

Hidden Pines

Post-Fire Behavior Report

10/13-10/24, 2015
Bastrop County, TX



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Fire Analyst I

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The Hidden Pines Fire is the third significant fire to impact Bastrop County in a six-year time frame. The purpose of the Hidden Pine Post-Fire behavior report is to describe the factors and conditions leading up to ignition and the resulting fire behavior. Information gathered is presented to help fire management officials for planning and preparedness if similar conditions occur again.

Some photos collected by firefighters were able to be geotagged and timestamped by the photo's Metadata. Using this data allowed for a better understanding of the fire's behavior and progression. After-fire photos were taken on November 13th, 2015

Thank you to all the fire departments, firefighters, emergency management staff, and support staff that were involved during the Hidden Pines Fire.

Special thanks to the following people that provided photos and information resources for this report:

Brad Smith, Texas A&M Forest Service

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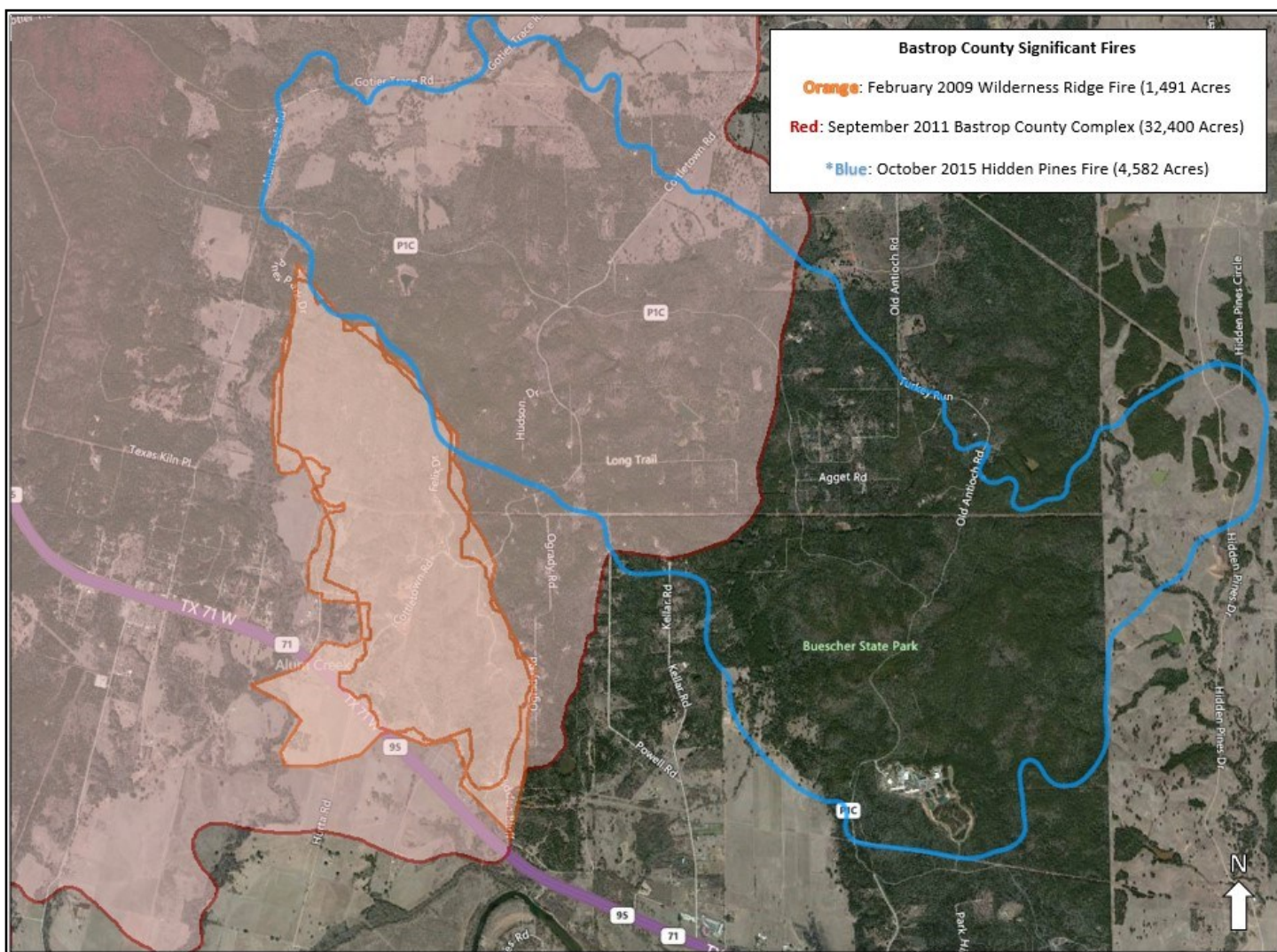
Jason May, Texas Parks and Wildlife

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Colton Curles, Texas A&M Forest Service

Kari Hines, Texas A&M Forest Service

Juan Acuña, Texas A&M Forest Service



Fire Environment

The Hidden Pines Fire began at approximately 12:45 PM on Tuesday, October 13th on private land 4 miles north of Smithville, Texas in Bastrop County. The most active time of the fire was from October 13th-15th. The fire burned into Buescher State Park and threatened the M.D. Andersen Cancer Research Center. Sixty-four homes were destroyed with 77 other structures lost in the fire. In total, the Hidden Pines Fire burned 4,582 acres and contained on October 24th, 2015.

Fuels

Bastrop County is located in the Post-Oak Savannah ecoregion of Texas, but is unique in that the area where the fire occurred is in the Lost Pines. The sandy and gravelly top soils coupled with a sub-surface clay profile provide water retention needed for loblolly pine trees to exist that far west (*Texas Parks and Wildlife*). Within the loblolly pine stands, a yaupon understory acts as a ladder fuel to the forest canopy creating a high-risk fuel. Intermixed around the pine stands are post-oak trees, eastern red cedar trees, grasses, and shrubs. The Hidden Pines Fire burned into the burn scar of the Bastrop County Complex Fire which included 3-4 year old loblolly pine regeneration with yaupon and grass. The Bastrop Live Fuel Moisture (LFM) sampling site was located in Buescher State Park, but unfortunately was burned during the Hidden Pines Fire. LFM ranges from 0-300%. September 2015 fuel samples recorded were:

Little Bluestem Grass: 67%

Eastern Red Cedar: 81%

Post-Oak: 75% (3rd percentile of normal)

Yaupon: 79%

Loblolly Pine: 113% (4th-10th percentile of normal)

Weather

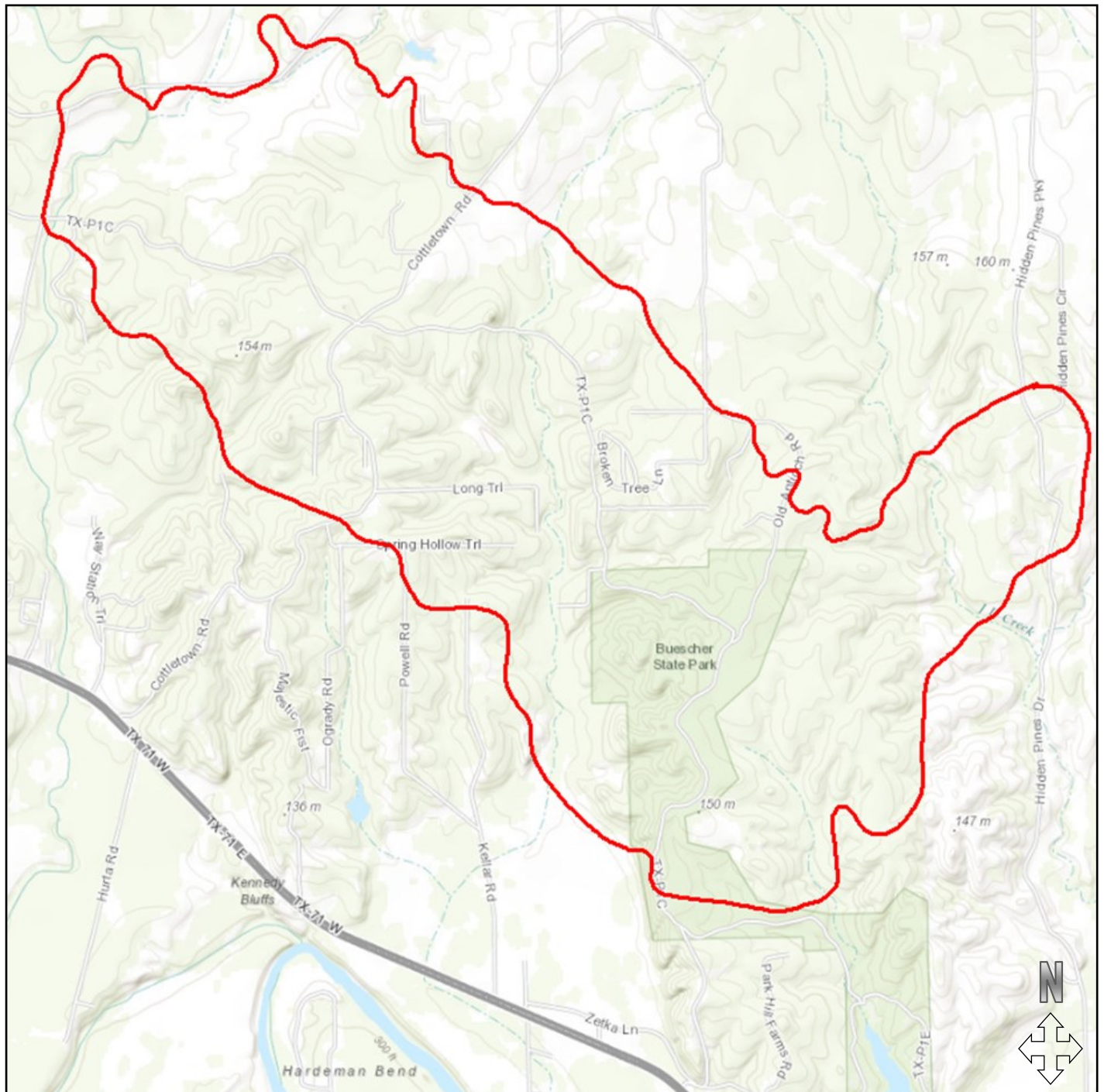
Bastrop County is located in the Central Texas Predictive Service Area (PSA). Critical Fire Weather Thresholds are as follows with recorded minimum relative humidity, and maximum wind and temperature observations for the 13th-15th at the Bastrop Remote Automated Weather Station (RAWS)

Critical Fire Weather Threshold	10/13 Obs.	10/14 Obs.	10/15 Obs.
Relative Humidity: 25% or less	8%	13%	18%
20' Wind Speed: 15 mph or more	11-8 mph G: 19mph	7 mph G: 17mph	9 mph G: 18 mph
Temperature: 10% above average (83° F)	+12% (93°)	+ 13% (94°)	+ 14% (95°)

Weather conditions during Hidden Pines fire were conducive to wildfire spread and growth. The 13th-15th were the peak burning days for the fire. Critical fire weather thresholds for relative humidity and temperature were met or exceeded and winds neared critical thresholds. Leading up to the ignition of the fire, prior weather conditions of extended precipitation deficits and above normal temperatures created abnormally fuels dryness sufficient for a significant wildfire to occur.

Topography

The fire occurred on the north bluff near Hardeman Bend of the Colorado River. Elevation ranges approximately 500-350 feet. Creek drainages were present within the burn area with slopes (15-20%) on the southwest region of the fire.

