

**Natchez Fire**  
**NW Team 7**  
**Strategic Planning for Southwest Fire Perimeter**  
**September 10, 2018**

**Purpose:** This strategic planning assessment has been developed to address fire growth west of the current planning area in the Siskiyou Wilderness. The plan explores strategies to manage fire growth within the wilderness while minimizing negative fire effects on the landscape. The late season environment potentially provides opportunities to achieve suppression objectives while minimizing exposure to firefighting resources and minimizing suppression impacts. These strategies acknowledge the distance to values at risk, seasonality, less frequent occurrence of critical fire weather, and the high probability of season modifying conditions.

**Fire Summary:**

The Natchez Fire started July 15, 2018 on the Rogue-Siskiyou National Forest between two tributaries of Poker Creek at an elevation of approximately 4400 ft. Within the next four days the fire had spread to the south and crossed over the boundary onto the Klamath NF. As of September 9th, the fire size is just over 32,000 acres. The fire is currently burning west of Highway 48 (Grayback Road), north of the 2017 Eclipse Complex (Baldy Mountain and the Oak Fire), east of the prominent ridge from Lookout Mountain south to Preston Peak, and south of the Oregon/California border. This ridge will be referred to as El Capitan Ridge for the remainder of this document.

Klamath National Forest managers recognized that active fire behavior typically continues in Northern California through late September and occasionally persists into November. Weather conditions associated with large fire growth events occur almost every year in September and some years occur multiple times during the September – October time period. It is prudent to assume that the fire will experience critical fire weather at least once in the next 60 days. (Sexton)

The fire has reached the western extent of the current planning area identified in the Wildland Fire Decision Support System (WFDSS) decision published on 8/30/2018. Any fire west of the El Capitan Ridge will require a new WFDSS decision with an enlarged planning area. It is recommended that this planning area incorporate areas of the Six Rivers National Forest within the Siskiyou Wilderness.

**Management Objectives:**

- Implement suppression actions that have a high potential for success, carefully weighing risk exposure to firefighters.
- Minimize undesirable fire effects by moderating fire intensity through suppression actions and strategic firing operations as necessary.
- Implement suppression actions in consideration of values at risk in order to minimize adverse impacts.
- Consider fire fighter exposure with respect to communications, driving, aviation and mop-up in decisions and actions.

**General Control Objective:**

- Keep fire within existing containment lines on the north and east perimeter, within the Siskiyou Mountain Wilderness to the west, and use the Eclipse Complex fire scar to contain fire to the south. Use a combination of direct and indirect actions along roads, trails, natural barriers, and constructed hand/dozer lines to contain the fire.

**Strategic Objectives and Supporting Actions:**

- Manage fire effects through deliberate actions using strategic methodologies and adapting to changing environmental conditions.
- Monitor Fire growth south of Copper Peak and east of Preston Peak. Minimize exposure to firefighters and aviation assets through the use of natural barriers to the south of the fire.
- Utilize firing patterns that will result in low-moderate severity fire within the Siskiyou Wilderness.
- Utilize aerial ignition to mitigate uphill high mortality runs.
- Take advantage of moderating conditions that will minimize negative fire effects; while recognizing critical fire weather events or concerns.
- Identify holding actions that will keep fire within the wilderness.

