Southern Area Wildfire Risk Assessment

Fall 2024

Southern Area Decision Support Group

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Executive Summary

This wildfire risk assessment evaluates critical factors from the summer season and assesses the potential activity for the Fall 2024 fire season. The outlook period extends from late September through November 2024. The analysis includes a look at the current weather situation, extended forecast, fuels compared to normal for the time of year, the National Fire Danger Rating System's Energy Release Component (ERC) and Growing Season Index (GSI) for select areas, and fire occurrence across the GACC to date. Recommendations are provided based on the findings and conclusions of the analysis.

The assessment is summarized into three scenarios: a most likely, best-case, and worst-case with a description of how each might unfold. Keep in mind that accurately predicting fall fire activity remains challenging this year due to several competing factors. Although drier than normal conditions are expected as La Niña strengthens, the potential for tropical moisture complicates forecasts, making it difficult to pinpoint specific fire risks. Tropical systems, depending on their timing and intensity, can either provide short-term relief or worsen fire hazards by introducing brief rainfall followed by extended dry periods.

Most Likely Scenario:

During late summer, Texas, Alabama, and Mississippi saw spikes in fire activity, which were subsequently eased by heavy rainfall. However, key factors remain uncertain going forward. The persistent drought in many parts of the region, combined with the forecasted arrival of more tropical moisture, could significantly alter the fire outlook. While recent rainfall has improved soil and dead fuel moistures, the wildfire risk is far from eliminated, especially in areas where live vegetation has already cured. Drought-stressed vegetation can quickly dry out again after rain, becoming highly flammable in a short period.

A major concern is the drought-induced pine tree mortality in the Gulf States. These dead trees introduce heavy fuels to the fire environment and no longer moderate the windspeed. Recently dropped needles are available to burn immediately. If significant fire activity occurs in these areas, additional out-of-area fire suppression resources will likely be required.

Areas with elevated fire risk include eastern Tennessee, Kentucky, and South Carolina, which have gone nearly two weeks without significant rainfall. Portions of Texas and Oklahoma remain dry, increasing the chance of early fire outbreaks. Though the potential for large fires remains relatively low into the first week of October, the combination of unpredictable precipitation, drought, and variable fuel conditions could cause fire risks to escalate quickly if conditions shift. This situation underscores the need for continued close monitoring of weather patterns and fuel conditions, as well as preparedness for rapid response to any emerging fire threats La Niña conditions are likely to develop over the coming months, with a transition from neutral conditions already observed. Previous transitions from El Niño to La Niña (e.g., 1995, 2016) have brought warm and dry conditions, particularly in the Mississippi Valley and southern Appalachians.

Best Case Scenario:

In a best-case scenario, tropical activity continues well into October, bringing widespread rainfall to drought affected areas. This influx of moisture would significantly reduce the fire risks that have built up over the dry summer months. The steady rains would help restore soil moisture, rejuvenate vegetation, and increase the moisture content in dry fuels, making it less likely for large-scale wildfires to occur.

Despite the reduced wildfire risk, concerns would still linger around pine mortality and the accumulation of grass fuels, which can ignite quickly once dry conditions return. Pine forests in the region have seen elevated mortality due to insect infestations and drought, leaving behind significant amounts of dead and stressed trees.

If rainfall patterns align with projections for a back-loaded hurricane season, as has occurred during previous La Niña years, continued rain through October and even into November could further mitigate fire risks. These later storms would bring much-needed relief to drought impacted areas and help moderate the fire environment. The additional rainfall would maintain higher fuel moistures, reducing fire activity even as La Niña strengthens.

Additionally, the timing of these storms is critical in counteracting the dry, windy conditions that typically follow cold fronts in La Niña years, which can quickly dry out vegetation and increase fire risks. Prolonged rain would lessen the impact of these dry spells, ensuring the fire risk remains low.

Worst Case Scenario:

In a worst-case scenario, the intensification of La Niña worsens drought conditions across the Southern region, significantly increasing the likelihood of wildfires. Rather than easing fire risks, tropical storms would introduce erratic weather patterns, creating a volatile mix of brief rainfall followed by prolonged dry periods. These storms may deliver too little moisture, or rainfall that is too localized to provide meaningful relief, leaving drought-stricken areas vulnerable to quick drying once the storms pass.

Adding to the threat are dry cold fronts and windy conditions that are common during La Niña years. These fronts can rapidly dry out vegetation and elevate wind speeds, making it easier for fires to start and spread quickly. This dynamic could create a broad zone of heightened wildfire risk, extending from Texas and Oklahoma into the Appalachians. The combination of drought-stressed fuels and unpredictable weather patterns would pose a severe threat across the region.

Another major concern is the worsening of pine beetle infestations, which are already widespread in parts of the Gulf States. These infestations leave behind large amounts of dead timber, which serve as potent fuel sources for fires. In the Appalachian region, where drought has slowed vegetation recovery, even small ignition events could quickly escalate into major fire incidents, especially if compounded by gusty winds from passing cold fronts.

Human activity further exacerbates this risk. Warm, dry weather typically encourages outdoor work and recreation, increasing the likelihood of accidental ignitions. If La Niña continues into the fall, the combination of these factors—intensified drought, insufficient tropical moisture, windy cold fronts, beetle-kill, and human activity—could create a prolonged period of severe wildfire danger across much of the Southern Area.

Key Findings

- Compared to fall of 2023 this summer had minimal fire activity in a few isolated areas. However, potential remains this year for pulses in fire activity in several different parts of the region – Texas, the Gulf Coast, and the southern Appalachians. Summer fire outbreaks in North Texas and the Gulf Coast were moderated by tropical moisture just as fire activity was spiking, illustrating how rapid that conditions can change.
- When the transition to a drier condition occurs will have a large impact on the remainder of the fall season. If precipitation trails off in late September, normally low rainfall in October will provide minimal relief for the southern Appalachians as leaves begin to fall. If above average moisture from tropical storms continues into October after most leaves have fallen, fire activity will be lessened. By then shorter days and a lower sun angle could prevent the necessary drying that large fire growth requires.
- Abnormally Warm Summer of 2024: Most of the Southern Area experienced unusually warm conditions, with near-normal temperatures only in parts of the Mid-Mississippi Valley and eastern Texas. Florida and Mississippi recorded their warmest summer on record.
- Variable Rainfall and Extreme Events: Rainfall was inconsistent in the summer, with flash droughts and flooding across different regions. Three hurricanes made landfall in 2024, bringing significant rainfall to some areas and exacerbating drought conditions in others.
- Hurricane Impact: Hurricanes Beryl, Debby, and Francine contributed to surplus rainfall, power outages, and flooding.
- Drought Conditions: abundant grass growth in northwest Texas followed by drought and heat has resulted in heavier than normal grass fuels, increasing fire risk. Drought anomalies remain severe in northern Texas and Oklahoma.
- Potential La Niña Development: Historically La Niña conditions have been accompanied by warmer and drier conditions in the southeastern states.
- Warm Ocean Conditions: Record warm sea surface temperatures in the Gulf and Atlantic, combined with potential late-season tropical cyclone activity, could complicate fire risk across the region, especially if storms fail to provide sufficient rainfall.

Management Implications and Recommendations

- Expect Extreme Fire Behavior: In areas where fire danger indices exceed the 97th percentile, anticipate rapid fire spread, full fuel consumption, and increased spotting. Fire intensity may prevent direct attack.
- Prolonged Mop-Up in Drought Areas: Fires in drought-affected regions may smolder for extended periods, requiring more resources for mop-up and patrol. Be prepared for possible

reburns on contained fires. Adjust tactics for firefighter and public safety, using point protection where necessary.

- Monitor Days Since Rain: Rainfall immediately following leaf drop reduces wildfire risk. However, dry periods after leaf fall increase fire risk significantly. Backpack blowers are less effective when ground fuels are consuming.
- Caution in Prescribed Burns: Drought conditions can amplify fire behavior. Prescribed burns may need additional staffing and contingency resources for safe execution.
- Manage Cured Hurricane Fuels and areas of overstory pine mortality: Indirect attack strategies are recommended for areas with blowdown from past hurricanes and/or recent pine mortality, as access may be limited due to downed large-diameter fuels.
- Prepare for Dry Cold Fronts: Expect rapid drops in humidity and strong gusty winds during fall cold fronts, which can sharply elevate fire behavior.
- Monitor Frost-Cured Vegetation: Leaf drop combined with frost curing can rapidly escalate fire conditions, especially during days with extreme temperature swings.
- Address Fatigue: Extended fire suppression efforts may lead to firefighter fatigue. Monitor fatigue closely and use out-of-region resources to relieve local personnel.
- Update Firefighter Pocket Cards: Ensure all pocket cards are current and posted online for reference.
- Use Predictive Services: Maintain timely updates of predictive services products and create new tools as needed.
- Prioritize Safety: Always STOP, THINK, TALK, and ACT to minimize risks to firefighters.

Background

The meteorological summer of 2024 was abnormally warm across most of the Southern Area, but near normal temperatures were observed from portions of the Mid-Mississippi Valley to eastern Texas (image 1a). Most areas along the Gulf Coast and in the Plains experienced average temperatures in the top 1/10th of the 130-year period, while multiple counties in Florida and Lauderdale County, Mississippi, observed their warmest summer on record.

Rainfall was highly variable in space and time, with large swings between flash drought and flooding observed in a number of areas. Three strengthening hurricanes have made landfall in the Southern Area so far in 2024, resulting in areas of surplus rainfall on the 90-day percent of normal map (image 1c). Hurricane Beryl brought widespread power outages and tree damage to southeast Texas in early July, along with another round of flooding after an unusually wet spring. Hurricane Debby drenched parts of Florida and the Eastern Seaboard in early August, as well. Rainfall with Hurricane Francine was a bit more scattered and occurred in areas that otherwise had an unusually dry summer. Francine's moisture is more evident on the 30-day percent of normal map (image 1d), and its remnants continue to produce rain in the Lower Mississippi Valley as of this writing.

Abundant springtime rain in northwest Texas and adjacent areas was followed by a period of hot and dry conditions in July and August, allowing abundant grasses to cure out in time for a period of increased fire activity. Since then, most of northwest Texas has been drenched yet again, but dry anomalies are still pronounced in far northern Texas and most of Oklahoma (images 1c, 1d). The full extent of grass loading in the Plains states is yet to be determined but will likely be a major factor in the dormant season once drought or freezes make these fuels burnable.

The standardized precipitation and evapotranspiration index (SPEI, image 1b) is a measure of the balance between evaporative demand and rainfall. Areas of extreme drought denoted in dark red are where excess evaporative demand and below normal rainfall likely resulted in the most severe stress to plant life in the region over the summer months. This includes much of western and northern Texas into southern Oklahoma, in addition to scattered areas of the middle and eastern Gulf Coast, Tennessee Valley and portions of the Appalachians. August's SPEI values were noteworthy across Mississippi, Alabama and Tennessee, generally lining up well with flash drought onset and an observed increase in fire occurrence. Issues with pine mortality caused by beetle infestations after 2023's drought eased once Francine's moisture worked into the region in mid-September, but this will likely become an issue again in the region for years to come.

