LANDFIRE Southeastern Drought Adjusted Surface Fuel Product

Responding to the 2023 Western Gulf Coast Drought

Jim Smith, TNC LF Program Lead

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LANDFIRE (LF) provides multiple, annual products related to wildland surface and canopy fuels. Most of these layers are static and are produced once per year, based on an average (not extremely wet or dry) set of weather assumptions. However, surface and canopy fuels are not static by nature, rather they fluctuate seasonally and with changing weather throughout the year.

Many groups are recognizing the need to create products that adjust to recent or predicted growing conditions, such as FuelCast/RPMS, GrassCast and LANDFIRE which is promising, but there are some differences (particularly with resolution - LF is at 30-m) across these groups products. To respond to the changing nature of these fuels and better capture growing season fluctuations, the LANDFIRE Program created two 30-m, seasonal fuel products (MoD-FIS) based on indices, one for the Southeastern US using Keetch Byrum Drought Index (KBDI) and another for the Southwestern/Great Basin areas based on the Normalized Difference Vegetation Index (NDVI). In this document we will demonstrate how the SE KBDI process provides seasonally adjusted LANDFIRE surface fuels and describe how LANDFIRE modified fuel products

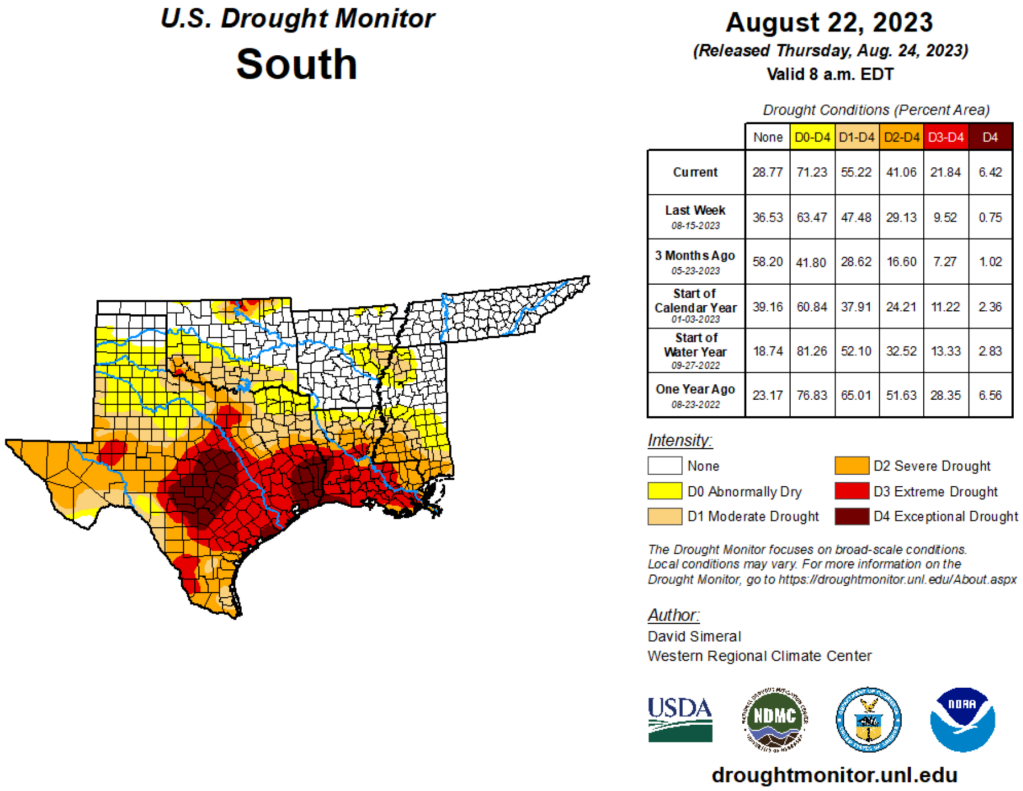

Figure 1: US Drought Monitor (South) for the area showing the extent of the extreme drought August 22, 2023

during a recent historic drought along the Gulf coast of Louisiana, Mississippi, and East Texas.

2023 DROUGHT IMPACTS: In the late summer and early Autumn of 2023, the western Gulf region of the United States experienced a historical drought (Fig 1). As a result, the region experienced several significant fires that exhibited behavior and extents that were outside of typical fires for this area.

