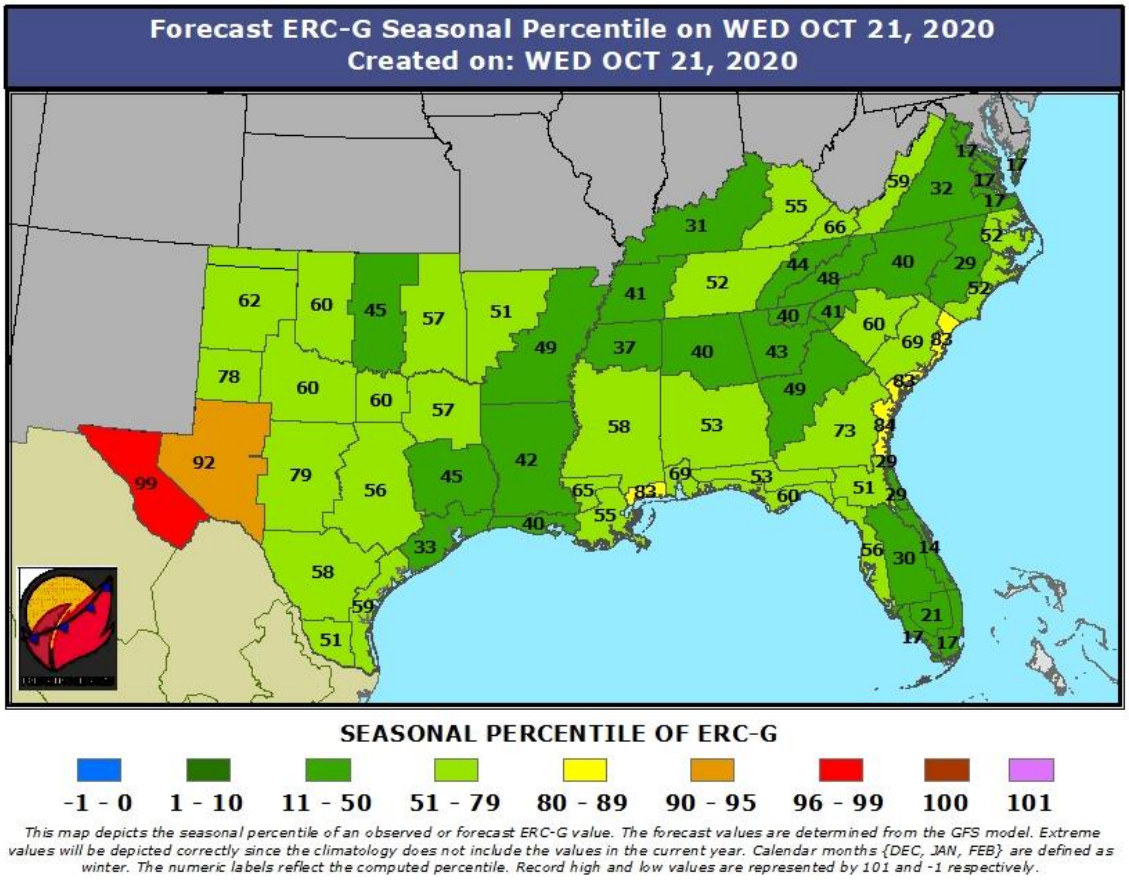
Southern Area Wildfire Risk Assessment

Fall 2020



Southern Area Coordination Center
Decision Support Group

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Executive Summary

Overall, drought conditions have moderated due to significant moisture from hurricanes and tropical storm passage across the Southern Area Geographic Area over the past two years. Significant rainfall impacts coupled with cooler than normal temperatures during the past three months have resulted in a transition back to a moderated fire season across large expanses of the Geographic Area. The assessment period for this risk analysis extends from late mid-October through December. The analysis included a look at the current weather situation and extended forecast, fuels compared to normal for the time of year, National Fire Danger Rating System's energy release component for each Southern Area Predictive Service Area, and fire occurrence. Recommendations are provided based on the findings and conclusions of the analysis.

Most of the region in the analysis area is entering their normal fire season. This combined with typical environmental factors, however, are persisting and building drought conditions that are expected to broaden over the upcoming months.

In response to the drought and its impact on the fire risk potential within the Southern Region, a fire risk analysis was conducted to determine:

- What is the probability of an above average fall fire season and what are the anticipated impacts?
- Where are the critical locations in the Southern Area?
- What are the key fire environment indicators and thresholds which demonstrate above normal fire potential?
- What are the season ending or season altering event probabilities?
- What are the possible impacts long term drought could have leading into the spring fire season (e.g., 1000hr, duff/organic matter outlooks)?

The primary components of weather, fuels, fire behavior, and fire occurrence were analyzed to assess the fire risk potential within the Southern Area.

Based on current fuel conditions and forecasted weather conditions, the most likely scenario is an average level of wildfire activity for the next month and beyond in most of the region. Certain areas of West Texas and coastal areas of Louisiana and Mississippi may experience elevated fire potential. This level of activity may cause an increased demand for firefighting resources being mobilized within states. There is an average probability that the Southern Area will see higher than normal mobilization across state boundaries and from outside the Geographic Area, for this time of the year. Although not assessed in entirety in this analysis, analysts have noted the potential for a transitioning to La Nina year and if this transition comes to fruition, fire danger conditions could worsen into the start of next year.

Analysis Findings and Recommendations

Analysis Findings

The analysis findings indicate the following probabilities for the fall fire season for the analysis area:

Scenario Description for the 2020 Fall Fire Season (October through December)	Probability
Most Likely Case Most of the Southern region has a normal Fall fire season with some small areas experiencing above average fire activity due to rainfall deficits. Current drought effected parts of west Texas, Oklahoma, and Arkansas will continue to be dry due to the La Nina weather pattern. Mobilization of aviation and ground resources to these locations within the geographic area is required due to increased fire behavior and spread potential. With some small-scale mobilization of out of region resources. However, few Type 3 incidents occur at the same time in the region.	70
Best Case Tropical systems continue and normal rainfall pattern develops. This brings frequent rainfall events and enough moisture to mitigate rainfall deficits and compact leaves after leaf drop. The normal fall time wildfire occurrence develops and very light to no initial attack is experienced.	15
Worst case The fall fire season extends deeper into fall than normal due to the light drought conditions and changing weather patterns. A normal amount of initial attack activity is experienced for this time of the year; however, new ignitions would cause severe fire behavior and spread potential due to prolonged drought and minimal rainfall frequency (i.e., fires would get bigger faster). Some additional aviation and ground resources are required due to fire behavior. Several Type III incidents occur at the same time in the geographic area. However, no large-scale mobilization of out of region resources are required due to some mitigating weather pattern (high humidity or periodic rainfall). The expected transition to La Nina is experienced and overall drought and associated fire danger conditions escalate over the next year.	15

Table 1. Analysis findings for the Southern Area 2020 Fall Fire Season with Probability Rating

- The majority of the geographic area should observe normal wildfire fire severity and condition through the fall. Fire managers should continually assess local drought conditions, and in those areas of where drought continues to build, consider resultant fire behavior, which can be more intense under moderate fire weather. As fire danger indices exceed the 97th percentile, extreme fire behavior and rapid fire spread characteristics should be expected. Tactics should be altered to provide for firefighter and public safety.
- Normal La Nino impacts have been moderated with several waves of tropical moisture events across the geographic area, however:
    - Expanded and intensifying drought during the winter months ahead, especially across the southern and central Plains and eastern Gulf Coast.
    - Greater chance for warmer-than-normal temperatures when you look at the winter months combined (this doesn't mean portions of the South won't see cold temperatures at all though).
    - The greatest chances for drier-than-average conditions are predicted in the Southwest, across Texas, along the Gulf Coast, and in Florida.
- Though the fall season isn’t projected to be anything more than normal, do not expect any fire to be routine. Be prepared to utilize indirect tactics with extended mop-up. Utilize aerial supervision to help direct crews and keep them informed on fire behavior. Ensure that LCES is in place before engaging on any fire. Remember to STOP, THINK, and TALK before you ACT… and actively look for ways to minimize risk to firefighters in what is forecast to be a period of very high fire danger.
- Maintain capabilities to mobilize Type I, II, and III teams.
- Augmentation of initial attack resources will likely be achieved through local partner to partner sharing, as normal.
- Ensure firefighter pocket cards are up to date and posted on the national website. http://fam.nwcg.gov/fam-web/pocketcards/
- Maintain national standardized predictive services products in a timely fashion. Produce new products as requested.

Introduction and Background

Drought conditions over portions of the Southern Area Geographic Area present a concern for the potential impact it could hold for a fall fire season. The National Drought Monitor (Fig. 1) shows the size and severity of the drought. The different levels of drought are classified by percentiles, with exceptional rating in the top 2-3% of the historical record. It takes a long period of dry weather to reach the exceptional level. A few of the thirteen states that makeup the Geographic Area are experiencing some variation of drought conditions. Portions of West Texas, Oklahoma, and NW Arkansas are currently experienced extreme drought. And parts of Texas in exceptional drought. Small pockets of Kentucky, Louisiana, Mississippi, Alabama, and Georgia are abnormally dry.

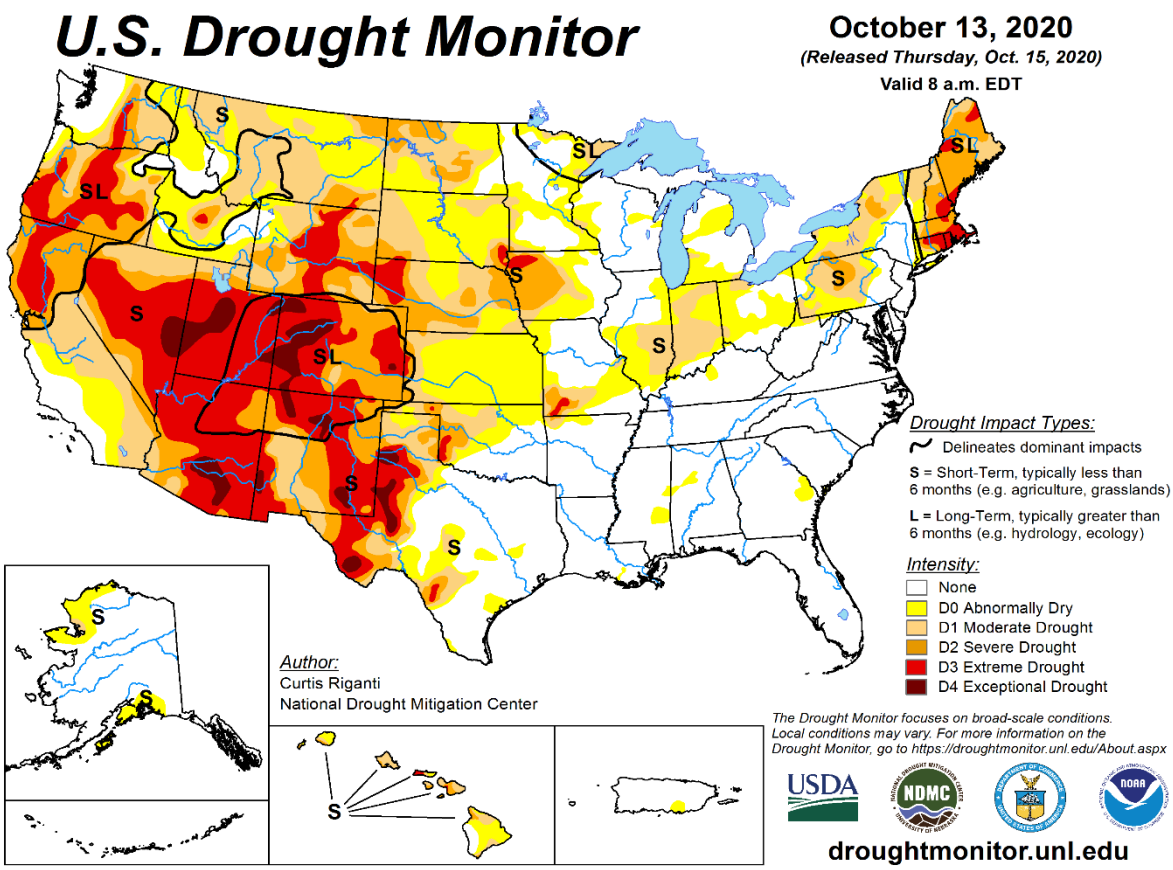


Figure 1. Map 1- The National Drought Monitor displays the size and severity of drought conditions across the United States. Source: National Drought Monitor website

(Figure 2 below) This series of maps shows that drought conditions have been deteriorating in parts of Texas, Oklahoma, Arkansas for 12 months with areas of extreme and exceptional drought. But, most of the southern area has seen improving conditions over the past year. In October of 2019 portions of central Texas, Georgia, Alabama, Tennessee, and Kentucky were experiencing extreme drought. The legend shows direction of change over time and is displayed as deteriorating (increasing drought) or improving (decreasing drought).

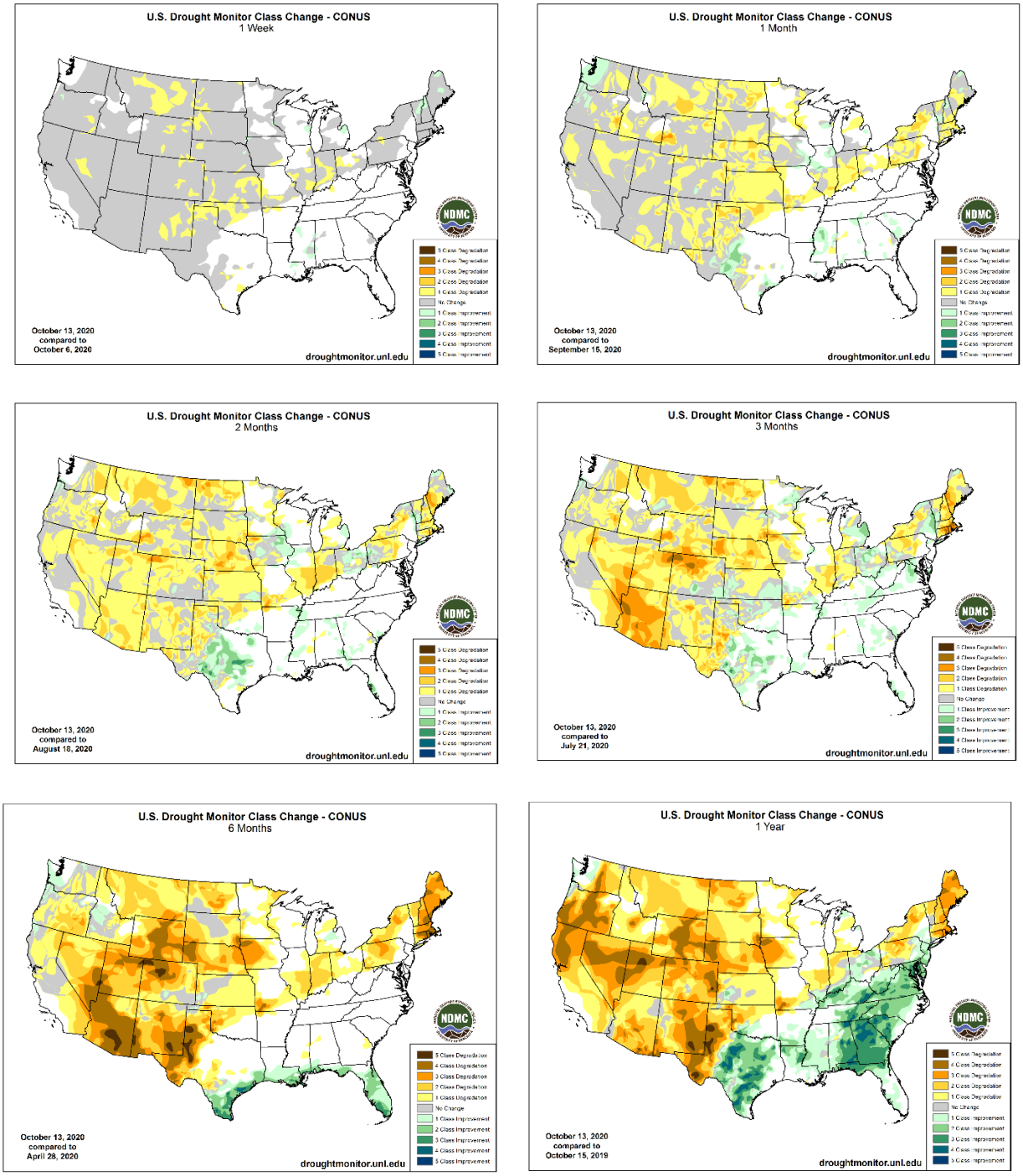


Figure 2. Maps 2 through 7- US Drought Monitor Change Maps

Recent tropical systems that moved across the geographic area from southwest to northeast have brought considerable relief while decreasing the overall drought. Of chief importance to fire managers is the impact drought can have on the vegetation and down woody material, collectively called fuels. Drought places stress on vegetation through reduced moisture availability. The result is a corresponding reduction in the moisture content of the foliage, as well

as reduced moisture content in both the duff layers and down material on the forest floor. There is an inverse relationship between fuel moisture content and the availability of a fuel to ignite and burn. As fuel moisture content decreases, fuel availability for ignition and burning increases. Currently With the drought, this process has taken place over an extended period of time, resulting in an increased amount of available fuels for combustion in a wildland fire. Along with increased fuel availability comes the potential for increased fire intensities and difficulties of control. With the La Nina in place, those portions of western Texas and Oklahoma observing extreme and exceptional drought, will continue to trend worse. Those smaller isolated pockets of abnormally dry conditions in Kentucky, Louisiana, Mississippi, Alabama, and Georgia will also increase in size and experience further developing drought over the coming months.