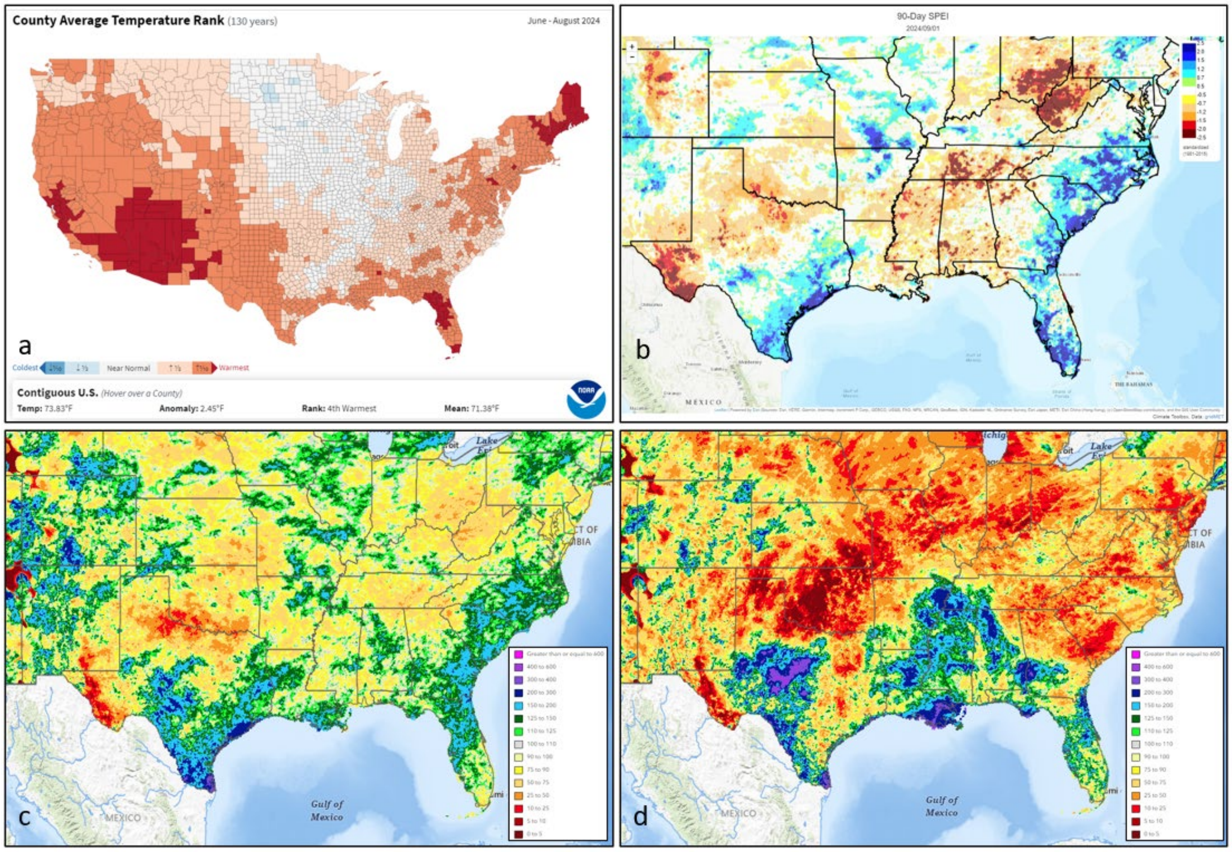

Figure 1: a) county/parish rankings of average temperatures during 2024's meteorological summer ([NCEI](#)), b) the standardized precipitation evapotranspiration index for 2024's meteorological summer ([Climate Toolbox](#)), c) 90-day percent of normal rainfall as of 0800ET September 16th and d) 30-day percent of normal rainfall as of 0800ET September 16th.

Typical Rainfall and Precipitation Trends from September to December

Rainfall across the Southern Area typically trends from convective-dominant forcing in September and early October to precipitation associated with large-scale low-pressure systems in October, November and December. This is evident in the distribution of rainfall near the Gulf Coast and East Coast through the first part of the outlook period, which is largely driven by sea breeze thunderstorms typical of late summer. Tropical activity also contributes to rainfall patterns, but this is highly variable year to year. October is certainly a transition month regionally, with relatively drier conditions favored over the Appalachians and Southeast most years. Because of the waning influence of solar heating, October is normally the beginning of drier weather across Florida, which extends through the winter for most of the peninsula. At the same time, monsoonal activity that often influences rainfall patterns in western parts of the geographic area quickly wanes through September, occasionally lingering into October a handful of years, before high pressure increasingly dominates the High Plains and Texas mountains heading into fall.

Low pressure systems and their associated fronts would normally be expected to result in broader areas of soaking rainfall during late fall and early winter, with the focus trending from Arkansas, eastern Oklahoma, east Texas and Louisiana in November to the Tennessee Valley and southern Appalachians by December. Precipitation near the Gulf Coast and East Coast may be influenced by tropical cyclones some years, with more abundant rainfall likely to occur in ENSO-neutral and especially La Niña years due to atmospheric conditions being more conducive to increased activity. Unfortunately, there is no obvious normal when it comes to determining where rainfall from tropical cyclones may be favored. In a normal year, rainfall needed to end the drought prior to the fall fire season is not favored to occur in areas of ongoing severe to exceptional drought without assistance from tropical cyclones.

Potential Impacts from This Year's Expected La Niña

It is too early to say with any confidence what conditions we can expect leading into the fall fire season. La Niña is likely to develop over the next few months as sea surface temperatures in the central and eastern tropical Pacific gradually cool down. Despite ongoing neutral conditions, there are some factors pointing towards La Niña-like conditions already occurring in the atmosphere. Whereas the standard Oceanic Nino Index (ONI) only accounts for three-month-averaged sea surface temperature anomalies in the east-central tropical Pacific, the Multivariate ENSO Index version two (MEIv2) factors in tropical Pacific sea level pressure patterns, sea surface temperatures, surface winds and outgoing longwave radiation (a measure of cloud cover and associated rainfall). As of August 31st, 2024, an ONI for June-July-August of +0.1°C is considered ENSO-neutral, while an MEIv2 for July-August of -0.7 is the 2nd two-month period of La Niña-like conditions. There are benefits and downsides to both indices, but the MEIv2 perhaps better correlates to conditions that are impacting weather patterns than the legacy ONI.

Developing a set of analogs based around years with a similar transition in ENSO conditions can tell us what type of weather patterns could dominate the next few months. However, in an era of rapidly warming oceans and other less understood factors, the traditional relationships between our weather and the status of ENSO may not fully apply. The following years were chosen as analogs based on the transition from moderate or strong El Niños early in a year (MEIv2 ≥ 1.0) to La Nina conditions the following autumn (MEIv2 ≤ -0.5): 1995, 1998, 2007, 2010 and 2016. Years were only considered that fit into the 1991-2020 climatology since a generally cooler climate regime in decades past can skew averaged temperatures in that direction. Analogs may not tell us much about local rainfall patterns, especially when it only takes one tropical cyclone to alter an ongoing drought, but they can give us a general idea of where dry or wet weather is favored due to the large-scale weather patterns that dominate.

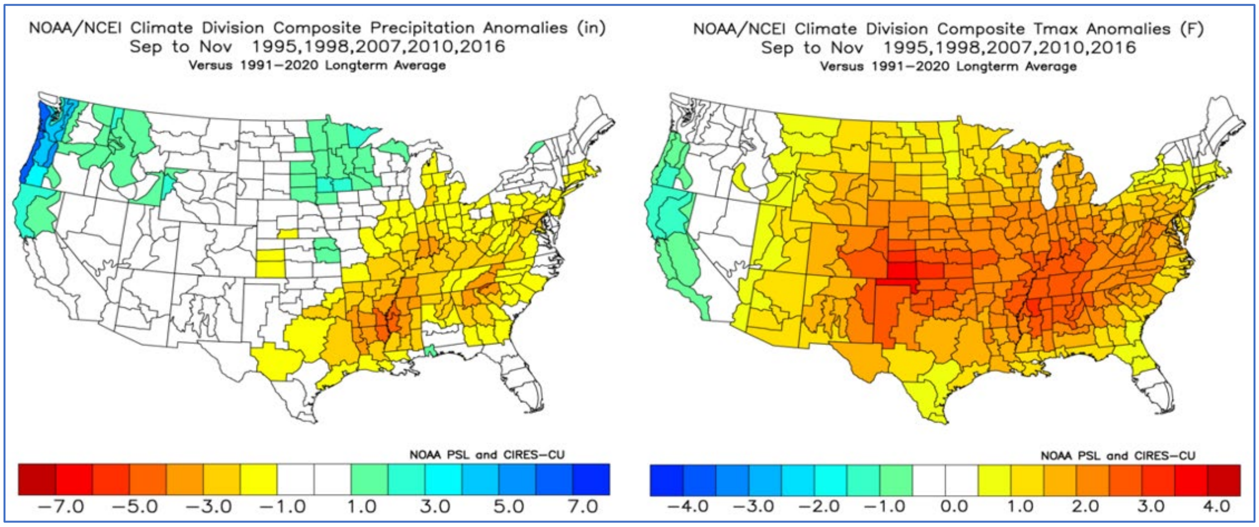

Figure 2: Composite analogs for meteorological fall precipitation anomalies (left) and high temperature anomalies (right), based on years with a transition from a moderate or strong El Niño to La Niña.

Based on these analogs, developing La Niñas have historically resulted in anomalously warm and dry conditions throughout large parts of the geographic area. Dryness on average is favored across the Mississippi Valley and southern Appalachians. Tropical activity these years was concentrated in the coastal Southeast or over the open Atlantic, with the exception of 1995, which featured multiple tropical disturbances spreading rainfall across central and eastern portions of the geographic area. Meanwhile, a dominant high pressure ridge that is on average centered in the Great Plains has tended to favor above normal daily average and high temperatures in most of the region, with conditions perhaps closer to normal along the coasts and over the Florida peninsula. The historic fire season of 2016 featured a high pressure ridge during meteorological fall that was unusually strong across areas from Quebec and Ontario, extending through the Great Lakes to the Mississippi Valley and Plains. This persistent ridge aloft in 2016 resulted in many areas experiencing the warmest and driest meteorological fall in over 100 years. 2016 was a clear outlier in the southern Appalachians, as is evident on the scatter plot of vapor pressure deficits versus rainfall below. Increased vapor pressure deficits draw moisture out of the soil and plants more readily, which is more impactful when rainfall is insufficient to alleviate drought.