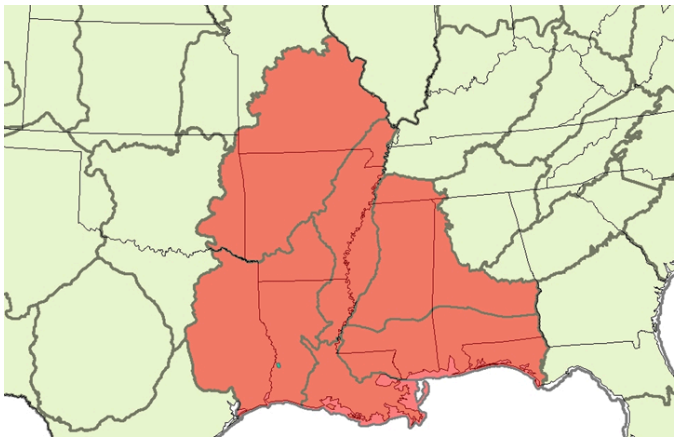

Figure 2: Fire behavior analysis region

REGIONAL ANALYSIS: Using the program gNEXUS, a system for assessing crown fire hazard, LANDFIRE experts conducted a regional analysis (Fig 2) of how the KBDI-modulated surface fuel layer changed the predicted spread rate, the amount of crown fire and distribution of flame lengths of a potential wildland fire.

Figure 3 shows how the expected fire type changed from the original (average - not extremely wet or dry) LF FBFM40 layer (blue bars) compared to the modified MoD-FIS layer (orange) for the analysis region. Note that SE KBDI shown in Figure 3 represents later drought conditions in October 20, 21

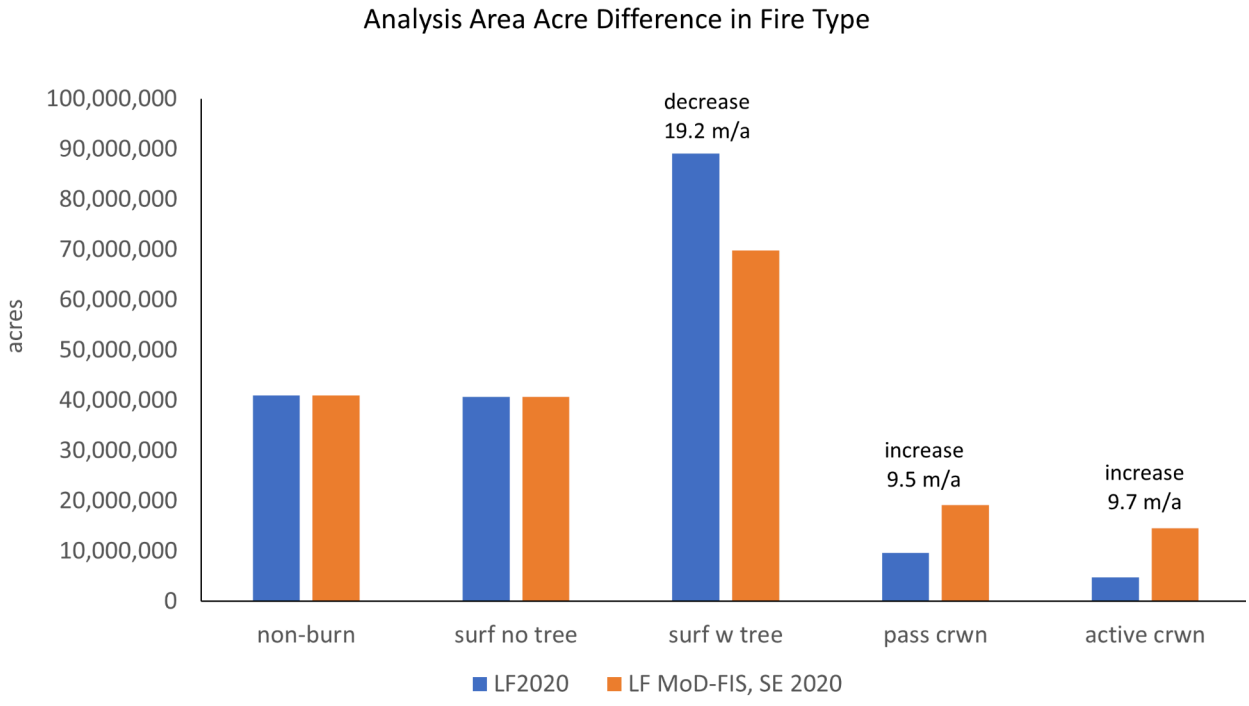

Figure 3: Comparison of predicted fire type before and after the drought using LANDFIRE's LF2020 Southeastern MoD-FIS product (LF MoD-FIS, SE 2020). Note: m/a = million acres

and 22 (Julian dates 293, 294 and 295) because LANDFIRE was not producing the SE KBDI in August during the peak time of the fire. Learn more about Julian dates here.