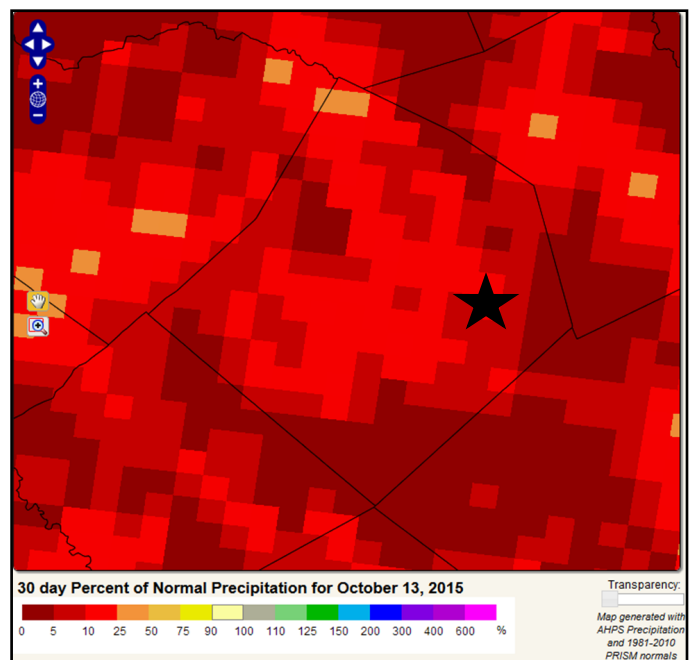
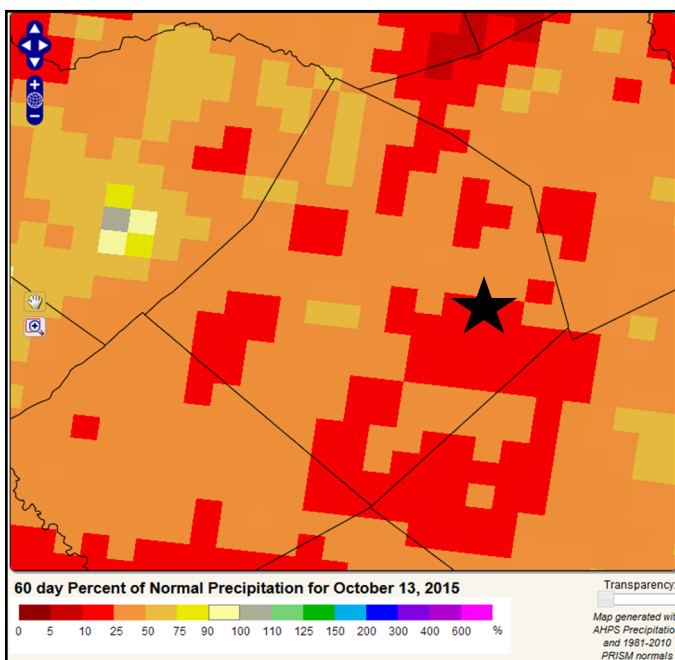


(*10 ft contour)

Past Precipitation

Bastrop County received record rainfall throughout the Spring of 2015. By June 28th, **31 inches** of rainfall had been recorded. Dominant High pressure set-up over Texas limiting rainfall in Bastrop County going into the Summer and Fall. From June 29th-October 13th, only **2.61 inches** of rain were recorded. The last date of recorded rainfall was September 15th, with **one-quarter inch (0.25)** of rainfall.

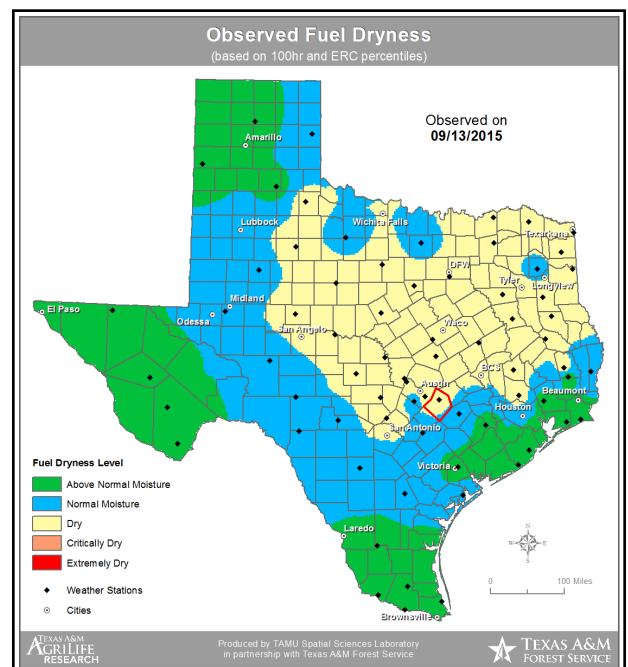
The “Percent of Normal Precipitation” maps indicates the precipitation deficit leading up to the Hidden Pines Fire. The 60-Day Percent of Normal Precipitation (left) observed was approximately 10% of normal. The 30-Day Percent of Normal Precipitation (right) indicates approximately 5% of normal observed rainfall. This extended precipitation deficit led to increasingly dry fuels.



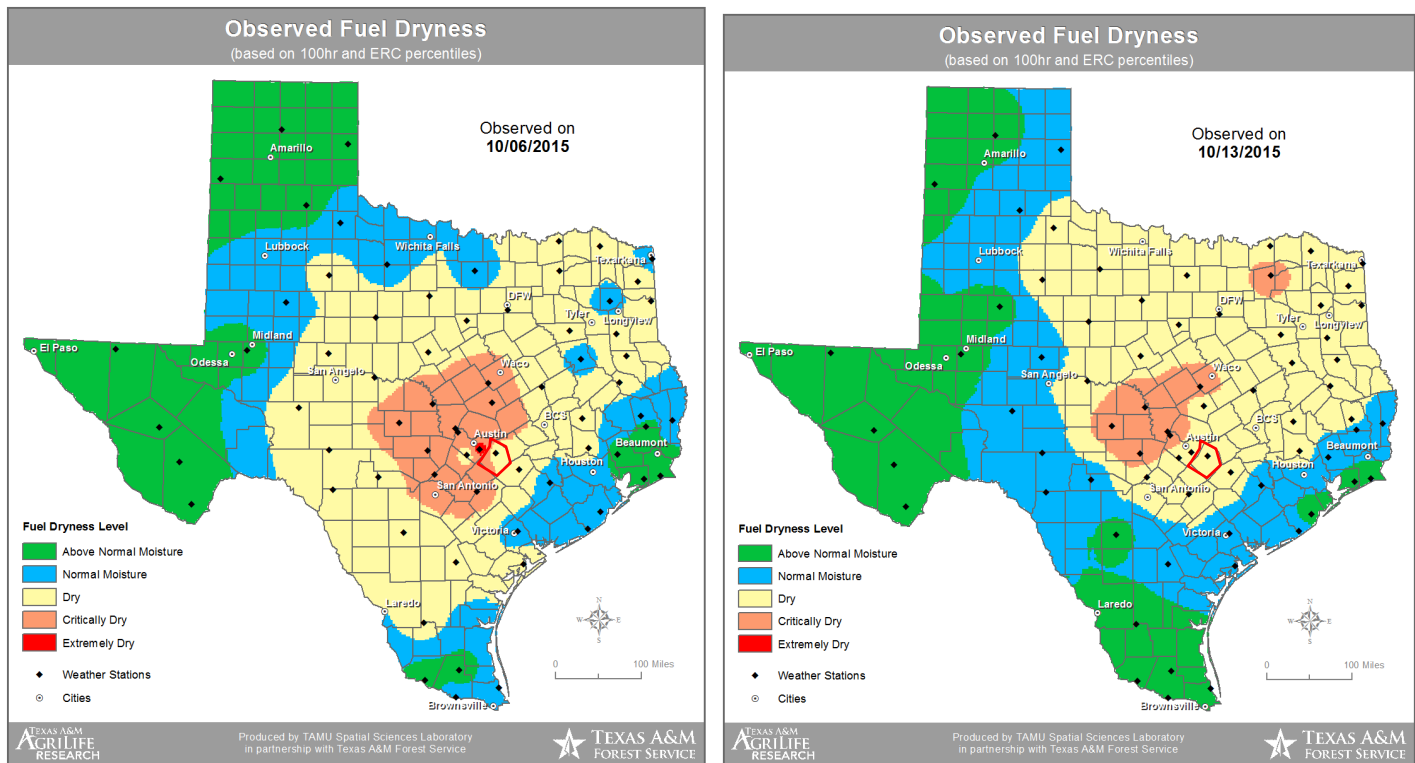
Fuels Dryness

Approximately a month before the Hidden Pines Fire, Fuels Dryness, a combination of 100-hour fuel moisture and Energy Release Component (ERC), indicated fuels were “Dry” in Bastrop County.

The continued late summer-early fall drying trend into October only increased overall fuels dryness.

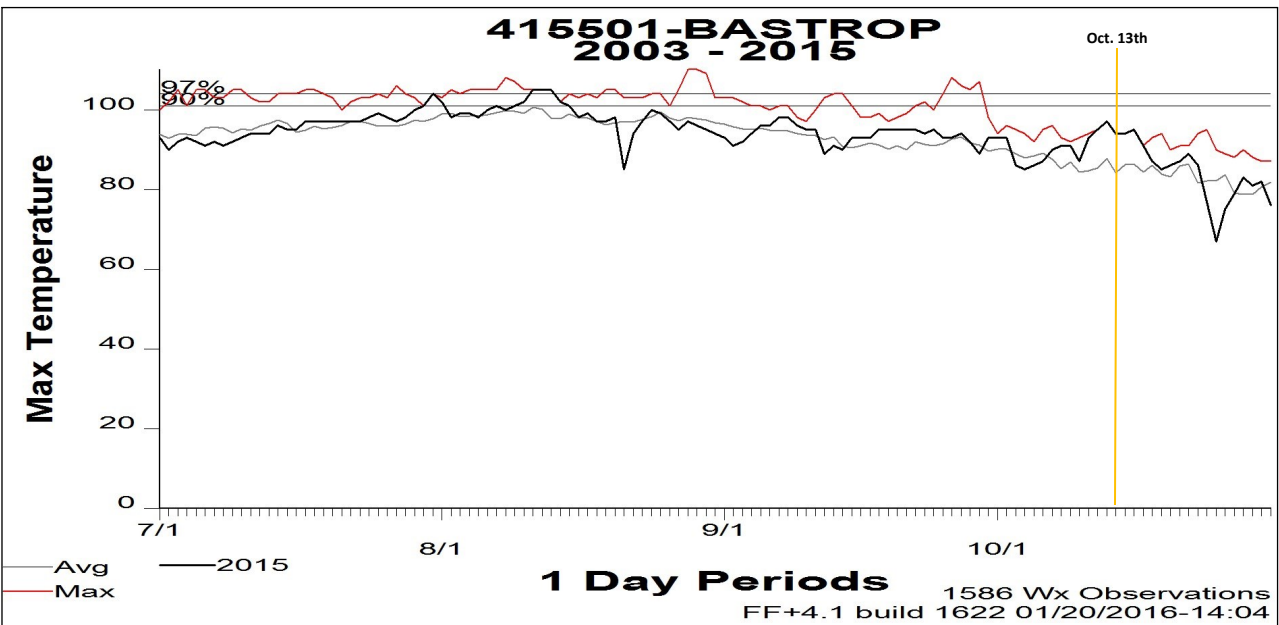


On October 6th, observed Fuels Dryness was still tracking as “Dry” with other areas to the west trending as “Critically Dry”. By October 13th, overall fuels dryness was still considered “Dry” in Bastrop County.