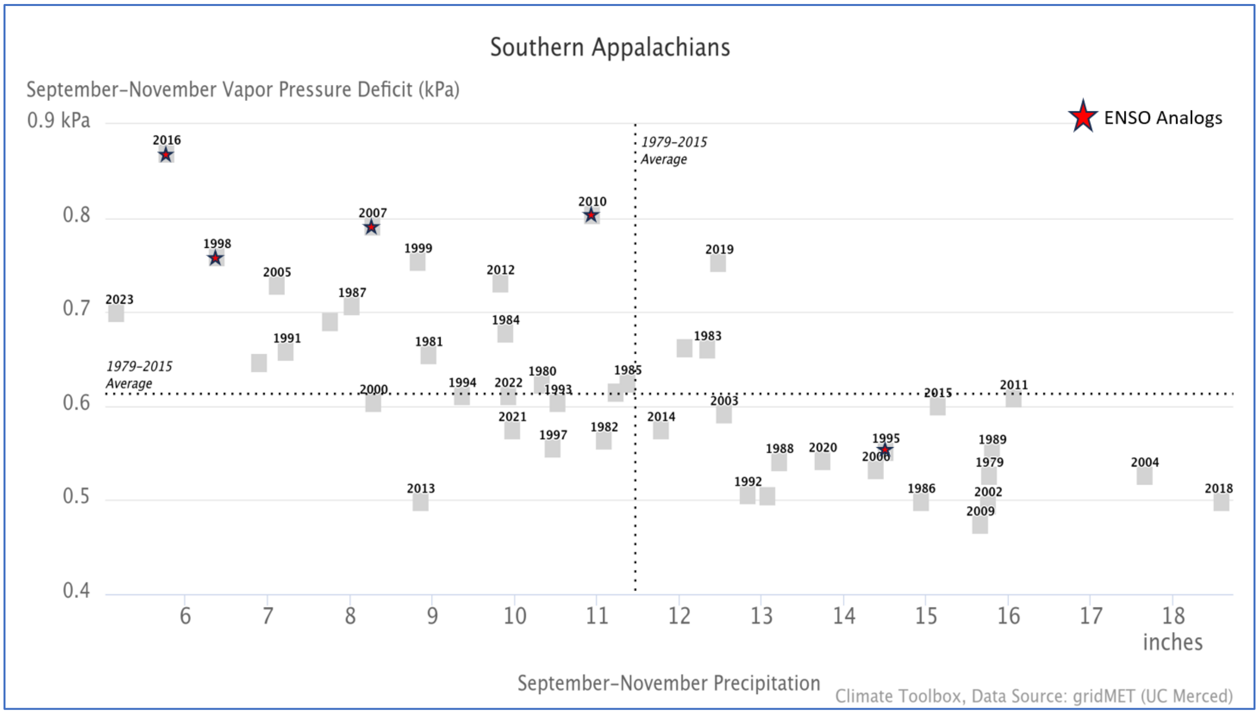

Figure 3: A scatter plot of area-averaged vapor pressure deficits versus precipitation over the Southern Appalachians from 1979-2023, using the Climate Toolbox's Historical Climate Scatter tool (link). Years on the upper left were abnormally dry, trending towards abnormally wet on the lower right.

The tropics are likely to play a major part in the fire environment for this year's fall fire season. Although calls for a hyperactive season have so far not come to fruition, abnormally warm to record warm sea surface temperatures remain widespread across the Gulf of Mexico, Caribbean Sea and north Atlantic. Some of the instability and Saharan dust issues appear to be diminishing, while the Madden-Julian Oscillation (MJO) appears likely to favor a burst of Atlantic tropical cyclones from the last week of September into at least the first half of October. Years featuring a transition from El Niño to La Niña often see a backloaded hurricane season that carries into October and November. There are some similarities to 2016 here, with unusual early season activity followed by a quieter period, before a rapid increase in named storms from mid-September onward. Three major hurricanes developed in 2016 between the end of September and late November, including Hurricane Matthew, a category five storm that devastated Haiti and drenched parts of the Southeast in early October.

Well over half of the Southern Area is in some form of abnormal dryness or drought after an unusually parched August. According to the US Drought Mitigation Center's long-term composite drought indicator, an objective measure of soil moisture and atmospheric conditions, the most significant drought is scattered from the Lower Mississippi Valley to the mountains of Virginia, with similar conditions in much of West Texas and northeast Oklahoma. Fuel conditions of note that played into this outlook include pine mortality from the 2023 drought and subsequent beetle infestations inland from the central Gulf Coast. Above normal grass loading in parts of the Plains will likely come back into the picture as La Niña is expected to begin this fall.

Critical Fire Weather Patterns

Lingering Late Summer and Early Fall Weather Watchouts

- **Pre-frontal Compressional Warming**: As weather fronts approach, compressional warming can lead to hotter than anticipated high temperatures. This phenomenon occurs when air is forced to descend, heating as it compresses. This can also drive minimum relative humidity lower than forecasted, creating an environment conducive to fire spread. These conditions may develop rapidly, leaving limited time for fire managers to respond.
- **Erratic Thunderstorm Winds**: Thunderstorms, even those producing little or no rainfall, may generate erratic outflow winds. These winds, often far from the storm's core, can be unpredictable, stirring extreme fire behavior in areas with drought-affected or high-risk fuels. Such conditions can catch firefighting teams off-guard, potentially causing fires to spread quickly in unexpected directions.
- **Sea Breezes and Abrupt Wind Changes**: Even into October, sea breezes can develop along coastal areas, especially during warm weather with light background winds. These breezes can cause sudden shifts in wind velocities and directions, temporarily increasing fire danger by altering how a fire spreads, especially in regions with dry fuels.
- **High Temperatures Persisting into Fall**: While temperatures at or above 100°F become less common as the days shorten, they are still possible in the warmer parts of the region into late September and early October. Sandy or dry soils can exacerbate this trend, leading to localized hotspots of high fire danger.

Dry Cold Fronts

- **Fall and Winter Dry Fronts**: October and November are prime months for dry frontal passages, though they can occur throughout the fall and winter. These fronts typically bring little to no precipitation but are followed by dry air masses that result in critically low relative humidity levels during the day, with minimal recovery overnight. If a dry front is accompanied by a strong pressure gradient, expect sustained westerly or northerly winds with gusts of 30-40 mph, significantly increasing fire risk.

- **Fuel Drying**: These dry air masses can quickly deplete moisture in dead fuels, creating dangerous fire conditions, especially in areas with freshly fallen leaf litter, grass-heavy regions, or where surface fuels combine with ladder fuels in drought-stressed pine forests.

Tropical Cyclones and Their Adjacent Dry and Breezy Conditions

- **Dual Impact of Tropical Cyclones**: While tropical cyclones can quickly alleviate drought conditions through heavy rainfall, they can also generate critical fire weather on their periphery. Strong winds, not directly linked to the cyclone's core, often occur between the cyclone and high-pressure systems. As high-pressure systems strengthen in fall, they generate dry air masses, which, combined with subsiding air from cyclones, can create corridors of dry, gusty winds.

- **Subsidence and Fire Risk**: Subsidence, or downward-moving air on the edges of a cyclone, can warm as it descends, further drying the atmosphere. This warming can create localized areas of extreme fire danger, with enhanced winds contributing to faster fire spread. Tropical Storm Harold and Hurricane Idalia demonstrated this effect, leading to enhanced fire weather conditions. Historically, many tropical storms have resulted in similar impacts.

Mountain Waves

- **Mountain Wave Formation**: Mountain waves are air movements that occur near mountainous terrain, often during stable air conditions. These waves are particularly common in late fall and early winter in the Appalachians but can develop near any elevated terrain in the region. Mountain waves are most likely when the wind direction is within 30 degrees of being perpendicular to a ridge line.
- **Extreme Winds and Fire Risk**: These mountain waves can produce narrow but extreme wind events, with gusts exceeding hurricane-force levels. Wind direction may shift rapidly, catching fire crews off-guard. The eastern side of the Appalachians is especially vulnerable to these events, which can enhance fire spread by rapidly drying fuels and fanning flames. Additionally, mountain waves can cause new fire ignitions by downing power lines in high-wind areas.

Outlooks

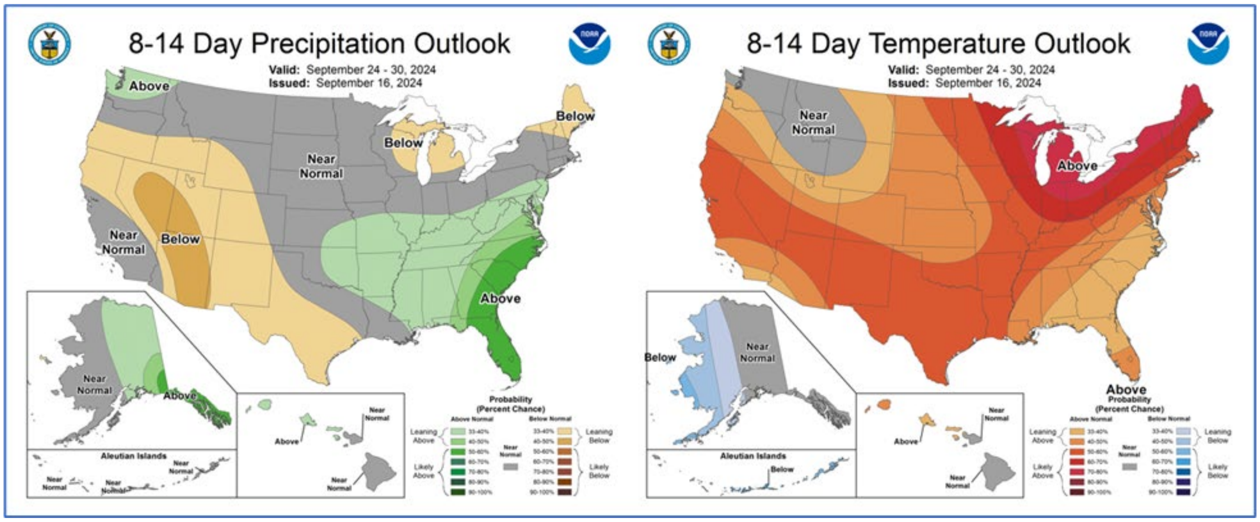

Figure 4: For the following week, the Climate Prediction Center suggests that above normal precipitation could occur along the East Coast and extending inland at lower confidence. Above normal temperature is also expected with greater confidence in the west part of the region.