The KBDI modulated fuels more than doubled the acres in the two crown fire categories (Fig 3. passive/active crown) across the analysis region, from around 12 million acres in total to nearly 30 million acres. The Active Crown fire category by itself increased by nearly 10 million acres for the analysis region.

Figure 4 provides a refined look at fire spread rate, another important measure when predicting fire behavior. From the figure below, we can see that, with the KBDI product (LF MoD-FIS, SE 2020), fire spread rates increase and shift to the next higher (or faster to spread) category than with the original LF2020 fuel product.

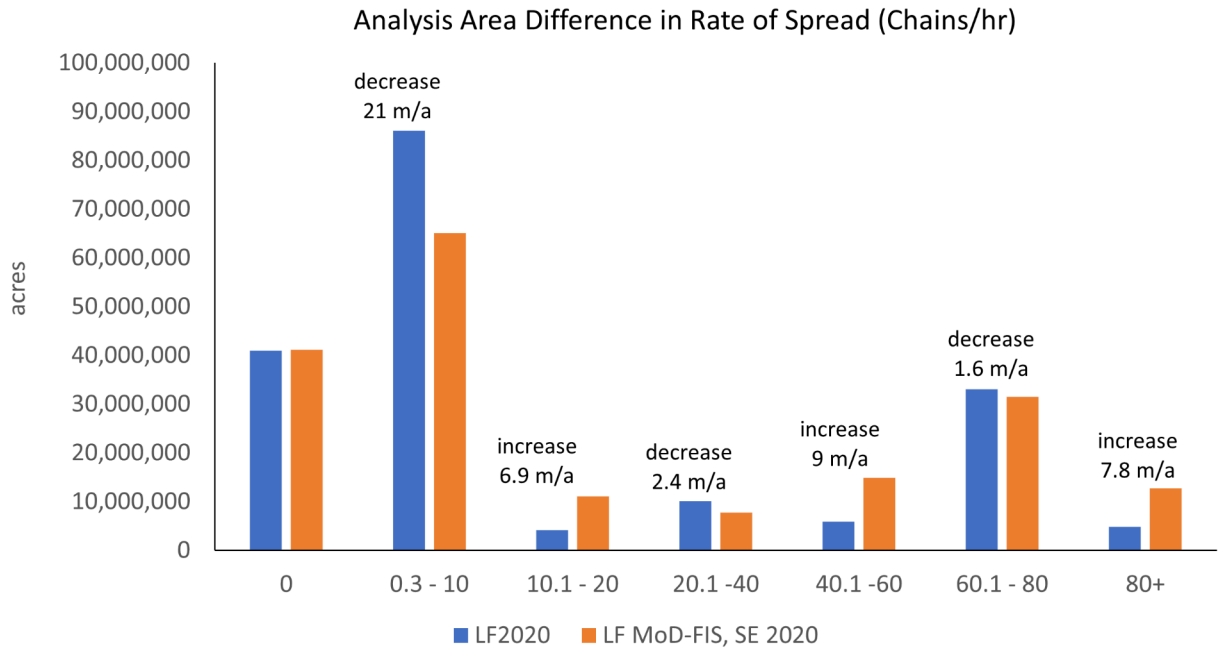

Figure 4: Comparison of predicted fire spread rate before and after the drought using LANDFIRE's Southeastern MoD-FIS product (LF MoD-FIS, SE 2020). Note: m/a = million acres

TIGER ISLAND FIRE: During the Summer of 2023, the Tiger Island Fire in SE Louisiana (Figure 5) burned more than 31,000 acres, damaging more than 20 homes and structures. We investigated how the FBFM40 shifted throughout the drought according to the LF SE MoD-FIS.

By comparing the original LF2020 and the MoD-FIS FBFM40 values for the final Tiger Island fire perimeter in August (Table 1), we can see the shift from one surface fuel model to another. For example, more than 40% of the burned area was modeled as a timber type (TU) surface model. Given the drought conditions in the area, they were updated to reflect this seasonal change to either a shrub (SH) or grass (GR) model. The modulated LF product clearly reflected how the drought could make fire behavior more extreme.