Risk Analysis

Weather

ENSO Situation

The El Niño Southern Oscillation (ENSO) has been neutral for much of the past year. In mid-April, a cooling trend began, and in August, a La Niña was declared. Most forecasters focus on Niño 3.4 (see figure 3) as it tends to be the best general indicator of the ENSO. However, all areas of the equatorial Pacific are showing negative SST anomalies. Niño 3.4 is still showing a steady decline in SST.

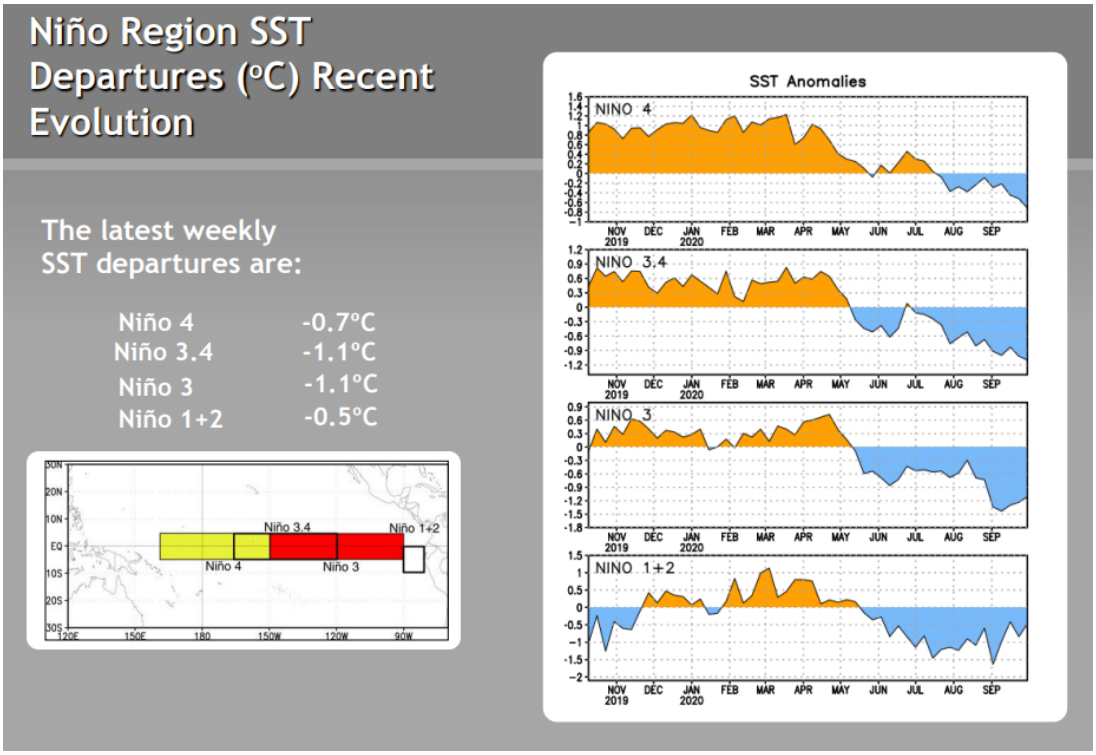


Figure 3. Location of Niño zones and recent evolution of SSTs. The y-axis on the set of graphs to the right represent the departure from normal SST in ºC. Valid October 8th, 2020.

A La Niña pattern means that storms track further north across the continental US (see Figure 4). The Pacific Northwest should be cool and wet, and the New England region is also cool and wet. However, because the storms are tracking near or just south of the Great Lakes, the Southeast is generally drier and warmer, and the moisture associated with the storms does not penetrate far enough south to provide the Southeast with more than just spotty or scattered precipitation.

Kentucky and Virginia sit on the cusp between receiving the southern extent of the storms that are tracking across the Great Lakes and then turning northward into New England. This allows for some moisture to work its way into northern portions of Kentucky and Virginia with the better coverage further north in Ohio, Pennsylvania, and Michigan. The northern most portions of Kentucky and Virginia are situated such that they could see regular precipitation, while areas south of I-64 see significantly less than normal precipitation. As you move further south into North Carolina, Tennessee, Georgia, northern Alabama, and the western reaches of South Carolina, winter precipitation is distinctly less than climatological averages.

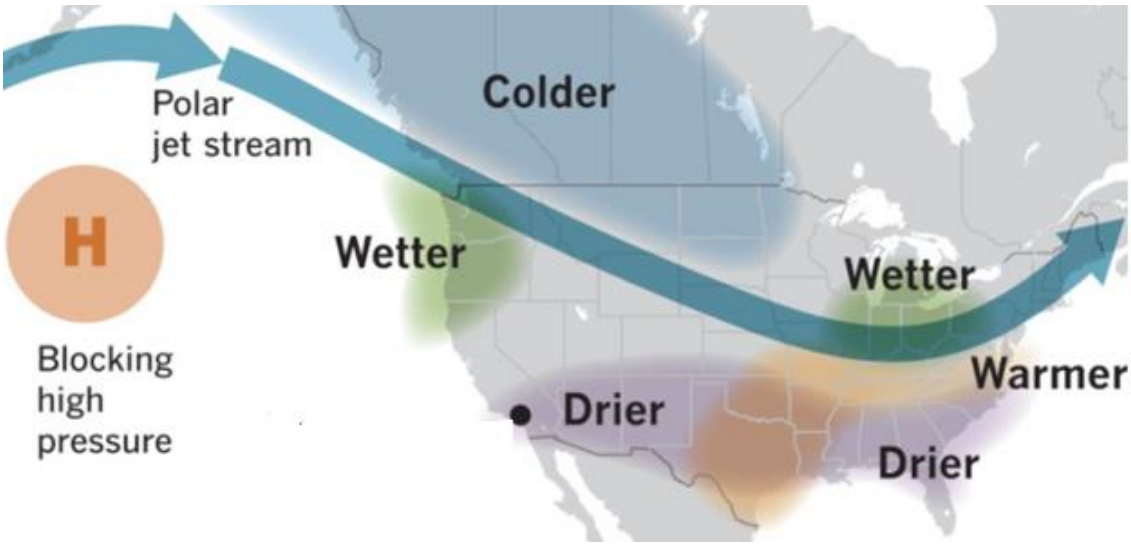


Figure 4. Map 8- Typical winter La Niña weather pattern.

The latest forecasts from several models suggest the likelihood of a moderate or even strong La Niña (Niño-3.4 index values < -1.0ºC) during the November-January time frame. The forecaster consensus supports that view in light of significant atmosphere-ocean coupling already in place. La Niña is likely to continue through the winter 2020-21 (~85% chance) and into spring 2021 (~60% chance during February-April).

PRECIPITATION FREQUENCIES

The fall fire season in general is highly dependent upon the precipitation frequency. The frequency is more important than the amount that actually falls. If you have a rain/snow frequency of zero to three days, there will be no fire season. If the frequency runs from three to seven days, there is generally some initial attack activity in days five through seven, but the fires are generally small and can be managed with local resources. Even if precipitation amounts are less than average, they will still prevent a fall fire season if they are spaced less than about three to five days apart.

Rainfall frequencies beyond seven days can easily become problematic, especially if resources and personnel are in short supply or are unavailable for other reasons. Rainfall frequencies of 7-14 days can lead to small incidents (Type III) of short duration that can place a strain on local resources. Frequencies of 14-21 days can lead to slightly larger incidents with multiple fires occurring simultaneously.

Finally, rainfall frequencies beyond 21 days will often include a team deployment, perhaps even a Type I team. These frequencies must be considered throughout the leaf-drop period. Most of the fires in the southern US are human caused, with debris burning being the leading cause where burn bans are not in effect. Lightning starts, while they do occur, are rare in the fall. Law enforcement efforts can be effective during and after the leaf-drop season in preventing fire occurrence.

PRECIPITATION AND TEMPERATURE OUTLOOK

The 6-10 day precipitation probability maps from the Climate Prediction Center indicate that all areas in the Southern Area will be above normal except normal for far SW TX. Temperature probabilities are below normal for the more western areas, with above normal south of a line from New Orleans to the western most MD/PA border.

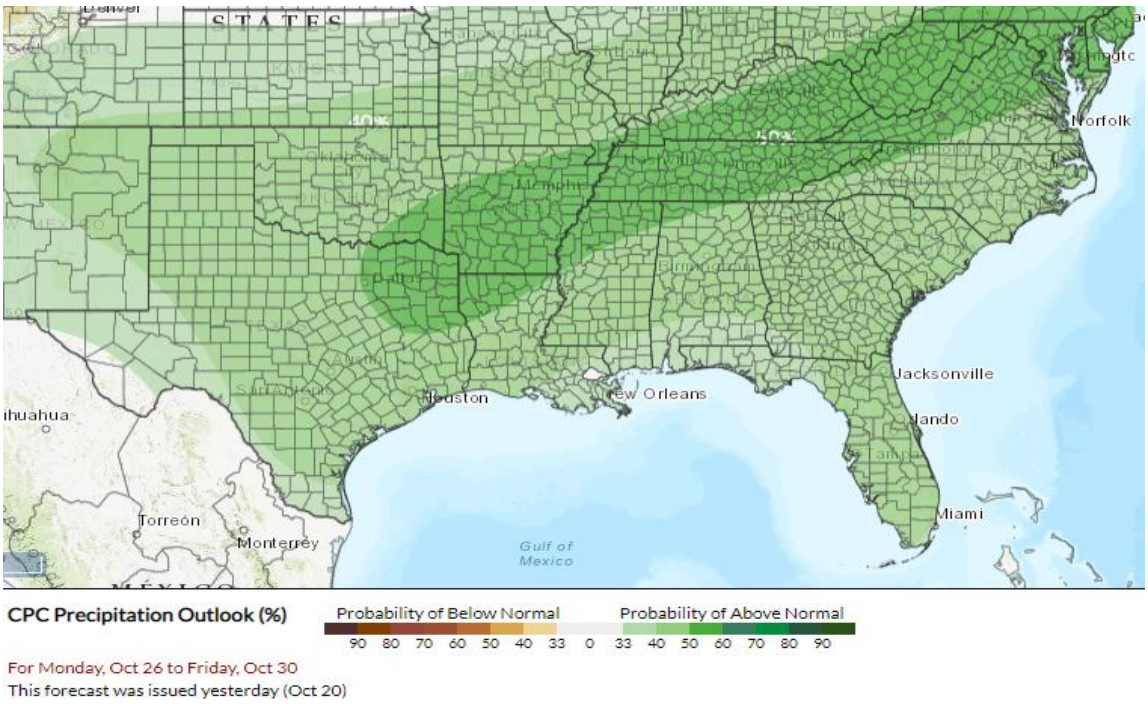


Figure 5. Map 9- Six to ten day outlook precipitation probability.

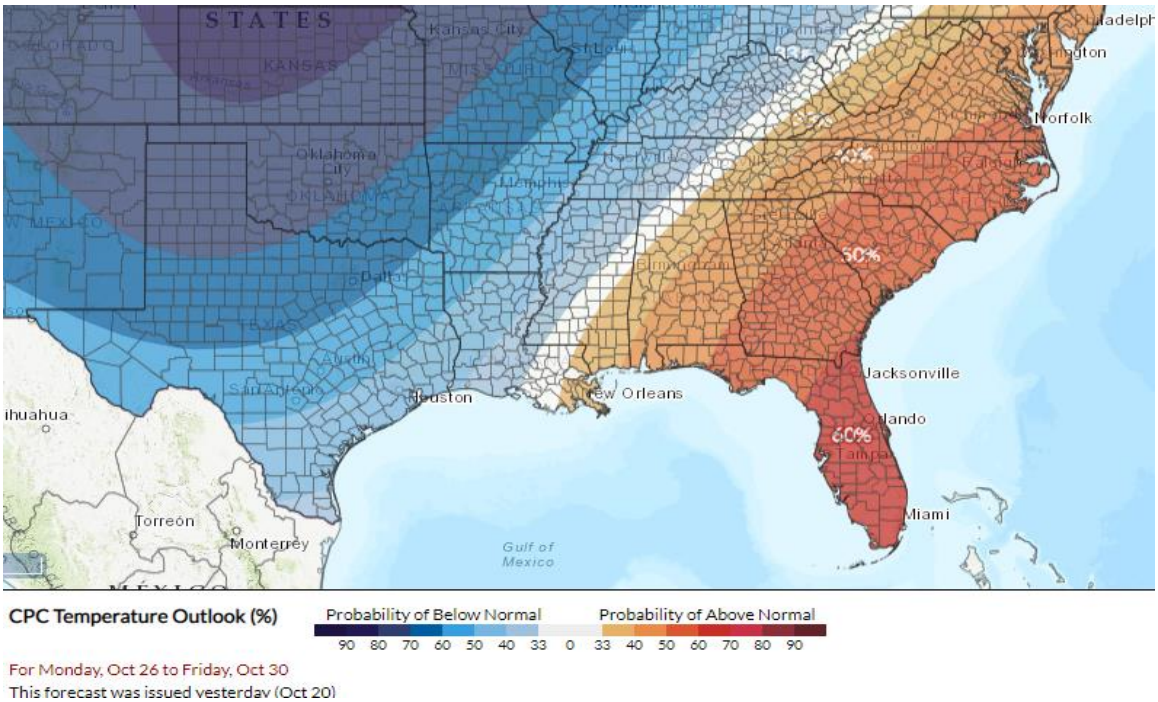


Figure 6. Map 10- Six to ten day outlook temperature probability

The 8-14 day outlook for precipitation shows below normal for most of the SA, with normal to above normal along the Atlantic coast. Temperatures will remain below normal for all of the area except SW GA and all of FL where they are likely to be above normal.