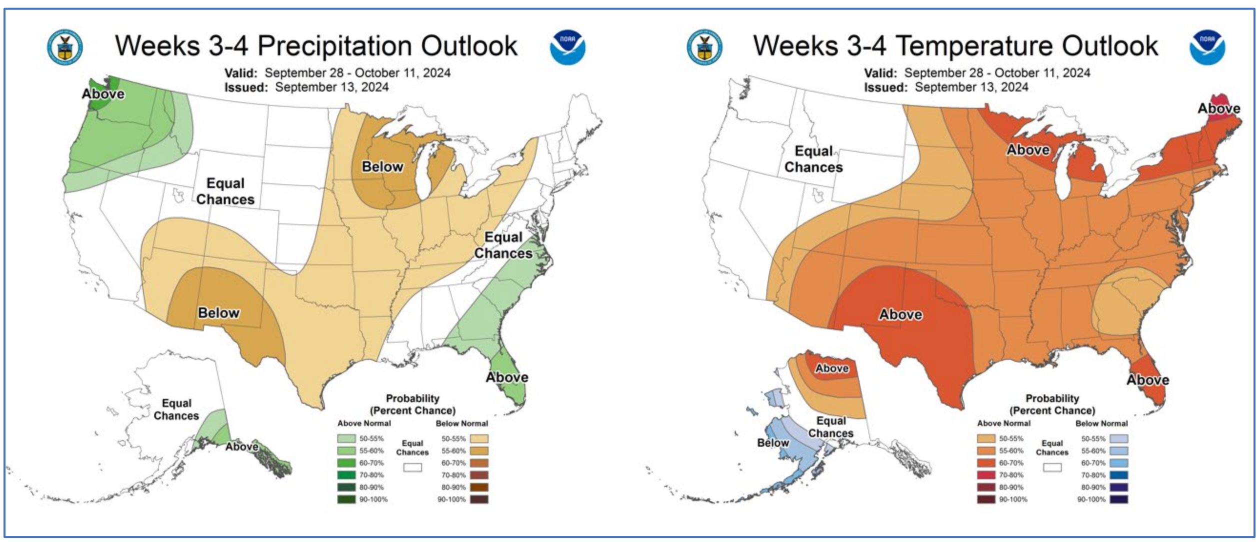

Figure 5: In weeks 3 and 4, a chance of above normal rainfall continues in Florida and up the East Coast, Temperatures are predicted at above normal levels.

Fuels and Fire Danger Conditions

At the beginning of Summer 2024, fuel conditions and fire danger across the Southern Area were low to moderate aside from Central/South Florida, the Trans-Pecos region of West Texas, and portions of the Texas Panhandle. ERC, GSI, and KBDI values for most of the region were fluctuating close to normal in early June with some areas of East Texas and the Coastal Plain experiencing excess precipitation and above average fuel moistures. By mid-June, flash drought in Virginia and portions of the Carolinas related to precipitation deficits and record high temperatures caused ERC-Y values to spike to historic maximum values and GSI to drop to record lows for the affected areas. ERC values began to rapidly increase, while GSI values fell, for PSAs within the Eastern Coastal Plain, Piedmont, and Southern Apps as a lack of rainfall and high temperatures persisted across much of those areas. Ample precipitation from Hurricane Debby alleviated soil and fuel moisture deficits in portions of Florida, the Carolinas, and Virginia in early August, but drought persisted in Northern Virginia and Tennessee and began expanding in Texas, Arkansas, Mississippi, and Alabama.

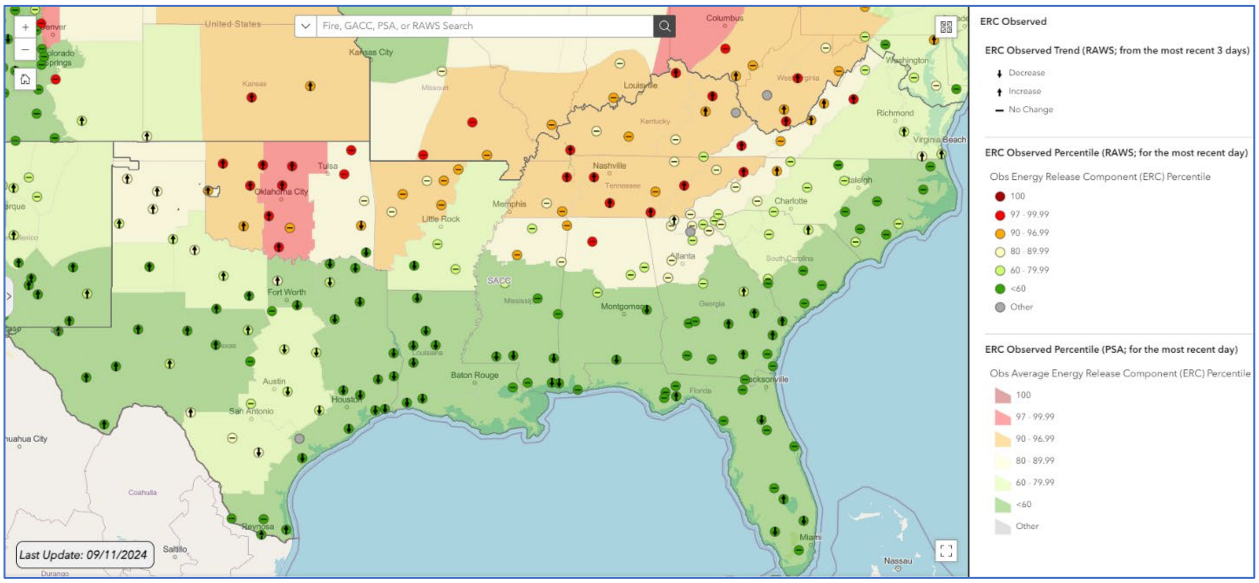

Figure 6: Map of Southern Area Geographic Area Predictive Service Areas (PSA) from the Risk Management Assistance (RMA) Dashboard. Observed ERC percentile as of 09/11/2024 is displayed.

ERC-Y and GSI Analysis

Energy Release Component (ERC) provides an index that is correlated with flammability of live and dead fuels 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).

ERC values above the 90th percentile represent critical fire danger that is only experienced 10% or less of the time. 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. However, based on fluctuations in temperature and precipitation, it is expected most areas will experience change over the next few days, weeks, and months.

The Growing Season Index (GSI) is a simple metric of plant physiological limits to photosynthesis.

It is highly correlated to the seasonal changes in both the amount and activity of plant canopies. It predicts the green-up and senescence of live fuels and the influence of water events on vegetation. Increasing values of GSI indicate periods of improving conditions for live fuels and decreasing values indicate periods of weather conditions detrimental to plant growth. GSI is calculated as a function of three indicators of important weather factors that regulate plant functions: minimum temperature, vapor pressure deficit (VPD), and photoperiod. These indicators are combined into a single indicator that integrates the limiting effects of temperature, water, and light deficiencies.

The following ERC-Y and GSI graphs are based on weather data from 2011-2024, averaged across a five-day period. For these analyses, nine PSAs were selected across the GACC to show differences within the region based on current and historical conditions. See Appendix A for weather stations associated with each PSA used in these analyses. The ERC and GSI graphs below for each PSA display 2024 values (dashed line) relative to the maximum (red), minimum (blue), and average (gray) trends from the past decade. The light blue line is for interannual comparisons between current year and a significant wildfire year in the past. 2016 was used for comparison across all PSAs except for the PSAs in Texas, for which 2023 was used. In general, ERC and GSI tracked with drought patterns and fire occurrence across the GACC.

SA05 Texas Central Northwest

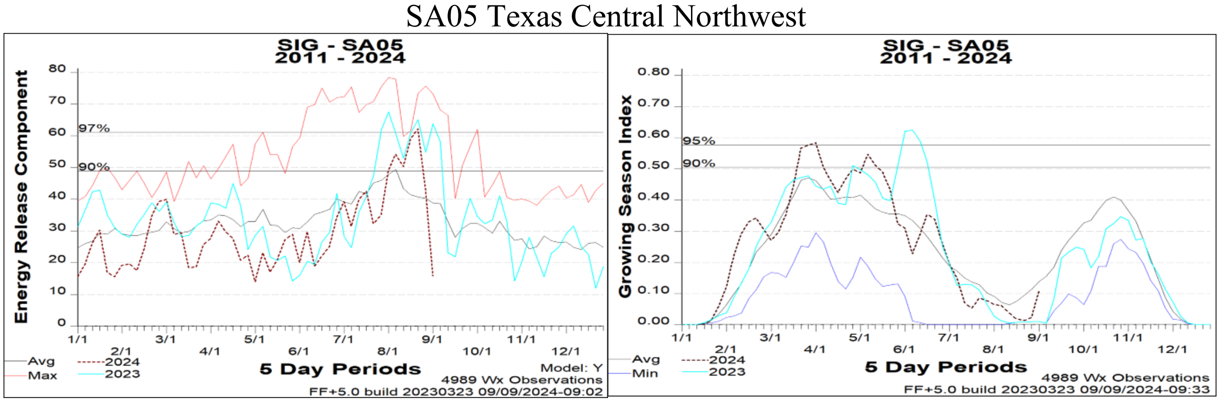

Figure 7: Elevated ERC-Y values were below normal coming into summer but rapidly increased in late July throughout SA05, Texas Central Northwest, to above the 97th percentile in August. GSI values were above average this spring and early summer, began declining in May, and are below average for this time of year, approaching minimum record values in mid-August.

SA12 Texas East South

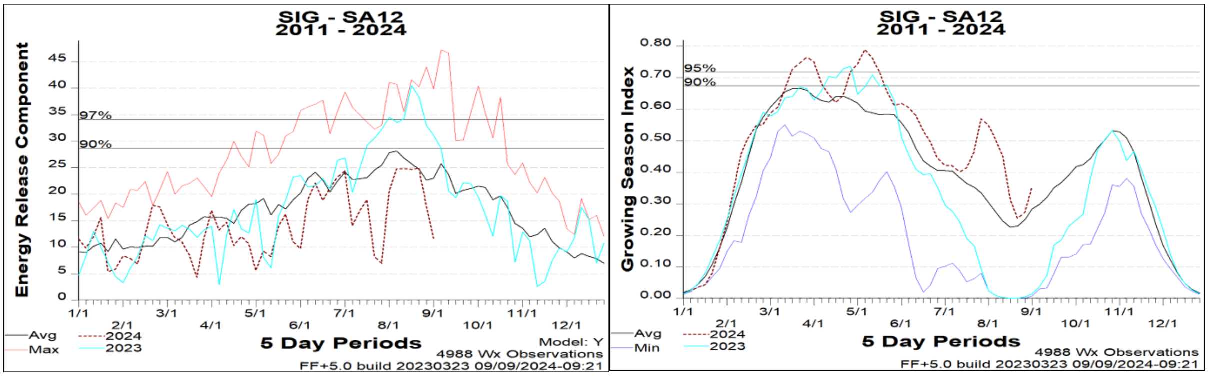

Figure 8: ERC-Y values in SA12 were at or below average for most of Summer 2024. GSI values, although declining through most of the summer as is typical, were above normal for the entire summer indicating more favorable conditions for vegetative fuel growth in 2024.