**Strategies:**

**Alternative 1:** Continue suppression actions to keep fire east of El Capitan Ridge.

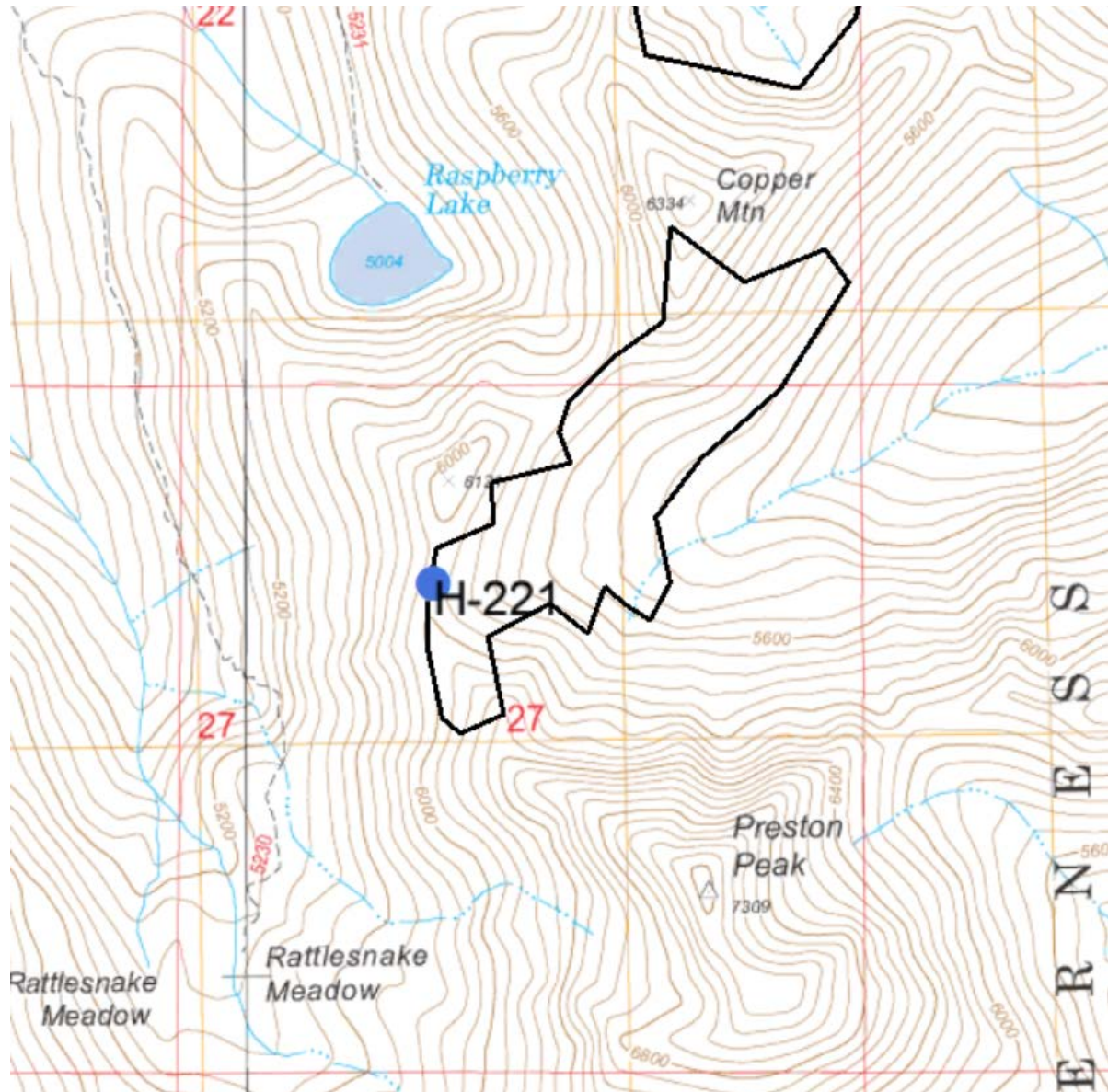
Suppression actions on the El Capitan Ridge have been implemented from Lookout Mountain to the north to Cyclone Gap to the south. The most likely area where fire may threaten to pass through natural barriers exist in the gap between Preston Peak and Copper Mountain east of Raspberry Lake. This gap will be referred to as Raspberry Gap. As of 9/8/2018, active fire is approximately two miles down canyon from Raspberry gap. Persistence modeling and the near term weather forecast indicate that fire is unlikely to threaten the gap for a minimum of seven days. Weather patterns that might push fire towards the gap at a faster pace would be apparent several days in advance of the event's occurrence. This would provide sufficient time to initiate tactical ignitions in Raspberry gap to reduce fuels and therefore minimize fire intensity that may occur under unfavorable conditions.