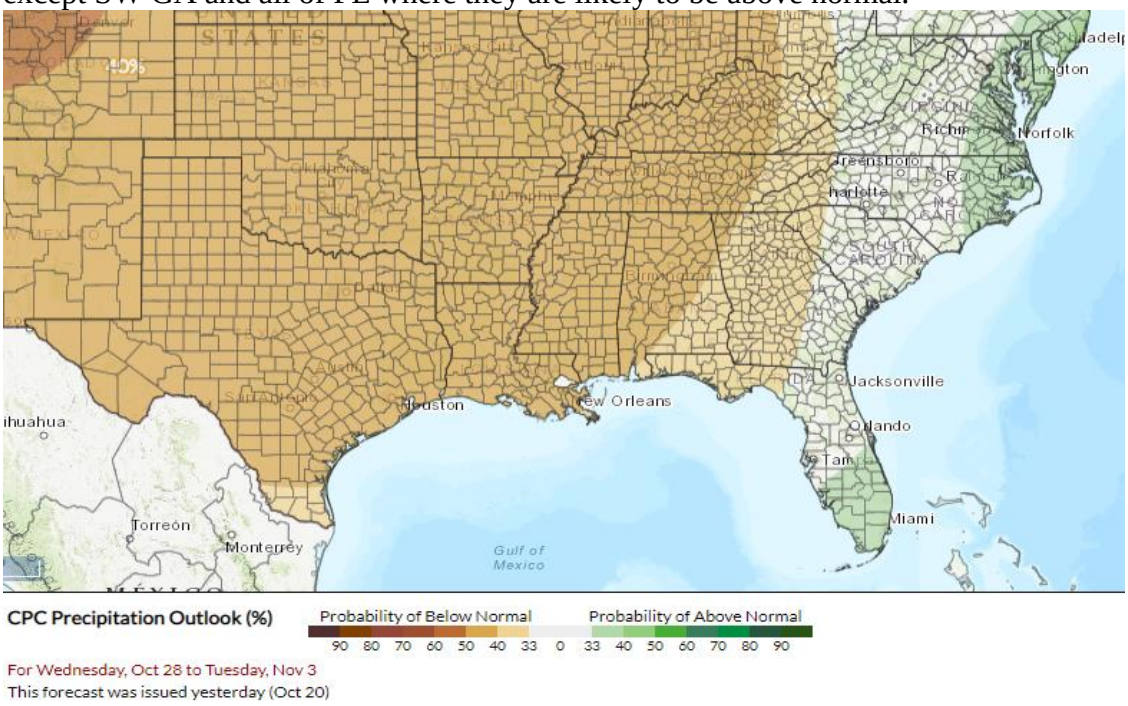


Figure 7. Map 11 - Eight to 14 day outlook precipitation probability

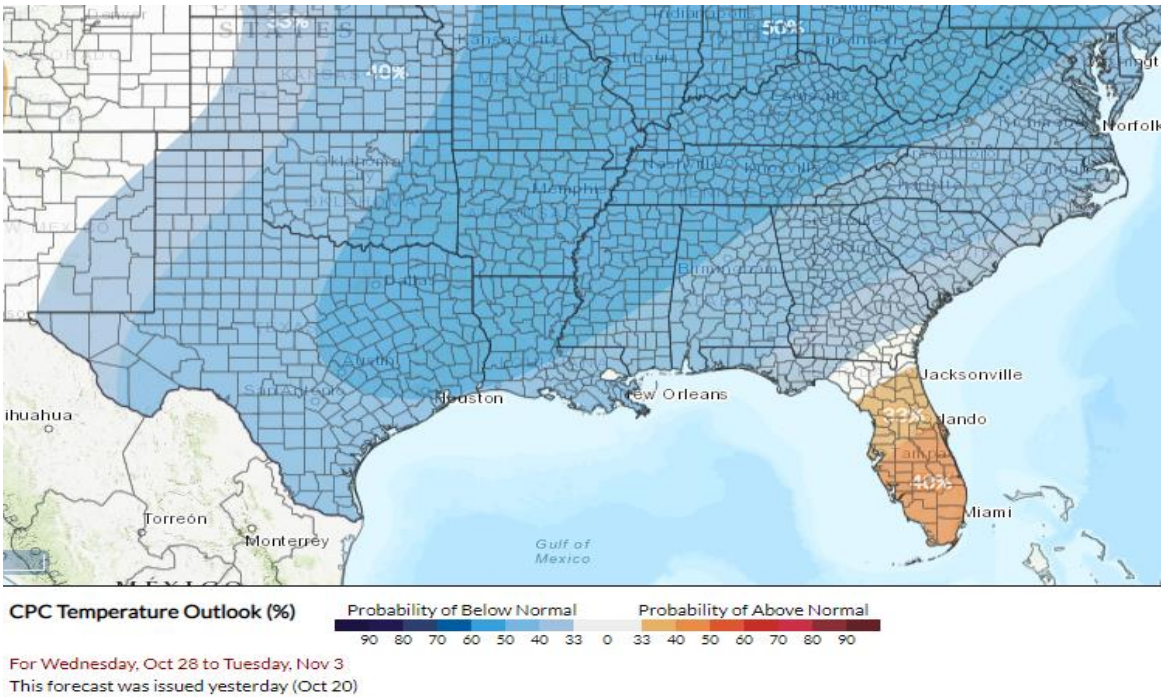


Figure 8. Map 12 - Eight to 14 day outlook temperature probability.

The long-term, three-month outlooks continue to project below normal precipitation for all except KY and portions ofVA,TN and AR which will have equal chances of above or below normal. The entire South has a probability of above normal temperatures, with W TX having the highest chance. These above normal readings could lead to delayed leaf drop and later than normal first frost and hard freezes. The December-February outlook shows a continuation of normal to below normal chances of precipitation and above normal temperature probabilities.

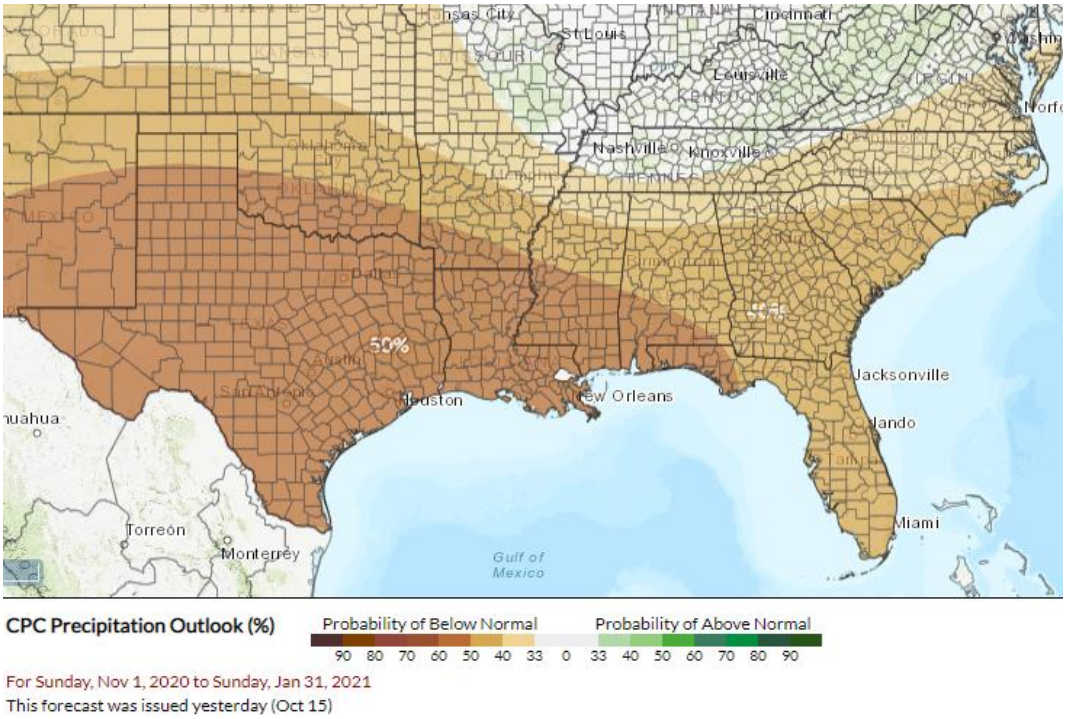


Figure 9. Map 13 – Three Month outlook precipitation probability

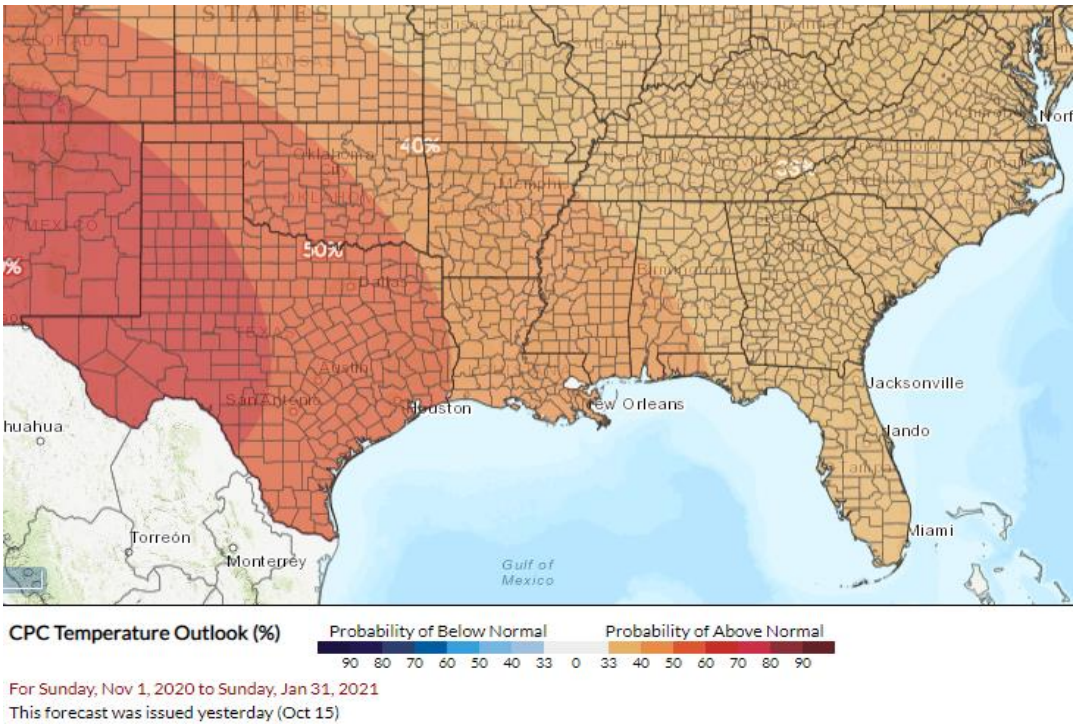


Figure 10. Map 14 – Three Month outlook temperature probability.

DRY COLD FRONTS

The other factor to consider in the fall fire season is dry cold fronts. October and November are the best months for that to occur. When that happens, the dewpoint will drop and the relative humidity can plummet into a 15-20% range. This typically translates into 10-hour fuel moisture values around 3-5%. If conditions are unusually dry before the dry cold front, it is not unprecedented that RH values of 8-15% could be realized. These types of conditions are extremely dangerous in areas with hardwood litter because dry cold fronts are often accompanied by 24-36 hours of fairly strong winds (15-25 miles per hour with gusts of 30-40 mph) in the wake of the frontal passage. Stronger winds almost always lead to larger fires that are more difficult to control and can lead to more complex incidents, especially if there are other fires that are ongoing before the dry front passes. La Niña typically has more dry fronts than its warm water counterpart, El Niño. Abnormally low RH values can be realized for four or five days following a dry frontal passage before recovering above 40% where fuel moistures return to a more manageable state. The dryness can also be accumulative and self-propagating.

TROPICAL SYSTEMS

The occurrence of tropical events provides a wildcard into the fall fire season of the southeastern United States. These systems typically produce rainfall amounts of six to twelve inches along and east of their center. Sometimes these amounts will swell to near twenty inches for slow moving systems or may decline to three to eight inches for systems that move more quickly.

The areas that lie along and east of the track that receive rain from a tropical system will likely not see significant fire activity for fourteen to twenty-one days afterwards. We have seen tropical events limit fire activity for as much as thirty days in the areas where copious amounts of rain fall. The high levels of ground moisture tend to be a self-reinforcing mechanism that promotes additional rainfall with subsequent frontal passages that maintains a low level of fire activity and high moisture content or even saturated fuels.

To the west of the track however, the gradient of rainfall totals is very sharp and it drops off to nearly nothing as your move westward away from the track of the event. As you move 50 or more miles west of the track, you typically enter a zone of subsidence where fire activity and dryness are exacerbated and accentuated. These areas have a noticeable increase in fire activity with rapid spread rates due to these passing systems and associated winds.

Numerous tropical systems have affected the area from TX to NC, bringing several inches of rain to many locations, but also adding to fuel loads with downed vegetation. Although the peak of the season has passed, the season continues through November, and history has shown that rain-making tropical events can occur in October and November.

DROUGHT CONDITIONS

Short term drought conditions (less than 6 months) are already present due to building deficits from the summer. Areas of drought are primarily confined to portions of Texas and Oklahoma., although there are some small areas in SE LA and NW AR with KDBI above 600 (Figures 11 and 12). The remainder of the Southern Area is at or below typical KBDI for mid-October.

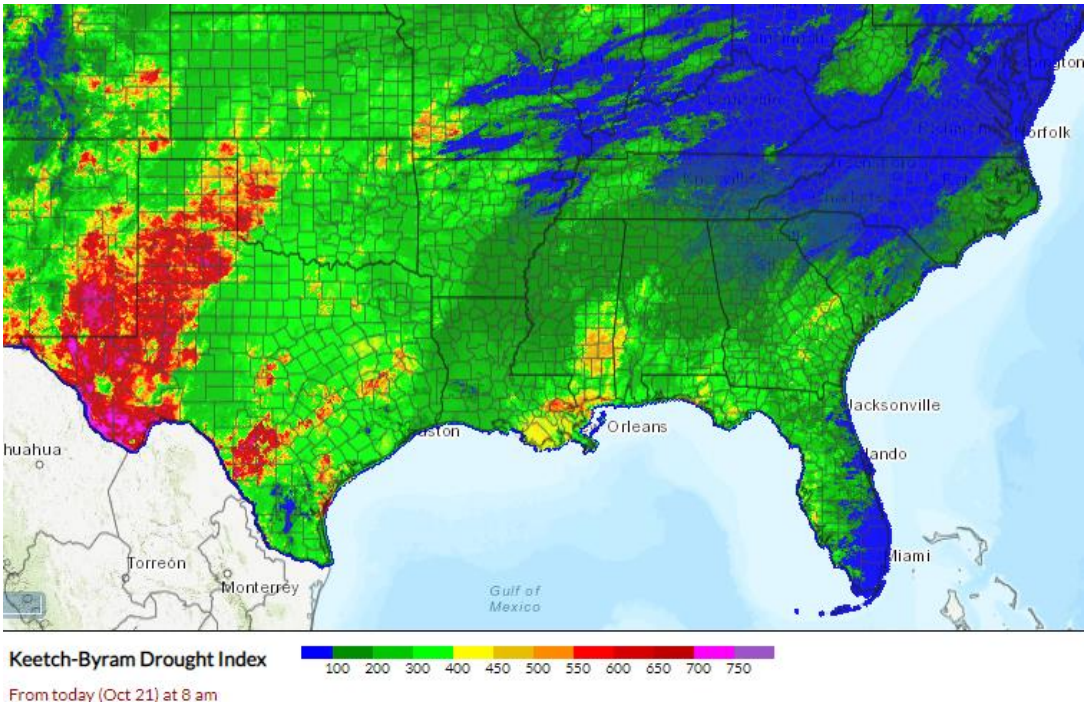


Figure 11. Map 15- of Keetch-Byram Drought Index

Figure 12 demonstrates the short-term moisture deficit for the past month. Areas in the track of tropical systems are well above normal, whereas most other areas are at normal or below. The W TX/OK area is in the worst deficit, with some areas receiving no precipitation in the past month.

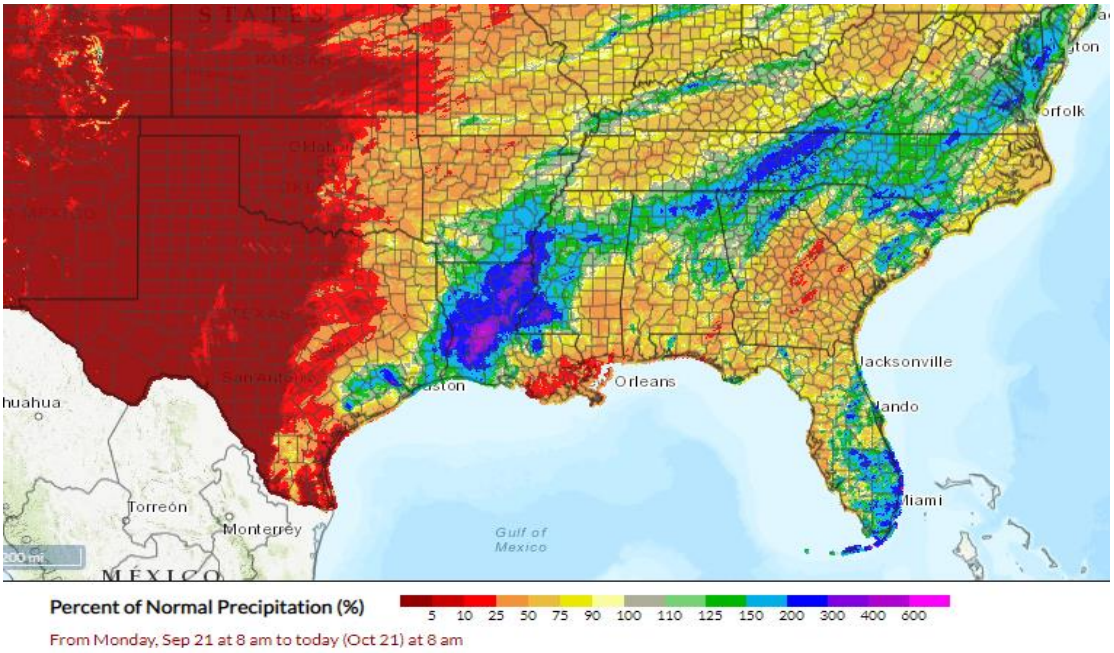


Figure 12. Map 16- above showing the Advanced Hydrologic Precipitation Analysis (AHPS), the short-term moisture deficit, for the past month in the Southern Area.

Drought development/persistence is likely over most of TX, OK, S GA,NE FL and far NW AR over the next few months.

