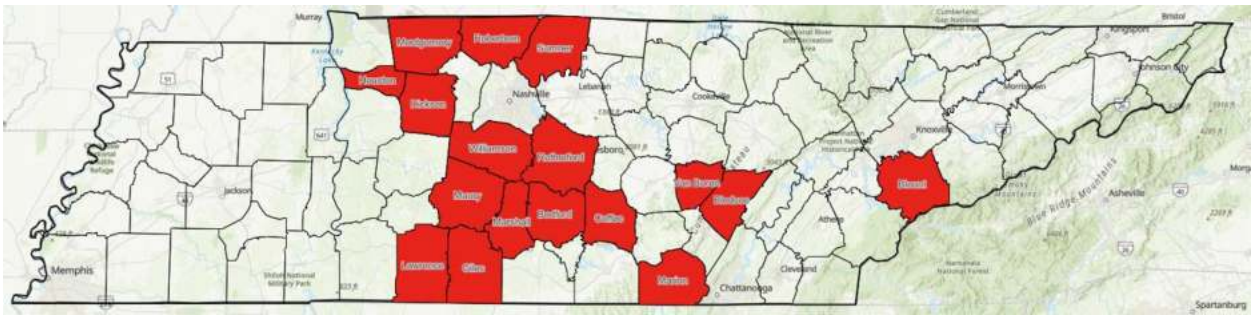
*Downtown Newport, TN flooded by the Pigeon River. Source: WBIR*

The French Broad, Pigeon, and Nolichucky rivers all empty into Douglas Lake, operated by the TVA, and the lake filled with water and debris from the floods. The TVA has deployed a 4,000-foot floating barrier in the lake to protect Douglas Dam intake from damage as they also set record levels of water flow through the dam, with minor flooding downstream.

Flooding along these rivers also led to the loss of drinking water supplies and wastewater treatment plants in several communities, with up to 5 counties issuing boil water advisories. In addition to flooding, large portions of the state also saw high winds that downed trees and powerlines, and at one point there were over 100,000 customers without power in the state. As of October 12, the Tennessee Emergency Management Agency was reporting 17 confirmed fatalities, with the Tennessee Bureau of Investigation coordinating on active leads for additional missing persons.

Heavy rainfall and high winds also impacted Middle and West Tennessee, with northern parts of Middle Tennessee reporting 4-6-inches of rainfall. Largely due to severe to extreme drought conditions in that region, there were no notable reports of flooding, although Nashville did break a rainfall record for September 27, with a total of 4.45”. Nashville also recorded their 9$^{th}$ lowest pressure ever with a barometric pressure reading of 988.4-millibars on September 27, as the center of Helene passed nearby. All airport locations in East and Middle Tennessee recorded barometric pressures below 990-millibars (a very strong low pressure reading), with Knoxville reporting the lowest atmospheric pressure in the state at 980.9-milibars, less than 3-millibars from their all-time record lowest pressure and the average central pressure of a strong Category 1 hurricane.