Tactical firing operations would be supported by aerial retardant and bucket drops to keep fire east of the gap between Preston Peak and Copper Mountain. Backing fire would be established on steep slopes below ridgelines to minimize fire intensity below the gap. Backing fire will reduce ridgeline fuels in front of the advancing fire in the valleys and chutes to the east. Moderated fire behavior will increase the effectiveness of retardant and water drops.

Desired fire behavior is low to moderate intensity surface fire, which results in the consumption of surface fuels and brush, with small amounts of group torching, and no crown fire. The targeted areas are those fuels that provide connectivity across Raspberry Gap. Desired spread is a downslope backing fire that progresses about 1000 feet to the east, consuming fuels high on the eastern aspects of the ridge along indirect control line/natural barriers. This firing operation is intended to create a sufficiently wide blackline to stop anticipated fire activity from spotting across it.

Fuels in the ignitions area are primarily composed of **Timber Litter (TL8)**, **Timber with Understory (TU5)**, **and Shrub (SH2)** fuel models. Primary tree species include mixed sizes of true fir species and pine species. Snags and heavy fuel concentrations are common in timbered areas. Live fuels are critically dry and will contribute to fire intensity and rate of spread, grasses are fully cured. Fuel types vary dependent upon the harshness of site and the fire area is characterized by patchy stringers of timber, brush, and rock.

Firing pattern would generally be a single line of ignition along the ridgeline, with strip-head pattern added as needed to increase depth in discontinuous fuels that prevent active and even backing. Depending on rate of backing, and observed fire effects, firing may occur during a single burn period or over several.