SA17B Arkansas West

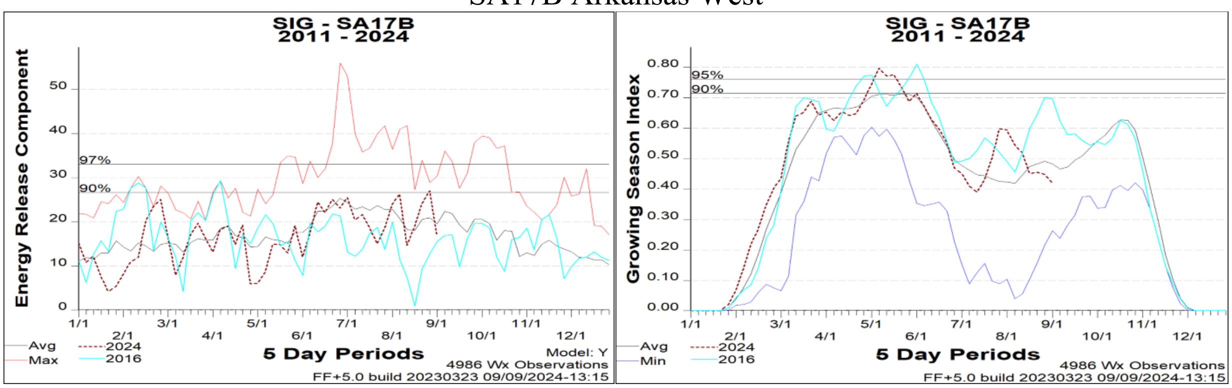

Figure 9: ERC-Y values in SA17B have been close to average most of the summer except for to spikes in August at which the ERC-Y approached the 90th percentile. GSI values were below average early in the summer, increased in late July, and are currently just below normal.

SA23 Mississippi North

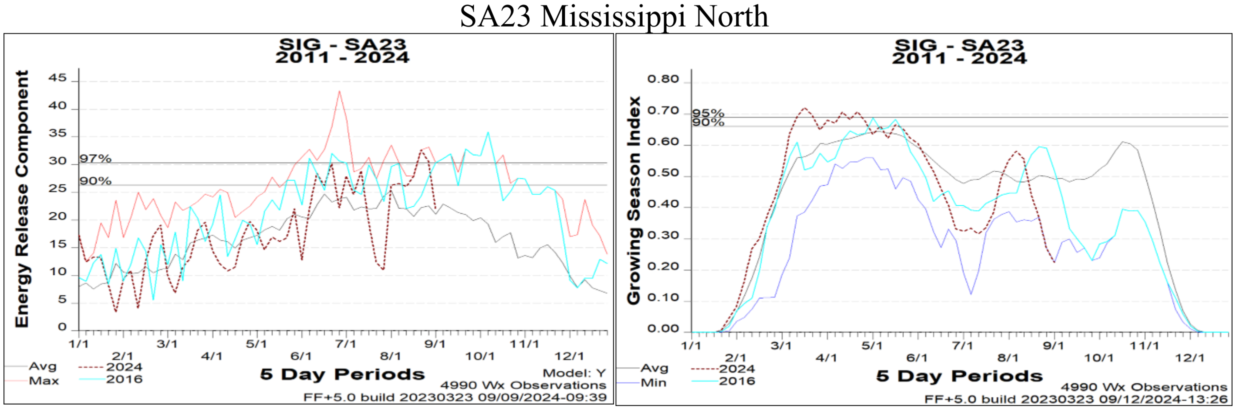

Figure 10: ERC-Y values in SA23 were elevated for most of the summer, except for a period in late July/early August, and have recently moderated after reaching record maximums in late August. GSI values have been below normal since early June, spiked in late July/early August, and reached record low levels prior to Hurricane Francine.

SA25B Tennessee Mountains

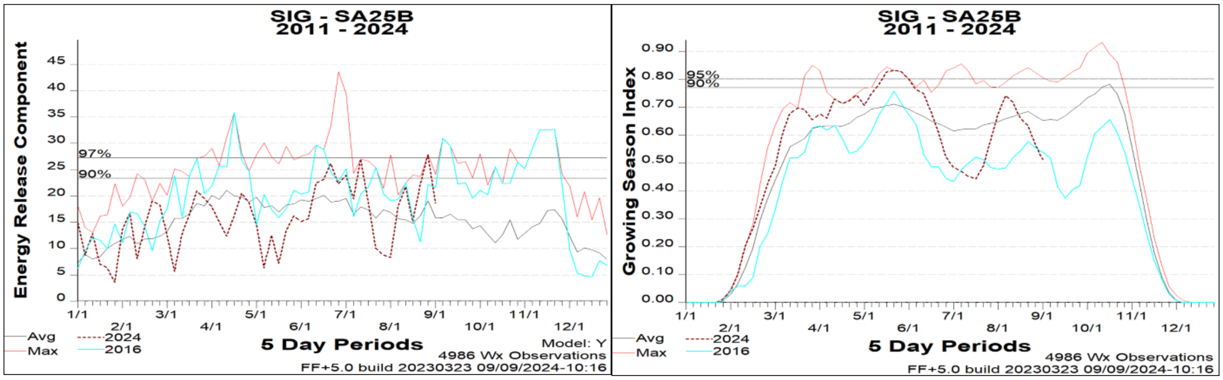

Figure 11: SA25B ERC-Y values were elevated most of Summer 2024 approaching historical maximums during two different periods. GSI values reached record high levels in spring and early summer, was well below average for most of July, rebounded in early August, and is currently below average.

SA27 Kentucky Mountains

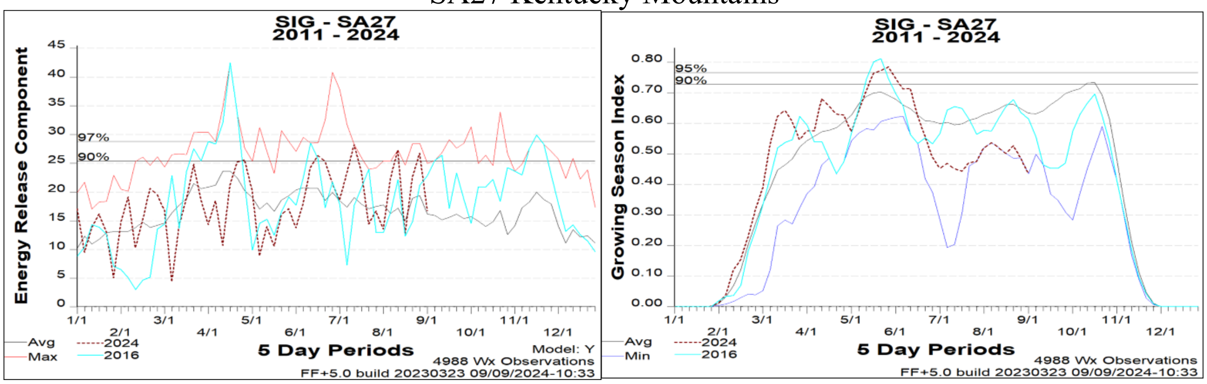

Figure 12: ERC-Y values in SA27 exhibited significant swings in maximum and minimum values throughout the summer setting record highs at least twice. GSI values have remained well below normal since late June and have recently tracked with historic minimum values.

SA28B Virginia West Mountains

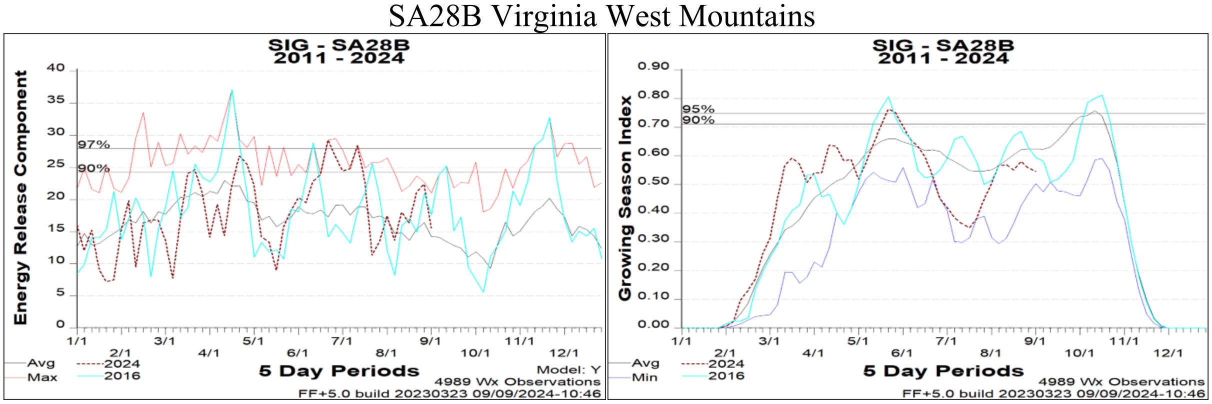

Figure 13: ERC-Y values, while at record maximum levels in late June, early July, and late August, have mostly remained near average this summer. Despite a recent increase, GSI values have been well below average since mid-June.

SA32 North Carolina Central

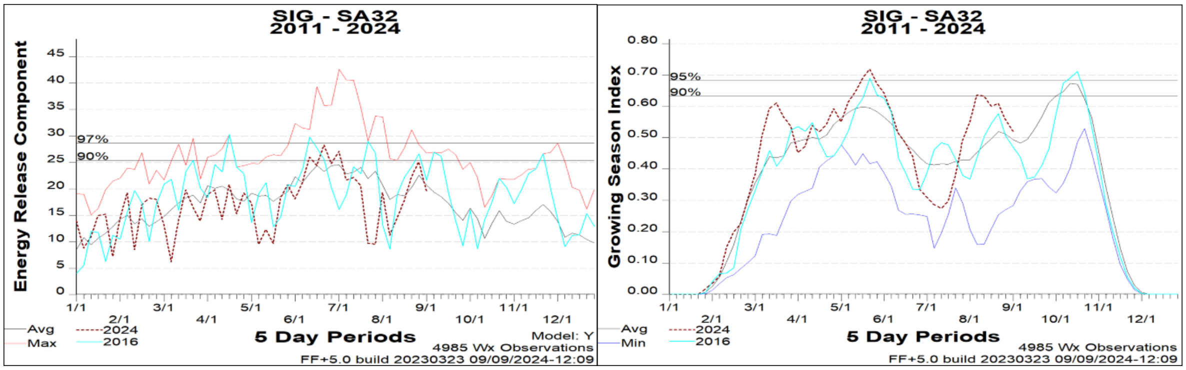

Figure 14: ERC-Y values in SA32 remain near average. GSI values, while lower than average in July, are trending above normal for this time of year.