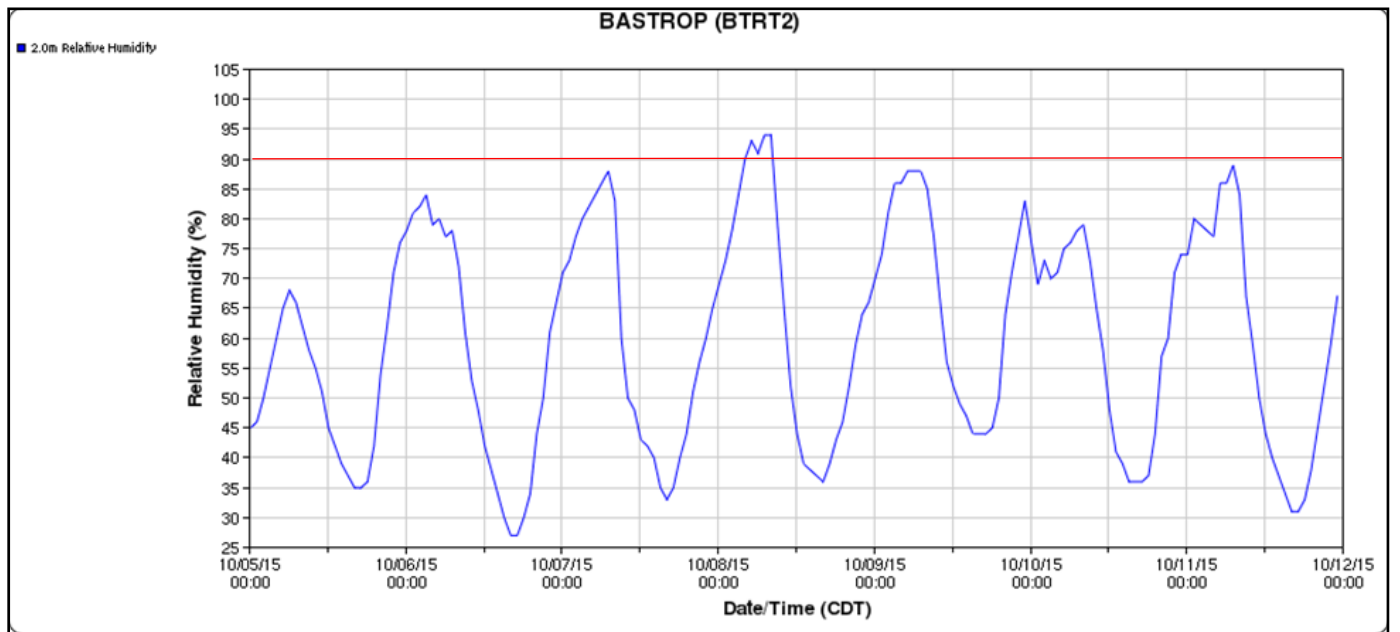
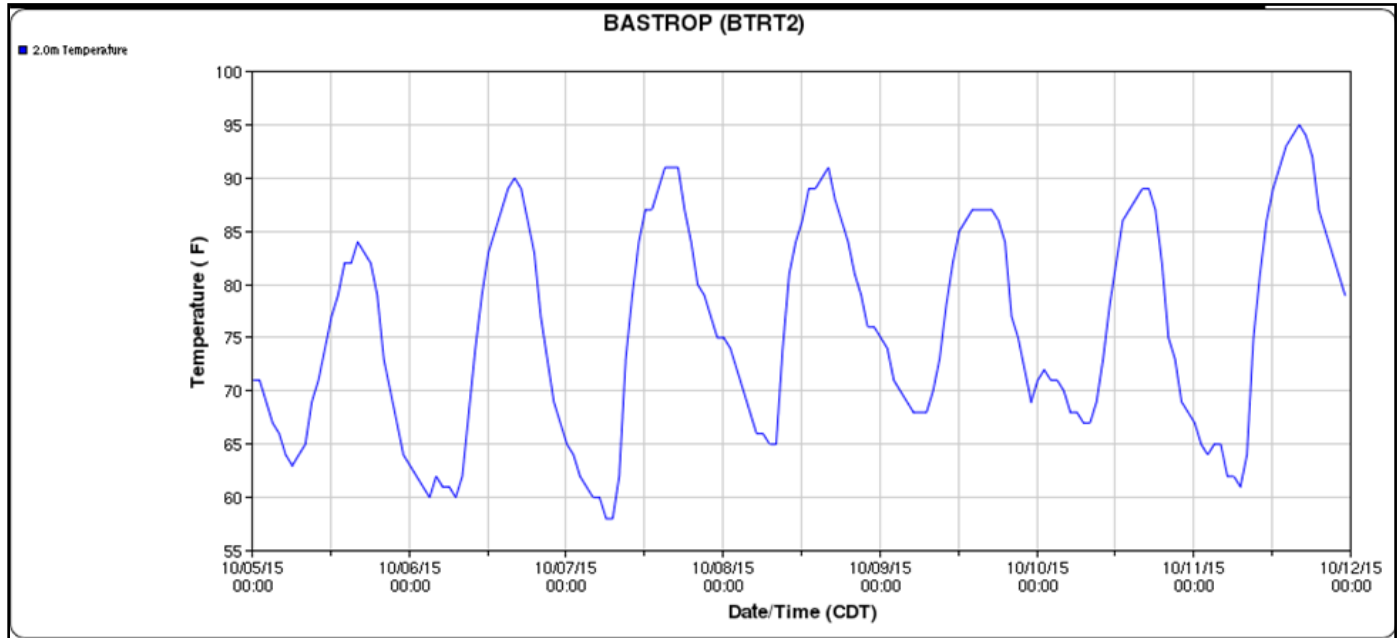


Weather

From July-October, dominate high pressure was in place over Texas limiting the passage of storm systems and precipitation over the state, particularly over Central and East Texas. Above normal temperatures were persistent during this time period. The Bastrop RAWS Maximum Temperature data indicates the above normal temperatures (black line) versus the average maximum observed temperatures (gray line) particularly evident from mid-September into mid-October.



From October 6th-13th, temperatures from the Bastrop RAWS were slightly above normal (83°F) with temperatures in the 85°- 90°F range. Minimum relative humidity (RH) values recorded were in the mid-30% range. Overnight recovery RH values began to show marginal recoveries starting on the 10th, staying below 90% or full recovery.



Previous Fire Occurrence

In the month leading up to the Hidden Pines Fire, Texas A&M Forest Service responded to 5 fires for a total of 111.6 acres throughout Bastrop County. Below are the start dates, fire name, and acres for the five fires:

9/12/15: Jackson Fire (5 Acres)

9/13/15: Cutting Horse Trail (4.1 Acres)

9/21/15: Baywood (36.4 Acres)

10/1/15: Cedar Hill (36.1 Acres)

10/11/15: Camino Creek (30 Acres)

Based on dispatch reports and verbal descriptions of firefighters on scene, the Cedar Hill and Camino Fires exhibited active fire behavior in cedar and post-oak timber fuels with single tree torching. However, initial attack on these fires was successful within the first operational period with little resistance to control.



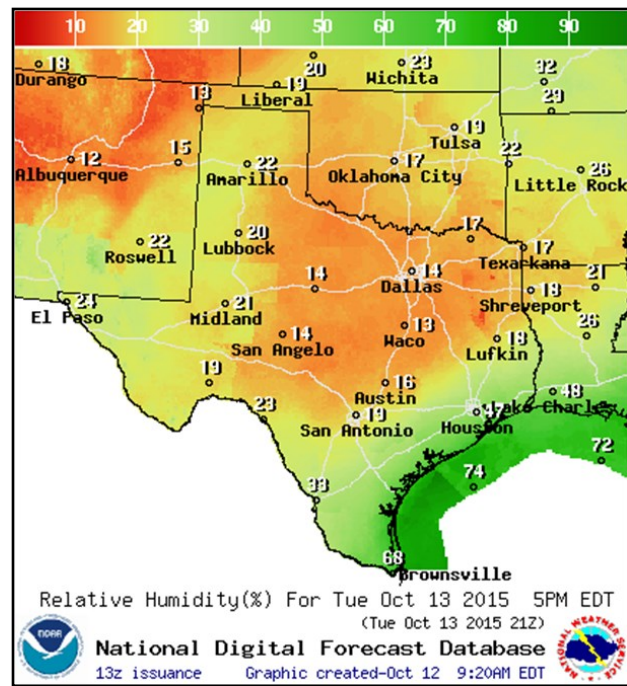
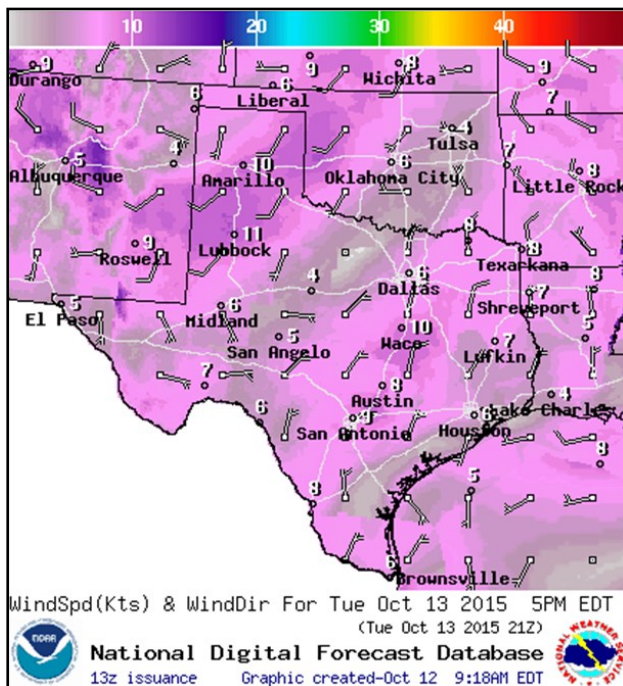
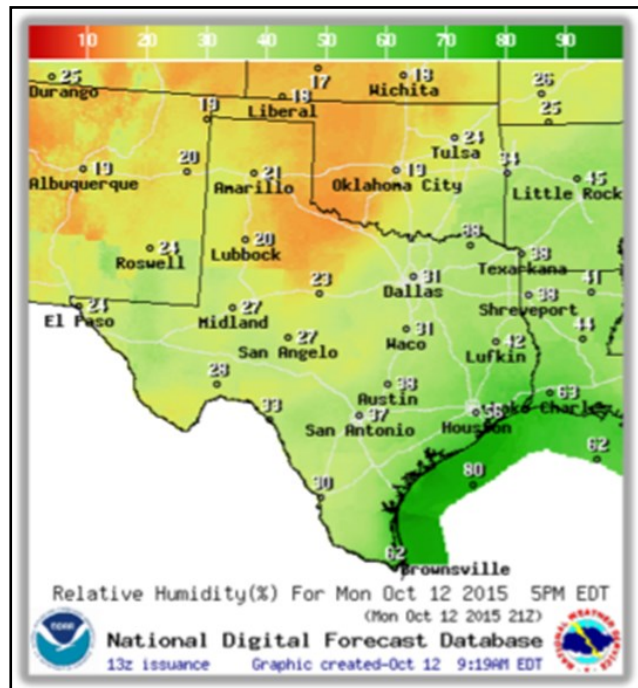
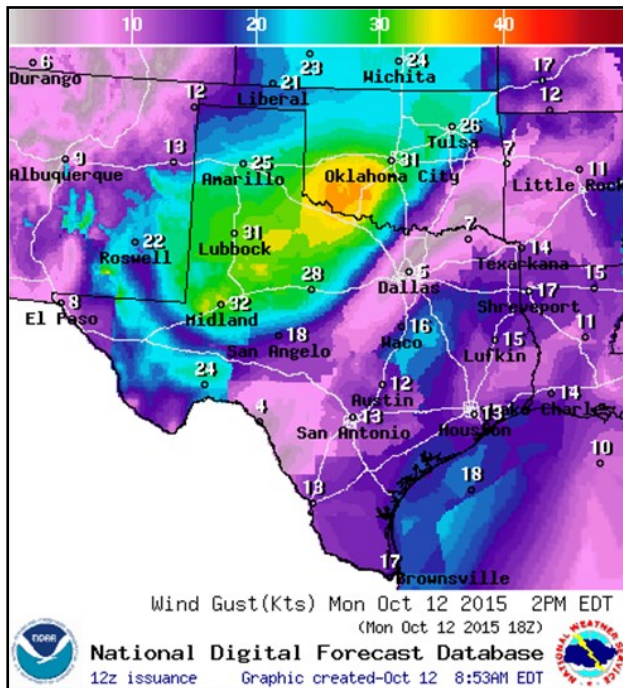
Jackson Fire, September 12th, 2015