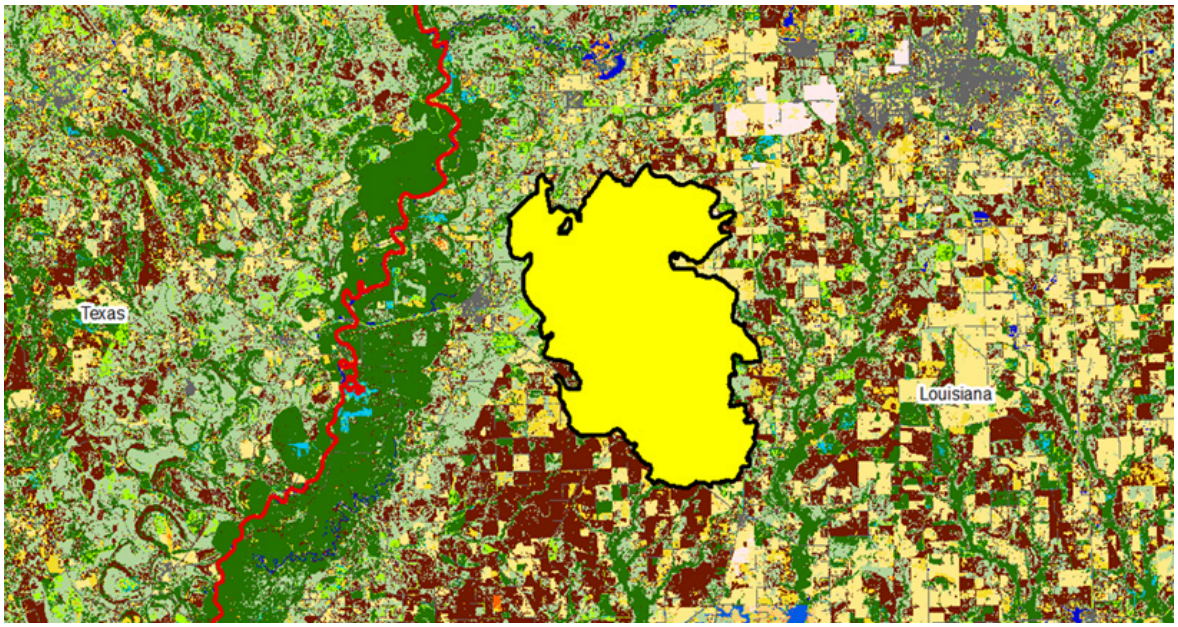

Figure 5: Map showing the final fire perimeter for the Tiger Island Fire

LF2020 Original FBFM40	October 22 KBDI Modified FBFM40	Acres	Percent of fire with this surface fuel model change in SE MoD-FIS
TU3	SH9	8,369	27.2%
TL6	GR3	4,347	14.1%
TL9	TU3	3,672	11.9%
GR3	GR6	3,402	11.0%
TL2	TU5	3,214	10.4%
TL6	TU3	1,565	5.1%
TU2	TU3	1,225	4.0%
SH4	SH9	1,185	3.8%
TU1	TU5	1,014	3.3%
NB1	NB1	935	3.0%
TL3	TU1	623	2.0%
SH6	SH9	524	1.7%
GR2	GR3	342	1.1%
GS2	GS3	262	0.9%
TL5	TU2	187	0.6%

Table 1: LF2020 Original and KBDI modified FBFM40 surface fuel models (SE MoD-FIS) for the total area burned in the Tiger Island Fire

Change Type	Spread Rate Change Percent	Flame Length Change Acres
no change	35%	15%
very low to low	2%	0%
very low to moderate	10%	10%
low to moderate	4%	27%
moderate to high	35%	0%
moderate to very high	0%	42%
high to very high	11%	2%

Table 2: Summarized changes in predicted spread rate and flame length using the KBDI modulated FBFM40 LANDFIRE layer

This LF SE MoD-FIS data set that presents daily values for the Southeastern US, provides a useful product for predicting fire behavior based on seasonality or critical changes in recent weather.

Using the FBFM40 descriptions, the increased fire behavior due to the drought is even more evident. Approximately two-thirds of the final burned area increased in spread rate category and more than 80% exhibited an increase in predicted flame length in the LF MoD-FIS product. It is especially important to note that more than 40% of the final burned area increased in predicted flame length from moderate to very high.

SUMMARY: How wildland surface and canopy fuels changes daily with weather is an important part of understanding and managing wildland fires. Responding to requests from the user community, the LANDFIRE Program is now providing seasonal/modulated fuel products for two regions of the US with modified mapped FBFM40 using indices called MoD-FIS. For the Southeastern US, the MoD-FIS product is linked to the previous three days of the Keetch-Byrum Drought Index. To explore the value of this product, we compared the LF 2020 FBFM40 LANDFIRE layer to SE MoD-FIS values in a region that experienced an historic drought in 2023. The modified fuels product clearly increased fire behavior during the drought. Fire planners and managers can expect more useful fuels information in times of unusual weather using the suite of LANDFIRE MoD-FIS products.

Do you have a story to share after using LANDIRE data? If so, get in touch at landfire@tnc.org – we always appreciate hearing from you.