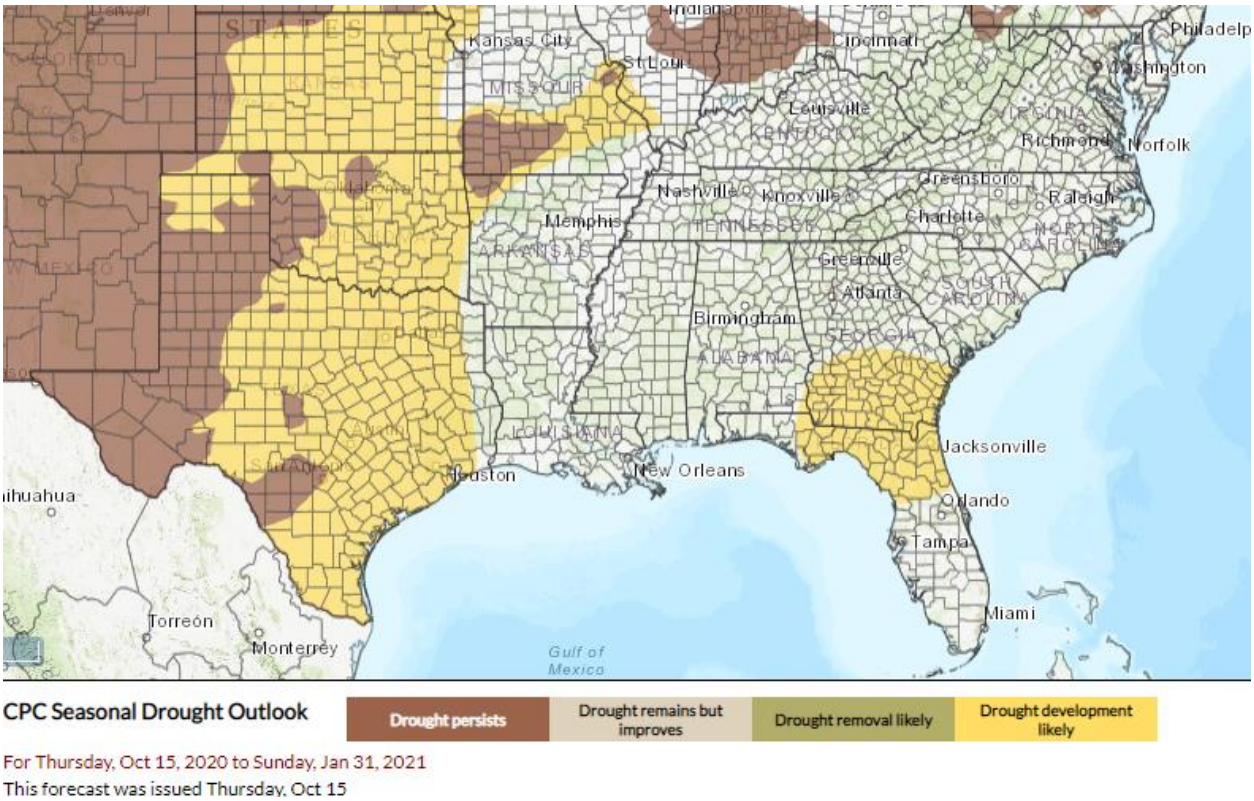


Figure 13. Map 17- of Seasonal Drought Outlook from October 15, 2020 - January 31, 2021

If La Nina persists through the winter as predicted, some additional areas may become abnormally dry with a lack of consistent precipitation. However, most areas outside of those predicted to incur drought through January have enough soil moisture to keep drought at bay. If La Nina, particularly a strong one, continues through late winter, the accumulated precipitation deficits and higher temperatures could bring more areas into drought as we enter the spring fire season.

Fuel and Fire Danger Conditions

Incidence of initial attack will be dependent on local rainfall frequency. Leaf drop and frost may be delayed at lower elevations by higher than normal temperatures in November.

For W and central TX and OK, and possibly NW FL/SW GA, any fire that escapes initial attack in the drier areas will be very resistant to control efforts. Expect some torching, especially in thick brush, and increased spotting. Since fire intensities will be higher than normal, particularly in large fuels, direct attack may not be safe or successful. Expect the need for extended mop-up. Expect an increase in long duration fires with heavy fuels being available to burn and leaves coming off trees. Also, expect a higher than normal probability of reburn on contained fires.

For all other areas, large fuel classes (100 hour and 1000 hour) are quite wet and will not likely contribute significantly to fire intensity this fall. If little or no precipitation is received during the leaf fall period, fresh fallen leaves will not be compacted and may be available to burn. However, deep duff burning is unlikely. Fires can still ignite and burn rapidly in exposed, light, flashy fuels, but they are likely to die down or even self-extinguish once they reach a forested area with dense canopy cover.

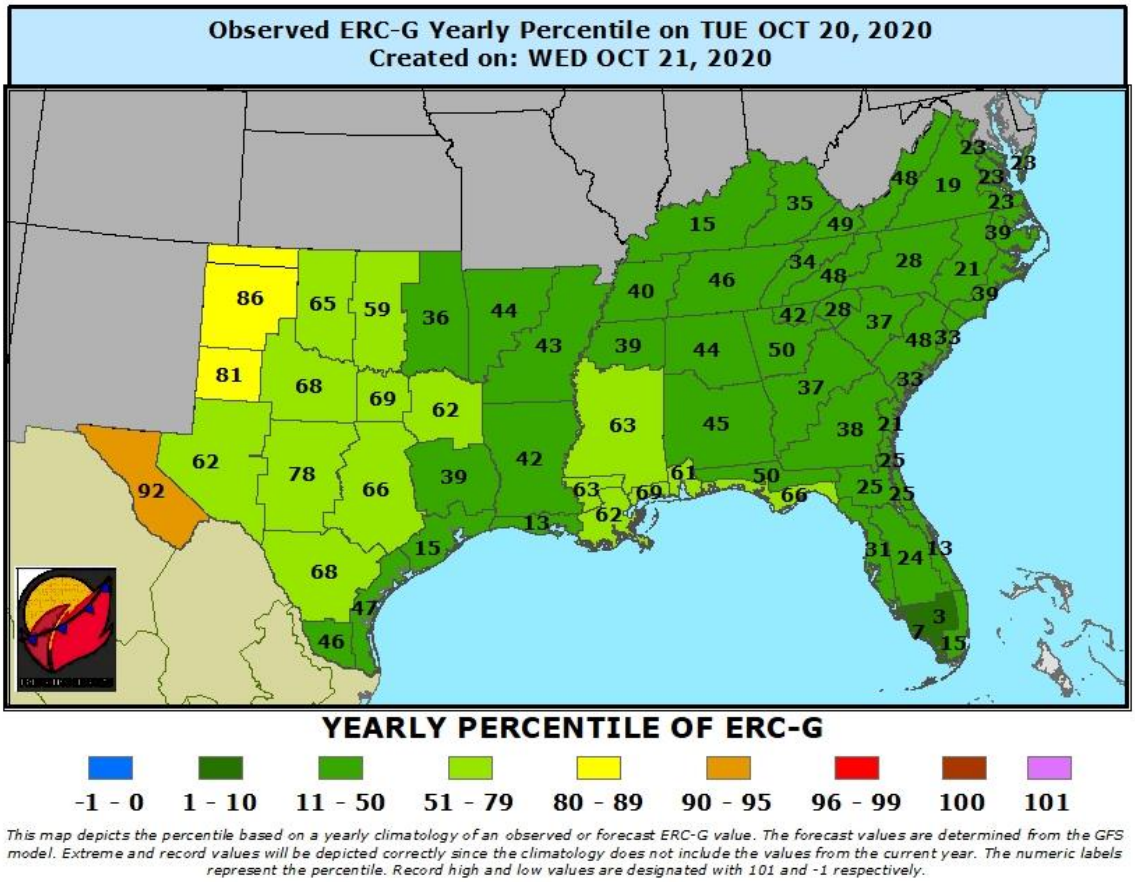


Figure 14. Map 18 – Observed ERC for the Geographic Area

Energy release component (ERC) is an index that is correlated with flammability of fuel and difficulty of suppression. ERC is often referred to as an indicator of fuel dryness. This index seems to be most useful for characterizing the seasonal severity of the fire season across the Southern Area. ERC for each Southern Area Predictive Service Area (PSA) can be calculated based on weather measurements taken at Remote Automatic Weather Stations (RAWS). The areas covered by the assessment are colored in Figure 15 below.
Values above the 90th percentile are considered critical and represent fire danger that is only experienced less than 10% of the time. Also, any ERC value that is close to the 97th percentile is closest to the record high ERC value, signifying that those areas are at record high fire danger values for that time of the year. The areas highlighted above the 90th percentile represent the most critical areas currently.

Hurricane season is still quite active in October/November and 2020 has already been a record setting year in the Atlantic Basin. Activity is predicted to continue to be high. Any tropical moisture system can cause a tremendous reduction in fire danger in localized areas. Currently, there are no active tropical storms in the Atlantic Basin, and none are predicted to develop in the next 5 days.

November will bring increased leaf drop in lower elevation and lower latitudes, while higher elevations and higher latitudes will experience frost and hard freezes. These events will lead to increased availability of fine fuels that can be receptive to a wider variety of ignition sources. Frontal passages also increase during November. Dry fronts can significantly increase fire danger for a few days after passage with increased winds and lower RH. Given the possibility of lower than normal precipitation over much of the Region, expect fire danger to remain elevated. If precipitation does increase to normal levels, it will take some time for larger fuel moistures to increase to the point that they will not contribute to fire intensity.

For December and January, fire risks are expected to remain at seasonal levels, except in portions of TX and OK, as temperatures cool and leaf drop becomes complete in all areas. If rain and snow amounts are well below normal, the Ozarks and southern Appalachians could have issues with more intense surface fires as fallen leaves will not be compacted as usual.

NOTE: Updated maps of the most recent observed FM100, FM1000, ERC, etc. values can be found on the Southern Area Coordination Center (SACC) Predictive Services page (http://gacc.nifc.gov/sacc/fire_weather.php). These maps are typically updated daily and are generally available between 730 and 800 AM Eastern time.

The Fire Weather Intelligence Portal (https://climate.ncsu.edu/fwip) has updated weather and NFDRS data and maps, as well as past and forecast conditions. It is hosted by NC State University, but it covers the entire Southern Region for all products and the CONUS for some products.

Figure 15 displays below PSAs which are analysis sample areas (highlighted in red fill). These graphs were chosen as they are geographically well-spaced and representative of the current fire danger situation throughout region. These are NOT the only areas being impacted by increased fire danger.

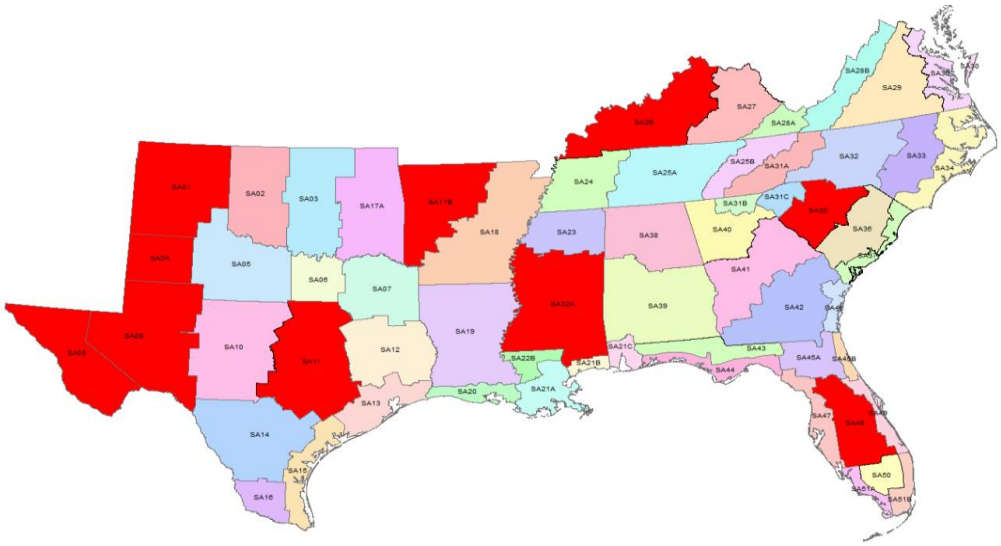
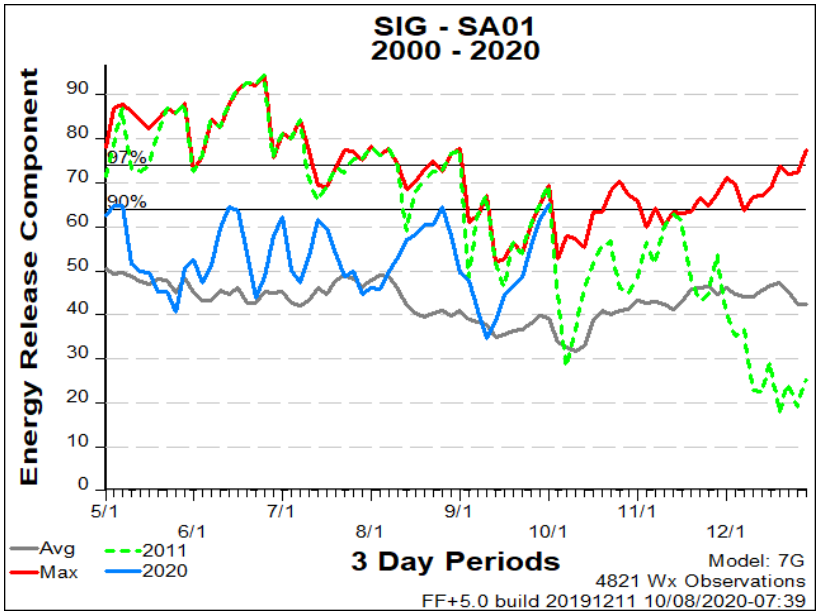


Figure 15. Map 19- Predictive Service Areas of the Southern Area. PSAs used for climatology, Growing Season Index, and season ending analyses are filled with red.

Figures 16-18 are examples from some of the most critical areas across the region of energy release component. ERC graphs have the current year ERC's and another year that was a significant fall fire season.

Figure 16. TEXAS PANHANDLE NORTH

ERC values for 2011 and 2020 in the North Texas Panhandle. 2011 was graphed with the current year's trend because data show 2011 was the most active fall fire season within the past 20 years.



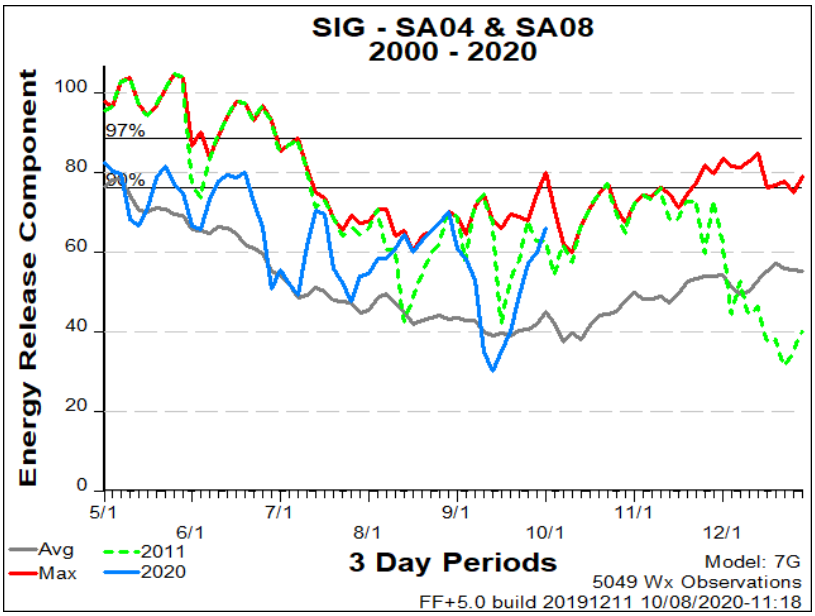
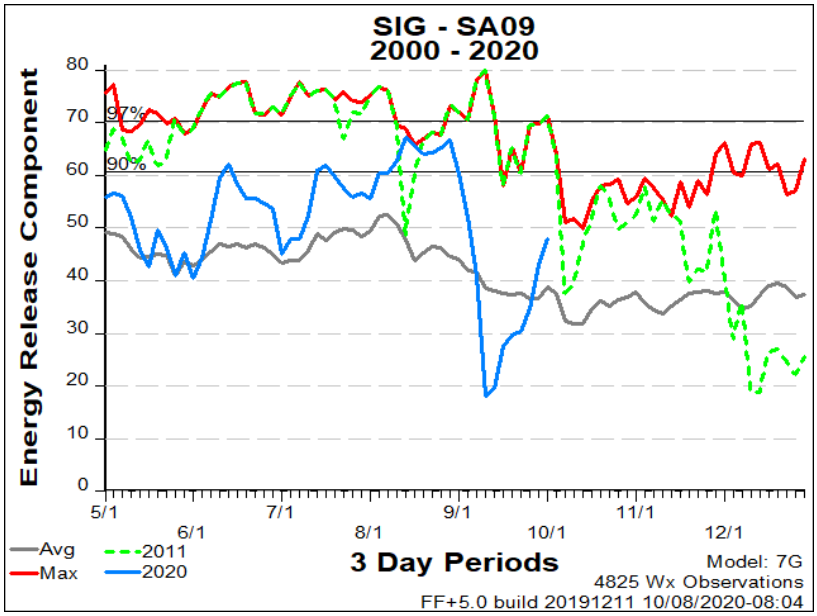


Figure 17. WEST TEXAS MOUNTAINS

ERC values for 2011 and 2020 in the Texas Mountains. 2011 was graphed with the current year's trend because data show 2011 was the most active fall fire season within the past 20 years.