Hidden Pines Fire

October 12th –13th Weather Forecast

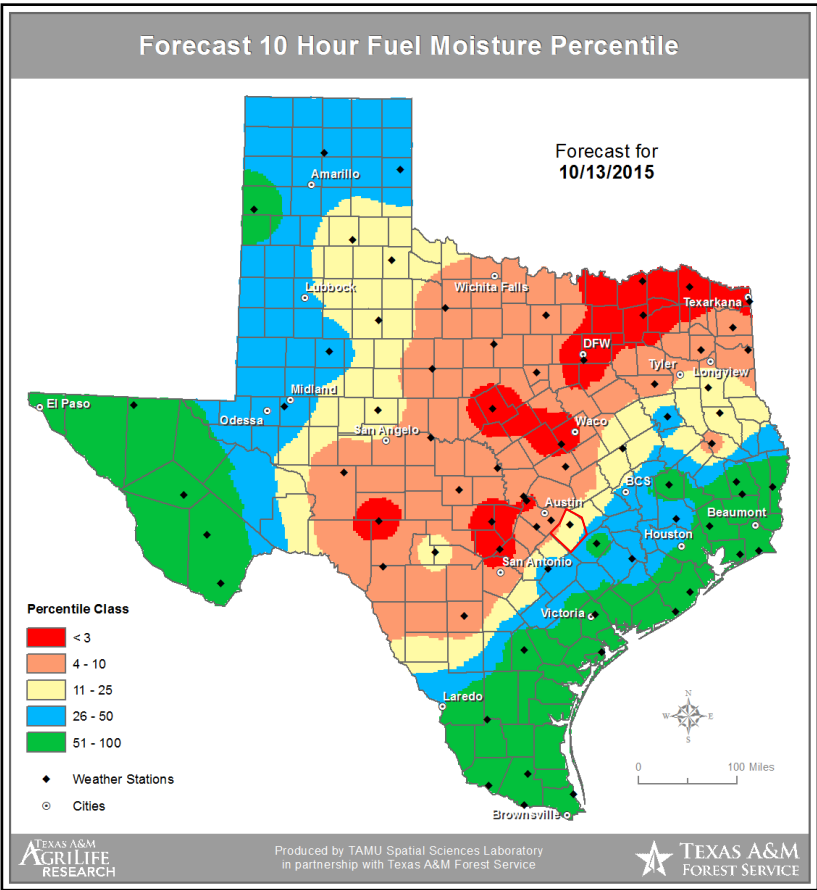
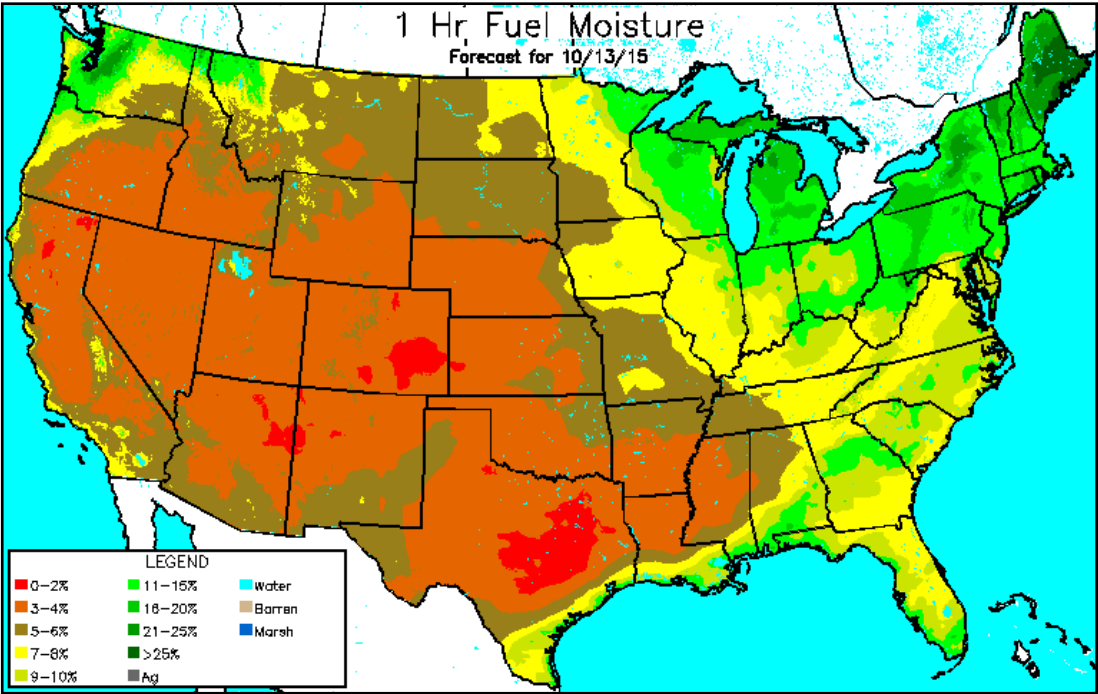
The passage of a dry cold front into the Texas Panhandle and North Texas on October 12th produced pre-frontal conditions of temperatures in the 90's, minimum RH values in the mid-30's, and southwest winds of 12-15 mph over Bastrop County.

From the passage of the cold front on the 12th, forecast conditions on the 13th indicated very dry air due to the northeast winds and low dew point temperatures. Minimum RH values in the teens were forecasted with temperatures still above normal at 90°+ F



October 13th: 1-Hour and 10-Hour Fuels

With the very dry air in place and low RH values, the 1-Hour and 10-Hour fuel moistures were readily affected. One-Hour fuel moistures were forecasted to be at 0-2% and ten-hour fuel moistures in the 11-26 percentile of available moisture. Resulting poor fuel moistures and overall fuels dryness (100-Hour fuels and ERC) created conditions for a wildfire to ignite and spread at the surface in grasses and timber litter fuels.

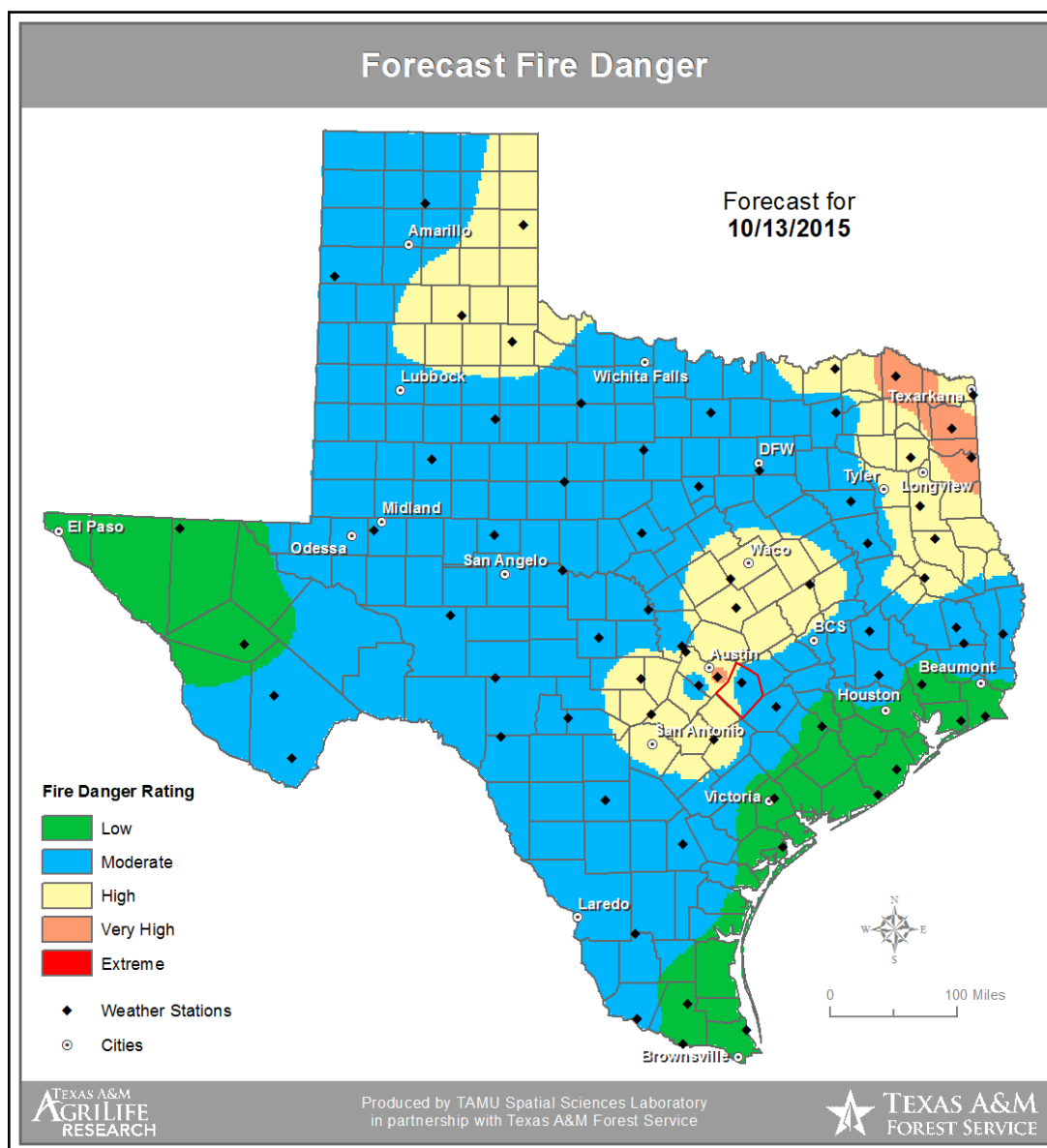


Forecast Fire Danger October 13th

The National Fire Danger Rating System (NFDRS) provided an adjective rating of “High” for Western Bastrop County and “Moderate” for the Eastern Bastrop County. Below are the descriptions for each adjective rating.

High: All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.



Moderate: Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.