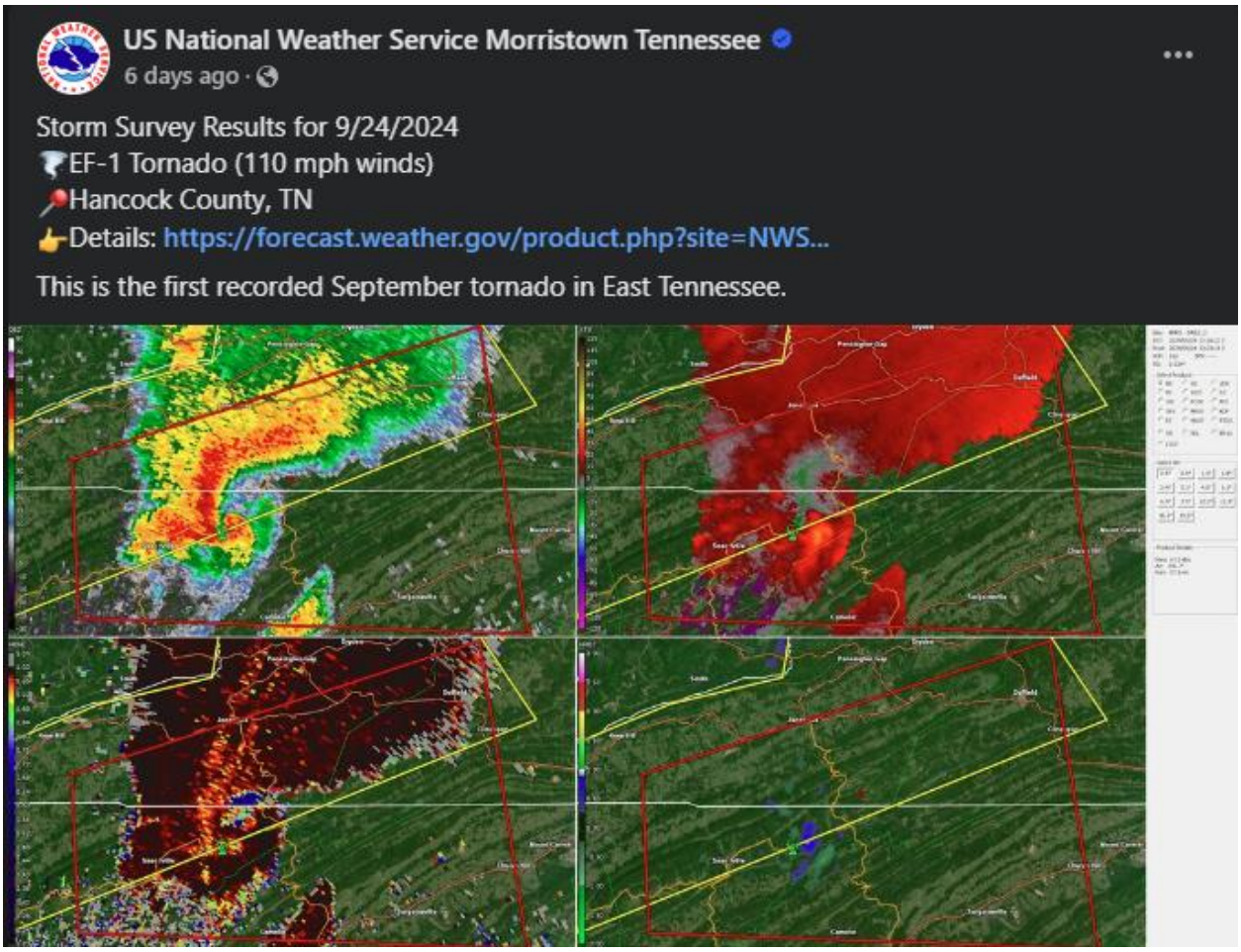
**Drought**: Prior to rainfall in the last week of the month, drought conditions had expanded and worsened across the state with low stream levels, and water use restrictions in place from utilities in several counties across Middle and East Tennessee. The main impacts of the drought were confined to agricultural concerns, with cattle producers among the hardest hit in Tennessee.




*Counties with at least one water utility issuing voluntary or mandatory water use restrictions due to drought conditions.*

*Photos submitted to CMOR (Condition Monitoring Observer Reports) showing dried up cattle ponds and streams in Marshall, Warren, Bedford, and Cocke counties.*

**East Tennessee Tornado**: As the frontal system that set up heavy rains before Helene first moved into eastern Tennessee it was accompanied by severe storms, which included one storm that produced an EF-1 tornado with a 6-mile path in Hancock County. This was the first tornado ever recorded in the month of September in East Tennessee.

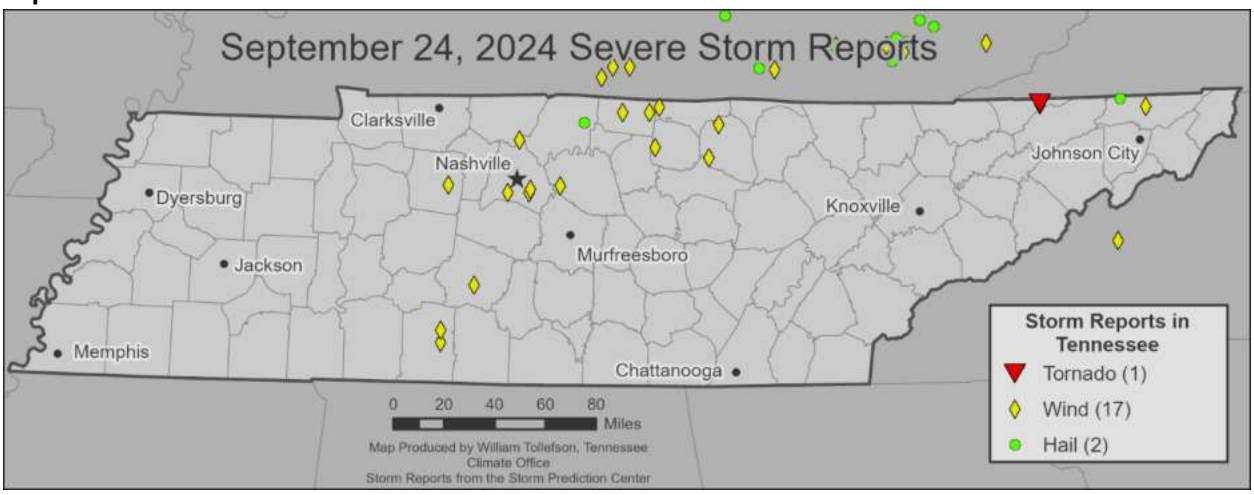

US National Weather Service Morristown Tennessee
6 days ago ·
Storm Survey Results for 9/24/2024
EF-1 Tornado (110 mph winds)
Hancock County, TN
Details: https://forecast.weather.gov/product.php?site=NWS...
This is the first recorded September tornado in East Tennessee.