Figure 18. TEXAS WEST

ERC values for 2011 and 2020 in Texas West. 2011 was graphed with the current year's trend because data show 2011 was the most active fall fire season within the past 20 years.



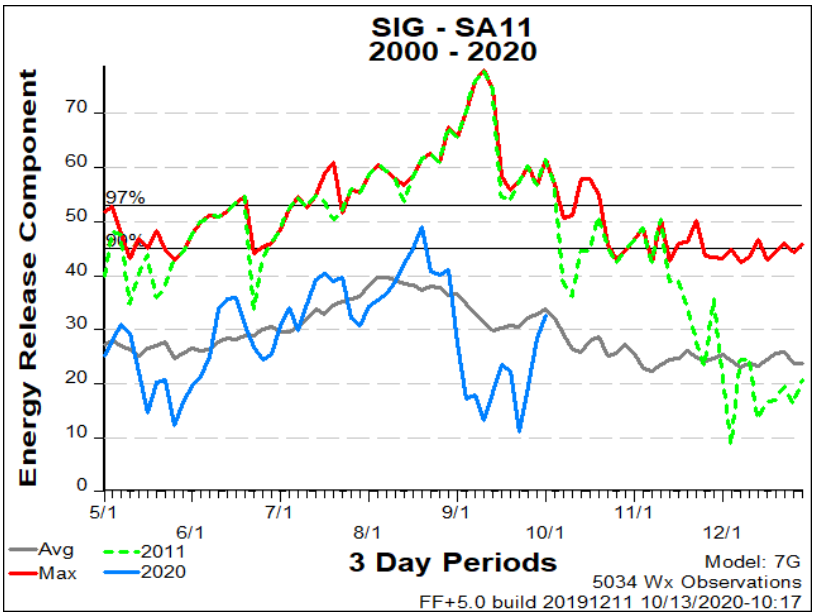
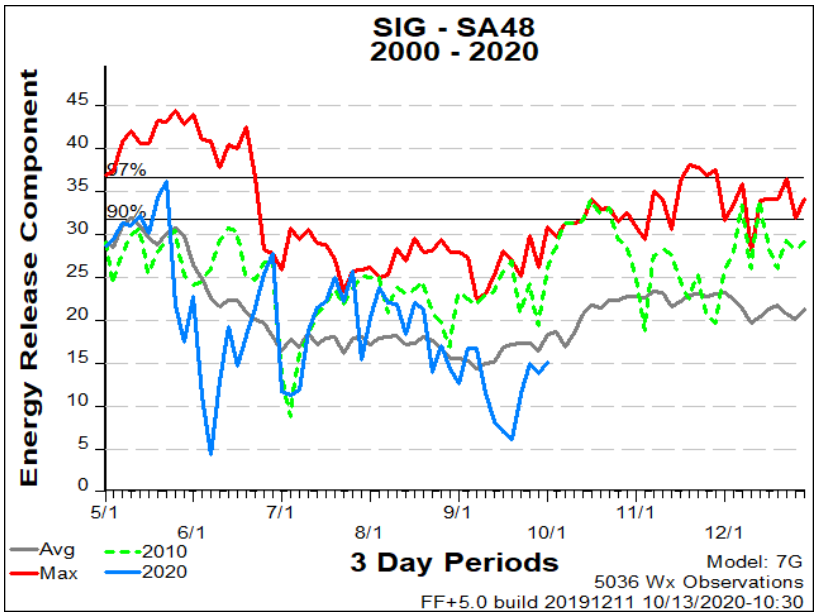


Figure 19. TEXAS CENTRAL SE

ERC values for 2011 and 2020 in Texas Central SE. 2011 was graphed with the current year's trend because data show 2011 was the most active fall fire season within the past 20 years.

Figure 20. FLORIDA CENTRAL

ERC values for 2010 and 2020 in Central Florida. 2010 was graphed with the current year's trend because data show 2010 was the most active fall fire season within the past 20 years.



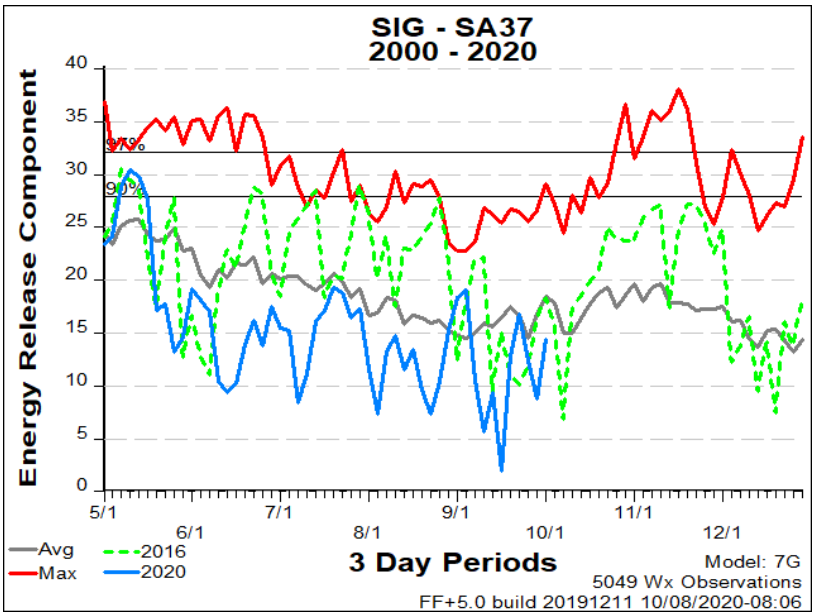
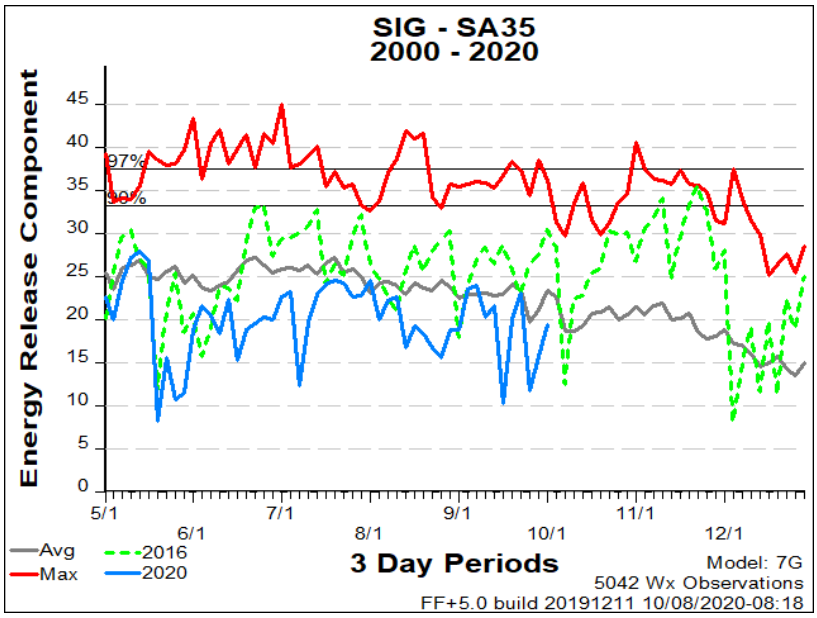


Figure 21. SOUTH CAROLINA COAST

ERC values for 2016 and 2020 in the South Carolina Coast. 2016 was graphed with the current year's trend because data show 2016 was the most active fall fire season within the past 20 years.

Figure 22. SOUTH CAROLINA CENTRAL

ERC values for 2016 and 2020 in the Piedmont of South Carolina. 2016 was graphed with the current year's trend because data show 2016 was the most active fall fire season within the past 20 years.



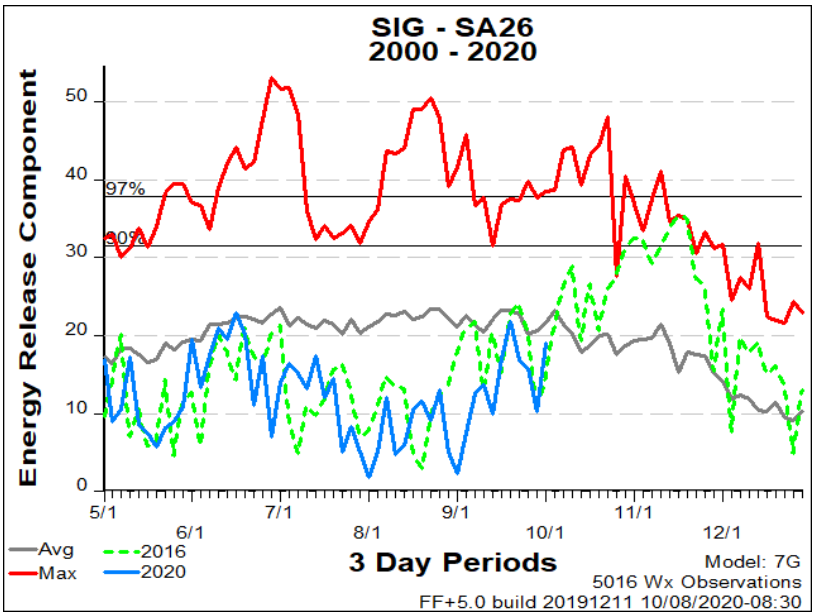
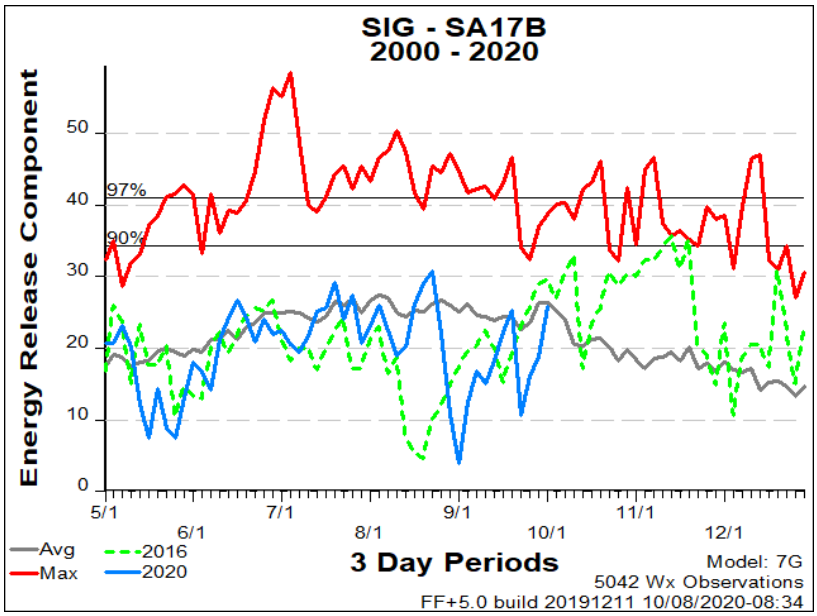


Figure 23. KENTUCKY WEST

ERC values for 2016 and 2020 in Western Kentucky. 2016 was graphed with the current year's trend because data show 2016 was the most active fall fire season within the past 20 years.

Figure 24. ARKANSAS WEST

ERC values for 2016 and 2020 in Arkansas West. 2016 was graphed with the current year's trend because data show 2016 was the most active fall fire season within the past 20 years.



Season Ending Event

WHEN WILL THE FALL FIRE SEASON END?

With the drought deepening across much of the region, fuel conditions becoming critical, and weather patterns showing no sign of relief, the question remains about when is the probable end of the season? There does not seem to be a significant weather pattern shift that would lead to an increase in precipitation events in the near-term future, as NFDRS components were analyzed in combination with historical weather data. This analysis provided a statistical fit to show a probabilistic end to the fall fire season.

Texas Panhandle North

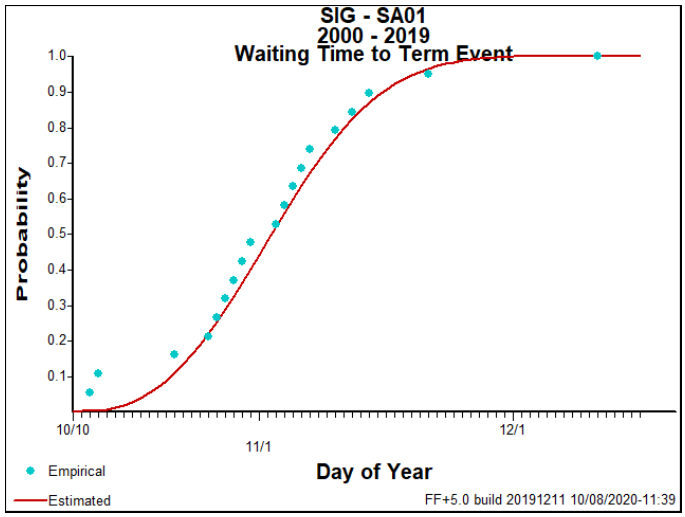


Figure 25 . FireFamily Plus Term Analysis for Texas Panhandle North.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	October 27
.50	November 03
.75	November 10
.90	November 16
.99	November 27

Table 1: Term Analysis Results for Texas Panhandle North for End Date of Fall Fire Season

West Texas Mountains

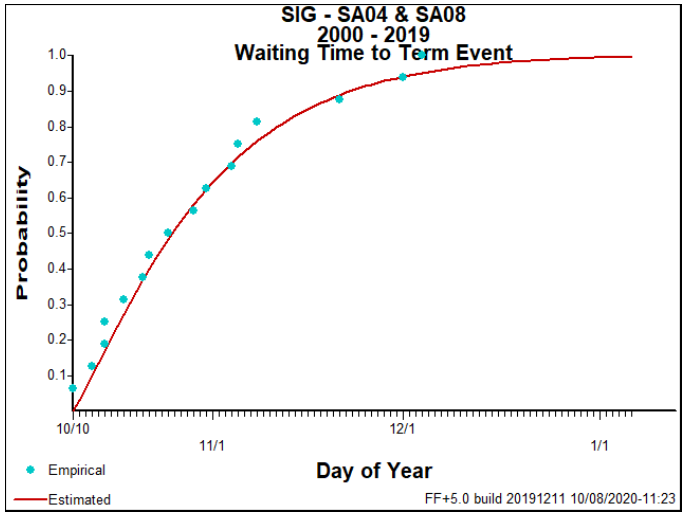


Figure 26. FireFamily Plus Term Analysis for the West Texas Mountains.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	October 18
.50	October 26
.75	November 08
.90	November 24
.99	December 30

Table 2: Term Analysis Results for the West Texas Mountains for End Date of Fall Fire Season

Texas West

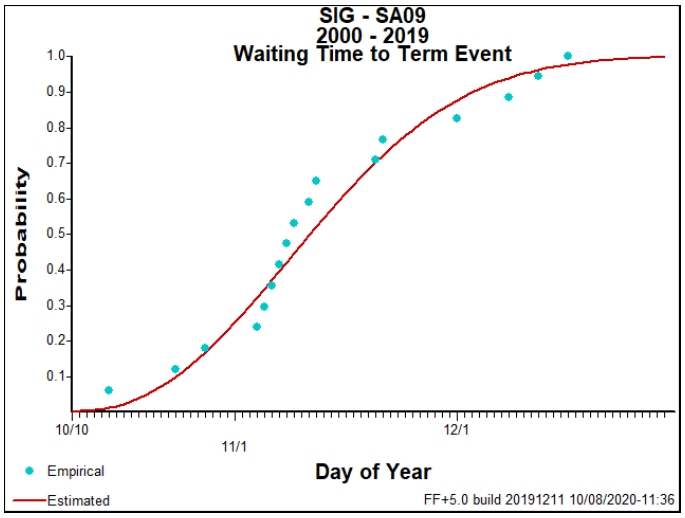


Figure 27. FireFamily Plus Term Analysis for Texas West.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	November 01
.50	November 12
.75	November 23
.90	December 04
.99	December 23