SA39 Alabama South

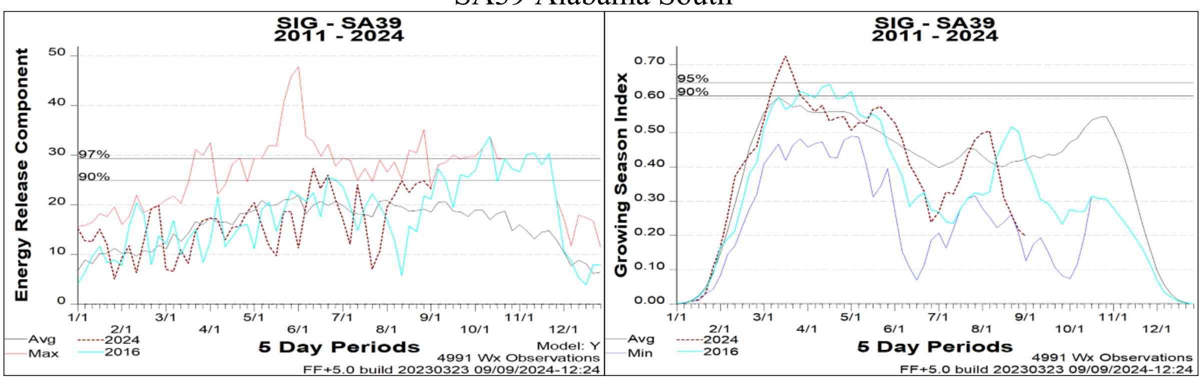

Figure 15: ERC-Y values in SA39 fluctuated in Summer 2024 but were fairly normal until recently approaching historical maximum values. GSI values have been below average most of the summer aside from a spike in late July/early August.

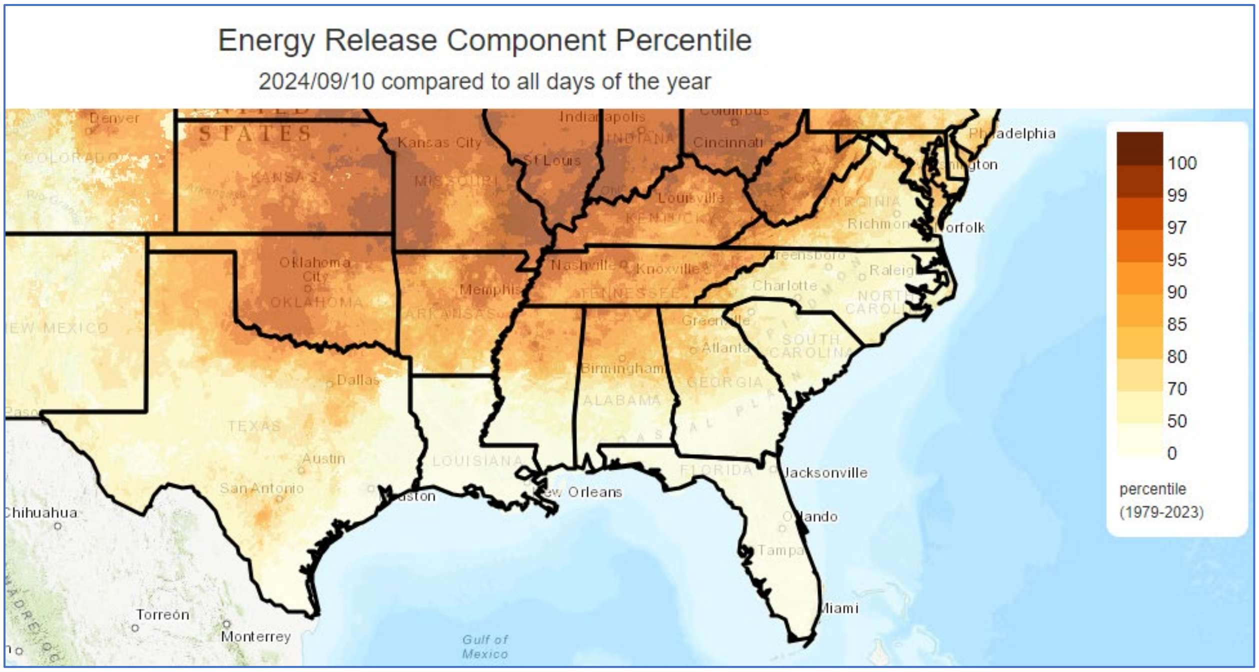

Figure 16: Map of Energy Release Component percentile for September 10, 2024, compared to all days of the year (climatology from 1979 -2023).

Keetch-Byram Drought Index (KBDI)

KBDI assesses the risk of fire based on the cumulative moisture deficiency within the soil layers. KBDI values correlate with the amount of precipitation needed to return an area from a moisture deficit. Below is a generalized graph depicting KBDI values and their significance on fuels.

KBDI Value	Significance on Fuels
0-200	Soil/fuels are moist
200-400	Fuels begin to dry
400-600	Litter/fuels contribute to fire intensity and will burn actively
600-800	Associate with severe drought and extreme fire behavior

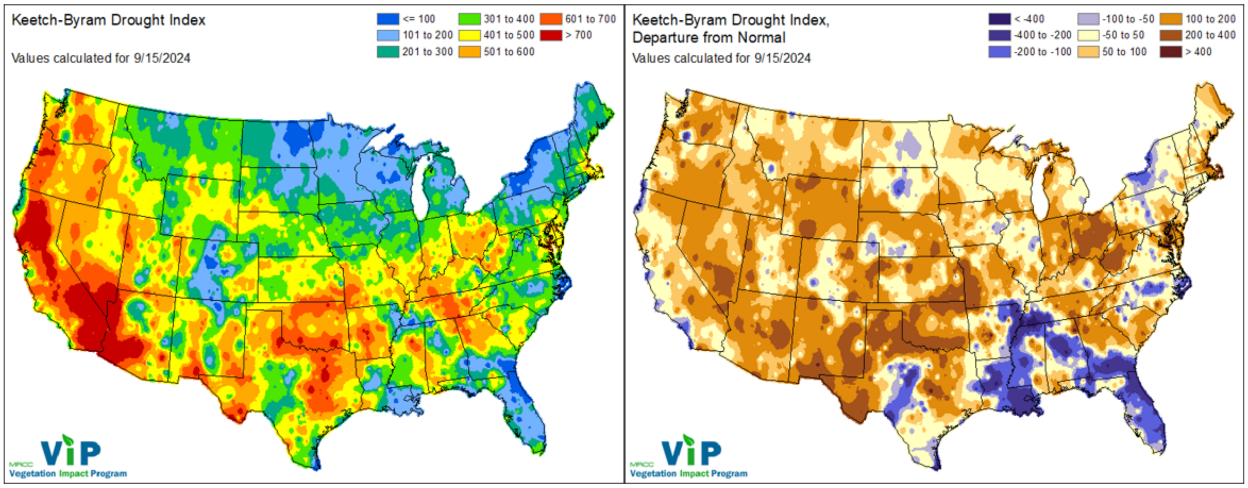

Figure 17: KBDI across the region is highly variable. The path of Hurricane Francine is apparent in the Gulf States where KBDI is several hundred points below normal. Portions of Arkansas, Oklahoma, Texas, and Tennessee have pockets of KBDI greater than 600.

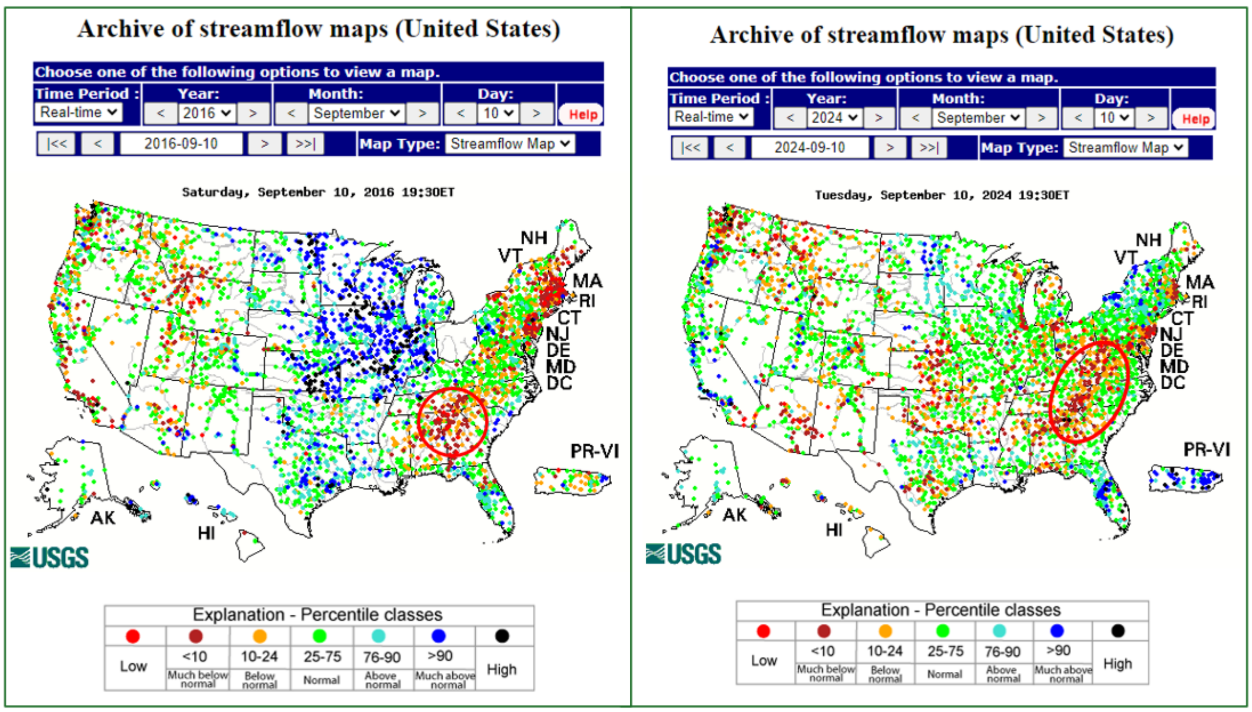

Figure 18: Stream flow may have been an early indicator of areas in the southern Appalachians that would experience extreme fire behavior late in the fall of 2016 (left). The map on the right from the same day in 2024 shows similar below normal stream flow in an area stretching from northeast Alabama to northern Virgina.