October 13th Significant Fire Potential Matrix

Based on the Bastrop RAWS NFDRS calculations, the forecasted and observed ERC* values and Burn Index^ for October 13th were:

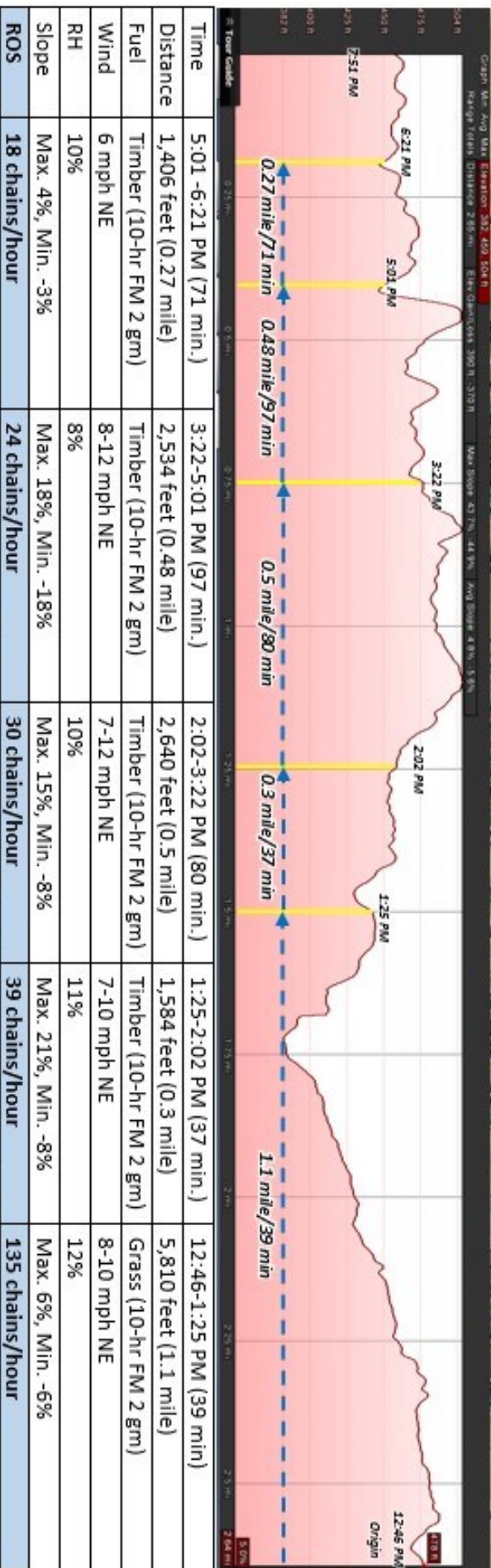
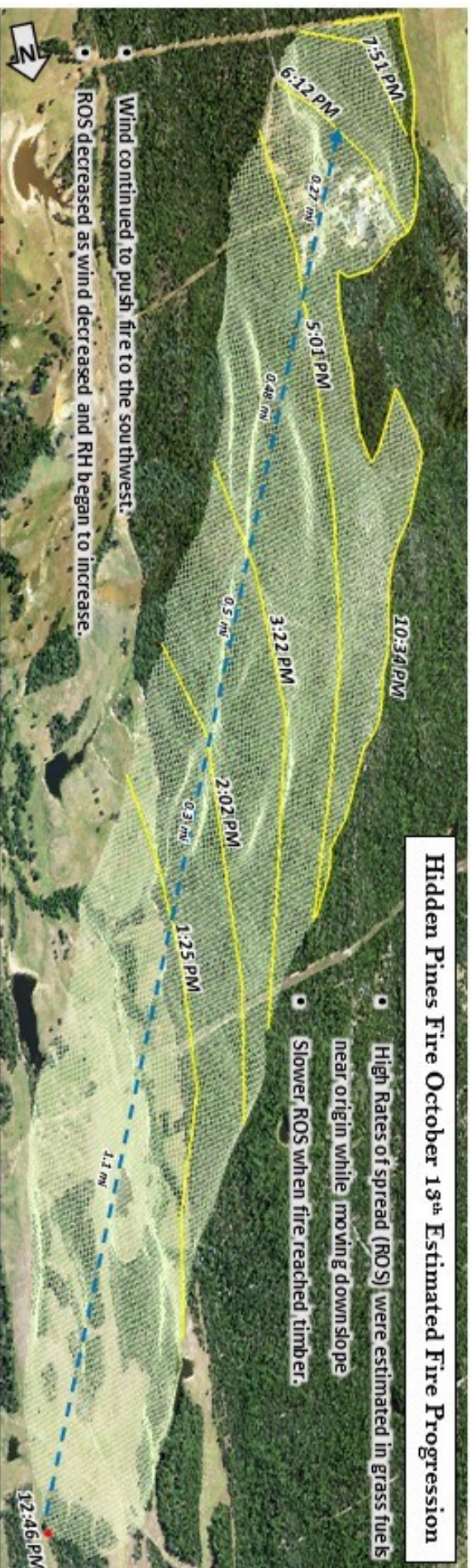
Indices	Forecast (Blue)	Observed (Green)
ERC	54	58
BI	48	41

Bastrop RAWS 2014		Preparedness Level Energy Release Component G (ERC)			
		1 0-36	2 37-50	3 51-60	4 61+
Dispatch Level Burning Index G (BI)	1 0-31	Low	Low	Moderate	Moderate
	2 32-46	Low	Moderate	Moderate 	Moderate
	3 47-59	Moderate	Moderate	High 	High
	4 60+	Moderate	Moderate	High	Very High

The Significant Fire Potential Matrix produced a moderate chance for a significant fire to occur on October 13th.

*The **ERC** is a number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of the fire. ERC is considered a composite fuel moisture index as it reflects the contribution of all live and dead fuel to potential fire intensity. As live fuels cure and dead fuels dry, the ERC will increase and can be described as a build-up index as ERC has memory.

^The **Burning Index** is a number related to the contribution of fire behavior to the effort of containing a fire. The BI (difficulty of control) is derived from a combination of Spread Component (how fast it will spread) and Energy Release Component (how much energy will be produced). The BI is expressed as a numeric value related to potential flame length in feet multiplied by 10. The scale is open-ended which allows the range of numbers to adequately define fire problems, even during low to moderate fire danger.



Hidden Pines Fire: Day 1 (10/13/15)

Bastrop RAWS 1:08 PM (1308) Weather Observations

Temperature: 90°F

Relative Humidity: 12%

Wind: Northeast 8 mph, Gusts 16 mph

The Hidden Pines Fire began at approximately 12:45 PM. The photos below were taken behind the TFS Smithville office at 12 :48 PM (left) and 1:08 PM (right). Note the increase in smoke from 12:48 to 1:08 as the fire spread. Low level instability was likely present as smoke rose vertically with ease.



Photo Credit: Colton Curles



Photo Credit: Colton Curles



Photo Credit: Steven Moore

This photo taken from the Luecke Ranch Rd at 1:02 indicates the northeast winds recorded at the Bastrop RAWS based on the lean of the smoke.

Surface fuels present in the photo indicate the cured grasses present that contributed to the spread of the fire and was a receptive fuel bed for spotting to occur based on firefighter observations.

Fire intensities were high to extreme in pockets of timber intermixed within the pastureland grasses. Full consumption of fuels occurred on the southwest corner of this timber stand based on the thick, black smoke, tree torching, and aerial photos after the fire had passed (yellow star in bottom left photo).



2:08 PM (1408) Weather Observations

Temperature: 92°

Relative Humidity: 11%

Wind: 7mph, Gusts 15 mph

The 2:08 PM Weather observations indicated a 1% decrease in RH and a 2° F temperature increase. Winds were consistent from the 1:08 PM observation.

Photos indicate the fire behavior in the grass surface fuels with low flame lengths that were not resistant to control.



The left photo is over the origin of the fire on the second day of burning. Note the intermix of timber pockets and grass fuels before moving into timber dominated fuels to the southwest. The right photo was taken in the timber dominated fuels on first day of burning. High to extreme fire behavior was observed by firefighter observations and descriptions. Single and group tree torching occurred (red oval). Surface fire behavior is very active and likely produced enough convective heat transfer coupled with understory fuels to cause tree torching.

Estimated Spotting

Dispatch reports indicate the fire spread into the MD Anderson Facility at approximately 5:00 PM on October 13th. Weather observations recorded at 5:08 PM were:

Temperature: 93°F

Relative Humidity: 10%

Wind: Northeast 6mph

Spotting distance is estimated as ember origin is difficult to determine. Two possible ember production points are listed due to the Northeast winds occurring when the fire reached the MD Anderson facility. Spotting could have occurred between 350-1000 feet based on the torched canopies of trees at these locations. Photo 1 is a spot observed in the MD Anderson Facility. Photo 2 is the pine timber line where trees were completely consumed from either group torching or a short period of active crown fire. Available surface fuels present likely generated convective heat to loft embers downwind of the fire's head.



Fuels around the MD Anderson Facility are a mixture of timber litter fuels from oak leaves and pine needles with a yaupon understory. This is considered a high-risk fuel where surface fuels can provide enough heat and energy to pre-heat a forest canopy ignite understory yaupon to cause torching and crown fire.



Estimated Spotting

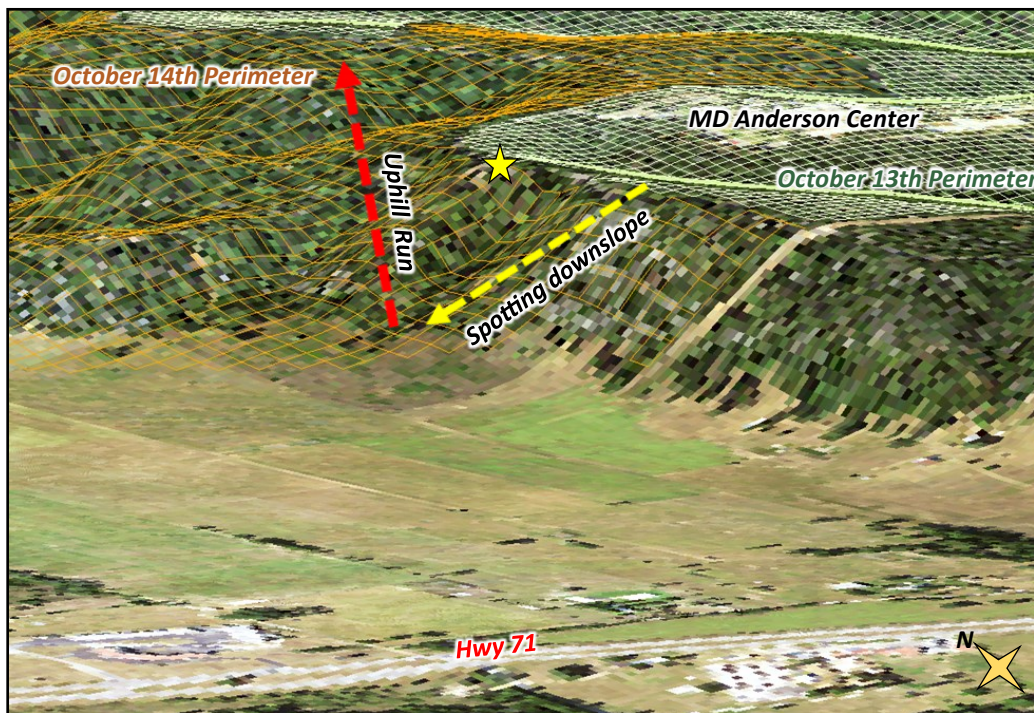
10:08 Weather Observations October 13th:

Temperature: 71°F

Relative Humidity: 15%

Wind: 2 mph (no direction recorded)

Dispatch reports indicate spotting of approximately 1/2 mile on the southwest perimeter of the fire along Park Rd 1C at approximately 10:00 PM. Spotting over the road, downslope to the base of the bluff, allowed the fire to burn back upslope to the Park Road. Spotting with light winds indicates high fire intensity which likely caused group torching and ember production onto a receptive fuel surface due to the existing fuels dry-ness. Limited uphill runs may have occurred on October 14th due to the wind shift from the south-southeast. The alignment of the slope's aspect (south) and wind could increase fire behavior and rate of spread at this bluff.