Table 3: Term Analysis Results for Texas West for End Date of Fall Fire Season

Texas Central SE

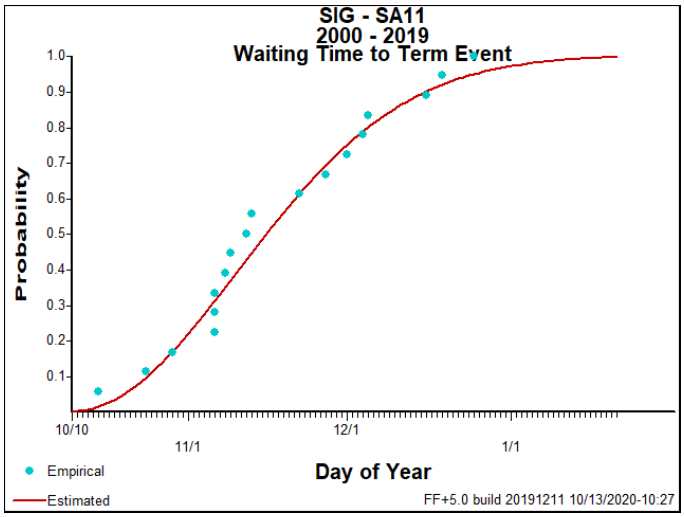


Figure 28. FireFamily Plus Term Analysis for the Texas Central SE.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	November 03
.50	November 16
.75	December 02
.90	December 17
.99	January 13

Table 4: Term Analysis Results for Texas Central SE for End Date of Fall Fire Season

Florida Central

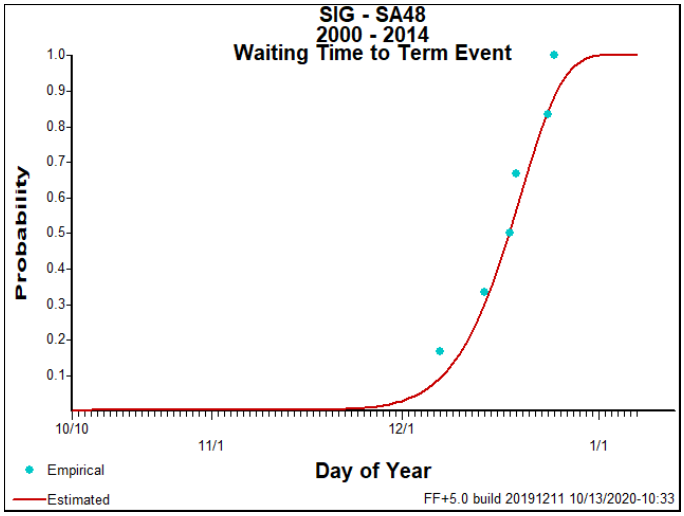


Figure 29. FireFamily Plus Term Analysis for Florida Central.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	December 13
.50	December 18
.75	December 23
.90	December 26
.99	December 31

Table 5: Term Analysis Results for Florida Central for End Date of Fall Fire Season

South Carolina Coast

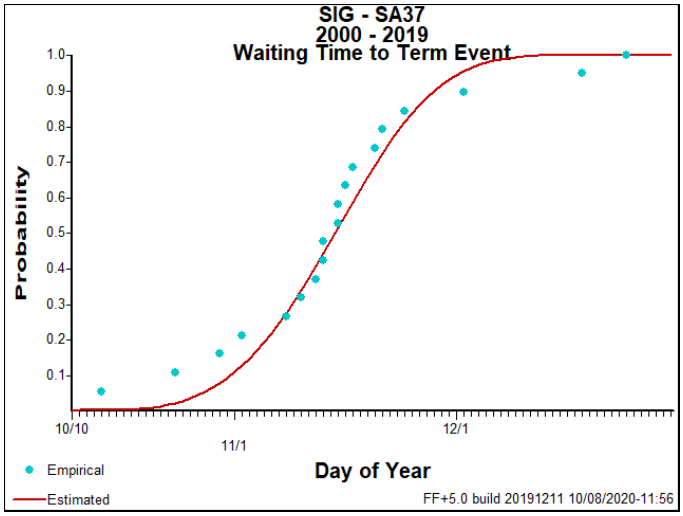


Figure 30. FireFamily Plus Term Analysis for the South Carolina Coast.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	October 23
.50	November 04
.75	November 19
.90	December 06
.99	January 11

Table 6: Term Analysis Results for the South Carolina Coast for End Date of Fall Fire Season

South Carolina Central

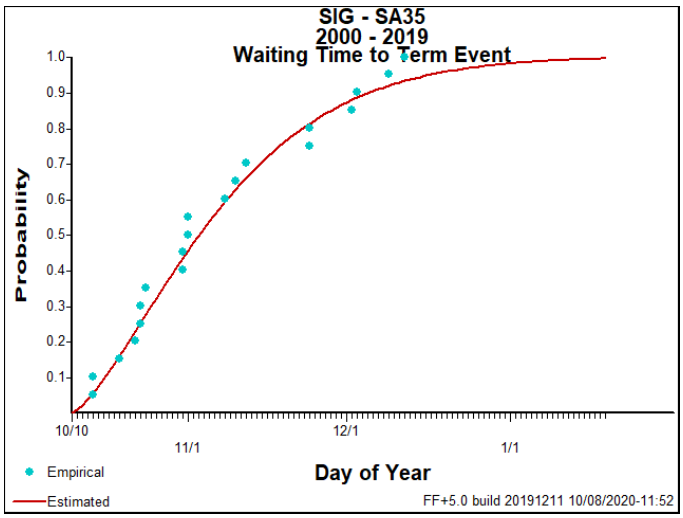


Figure 31. FireFamily Plus Term Analysis for South Carolina Central.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	November 08
.50	November 15
.75	November 22
.90	November 29
.99	December 09

Table 7: Term Analysis Results for the Piedmont of South Carolina for End Date of Fall Fire Season

Kentucky West

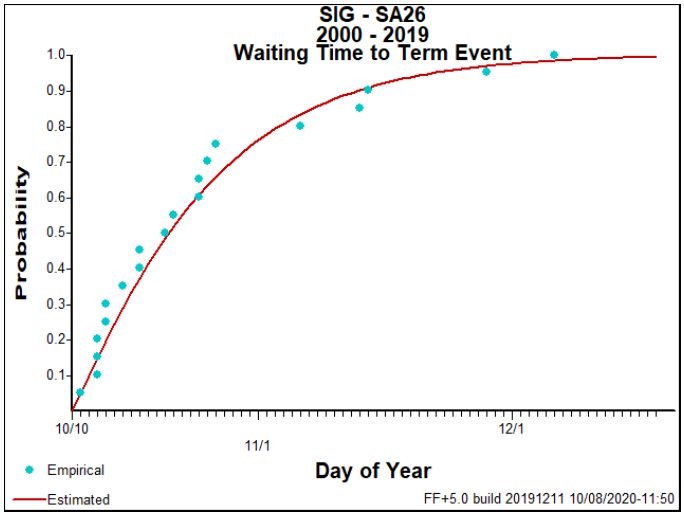


Figure 32. FireFamily Plus Term Analysis for Kentucky West.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	October 16
.50	October 22
.75	November 01
.90	November 13
.99	December 13

Table 8: Term Analysis Results for Western Kentucky for End Date of Fall Fire Season

Arkansas West

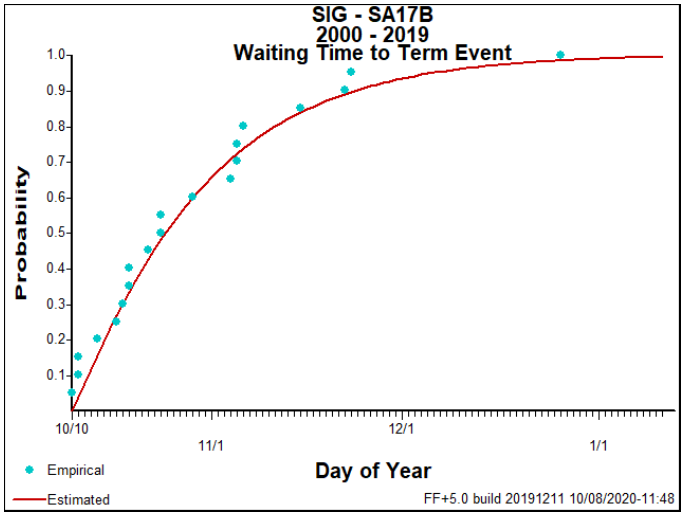


Figure 33. FireFamily Plus Term Analysis for Arkansas West.

Using a combination of ERC <60th percentile and max daily temperatures of <70º over at least a 3-day period, we see the probabilistic chance of the season ending:

Probability	Date
.25	October 17
.50	October 25
.75	November 08
.90	November 25
.99	January 04

Table 9: Term Analysis Results for Western Arkansas for End Date of Fall Fire Season

Current Summarized Observations by Fire Managers

Daniel Martin
George Washington and Jefferson NFs
Weather and Fuel Conditions

Virginia appears to be headed into a relatively normal fall fire season. Temperatures have been trending higher than recent years, however rain events are occurring approximately every 7-14 days. Precipitation is continuing to mitigate the drying of fresh fuels from the leaf-off that is just beginning to occur across both higher and lower elevations.

The Energy Release Component is currently sitting just above the minimum 10 year average for most stations across along the Blue Ridge Mountains, indicating a significant drying trend would be needed to elevate fire danger across the area. Additionally, KBDI values are at nearly 0, well below the average for October. Any new fire starts would be driven largely by wind and topography as the duff layer and larger woody debris content is hovering at the 10 year average mark (approximately 15% for 100 hour fuels and 23% for 1000 hour fuels).

Mike Davis
Chattahoochee-Oconee NFs
Weather and Fuel Conditions

As of October 2nd, we are recording KBDI's in the less than 200 range across the Oconee and well under 100 in the mountains. The Ridge and Valley geographic area of far NW Georgia is seeing KBDI's in the upper 300-400+ range. Remnants of Tropical Storm Sally and Tropical Storm Beta brought significant precipitation to most of North Georgia in September. We are beginning to see a cool down in temperatures and a drying trend typical of October weather patterns. We are still near 100% canopy, but we are beginning to see light leaf drop, typical for this time of year. If this drying trend continues with a lack of wet frontal passages, we would expect to see elevated fire conditions in November. If this scenario unfolds, we would welcome additional aviation resources strategically located across the Southern Area.

Mike Bot
Cherokee NF
Weather and Fuel Conditions

Exiting August/Entering September, East Tennessee was experiencing abnormally dry conditions (D0 Drought Category). As September continued the area saw substantial precipitation as assorted tropical waves pushed through the area. September brought

average to slightly above average temps with above average precipitation totals and days. This rapidly changed the dryer conditions that were seen in August and early September. Here is a current snapshot of the drought conditions in Tennessee:

Per NWS Morristown TN, September was the 2nd wettest year-to-date for the Tri-Cities (NE TN) and the 5th wettest year-to-date for Knoxville (East Central TN) and Chattanooga (SE TN)

**The three-month probability outlooks show an above average chance of higher than normal temps with a slight chance of below average precipitation amounts for the furthest SE section of Tennessee.*

Current Fuel Conditions in East Tennessee and the Cherokee NF are slightly below seasonal averages at present. Here is a snapshot of conditions as of 04 October 2020:

WDY	HRB	1H	10	HU	TH	KBDI
200	250	9.5	11.76	21	29	56
200	250	8	9.73	17	28	28
200	250	9.39	11.46	20	29	49
200	250	8.36	10.52	19	28	45

If predictions hold true, the area will likely see and average Fall Fire Season.

Daron Reynolds
National Forests in Mississippi
Weather and Fuel Conditions

Conditions as of 05 October 2020; Mississippi is experiencing elevated fire danger potential in the south eastern to east central portion of the state with average conditions elsewhere (see figure 1-3). We have had a very active hurricane season and the models indicate that will continue through the month of October. If the hurricane models are correct, the state should experience some significant rain events that would drastically reduce any higher fire potential conditions that might exist. If the state does not experience these precipitation events, we could experience severe fire potential conditions by mid-October with the accompanying increased fire behavior. We are still near 100% canopy, but we are beginning to see light leaf drop, typical for this time of year.

Figure 1. ERC Southern MS

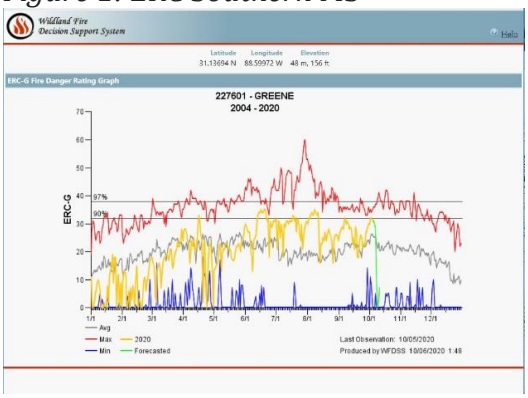


Figure 2. ERC Central MS

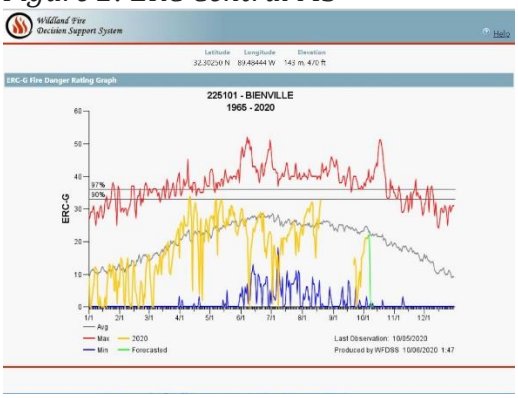
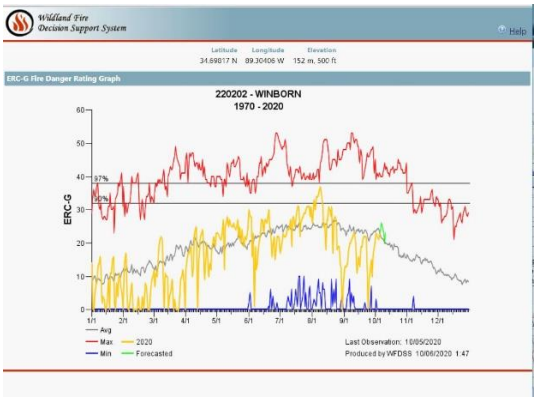


Figure 3. ERC Northern MS



James Flue

Kisatchie National Forest

Weather and Fuel Conditions

Hurricane Laura made landfall on the Louisiana coast August 27, 2020. The storm sustained hurricane force winds for approximately 150 miles inland. Laura greatly increased the 1 hour and 10 hour fuel loads over the entire Forest. Hurricane damage is most apparent on the Calcasieu Ranger District. The Catahoula, Kisatchie, and Winn Ranger Districts received overall light hurricane damage with areas of moderate damage. The Vernon Unit of the Calcasieu Ranger District received the most damage. Across the Forest, there is an estimated 17,000 acres of severe (75-100%) pine timber damage, all of which are on the Vernon Unit. Forest wide, there is also 152,000 of moderate (25-75%) pine timber damage and 125,000 or light pine timber damage. There is approximately 70,000 acres of hardwood timber damage across the Forest. Salvage operations may be conducted on 95,000 acres. Many control lines for prescribed fire on the Vernon Unit are currently decked with fallen timber and many landlines will require reestablishment.

In addition to Hurricane Laura, the Kisatchie has accomplished less than half of the normal prescribed fire target in 2019 and again in 2020. The Kisatchie burns a majority of the upland acres on a three year average.

David Quisenberry
National Forests in Florida
Weather and Fuel Conditions

The NFFL has seen fewer fires this August and September than in the previous 2 years. The few fires we did have showed moderate fire behavior and growth potential. But due to dry conditions they crept into and thru some wet areas that were not accessible to heavy equipment. So indirect strategies using roads were used to avoid getting the equipment stuck. Since that time significant rainfall amounts have accompanied tropical storm activity to increase water levels. Swamps currently have some water. ERC and KBDI Indices are currently rising but remain below 10-year averages as we enter the fall season.

Lt. Joel Figueroa
FMO, Puerto Rico Fire Department

Fuel or vegetation in Puerto Rico is green and abundant at this point. With recent rain, the fuel remains wet. For the central and mountainous area of the island, there is accumulation of dead fuel. There are still many fallen or snags trees that require mitigation work.

John Raulerson
Chief of Forest Protection, Florida Forest Service

Florida Fuels Assessment

La Niña conditions are currently present in the Pacific, and there is about a 75% chance for it to persist through the end of February 2021. During the fall and winter, La Niña typically means drier and warmer conditions in the Southeast, which could mean above normal fire activity.

Our prescribed burning is down about 20% this year from the previous two years as a result of drought conditions and wildfire activity in the first half of the year and excess rainfall from tropical systems that have happened in the second half of the year. These conditions coupled with downed timber from previous tropical systems in the past two years have made suppression efforts more difficult. Frontal passages this winter that bring lower humidity levels will only help to make suppression difficult. The challenges we will face are that we have large areas in parts of the state with limited access and hard to cut through due to downed timber from tropical storms, on top of the excess moisture we have gotten this year that will make the ground softer resulting in suppression equipment having to avoid getting stuck.