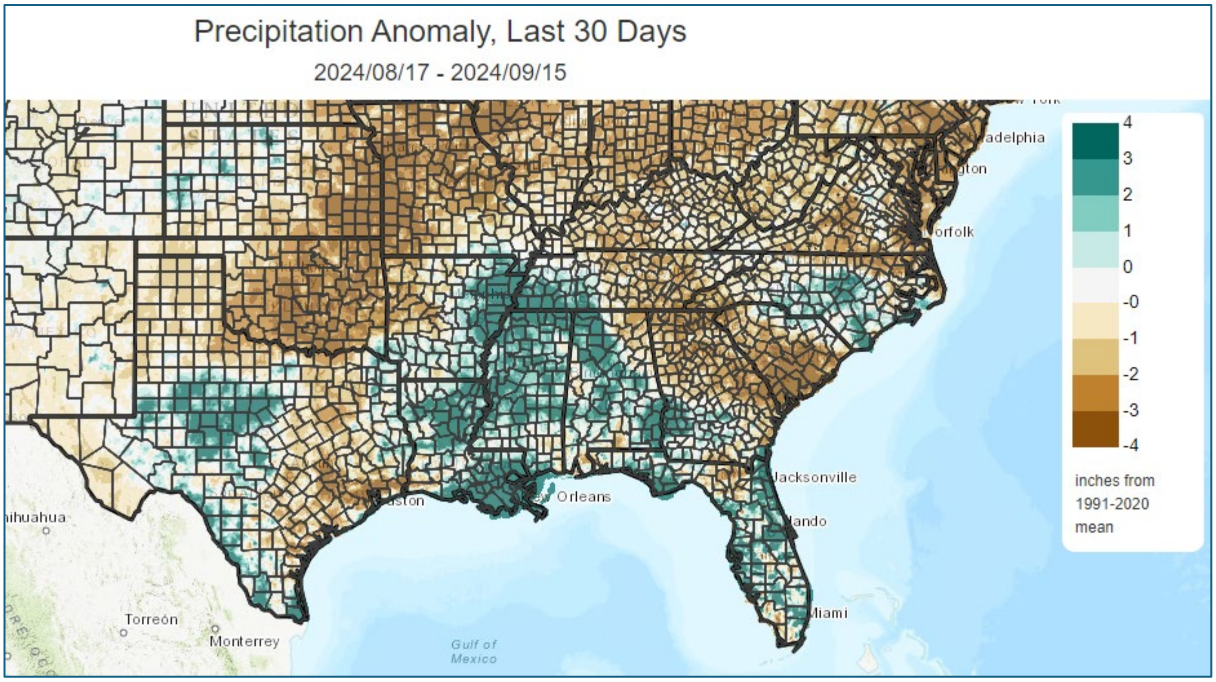

Figure 19: Rainfall anomalies over the last 30 days are greatest in Oklahoma and east Texas. Some deficiencies in the mid-Atlantic region have been erased since 9/15. However, a strip running from western Kentucky through Tennessee to South Carolina has not had more than a 1/4" of rain for over 2 weeks.

Fire Occurrence

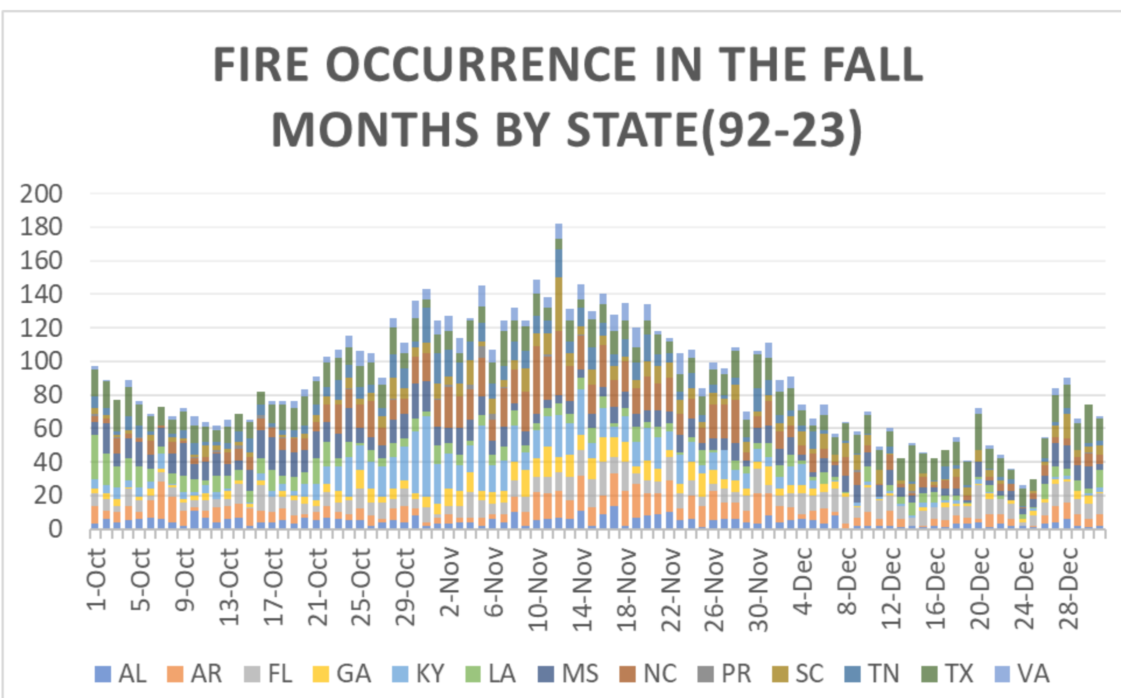

Figure 20: Fire occurrence in the fall historically begins to rise in the second week of October following a lull that typically occurs in early October. The number of fires increases until peaking in mid-November and begins falling until mid-December.

Predictions concerning fall fire occurrence are uncertain, but we can look to long-term historical trends coupled with current conditions to make inferences.

Historically, early fall has coincided with a substantial decrease in fire activity throughout Texas, Arkansas, and Louisiana but a corresponding uptick in activity from Mississippi eastward into the Southern Appalachians. The Southern Area fall fire season is typically dominated by many starts in the Cumberland Mountains of eastern Kentucky and Tennessee, portions of southern Mississippi and the Texas Gulf Coast and a broad swath of eastern Oklahoma.

Despite a typical decrease in overall activity, Texas leads the region in the number of starts during much of the fall most years. Oklahoma has the highest average fire size in the fall historically, but Mississippi, Kentucky and Virginia are frequently close behind in these categories.

[Charts were developed from a combination of the Spatial wildfire occurrence data for the United States, 1992-2020 [FPA_FOD_20221014] (6th Edition) (Short, 2022) for fire years 1992-2020 and INFORM fire incident records for 2021-September 7, 2023, where applicable. Because of missing records for fires under 100 acres in the INFORM dataset, periods of analysis excluded those years when indicated in the chart titles. In all cases, records were filtered to only include fires of 1 acre or greater.]

The chart below shows monthly cumulative fires (over 1 acre) by year between 1992 and 2020 to illustrate years and months with elevated fire activity across the Southern Area. Elevated August fire occurrence was followed by high fire occurrence in either September or October, or both, in some years including 1999, 2000, and 2011. Conversely, fire activity in August of 2016 was low prior to an active fall fire season in October and November.

2017-2020 did not contain any of the top 5 monthly records and activity across the Southern area appeared to enter a multi-year lull, change in activity from 2021-2023 cannot be compared to past periods in the Fire Occurrence Dataset because of incomplete entries in the INFORM database.

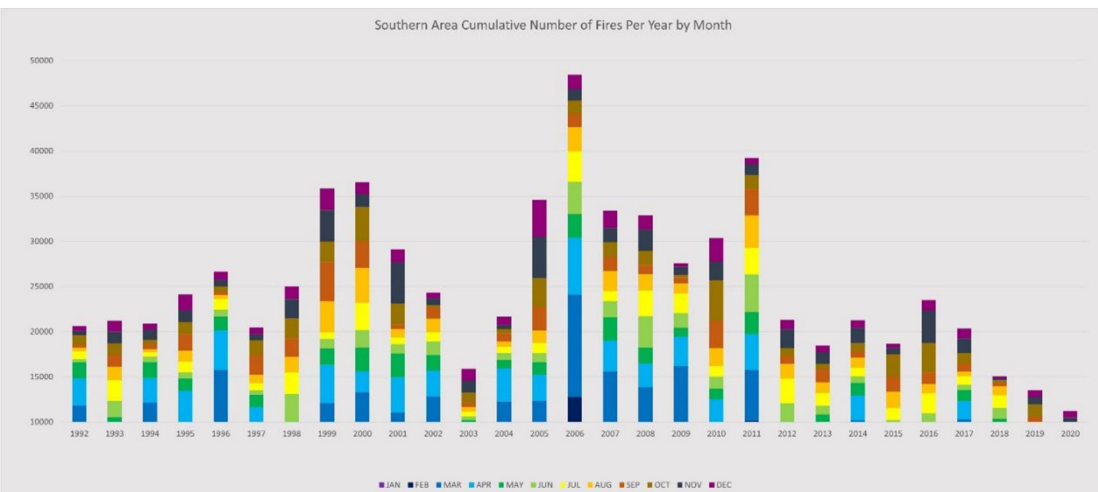

Figure 21: Southern Area cumulative number of fires per year by month. Examining fire activity trends during fall months in past years may inform expectations for fire occurrence in fall 2024.

On an annual basis, the Southern Area experiences a weak bimodal pattern in fire occurrence with the largest peak during February through March, followed by a decline in all states other than Florida into May. The early summer is dominated by declining but still numerous Florida fires and increasing Texas fires. As the peak of the Texas summer fire season wanes, the fall fire season returns, sweeping eastward with time from Mississippi into the Cumberland Plateau and to a lesser extent the east side of the Appalachians through the Carolinas.

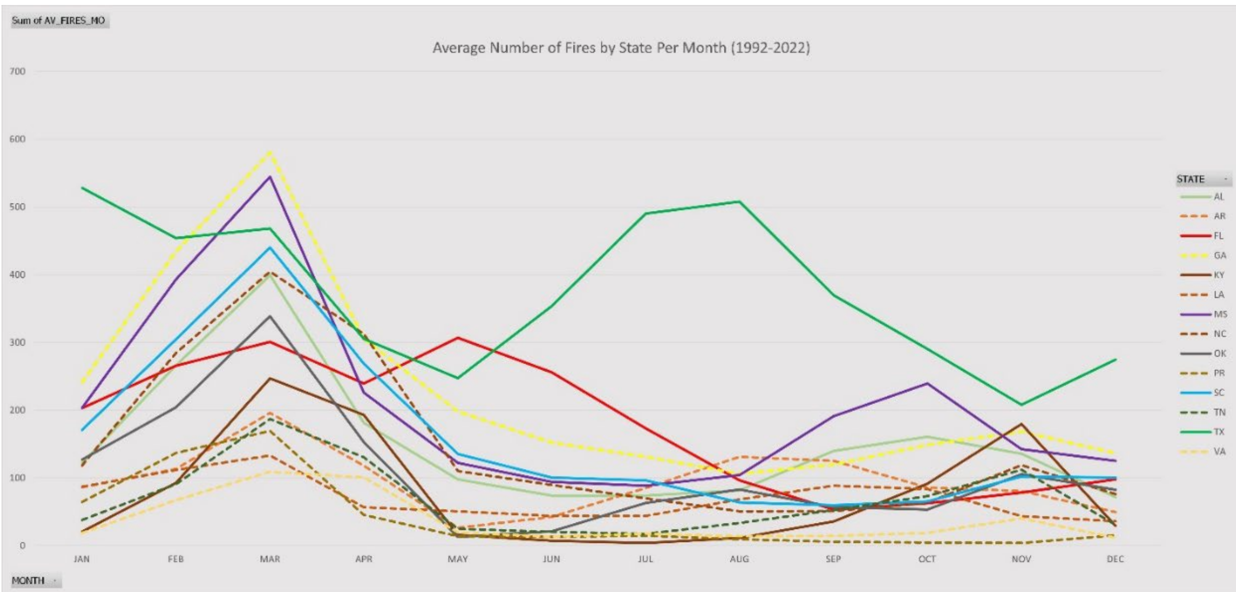

Figure 22: Average number of fires by state per month for all months (1992-2022).