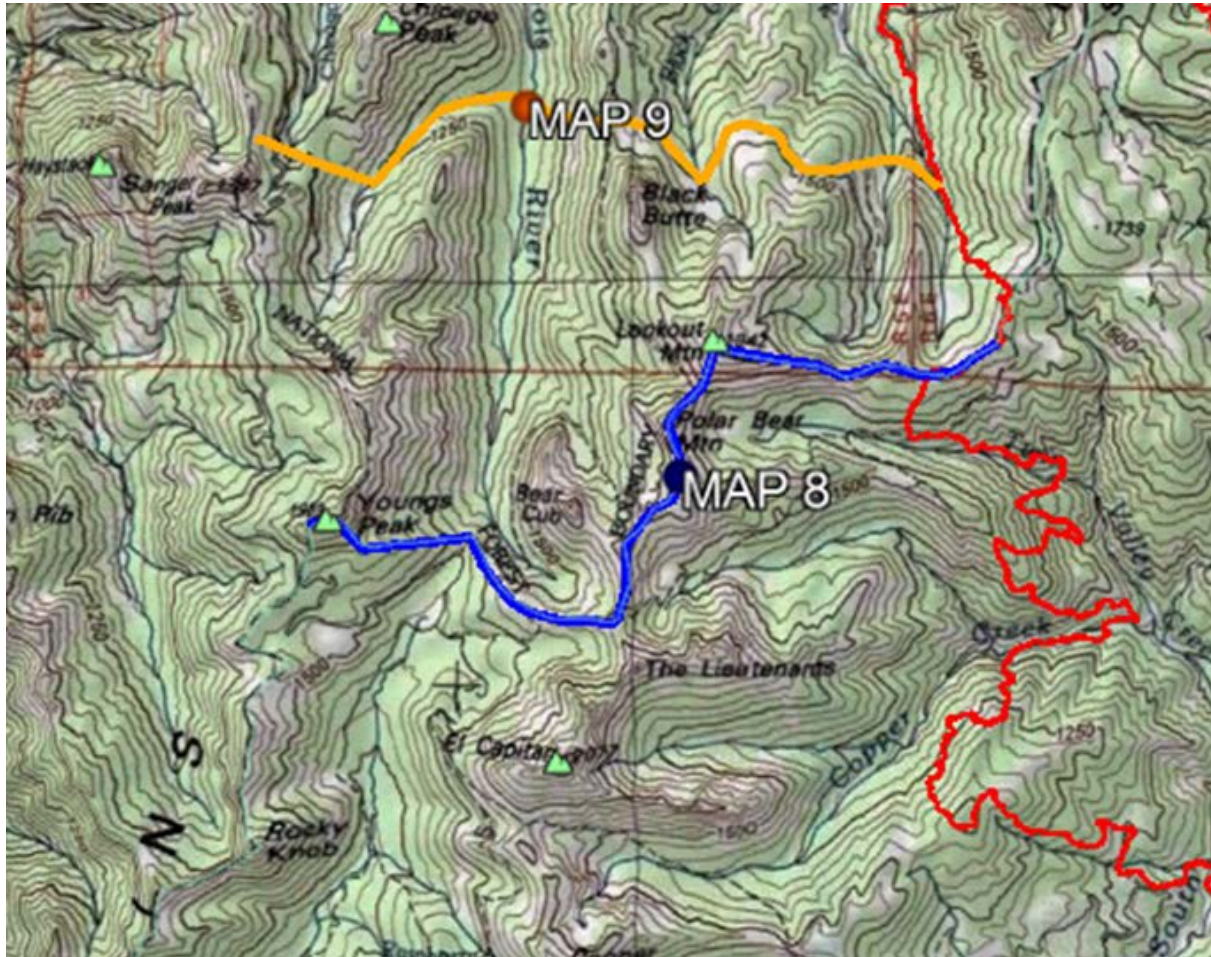


Raspberry Gap. Targeted firing area is outlined in black.

**Alternative 2:** Unabated fire within Siskiyou Wilderness

Unabated fire within the wilderness has the potential to result in a variety of fire effects ranging from low severity understory burning to stand replacing high severity impacts. Unabated burning could result in a series of downhill backing fires transitioning to uphill head fire runs in a slope reversal process. The daily cycle of fire would depend upon a combination of fuel, weather, and topographical factors. Scenarios have been developed based on possible weather conditions and associated fire behavior.

Management Action Points (MAPs) have been developed to address fire spread into the East Fork Illinois River and are identified in the WFDSS decision. MAP 8 and MAP 9 were created to ensure notification and protection of the Sunstar, CA and Takilma, OR communities located north of the MAP. Although these MAPs were never breached, contingency lines and road preparation activities were initiated for the protection of these communities.



WFDSS Management Action Points (MAPs) 8 and 9

Fire that crosses the ridge between the Eclipse Burn Scar and Young’s Peak will be on the Six River’s National Forest in the Smith River watershed. Limited opportunities to stop the spread of fire exist in the broken topography of these drainages and Highway 199 may provide the best opportunity to stop fire spread in the westerly direction.

Weather and fire behavior scenarios have been developed to demonstrate the potential variability in fire growth that may be observed.

**Best Case Weather and Fire Behavior Scenario:**

**Weather** – Mild to moderate seasonal pre-fall weather would persist throughout the remainder of the period until the season ending event occurs. Overall fire activity would be in the low to moderate range. Energy Release Component (ERC) values would trend downward below the 70<sup>th</sup> percentile with unlikely

sustained recovery above the 90<sup>th</sup> percentile. Seasonal average conditions of temperature and relative humidity, with season slowing events ( $\geq 0.25''$  precip. In 24-hour period), and/or pre-fall conditions would provide a general diminishing of fire danger. Strong wind events would be unlikely without associated precipitation. Elevated temperatures (above 80 degrees), and low relative humidity (below 25%) may occur for short periods, and nighttime relative humidity recovery on ridge tops would be generally fair- good ( $>60\%$ ). Winds in the fire area would generally be light (3-5 mph) and terrain dominated; peak gusts generally less than 15 miles per hour. Favored wind directions (NW-SW) would be likely, although minor NE wind episodes may occur. Mild cool or cloudy conditions would occur for portions of time with daytime relative humidity minimums above 35%. Seasonal weather systems would include high pressure ridges and low pressure troughs that would transition predictably.