## Storm Reports:

**Storm Reports are based on filtered NOAA Storm Prediction Center data or local NWS storm reports. Future quality control checks may change the official record of severe events, please see spc.noaa.gov for any updates.*

During the month of September 2024 there was 1 day with severe thunderstorm reports, with 1 tornado report, 17 reports of severe winds/severe wind damage, and 2 reports of severe hail (1" or larger).

**September 24**




Tornado:

| Time (UTC) | Strength | Location | County | Lat | Lon | Comments |
|---|---|---|---|---|---|---|
| 22:23 | EF1 | 2 WSW Kyles Ford | Hancock | 36.56 | -83.08 | A storm survey confirmed an EF1 tornado that tracked for 6 miles along Alder Road and the Clinch River between Sneedville and Kyles Ford. Damage was mainly in the form (MRX) |

Wind:

| Time (UTC) | Speed (mph) | Location | County | Lat | Lon | Comments |
|---|---|---|---|---|---|---|
| 18:47 | -- | Ridgetop | Robertson | 36.39 | -86.77 | A few powerlines down. Time estimated from radar. Intersection of Highland Road and OBrian Road in Ridgetop. (OHX) |
| 18:53 | -- | 4 WNW White Bluff | Dickson | 36.13 | -87.27 | Delayed report on social media. Trees down on powerlines. (OHX) |
| 19:42 | -- | 1 S Belle Meade | Davidson | 36.09 | -86.85 | Multiple reports of trees down in the Belle Meade area. (OHX) |
| 19:55 | -- | 5 NE Red Boiling Spring | Clay | 36.58 | -85.78 | Delayed social media report. Tree down. (OHX) |
| 19:57 | -- | 2 NW Antioch | Davidson | 36.09 | -86.7 | A couple trees down on Harding Place near I-24. (OHX) |

| Time (UTC) | Speed (mph) | Location | County | Lat | Lon | Comments |
|---|---|---|---|---|---|---|
| 20:00 | -- | 2 NNW Lafayette | Macon | 36.55 | -86.04 | Trees down in the Lafayette area. (OHX) |
| 20:03 | 69 | 4 NNW Antioch | Davidson | 36.11 | -86.69 | Measured wind gust of 69 mph at BNA. (OHX) |
| 20:10 | -- | 2 SE Lawrenceburg | Lawrence | 35.23 | -87.31 | A tree was blown down on Fall River Road. (OHX) |
| 20:10 | -- | 5 SSW Columbia | Maury | 35.56 | -87.08 | A power pole leaning. (OHX) |
| 20:13 | -- | 2 NE Rural Hill | Wilson | 36.13 | -86.48 | Tree down over Logue Rd. (OHX) |
| 20:15 | -- | 1 N Red Boiling Spring | Macon | 36.55 | -85.85 | Trees down in the Red Boiling Springs area. (OHX) |
| 21:10 | -- | 9 W Gainesboro | Jackson | 36.35 | -85.81 | A few trees down in the Gladdice area. (OHX) |
| 21:24 | -- | 1 S Ethridge | Lawrence | 35.3 | -87.31 | *** 3 INJ *** Downed power lines... a few structures with roofs off... downed trees... and a tent collapsed. 3 injuries due to the tent collapse. (OHX) |
| 21:50 | -- | 7 N Algood | Overton | 36.29 | -85.43 | Delayed report. Tree down. (OHX) |
| 21:55 | -- | 6 NNW Livingston | Overton | 36.48 | -85.36 | Tree down. (OHX) |
| 22:23 | -- | 2 WSW Kyles Ford | Hancock | 36.56 | -83.08 | EM officials relay reports of wind damage... power outages... and trees down in the Kyles Ford vicinity. This was near a potential radar TDS at 6:23pm ET. (MRX) |
| 0:05 | -- | Blountville | Sullivan | 36.53 | -82.33 | 911 call center report of 4 trees down in Blountville area. (MRX) |

Hail:

| Time (UTC) | Size (in) | Location | County | Lat | Lon | Comments |
|---|---|---|---|---|---|---|
| 19:40 | 1.00 | Bethpage | Sumner | 36.49 | -86.31 | Delayed report. (OHX) |
| 23:42 | 1.00 | Bloomingdale | Sullivan | 36.58 | -82.51 | Public report of 1 inch diameter hail in Bloomindale. Time estimated by radar. (MRX) |

## CPC Outlooks for the Next Month:

The NOAA Climate Prediction Center outlooks for October show that all of Tennessee will have equal chances for normal, warmer than normal, or cooler than normal temperatures. East Tennessee and southeastern Middle Tennessee are shown with equal chances for precipitation, but the rest of the state is leaning towards below normal precipitation, with slightly higher confidence in far northwest Tennessee. Shorter-term outlooks show high probabilities for a warm and dry pattern across Tennessee for the rest of October and into early November.