John Miller

Director of Fire and Emergency Response, Virginia Department of Forestry

The VDOF tracks a daily KBDI reading at six locations around the state, and as of this morning, those readings range from 24 to 159. Although KBDI really gives you nothing more than a reading on soil moisture level, we do see some corollary of KBDIs to general fuel moistures, especially in the larger fuel classes. The fact that our current early October KBDIs are amongst the lowest readings of the last ten years, and when you combine that with the Virginia RAWS station inputs of 100 and 1000 hour fuels in the 19 – 28 % range, our general feeling is that we are likely in for a lower than average fall fire season. Suppression is also not expected to be a significant problem this year, thanks to greater than average soil and large fuel moistures.

One final factor on timing is the additional impact of a killing frost. With the exception of our highest elevations and normally coldest portions of the state, which saw a killing frost on the morning of September 19, there have been no other frost events in Virginia, nor are any currently expected until the final weekend of October. Typically, any delay in our first major killing frost has historically reduced our fall fire potential. Frost related delays in both leaf fall and cured vegetation typically result in a much shorter window between our normal fall fire activity and the onset of Virginia's winter condition.

From a practical standpoint, I would also add that some of our upcoming potential will be effected by the ultimate path of the current Hurricane Delta in the Gulf. Tropical moisture has really put VA into a good situation for this fall, and Delta can make sure that our luck continues.

If we can receive one more shot of statewide tropical moisture out of Delta during the middle of next week, we will basically be starting back at zero in terms of fire potential, with really only 4 or 5 weeks of fall fire season remaining.

On the other hand, if Delta ends up bringing little or no precip to VA, then we are currently dry enough to start picking up a few small fires, and that activity will slowly increase as we move forward, with a final uptick in activity a couple of weeks following our first frost.

The bottom line is that nearly all of the key factors seem to be currently lined up to help Virginia see a lighter than average fall fire season. Our hope at this point is also that the same trend ignores the incoming La Nina influence to also give us a calm spring!

Frank Sorrells

Chief of Forest Protection, Georgia Forestry Commission

For us in Georgia, we currently are experiencing low to moderate wildfire potential and activity for all parts/areas of the state. We are dispatching resources to about 4-6 reported wildfires a day with minimum acres burned and subdued fire behavior reported. KBDI range from the 100's up to around 400 for most areas, with a couple of isolated pockets of 600 to 700 in the NW part of the state and in areas near Savannah, GA extending northward along

the Savannah River for a few miles. 100 and 1000 hours fuel moisture in all areas of the state range from the high teens to upper 20 percent.

We typically experience an annual uptick in wildfire occurrence and intensities in the North GA mountains, ridge and valley areas of NW GA and some parts of the Piedmont beginning somewhere a couple of weeks before Thanksgiving and continuing through the mid-December based on weather, the onset of killing frost, and it's influences on leaf fall. At this point, due to recent tropical storm/depressions that have provided rainfall to these areas, we are entering that normal period in fairly good shape. We are aware of the potential drying being forecasted (La Nina) and are monitoring extended forecast to determine if changes may occur.

Brad Smith

Predictive Services Department Head, Texas A and M Forest Service

Growing season rainfall from May through September has proven to be a reasonable metric for grass production during the growing season. Above normal rainfall translates into above normal grass production. Below normal rainfall translates to normal or below normal loading. Grazing practices on individual ownerships can reduce grass loading on the winter/spring fuelscape.
Above normal grass loading in north central Texas will be a driver for above normal fire activity once a hard freeze is observed. November 1st-15this the normal period for the first freeze in this region.

Fire activity in this region will center around frontal activity. Both prefrontal and postfrontal conditions will increase fire activity.
October 2020 could likely finish up as one of the top 10 driest Octobers since 1900. Expanding drought to the east will encounter brush and timber fuels that will increase the scope and scale of a Fall fire season. The La Nina fall years of 2016 and 2010 made the top 10 driest Octobers.
30-day rainfall deficits are increasing in central and northeast Texas. Below normal October precipitation forecasts will increase rainfall deficits in these regions. Increasing fuel dryness in the timber fuels of central and northeast Texas suggests normal to above normal fire activity for late October into November. The average first freeze for these regions is November 11-20th. Freeze cured grass conditions will increase the number of accidental ignitions.

Kevin Kilcrease

Staff Training Supervisor, Arkansas Department of Agriculture, Forestry Division

Arkansas has seen slower than average fire seasons for the past eight years, due to above average rainfall amounts and moisture levels. These conditions have resulted in abundant vegetation growth in the understory and mid-story of our forest lands, most especially in the Gulf Coastal Plain of Southern Arkansas. We do have some isolated areas of storm damage, but not a widespread storm damage problem.

On a positive note, we also have healthy timber industry harvesting, and progressive prescribed burning regimes in many areas. Rainfall amounts from the very active hurricane season have held down fire occurrence to a minimum thus far this fall.

Cabe Speary
Fire Environment Forester, North Carolina Forest Service

With a few short exceptions, consistent rainfall events coupled with high RH and moderate temperatures have kept fire activity well below normal this year. Soils are moist to saturated. Groundwater and surface water levels are at normal or higher. Forest fuels in NC are currently wet, with 1000 HR FMs in the 24-34% range. Some pockets of damage from Hurricane Isais have added to fuel loads in very localized areas, but NC was mostly spared high winds.
Given our current fire environment, we are anticipating a normal to below normal fire season, even with the likelihood of a strong La Nina. If precipitation events are less frequent and/or less intense through the winter and into early spring, we could see an early start to spring fire season, with above normal fire risk.

Fire Behavior

An analysis of potential fire behavior within the assessment area was conducted to provide fire managers and firefighters insights into the intensity, rates of spread and flame lengths of fires burning under current and expected fire environment conditions. These insights can be used to help inform staffing and fire response needs based on resistance to containment and line production requirements. Fire behavior scenarios for three common fuel complexes throughout the assessment area (forested with shrub understory, forested with grass/shrub understory, forested with litter understory) were evaluated under various fuel moisture, wind speed and slope conditions using BEHAVE 6.0. Seven fire behavior fuel models were utilized to represent typical fuel beds found in these fuel complexes.

- Low Load, Humid Climate Timber-Shrub (SH4)
- High Load, Humid Climate Shrub (SH8)
- Moderate Load Broadleaf Litter (TL6)
- Very High Load Broadleaf Litter (TL9)
- Moderate Load, Humid Climate Timber-Grass-Shrub (Dynamic) (TU3)
- Moderate Load, Dry Climate Grass (Dynamic) (GR4)
- * High Load Blowdown (SB4): *This fuel model was also evaluated to represent hurricane and tornado impacted areas within the assessment area.*

Slope classes of 0, 35 & 70 percent were utilized for each BEHAVE run to represent the effects of slope on fire spread and intensity. These slope classes were identified based on common line construction methods (dozers and crews) and associated operability rating limits.

Low fuel moisture percentages were then applied to each fuel model run based upon currently observed and expected fuel curing conditions. Due to the assumptions of the model variations of representative fuel dryness were utilized to represent availability and reactivity of the fuel models to wind and slope. An estimated 1 hour fire size and spread distance for new starts with no suppression response was also assessed for each fire behavior scenario.

RESULTS

The analysis results indicate that Fire Intensity Levels, Rates of Spread and Flame Lengths for each representative model have the potential to exceed direct fire suppression tactics and would be conducive to large fire growth. The tables below identify a range of fire behavior characteristics that can be expected under the moisture, wind speed, and slope scenarios analyzed. Under these analyses most of the fuel bed can be expected to be available for combustion including 1,000 hour fuels and organic soils (duff). Live woody shrub component will contribute significantly to fire intensity and spotting potential.

Shrub Fuels

Shrub Fuel Model 8 (SH8) - High Load Humid Climate Shrub

The primary carrier of fire in the SH fuel models is live and dead shrub twigs and foliage in combination with dead and down shrub litter. Southern Region examples include: Mountain Laurel/rhododendron stands, Pocosin, palmetto, titi, gallberry, yaupon, bays, and oak scrub.

Fire Behavior Fuel Moisture Analysis Inputs

1 Hour FDFM: 4%
10 Hour FDFM: 6%
100 Hour FDFM: 8%
Live Woody Fuel Moisture: 65%

	Slope 0%		Slope 35%		Slope 70%	
Windspeeds (20') **(Adjustment Factor of .3)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**
Flame Length (ft.)	9	17	11	18	14	20
Rate of Spread (ch/hr)	17	63	23	68	40	85
Fireline Intensity (Btu/ft/s)	732	2683	973	2924	1694	3646
1 Hour Fire Growth Potential (size: acres/perimeter: chains)	16ac / 47ch	99ac / 141ch	24 ac / 59ch	112 ac / 153ch	52ac / 95ch	151ac / 186ch

Table 1. Fire Behavior Characteristics for the SH8 Fuel Model

Implications to Mangers

If live woody moisture percentages are less than 100% and wind speeds are greater than 10 mph direct attack by dozer, tractor plows, or water delivery systems may not be effective or possible due to fire intensities. Direct attack by hand crews is not recommended under any of the modeled live fuel moistures, slopes or windspeeds.

Consideration of organic soils & duff layers contributing to fire intensity and long-term duration should be expected if duff moisture percentages fall below 100%. Long duration smoldering, complete consumption of 1000 hour fuels and stump holes holding heat for long durations can be expected.

Reburn potential high in areas of heavy scorch.

Shrub Fuel Model 4 (SH4) - Low Load Humid Climate Timber-Shrub

Primary carrier of fire is light to moderate loading (3-5 year rough) mixed scrub/shrub, herbaceous and leaf litter/pine needle cast. Young pine plantations, shelterwood hardwood regeneration areas, flatwoods.

Fire Behavior Fuel Moisture Analysis Inputs
1 Hour: 4%
10 Hour: 6%
100 Hour: 8%
Live Fuel Moisture 65%

	Slope 0%		**Slope 35%**		**Slope 70%**	
Windspeeds (20') **(Adjustment Factor of .3)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**
Flame Length (ft.)	7	13	8	13	10	15
Rate of Spread (ch/hr)	22	96	30	104	53	127
Fireline Intensity (Btu/ft/s)	339	1460	457	1578	811	1932
1 Hour Fire Growth Potential (size: acres/perimeter: chains)	27ac / 62ch	236ac / 217ch	42 ac / 79ch	263 ac / 233ch	52ac / 129ch	151ac / 281ch

Table 2. Fire Behavior Characteristics for the SH4 Fuel Model

Implications to Mangers -

If live woody moisture percentages are 65-100%, direct attack by dozer, tractor plows or water delivery systems will be limited to fires with wind speeds less than 20mph. As live fuel moisture drops below 65%, direct attack is only possible with dozer and tractor plow on flat ground with wind speeds less than 10mph. Fire spread will be more rapid but with less intensity than heavy load shrub.

Timber-Understory Fuels

Timber Understory Model 3 (TU3) Medium Load Humid Climate Timber-Shrub

The primary carrier of fire in the TU fuel models is forest litter in combination with herbaceous or shrub fuels. Wind speed and slope significantly affect rates of spread in this fuel type. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model. Southern area comparative forest types: Open canopy (closure 35-50%) longleaf/shortleaf pine, 1-3 year rough flatwoods, and shelterwood cut hardwood stands 3-6 years.

Fire Behavior Fuel Moisture Analysis Inputs

- 1hr 4%
- 10hr 6%
- 100hr 8%
- Live Herbaceous Moisture 40%
- Live Woody Moisture 65%

	Slope 0%		**Slope 35%**		**Slope 70%**	
Windspeeds (20') **(Adjustment Factor of .3)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**
Flame Length (ft.)	8	16	9	16	12	18
Rate of Spread (ch/hr)	29	123	36	129	57	150
Fireline Intensity (Btu/ft/s)	519	2195	646	2321	1025	2700
1 Hour Fire Growth Potential (acres)	38	304	52	329	102	407

Table 3. Fire Behavior Characteristics for the TU3 Fuel Model

Implications to Mangers

Direct attack with hand crews, dozers and engines would be ineffective in these fuels under drought conditions (1hr: 3, 10hr: 5, 100hr: 6) with wind speeds above 10 mph with no slope. Initial attack with equipment may be possible if fine dead fuel moistures are higher (1hr 6, 10hr 7, 100hr 8) and wind speed is at or below 10 mph.

If drought conditions are present during fall leaf drop careful consideration of line construction locations and holding capability of the available resources should be observed due to increased spotting potential of fine non-compacted fuel load. Organic duff soil can be expected to be available for ignition and sustained smoldering fire at moisture percentages less than 100%.

Timber Litter Fuels

Timber Litter Model 6 (TL6) Moderate Load Broadleaf Litter

Primary carrier of fire is moderate hardwood litter and dead/down woody fuel loading. Recently fallen hardwood leaf litter typically forms a fluffy bed of continuous fine fuels that dries rapidly and can be dispersed by moderate surface winds often contributing to fire spotting in front of the main fire and creating control problems on prepared fire breaks.

Fire Behavior Fuel Moisture Analysis Inputs

1 hour: 3%
10 hour: 5%
100 hour: 8%

	Slope 0%		Slope 35%		Slope 70%	
Windspeeds (20') **(Adjustment Factor of .3)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**
Flame Length (ft.)	3	5	3	5	4	6
Rate of Spread (ch/hr)	4	18	6	20	11	25
Fireline Intensity (Btu/ft/s)	41	179	57	195	104	242
1 Hour Fire Growth Potential size: (acres)/ perimeter(chains)	1ac/12ch	9ac/41ch	1.5ac/15ch	11ac/45ch	4ac/26ch	13ac/55ch

Table 4. Fire Behavior Characteristics for the TL6 Fuel Model – 1 hr FDFM 3%

Implications to Mangers

Overall, direct attack by hand crews and dozers should be effective in conditions of wind speeds less than 30 mph. If drought conditions are present organic duff layers of the forest floor may be susceptible to ignition and longer duration smoldering fire, typical leaf blower line construction may not be as effective in creating fire lines or may only be effective for short durations (<1-2 hours).

Timber Litter Model 9 (TL9) High Load Broadleaf Litter

The primary carrier of fire in TL9 is very high load, fluffy broadleaf litter. TL9 can also be used to represent heavy needle-drape.

Fire Behavior Fuel Moisture Analysis Inputs

1 Hour: 3%
10 Hour: 5%,
100 Hour: 8%

	Slope 0%		**Slope 35%**		**Slope 70%**	
Windspeeds (20') (Adjustment Factor of .3)	**Low (10mph)**	**High (30mph)**	**Low (10mph)**	**High (30mph)**	**Low (10mph)**	**High (30mph)**
Flame Length (ft.)	5	8	5	9	7	10
Rate of Spread (ch/hr)	7	26	9	28	17	36
Fireline Intensity (Btu/ft/s)	147	579	203	636	373	805
1 Hour Fire Growth Potential size: (acres)/ perimeter(chains)	2ac/18ch	17ac/58ch	4ac/24ch	19ac/63ch	9ac/39ch	27ac/78ch

Table 5. Fire Behavior Characteristics for the TL9 Fuel Model

Implications to Mangers

Direct attack by dozers should be effective in conditions of wind speeds less than 30 mph with a 1hr FDFM > 7%. At very low 1 hour FDFM (3%) direct attack may be possible with winds less than 30 mph. If drought conditions are present, organic duff layers of the forest floor will be susceptible to ignition and longer duration smoldering fire, typical leaf blower line construction may not be as effective in creating fire lines or may only be effective for short durations (<1-2 hours).

Grass Fuels

Moderate Load, Dry Climate Grass (Dynamic) GR4

The primary carrier of fire in GR4 is continuous, dry-climate grass. Load and depth are greater than GR2; fuel bed depth is about 2 feet.

Fire Behavior Fuel Moisture Analysis
Inputs
1 hour: 4%
10 hour: 6%
100 hour: 8%

	Slope 0%		Slope 35%		Slope 70%	
Windspeeds (20') **(Adjustment Factor of .7)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**	**Low** **(10mph)**	**High** **(30mph)**
Flame Length (ft.)	14'	28'	14'	28'	16'	29'
Rate of Spread (ch/hr)	187	672	200	672	238	672
Fireline Intensity (Btu/ft/s)	1711	6139	1826	6139	2171	6139
1 Hour Fire Growth Potential size: (acres)/ perimeter(chains)	822	5087	904	5087	1162	5087

Table 4. Fire Behavior Characteristics for the GR4 Fuel Model – 1 hr FDFM 4%

Implications to Mangers

Abundant and receptive grass fuels in addition to drought and frost curing will remain a concern across West and North Texas as well as Western Oklahoma. Mobile direct attack, from the black should be successful on most fires within this fuel model, with winds <20 mph if the terrain is conducive for equipment. Rapid rates of spread will result in a large fire within an hour with a 10mph wind. Think ahead 2-4 hours and monitor your fire behavior, weather conditions and forecast.