During the early fall, fires per month (1 acre or larger) are typically on the decline, but still significant in Texas until rebounding between Nov-Dec. Mississippi often has the most active early fall season in the region, peaking in October, followed by Georgia and Kentucky in November with lesser peaks for Tennessee, North Carolina, and Oklahoma, all of which decline after November 1st. The drought years of 2000, 2006, and 2011 were preceded by dry fall fire seasons in 1999, 2005, and 2010 respectively. This pattern did not replicate in the last active fall fire season on record in 2016.

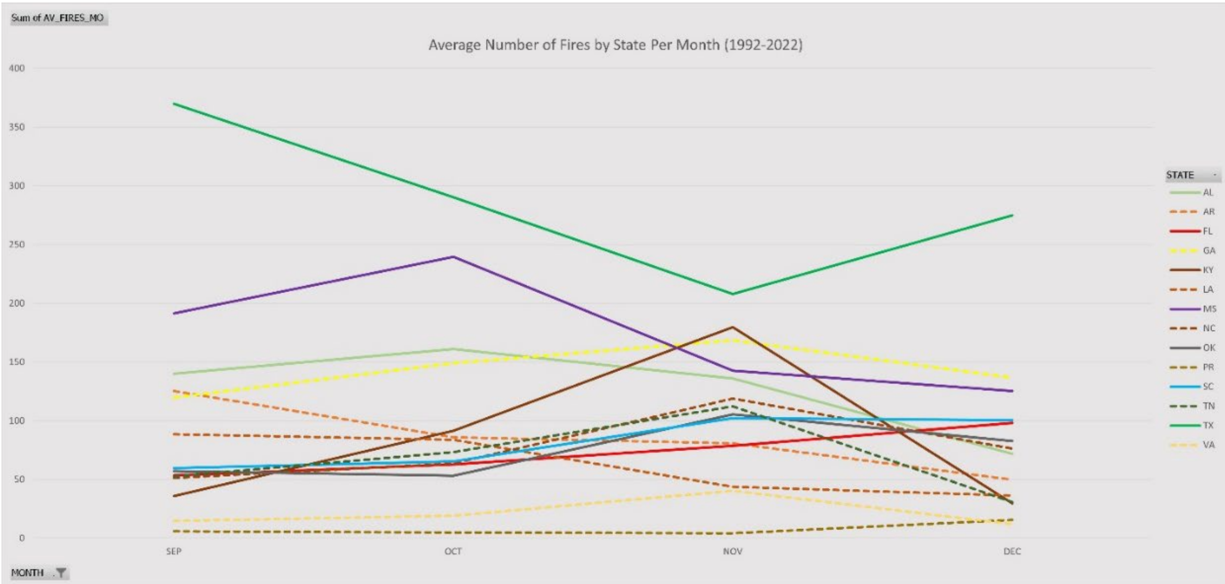

Figure 23: Average number of fires by state per month in the fall (1992-2022).

Looking at the area most affected by the late summer drought in 2023, the historical trend has been for fires in Texas to significantly outsize those in Oklahoma, Louisiana, and Mississippi with the notable exceptions of 2012 and 2014. However, even in the most active years, acres burned and total new fire starts in Texas tends to precipitously drop by mid-September when the focus shifts eastward – less so in absolute acres burned but in terms of a high number of starts.

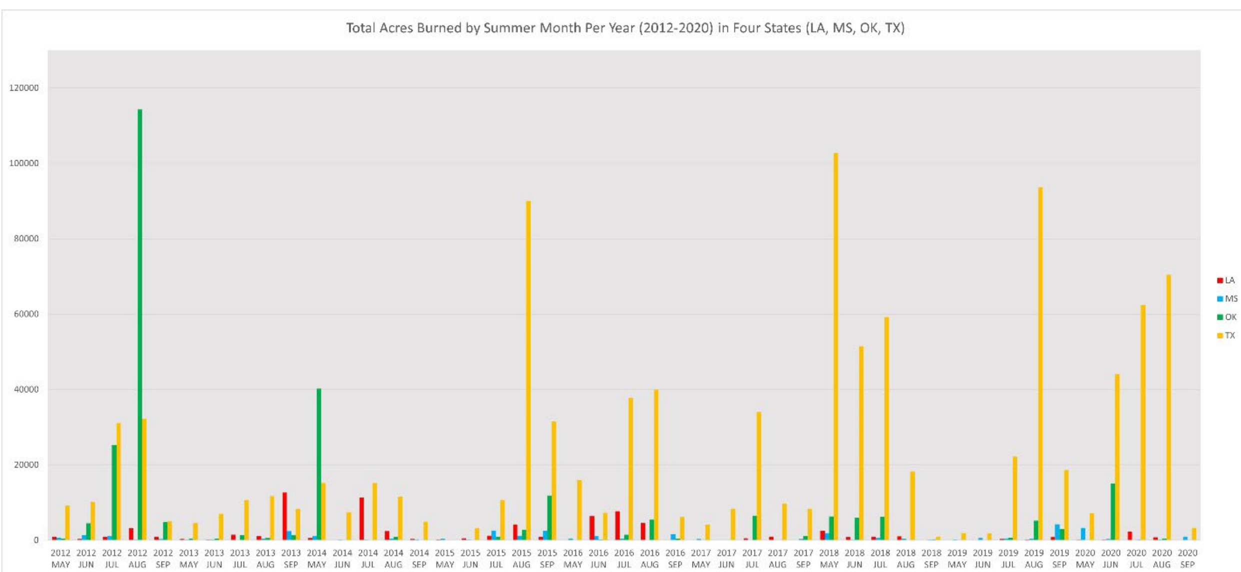

Figure 24: Total acres burned by summer month per year (2012-2020) in LA, MS, OK and TX.

The following seasonal fire density map was created in ArcGIS Online using ESRI's Calculate Density tool which calculates kernel density of features utilizing a specified search radius. The datasets used included a combination of the Spatial wildfire occurrence data for the United States, 1992-2020 [FPA_FOD_20221014] (6th Edition) (Short, 2022) for fire years 1992-2020 and

[INFORM](#) fire incident records for 2021-September 7, 2023, filtered to fires of 100 acres or greater. For the large summer fires, records were further filtered to 8,909 fire location points occurring within the months of May, June, July, August and September, spanning May 1, 1992 – Sept 7, 2023. For the large fall fires, records were filtered to 4,519 fire location points occurring within the months of October, November, and December, spanning October 1, 1992 – December 31, 2022. The density analyses were run with a search radius of 50 miles for both the spring and fall density maps and the resulting values, density of fires per square mile over the time period, were classified into 7 categories using [natural breaks (Jenks)](#) Of these, the first category was intentionally not displayed in order to visually focus on the next six highest density categories. It should be noted that the resulting density layer class values offer a representative index of large fire frequency by season but the categories themselves do not directly express actual values in terms of fires per square mile.

The occurrence and proximity of large wildfires across the Geographic Area typically progress from the states within the Coastal Plain, Interior Plains, and Highlands in the summer months, to the Appalachian Mountains through the fall. Large fire occurrence remains fairly high in eastern Oklahoma and western Arkansas in the fall as well. The following map displays fire season progression from early-May to the end of December, using data compiled from 1992-2020. It is evident that while large fires have historically occurred anywhere in the Geographic Area, in both the summer and fall seasons, the bulk density of these large fire footprints follows this summer to fall progression.

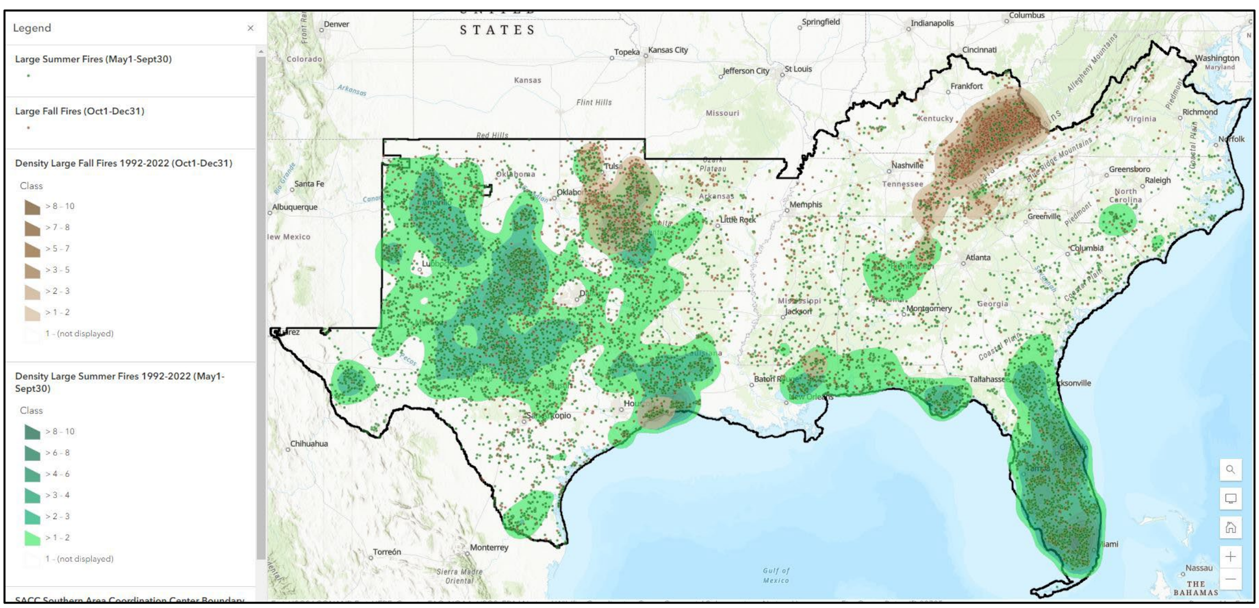

Figure 25: Map of Southern Area historical summer vs. fall large fire occurrence density (1992-2022).