Looking toward base of bluff on Oct. 14th from Hwy 71



Photo point from overlook along Park RD 1C (yellow star)



Weather conditions into the evening and nighttime did improve on the first day as RH values began to recover and winds subsided by 10:08 PM. Even with improving weather conditions, fire behavior and intensities were high, likely due to underlying fuels dryness. Ten-hour fuel moistures remained low (red) compared to the night before (blue). The difference in 10-hour fuels is related to the differences in RH recovery.

Tabular Listing of 25 Observations from 10/12/2015 23:08 CDT to 10/13/2015 23:08 CDT:

Time (CDT)	2.0m Temperature °F	2.0m Dew Point °F	2.0m Wet bulb temperature °F	2.0m Relative Humidity %	6.1m Wind Speed mph	6.1m Wind Gust mph	6.1m Wind Direction	Solar Radiation W/m ²	Fuel Temperature °F	Fuel Moisture %	Precipitation accumulated in	Battery voltage volt	Quality Control
23:08	60.0	43.3	51.0	54	0.0	0.0		0.0	54.0	8	33.61	12.80	OK
22:08	63.0	41.3	51.4	45	0.0	0.0		0.0	56.0	7	33.61	12.90	OK
21:08	66.0	39.7	52.1	38	0.0	0.0		0.0	59.0	6	33.61	12.90	OK
20:08	71.0	37.1	53.2	29	0.0	2.0		0.0	63.0	5	33.61	13.00	OK
19:08	83.0	30.6	56.0	15	2.0	8.0	NE	84.0	75.0	3	33.61	13.20	OK
18:08	91.0	29.2	58.7	11	6.0	14.0	NNE	315.0	95.0	2	33.61	13.10	OK
17:08	93.0	28.4	59.2	10	6.0	15.0	NNE	539.0	105.0	2	33.61	13.50	OK
16:08	94.0	23.7	58.7	8	8.0	16.0	N	721.0	106.0	2	33.61	13.10	OK
15:08	93.0	28.4	59.2	10	7.0	16.0	ENE	839.0	107.0	2	33.61	13.10	OK
14:08	92.0	29.9	59.2	11	7.0	15.0	NNE	896.0	107.0	2	33.61	13.10	OK
13:08	90.0	30.6	58.7	12	8.0	16.0	NE	873.0	104.0	2	33.61	13.20	OK
12:08	88.0	31.0	58.0	13	11.0	19.0	NNE	774.0	99.0	3	33.61	13.30	OK
11:08	86.0	36.1	58.7	17	8.0	17.0	NE	603.0	96.0	4	33.61	13.30	OK
10:08	81.0	39.7	58.0	23	8.0	15.0	NE	397.0	90.0	6	33.61	13.50	OK
9:08	75.0	46.9	58.6	37	7.0	12.0	NNE	181.0	81.0	8	33.61	13.80	OK
8:08	70.0	50.5	58.3	50	3.0	6.0	N	16.0	68.0	11	33.61	12.80	OK
7:08	71.0	52.5	59.7	52	4.0	11.0	N	0.0	68.0	10	33.61	12.70	OK
6:08	74.0	53.6	61.3	49	6.0	17.0	N	0.0	72.0	10	33.61	12.70	OK
5:08	79.0	53.9	63.2	42	10.0	16.0	NNE	0.0	78.0	11	33.61	12.70	OK
4:08	78.0	72.0	73.7	82	6.0	10.0	N	0.0	78.0	17	33.61	12.80	OK
3:08	79.0	73.0	74.7	82	0.0	2.0		0.0	79.0	17	33.61	12.80	OK
2:08	79.0	72.7	74.4	81	1.0	4.0	NNE	0.0	79.0	16	33.61	12.80	OK
1:08	79.0	73.0	74.7	82	2.0	9.0	NE	0.0	77.0	16	33.61	12.80	OK
0:08	80.0	72.1	74.3	77	6.0	13.0	SSE	0.0	78.0	14	33.61	12.80	OK
23:08	82.0	71.6	74.5	71	8.0	14.0	SSE	0.0	79.0	12	33.61	12.80	OK

Time: 10:33 PM (Steven Moore)



Time: 10:56 PM (Steven Moore)



10:08/11:08 PM (2208/2308) Weather Observations

Temperature: 63°/60°

Relative Humidity: 45%/54%

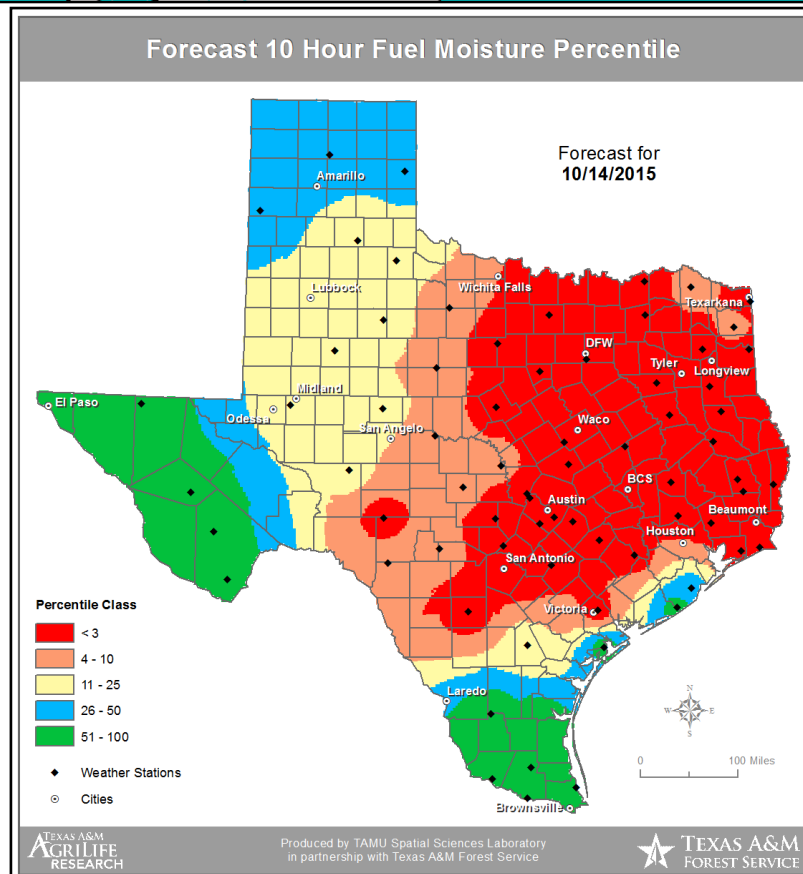
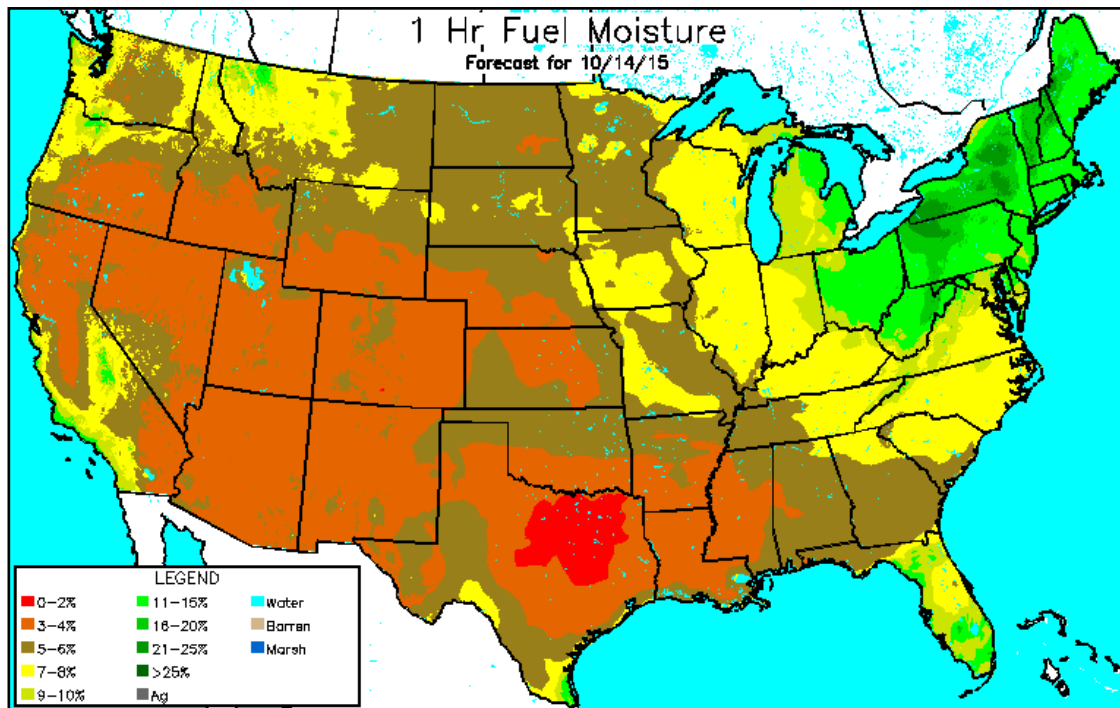
Winds: Calm/Calm

Photos taken on Park Road 1C in Buescher State Park in between Old Antioch Rd and the MD Andersen Center indicate high to extreme fire behavior between 10:00-11:00 PM. Torching was observed (red oval) and likely led to spotting from convection at the surface created by the high fire intensity.

October 14th Conditions

October 14th: 1-Hour and 10-Hour Fuels

Similar to October 13th, forecasted 1-hour fuel moistures were to be in the 0-2% range indicating the cured grass fuels and dry air in place. This dry air and poor overnight RH value of 77% produced extremely dry 10-hour fuels as forecasted moisture dryness is in the 3rd percentile. Susceptible 1 and 10-hour fuels created an earlier burn period and provided more available fuels for ignition and consumption.