Slash-Blowdown Fuel Type Models (SB)
Hurricane and/or Tornado Impacted Areas

Slash Blowdown Model (SB4) - High Load Blowdown

The primary carrier of fire in SB4 is heavy dead and down blowdown. Extremely High fire intensities and high resistance to containment can be expected in this fuel type.

Fire Behavior Fuel Moisture Analysis Inputs

1 Hour Fuel Moisture 4%
10 Hour Fuel Moisture 6%
100 Hour Fuel Moisture 8%
Wind Adjustment .5

Slope 0%

	Low (10mph)	**High (30mph)**
Flame Length (ft)	12	26
Rate of Spread (ch/hr)	53	268
Fireline Intensity (Btu/ft/s)	1398	6799

Table 6. Fire Behavior Characteristics for the SB4 Fuel Model

Implications to Mangers

Flame lengths will exceed direct attack capabilities of hand crews, dozers, engines and tractor plows in these blowdown areas. Focal areas for these fuel conditions are: Florida pan handle and southwest Georgia in the path of Hurricane Michael from 2018, tornado disturbed stands from Texas to North Carolina, flood plain and drainages impacted from severe flooding events in TX, MS, AR, LA, SC, NC.

Hurricane Fuels

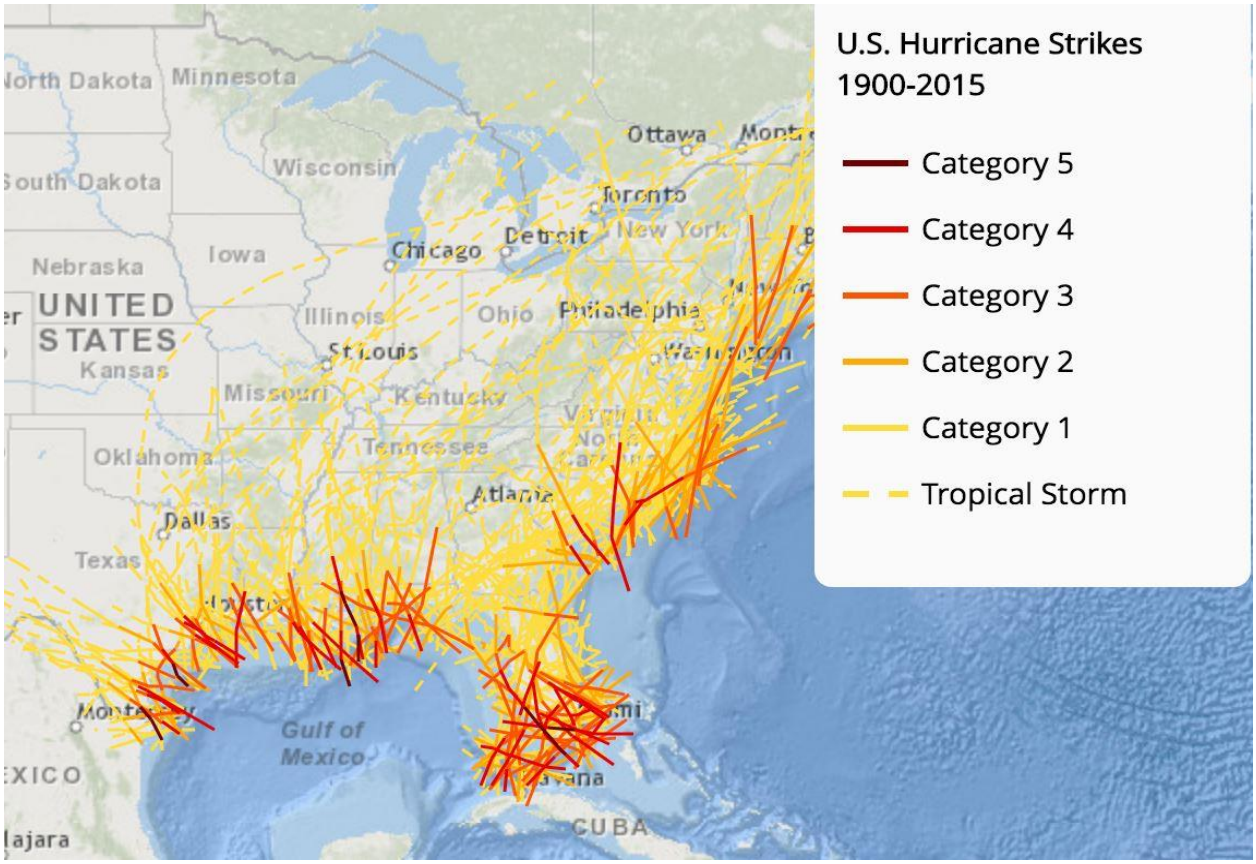


Figure 34. Map 20- Hurricane tracks in the southeastern United States, 1900-2015

Recent hurricanes have impacted wildland fuels in the southeast. Storm damage is predominantly in the coastal plain but can extend far inland. Hurricane Michael in October 2018, Laura, and Delta in 2020. Some studies have shown that elevated fire hazards after a catastrophic hurricane can last for decades. The damage from hurricanes includes defoliation, bending, bole breakage, uprooting, and canopy damage. Hurricane Michael caused significant amounts of damage to areas of the Florida panhandle created difficult access and placing large amounts of heavy fuel on the ground. Large trees are more susceptible to wind damage than younger or shorter tree. Some stands were reported to be "high graded" by the storms with only younger trees and woody shrubs remaining. Portions of the Kisatchie National Forests this year from hurricane Laura have seen pine stands with near 100% of large trees on the ground. Hurricane Hugo in 1989 was said to snap off or uproot 70% of merchantable pines on the Francis Marion NF. Damage is highly variable across the landscape with areas of heavy damage interspersed with less damaged stands.

Prior fire management of the forest effects how the storm damage effects the post storm fire behavior. Frequently burned areas such as the Apalachicola which was impacted by hurricane Michael in 2018 reported few impacts to fire behavior on prescribed burns and wildfires after the storm. The storm increased the fuel loading on the forest floor, but the availability of the heavy fuels was staggered over the course of several years. This allowed for prescribed fire treatments to proceed without significant changes to fire behavior. Wildfires in the immediate aftermath were reported to burn "somewhat hotter".

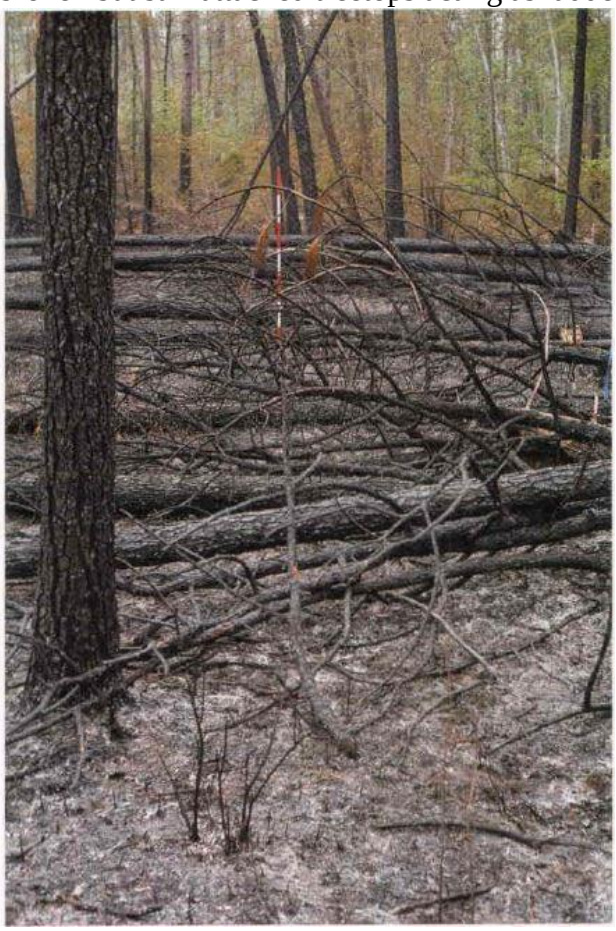
As fire moved thru the blown down canopies with still attached brown needles consuming in a jackpot pattern leaving the boles, branches, and stems intact.
Other areas of Florida that were more heavily impacted had difficulty in suppressing fires due to increased spotting and the inability of heavy equipment to push through the debris. The movement of fire along drainages was particularly difficult to stop due to uprooted hardwoods. The most reported impact to wildfire suppression was difficulty in accessing the fires and using heavy equipment to install containment lines. The roads leading to the fires were blocked and had to be cleared for use by UTVs and engines. The dozers were slowed considerably by having to push the heavy logs around. Managers in the heavy blow down areas reported that using indirect strategies and burn outs for suppression was more effective. Cross country travel by personnel was also limited by the addition of limbs and branches from the overstory mixed in the existing shrub component. One manager described this as a watch out situation.

Methods for quantifying the changes in fuel loading post hurricane include measuring surface fuel loadings in previously installed plots and using remote sensing to detect vegetative differences. The Normalized Vegetation Difference Index NDVI has been used to determine areas where the forest was altered by storms. In those damaged areas the fuel that was in the canopy is assumed to be on the ground with Landfire data modified accordingly. Fuel loading measured for the stereo photo series in 2007 and 2008 indicate that post hurricane fuel loading increased substantially following the damage. In sampled areas without recent storm damage the fuel loading of woody material in coastal plain forests averaged 3 to 4 tons per acre. Data collected on post hurricane sites around the region averaged 44 tons per acre. The average fuel loading from litter and duff increased slightly after the storm damage in these plots.

Plot	Forest Type	Times since Hurricane	% boles snapped	Location	Woody material tons/ acre	Forest Floor tons/ acre
ACPH 03	Sand Pine	2.5 years	4	FL	22.3	3.1
ACPH 04	Sand Pine	2.5 years	13	FL	23	5.7
ACPH 06	LL – palmetto	2.5 years	2	FL	42.1	6.7
ACPH 07	LL – Paletto	2.5 years	3	FL	46.4	5.3
ACPH 05	Sand Pine	2.5 years	7	FL	47.4	4.7
GCPH 02	SL – oak	1 month	6	Davy Crockett	21.3	2.2
GCPH 09	SL – oak	1 month	13	Texas	62.3	2.9
GCPH 05	SL – oak,	1 month	13	Davy Crockett	41	2.3
GCPH 10	SL – oak	1 month	23	Davy Crockett	71.9	3.5
GCPH 11	SL oak	1 month	44	Davy Crockett	74.6	1.5
GCPH 12	SL – Oak	1 month	75	Davy Crockett	82.7	4
GCPH 13	SL – oak	1 month	0	Davy Crockett	88.2	4
GCPH 08	SL – Oak	1.5 years	2	Desoto	58.1	3.7
GCPH 01	LL – Slash	1.5 years	3	Desoto	7.8	2.9
GCPH 06	SL – oak	1.5 years	0	Desoto	46.3	5.3
GCPH 07	Oak – Hickory	1.5 years	2	Desoto	51.1	6.6
GCPH 04	Lob pine – oak	1.5 years	0	Desoto	39.1	6.7
GCPH 03	SL – oak	1.5 years	5	Desoto	22.5	4.1
ACPH 02	Sand Pine	2.5 years	24	FL	15.3	5.9
ACPH 01	LL – palmetto	2.5 years	29	FL	8.9	0.9
				Average	43.615	4.1

Figure 35. Showing data from Stereo Photo Series for Quantifying Natural Fuels, volume XII: Post hurricane Fuels in Forests of the Southeastern United States

To model fire behavior in hurricane affected areas increase the wind adjustment factor, use unshaded fuel moisture calculations, reduce canopy bulk density, and change the fuel models based on observed changes to fuel loading. Expect higher rates of spread, flames lengths, and fire line intensity. Increased smoke production from residual smoldering of heavy fuels can be a concern in WUI areas. Plot data shows that 1000-hour fuels can take years to consume incrementally over the course of many burns. The reduction to the canopy effects fire behavior in several ways. Fuels that had previously been shaded are now exposed to the sun for longer periods each day. Anticipate quicker drying times and longer burning periods on exposed sites. Winds will also be greater in stands with less over story due to a lack of obstructions. Some managers described broken but still attached treetops acting as ladder fuels.



Studies on the Francis Marion conducted in April and May of 1990 (see photos above) concluded that immediate and extensive use of prescribed fire to reduce fine-fuel loadings was the most appropriate fire management action following hurricane damage (General Technical Report SE-82). The research burns were implemented 6 to 7 months after the hurricane damage. The results are like observations and reports from fire managers on the Delta NF following hurricane Katrina in 2005 and on the Apalachicola NF following hurricane Michael in 2018. On these forests, prescribed fire was used to “clean up” storm debris prior to the drying and availability of heavy fuels.

Summary

Overall, drought conditions have moderated due to significant moisture from hurricanes and tropical storm passage across the Southern Area Geographic Area over the past two years. Significant rainfall impacts coupled with cooler than normal temperatures during the past three months have resulted in a transition back to a moderated fire season across large expanses of the Geographic Area. In response to this building drought a Fire Risk Analysis was conducted to assess the potential and expected fire situation for the fall fire season. The assessment period extends from late September through December. The analysis included a look at the current weather situation and extended forecast, fuels compared to normal for the time of year, National Fire Danger Rating System's energy release component for each Southern Area Predictive Service Area, and fire occurrence. Recommendations are provided based on the findings and conclusions of the analysis. The portion of the region in this analysis is entering their normal fire season. Combined with typical environmental factors, however, are persisting and building drought conditions that are expected to broaden over the upcoming months.

Based on current fuel conditions and forecasted weather conditions, the most likely scenario is an average level of wildfire activity for the next month and beyond in most of the region. Certain areas of West Texas and coastal areas of Louisiana and Mississippi may experience elevated fire potential. This level of activity may cause an increased demand for firefighting resources being mobilized within states. There is an average probability that the Southern Area will see higher than normal mobilization across state boundaries and from outside the Geographic Area, for this time of the year. Although not assessed in entirety in this analysis, analysts have noted the potential for a transitioning to La Nina year and if this transition comes to fruition, fire danger conditions could worsen into the start of next year.

Conclusions

Most Likely Case, Probability-70%, Most of the Southern region has a normal fall fire season with some small areas experiencing above average fire activity due to rainfall deficits. Current drought effected parts of west Texas, Oklahoma, and Arkansas will continue to be dry due to the La Nina weather pattern. Mobilization of aviation and ground resources to these locations within the geographic area is required due to increased fire behavior and spread potential. With some small-scale mobilization of out of region resources. However, few Type 3 incidents occur at the same time in the region.

Best Case, Probability–15%, Tropical systems continue and normal rainfall pattern develops. This brings frequent rainfall events and enough moisture to mitigate rainfall deficits and compact leaves after leaf drop. The normal fall time wildfire occurrence develops and very light to no initial attack is experienced.

Worst case, Probability–15%, The fall fire season extends deeper into fall than normal due to the light drought conditions and changing weather patterns. A normal amount of initial attack activity is experienced for this time of the year; however, new ignitions would observe severe fire behavior and spread potential due to prolonged drought and minimal rainfall frequency (i.e., fires would get bigger faster). Some additional aviation and ground resources are required due to fire behavior. Several Type III incidents occur at the same time in the geographic area. However, no large-scale mobilization of out of region resources are required due to at least some mitigating weather pattern (high humidity or periodic rainfall). The expected transition to La Nina is experienced and overall drought and associated fire danger conditions escalate over the next year.

Recommendations

- The majority of the geographic area should observe normal wildfire fire severity and condition through the fall. Fire managers should continually assess local drought conditions, and in those areas of where drought continues to build, consider resultant fire behavior, which can be more intense under moderate fire weather. As fire danger indices exceed the 97th percentile, extreme fire behavior and rapid fire spread characteristics should be expected. Tactics should be altered to provide for firefighter and public safety.
- Normal La Nino impacts have been moderated with several waves of tropical moisture events across the geographic area, however:
    - Expanded and intensifying drought during the winter months ahead, especially across the southern and central Plains and eastern Gulf Coast.
    - Greater chance for warmer-than-normal temperatures when you look at the winter months combined (this doesn't mean portions of the South won't see cold temperatures at all though).
    - The greatest chances for drier-than-average conditions are predicted in the Southwest, across Texas, along the Gulf Coast, and in Florida.
- Though the fall season isn’t projected to be anything more than normal, do not expect any fire to be routine. Be prepared to utilize indirect tactics with extended mop-up. Utilize aerial supervision to help direct crews and keep them informed on fire behavior. Ensure that LCES is in place before engaging on any fire. Remember to STOP, THINK, and TALK before you ACT… and actively look for ways to minimize risk to firefighters in what is forecast to be a period of very high fire danger.
- Maintain capabilities to mobilize Type I, II, and III teams.
- Augmentation of initial attack resources will likely be achieved through local partner to partner sharing, as normal.
- Ensure firefighter pocket cards are up to date and posted on the national website. http://fam.nwcg.gov/fam-web/pocketcards/
- Maintain national standardized predictive services products in a timely fashion. Produce new products as requested.

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