October 14th Significant Fire Potential Matrix

Based on the Bastrop RAWS NFDRS calculations, the forecasted and observed ERC values and Burn Index for October 14th were:

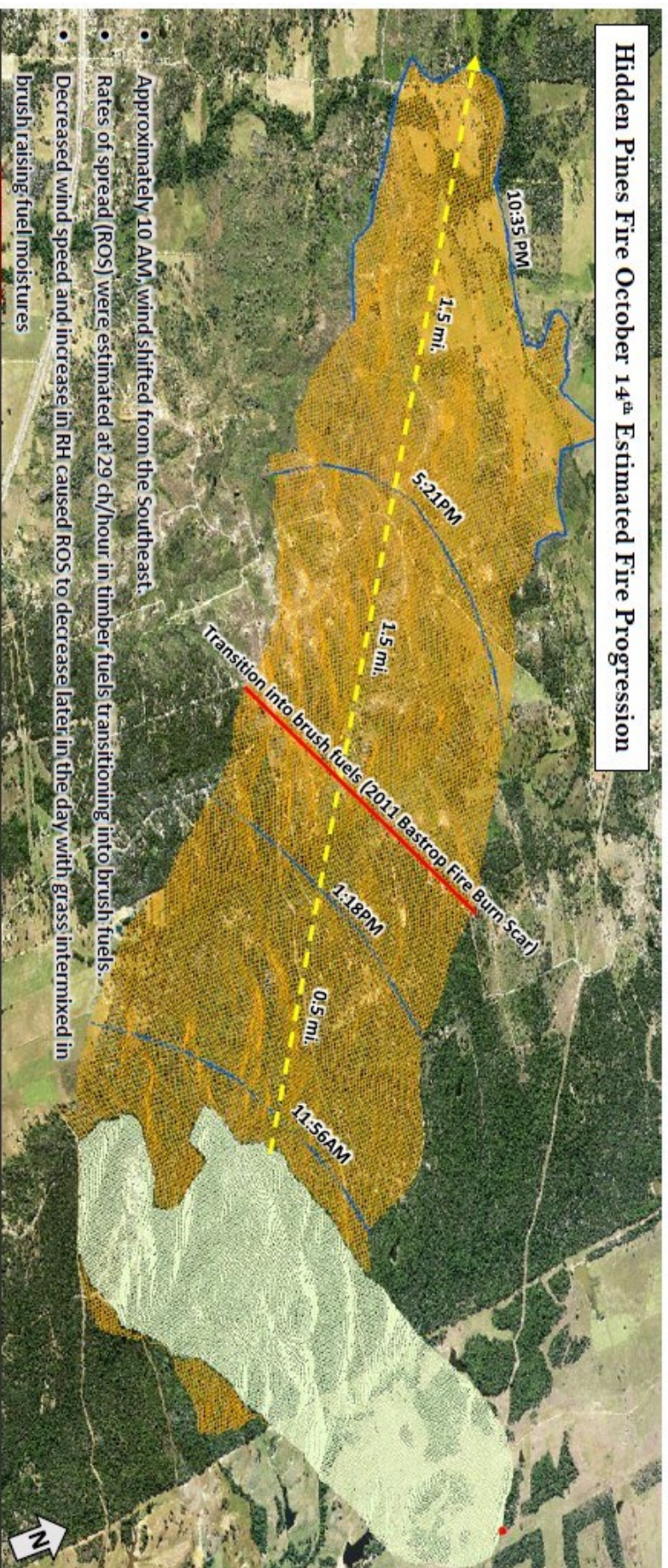
Indices	Forecast (Blue)	Observed (Green)
ERC	60	60
BI	41	55

Bastrop RAWS 2014		Preparedness Level Energy Release Component G (ERC)			
		1 0-36	2 37-50	3 51-60	4 61+
Dispatch Level Burning Index G (BI)	1 0-31	Low	Low	Moderate	Moderate
	2 32-46	Low	Moderate	Moderate★	Moderate
	3 47-59	Moderate	Moderate	High★	High
	4 60+	Moderate	Moderate	High	Very High

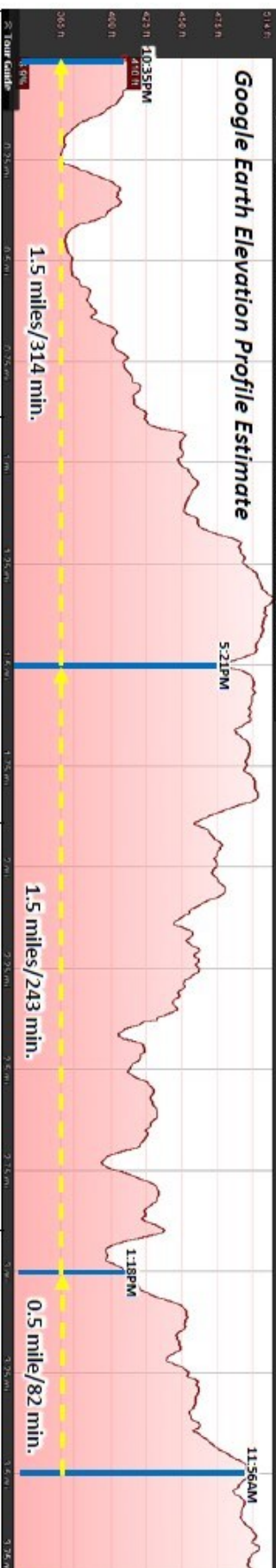
The Significant Fire Potential Matrix forecasted a **Moderate** chance for a significant fire to occur (in this case continue). The observed indices of ERC and BI for the 14th produced a **High** chance for a significant fire to occur or continue. The increase in BI value is an accurate representation based on the fire’s difficulty to control and spread on the 14th.

Hidden Pines Fire October 14th Estimated Fire Progression

- Approximately 10 AM, wind shifted from the Southeast.
- Rates of spread (ROS) were estimated at 29 ch/hour in timber fuels transitioning into brush fuels.
- Decreased wind speed and increase in RH caused ROS to decrease later in the day with grass intermixed in brush raising fuel moistures



Google Earth Elevation Profile Estimate



Time	5:21 PM-10:35 PM (314 minutes)	1:18 PM-5:21 PM (243 minutes)	11:56 AM-1:18 PM (82 minutes)
Distance	7,920 feet (1.5 miles)	7,920 feet (1.5 mile)	3,960 feet (0.5mile)
Fuel	Brush (10-hr Δ FM 3-7 gm)	Timber/WUI (10-hr FM 2 gm)	Timber (10-hr FM 2 gm)
Wind	5-7 mph SE	7-10 mph SE	5-7 mph S-SE
RH	25%	13%	16%
Slope	Max 17%, Min -6%	Max 20%, Min -6%	Max 16%, Min -5%
ROS	23 chains*/hour	29 chains/hour	29 chains/hour

Δ FM=Fuel Moisture, *1 Chain = 66 feet, 80 Chains = 1 Mile (5,280 feet)

Hidden Pines Fire: Day 2

October 14th Weather Observations

Weather conditions observed on October 14th had high temperature in the mid 90's and RH values in the mid-teens. The most notable change is the wind direction as winds on the October 13th, winds were from the Northeast and shifted from the Southeast on the 14th. The South/Southeast winds shift occurred at approximately 10:00 AM (Red Rectangle).

Also influencing fire behavior was the poor overnight RH recovery of 77% (blue square) and poor recovery of 10-hour fuels. This provided an earlier burn period with more available fuels for ignition and consumption

Tabular Listing of 25 Observations from 10/13/2015 23:08 CDT to 10/14/2015 23:08 CDT:

Time (CDT)	2.0m Temperature °F	2.0m Dew Point °F	2.0m Wet bulb temperature °F	2.0m Relative Humidity %	6.1m Wind Speed mph	6.1m Wind Gust mph	6.1m Wind Direction	Solar Radiation W/m²	Fuel Temperature °F	Fuel Moisture gm	Precipitation accumulated in	Battery voltage volt	Quality Control
23:08	77.0	47.2	59.4	35	7.0	12.0	SSE	0.0	70.0	7	33.61	12.80	OK
22:08	78.0	39.3	56.7	25	5.0	9.0	SE	0.0	69.0	7	33.61	12.80	OK
21:08	76.0	40.5	56.4	28	3.0	5.0	ESE	0.0	66.0	7	33.61	12.90	OK
20:08	78.0	39.3	56.7	25	3.0	6.0	ESE	0.0	68.0	6	33.61	13.00	OK
19:08	82.0	41.6	59.0	24	3.0	4.0	ESE	50.0	73.0	5	33.61	13.30	OK
18:08	83.0	42.5	59.7	24	0.0	4.0		42.0	78.0	4	33.61	13.30	OK
17:08	87.0	38.3	59.7	18	3.0	12.0	SSE	107.0	84.0	3	33.61	13.30	OK
16:08	93.0	34.9	60.8	13	7.0	11.0	SSE	448.0	104.0	2	33.61	13.70	OK
15:08	93.0	34.9	60.8	13	7.0	17.0	SSE	723.0	113.0	2	33.61	13.50	OK
14:08	94.0	35.6	61.4	13	7.0	14.0	S	789.0	116.0	2	33.61	13.50	OK
13:08	91.0	35.2	60.2	14	7.0	11.0	S	786.0	115.0	2	33.61	13.50	OK
12:08	90.0	37.7	60.6	16	5.0	12.0	ESE	730.0	109.0	3	33.61	13.40	OK
11:08	87.0	39.7	60.2	19	6.0	10.0	S	602.0	109.0	3	33.61	13.60	OK
10:08	82.0	43.7	59.8	26	2.0	5.0	SE	416.0	95.0	6	33.61	13.80	OK
9:08	69.0	44.3	55.1	41	0.0	2.0		198.0	78.0	10	33.61	14.10	OK
8:08	56.0	46.4	50.7	70	0.0	0.0		16.0	54.0	20	33.61	12.80	OK
7:08	53.0	43.9	48.2	71	0.0	1.0		0.0	47.0	17	33.61	12.70	OK
6:08	52.0	45.0	48.3	77	0.0	2.0		0.0	48.0	16	33.61	12.70	OK
5:08	54.0	44.4	48.9	70	0.0	2.0		0.0	48.0	15	33.61	12.70	OK
4:08	54.0	45.9	49.6	74	0.0	2.0		0.0	48.0	14	33.61	12.70	OK
3:08	55.0	43.0	48.7	64	0.0	1.0		0.0	49.0	13	33.61	12.80	OK
2:08	56.0	45.6	50.4	68	0.0	2.0		0.0	50.0	12	33.61	12.80	OK
1:08	58.0	44.2	50.6	60	0.0	3.0		0.0	52.0	11	33.61	12.80	OK
0:08	59.0	43.8	50.8	57	0.0	1.0		0.0	53.0	10	33.61	12.80	OK
23:08	60.0	43.3	51.0	54	0.0	0.0		0.0	54.0	8	33.61	12.80	OK

October 14th Observed Fire Activity (Steven Moore)



12:08 PM Weather Observations

Temperature: 90°

Relative Humidity: 16%

This photo was taken at 11:57 AM on Old Antioch Rd between Park road 1C and the high tension lines. Fire intensities were high to extreme with active crown fire occurring.

1:08 Weather Observations October 14th:

Temperature: 91°F

Relative Humidity: 14%

Wind: South 7 mph

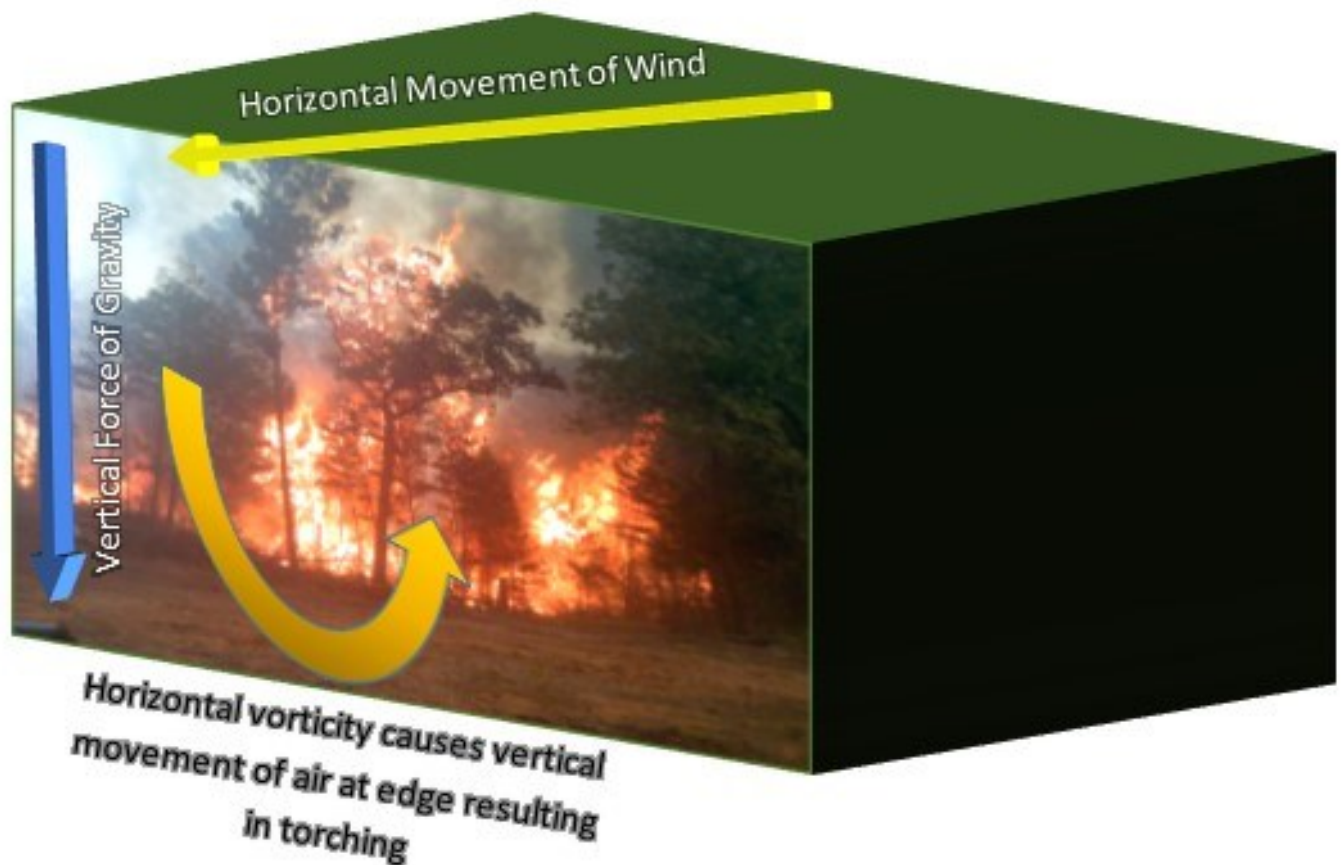
The 34 second time-lapse of photos taken around a structure on Raven Road depict the high to extreme fire activity that occurred on October 14th. Fire behavior exhibited rapid transition from the surface to the crown and back to the surface with these timestamped images. The edge effect of wind and gravity may have caused a horizontal vorticity that caused vertical movement of air resulting in torching.



Edge Effect

Single or group torching at the edge of a forest or timber stand may at times be influenced by the horizontal movement of air or the edge effect. The horizontal movement of air (wind) over the forest canopy flows over and opening or edge where the downward force of gravity causes a portion of the wind to move down toward the surface. Once this wind hits the surface, some air then may roll back toward the timber and up from the surface into the canopy. With sufficient ladder fuels and low fuel moisture, the fire then may move into the canopy and cause torching. Torching then could produce embers for spotting to occur downwind.

Edge Effect from Timber and Torching





Transition from surface to crown

The Hidden Pines exhibited high to extreme fire Behavior as active surface fire transitioned into the canopy is fire behavior that is resistant to control and suppression efforts.

Photos 1 and 2 depict the active surface fire with trees to the right beginning to torch. The trees to the left have surface fire burning under the canopy providing convective heat to pre-heat the aerial fuels. Live foliar moisture from September live fuel sampling in loblolly pine was at 113% which is in the 4th-10 percentile of dryness.



Photos 3 and 4 depict the high to extreme fire behavior due to the transition of high intensity surface fire into the canopy with increase flame lengths. Contributions to the surface fire intensity likely include heavy fuel loading, low fuel moisture content, and low level atmospheric instability.



Vertical arrangement of fuels is also a factor to the transition depending on the amount ladder fuels in place or how low the crown height is to the surface. A lower crown height reduces heat transfer distance from surface to crown allowing more energy to reach the canopy and less lost to the environment.



Another consideration is the location of the torching in relation to timber stand. The edge of a stand of timber receives greater amounts solar radiation, therefore having greater evapotranspiration and lower fuel moisture. Microscale winds could also contribute to the torching at the edge of tree with horizontal vertices or eddies of wind influencing vertical fire growth and torching.

Burning into 2011 Bastrop County Complex Burn Scar

The Hidden Pines fire burned northwest into the 2011 Bastrop County Complex burn scar. After 4 years from the 2011 fire, natural loblolly pine regeneration was present mixed with oak, grass, and yaupon. The young pine with a lower and open canopy provided sunlight to reach the surface for the grass and yaupon to grow and intermix with the young pine. This fuel acted more as a brush fuel model and provided more fuel available for consumption.



Burning into the 2011 burn scar with fire with torching of young 3-4 year old loblolly pine.

*Representative 4 year old pine
intermixed with grass and yaupon.*



October 15th Weather Conditions

Overnight from October 14th into the morning of the 15th, RH values recovered into the mid and upper 90% range. The increase in RH also increased the observed 10-hour fuel moistures as compared to October 13th and 14th. The increase in RH will also readily increase 1-hour fuel moistures. The minimum afternoon RH value observed on the 15th was also higher at 18%. The increase in RH can be attributed to the southerly wind as air from the Gulf of Mexico is tropical in origin and contains more moisture. The impact in rising RH values and fuel moistures helped limit the growth of the Hidden Pines Fire on October 15th.

RAWS Observations	10/13 Obs.	10/14 Obs.	10/15 Obs.
Maximum Morning Relative Humidity	82%	77%	98%
Maximum 10-hour Fuel Moistures	17gm	20gm	24 gm
Minimum Afternoon Relative Humidity	8%	13%	18%

Tabular Listing of 25 Observations from 10/14/2015 23:08 CDT to 10/15/2015 23:08 CDT:

Time (CDT)	2.0m Temperature °F	2.0m Dew Point °F	2.0m Wet bulb temperature °F	2.0m Relative Humidity %	6.1m Wind Speed mph	6.1m Wind Gust mph	6.1m Wind Direction	Solar Radiation W/m²m	Fuel Temperature °F	Fuel Moisture gm	Precipitation accumulated in	Battery voltage volt	Quality Control
23:08	74.0	51.3	60.2	45	4.0	9.0	SSE	0.0	64.0	10	33.61	12.80	OK
22:08	77.0	48.7	60.1	37	6.0	9.0	SE	0.0	68.0	9	33.61	12.80	OK
21:08	78.0	49.6	60.8	37	4.0	6.0	SSE	0.0	67.0	8	33.61	12.80	OK
20:08	78.0	51.0	61.5	39	1.0	5.0	ESE	0.0	70.0	7	33.61	13.00	OK
19:08	85.0	48.2	62.6	28	4.0	13.0	ESE	80.0	79.0	5	33.61	13.20	OK
18:08	91.0	46.8	64.1	22	7.0	16.0	SE	309.0	95.0	4	33.61	13.20	OK
17:08	94.0	45.4	64.5	19	9.0	16.0	SSE	521.0	111.0	2	33.61	13.50	OK
16:08	95.0	44.8	64.6	18	8.0	18.0	S	693.0	117.0	2	33.61	13.60	OK
15:08	93.0	49.7	65.8	23	9.0	17.0	SSE	807.0	118.0	2	33.61	13.50	OK
14:08	92.0	52.2	66.6	26	7.0	17.0	SSE	859.0	118.0	3	33.61	13.40	OK
13:08	90.0	60.9	70.2	38	4.0	13.0	SW	831.0	112.0	4	33.61	13.40	OK
12:08	86.0	60.9	69.0	43	6.0	12.0	S	747.0	113.0	5	33.61	13.50	OK
11:08	81.0	69.4	72.8	68	6.0	11.0	SSW	560.0	102.0	9	33.61	13.70	OK
10:08	73.0	68.9	70.2	87	2.0	5.0	SSW	190.0	79.0	20	33.61	13.80	OK
9:08	66.0	65.4	65.7	98	0.0	2.0		66.0	68.0	24	33.61	13.10	OK
8:08	62.0	61.1	61.5	97	0.0	3.0		11.0	62.0	24	33.61	12.70	OK
7:08	59.0	57.9	58.4	96	0.0	0.0		0.0	58.0	24	33.61	12.70	OK
6:08	56.0	54.9	55.4	96	0.0	1.0		0.0	51.0	22	33.61	12.70	OK
5:08	58.0	56.6	57.2	95	0.0	2.0		0.0	53.0	21	33.61	12.70	OK
4:08	59.0	57.3	58.0	94	0.0	3.0		0.0	54.0	19	33.61	12.80	OK
3:08	65.0	60.7	62.3	86	1.0	7.0	S	0.0	59.0	16	33.61	12.80	OK
2:08	68.0	61.2	63.6	79	4.0	8.0	SSE	0.0	61.0	12	33.61	12.80	OK
1:08	71.0	58.2	62.8	64	5.0	13.0	SSE	0.0	65.0	10	33.61	12.80	OK
0:08	74.0	54.7	61.9	51	7.0	11.0	SSE	0.0	67.0	9	33.61	12.80	OK
23:08	77.0	47.2	59.4	35	7.0	12.0	SSE	0.0	70.0	7	33.61	12.80	OK

Summary

- After record rainfall during the Spring of 2015, the Smithville, TX area in Bastrop County only received 10% of normal precipitation 60 days before October 13th and 5% of normal precipitation 30 days prior.
- Dominate high pressure across the Eastern two-thirds of Texas provided above normal temperatures for many regions, including Bastrop County. The warm, dry pattern caused Dry fuels (100-hour fuels and Energy Release Component).
- The passage of a dry cold front on October 12th caused winds to shift from the northeast ushering unusually dry air with above normal temperatures for October 13th, the day of ignition.
- The dry air impacted 1 and 10-hour fuels as overnight relative humidity values were poor to recover (90% or less) and fuel moistures did not recover. This created a earlier burn period and more available fuels for ignition.
- The Hidden Pines Fire began in Summer cured, fine, grassy fuels and was quickly spread by the Northeast winds of 8 mph. High rates of spread (135 chains/hour) occurred in the grass fuels while high to extreme fire behavior was observed with spotting in pockets of timber fuels.
- High to extreme fire behavior continued to occur once the fire reached the main timber adjacent to Buescher State Park although rates of spread decreased due to heavier fuels being consumed. The pine timber intermixed with yaupon and brush (ladder fuels) is considered a high risk fuel.
- Fire activity continued to be high with torching and spotting into the night of the 13th and early morning of the 14th as relative humidity values were slow to recover allowing fuel moistures to stay low and available for ignition.
- Spotting over containment lines likely occurred to due the light to moderate winds as embers were likely to be lofted higher into the air and landed onto a receptive fuel bed with a high probability of ignition due to overall fuels dryness.
- On October 14th, at approximately 10:00 AM, a wind direction change from the south-southeast pushed the fire northwest into timber dominated fuel where active crown fire and spotting occurred.
- The afternoon of the October 14th, the fire progressed into the 2011 Bastrop County Complex burn scar where fuels transitioned into a brush model of 3-4 year old pine regeneration mixed with grass and yaupon where fire remained active.
- Overnight RH recoveries on October 14th/15th were nearly 100% or which increased 1 and 10-hour fuel moistures decreasing fire activity and the burn period compared to October 13th and 14th. Moderating fire behavior was less resistant to control and suppression efforts.

References

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