**Fire Behavior** – Fire would experience a low level of fire activity generally. Significant fire spread would likely not occur, although continued isolated activity would be present in focused areas. Singular areas of concern may be present, but would not pose significant threat to control lines or produce undesirable fire effects. Fire behavior would be conducive to meeting management objectives with limited planned actions as necessary. Fire would primarily exhibit smoldering, creeping, limited low/moderate intensity surface fire spread, low intensity backing - especially in timber litter and shrub fuels. Low fire intensity could be expected overall except in patches of heavy fuels (TU5) where group torching and short crown runs may be expected. Diminishing peak burn period conditions would provide irregular fire spread (heading and backing), while some periods may include higher rates of spread. Slope reversals and fuel model transitions may produce moderate to high intensity fire behavior with group torching and short crown fire runs when wind and slope align.

#### **Intermediate Case Weather and Fire Behavior Scenario:**

**Weather** – Moderate weather conditions would occur throughout the period, with the possibility of severe conditions/events of limited duration and significance occurring. Generally higher daytime temperatures (80's degrees), lower relative humidity (20%-30%), and stronger winds would occur periodically. Potential episode(s) of critical weather conditions would occur before end of season that would include relative humidity less than 20% (day and/or night) and winds greater than 20 mph. ERC values would remain near or below 90<sup>th</sup> percentile value for much of the period. Periods of high fire danger may be frequent through end of season. Weather patterns may include persistent high pressure ridges (warm/dry at high elevation, strong inversion low elevations). Weather system transitions between high pressure ridges and low pressure troughs may produce periods of critical fire weather. Generally warmer, drier conditions would be characteristic of this scenario with temporary fluctuations in ERC producing a spiking effect punctuating a seasonal decline.

**Fire Behavior** – Portions of the fire would continue to be active to very active and producing larger areas of fire spread. One or more areas would experience fire growth, but spread distances would be moderate and confined to specific aspects and areas of fuel concentration. Slope, available fuel, and local winds would be the predominate factors in fire spread. Fuel type changes would provide opportunities for suppression effectiveness. Moderate fire intensity and rates of spread could be expected during periodic isolated episodes of fire activity. Active backing may be expected, with high intensity fire behavior due to slope reversals.

**Worst Case Weather and Fire Behavior Scenario:**

**Weather** – Moderate to severe conditions would exist more frequently at various levels throughout the period, with anomalous events occurring until the end of the season. ERC values would remain near 90<sup>th</sup> percentile values with 97<sup>th</sup> percentile spikes. Atypical conditions of temperature and humidity would occur frequently for much of the period, or with persistence. Persistent poor nighttime relative humidity recovery may sustain active burning conditions and aggravate daytime fire behavior. Weather systems would be strong, and/or their changes would be fairly significant, such as “frontal passages” (thermal troughs or cold-front) or dominating high pressure systems. Winds may be generally stronger, or persistent, and show higher velocity (especially on ridge tops).

**Fire Behavior** – Overall escalation of fire activity would occur. High to extreme fire behavior could be likely; wind-driven or plume dominated event(s) would be possible. Large fire spread event(s) would require use of complex tactics and sophisticated strategies. Fire characteristics may include long-range spotting, crowning runs, and high intensity surface fire spread. Fire activity may occur through night and/or spread for multiple burn periods. Fire effects would be undesirable, and the threat of escape outside of Wilderness would be high.

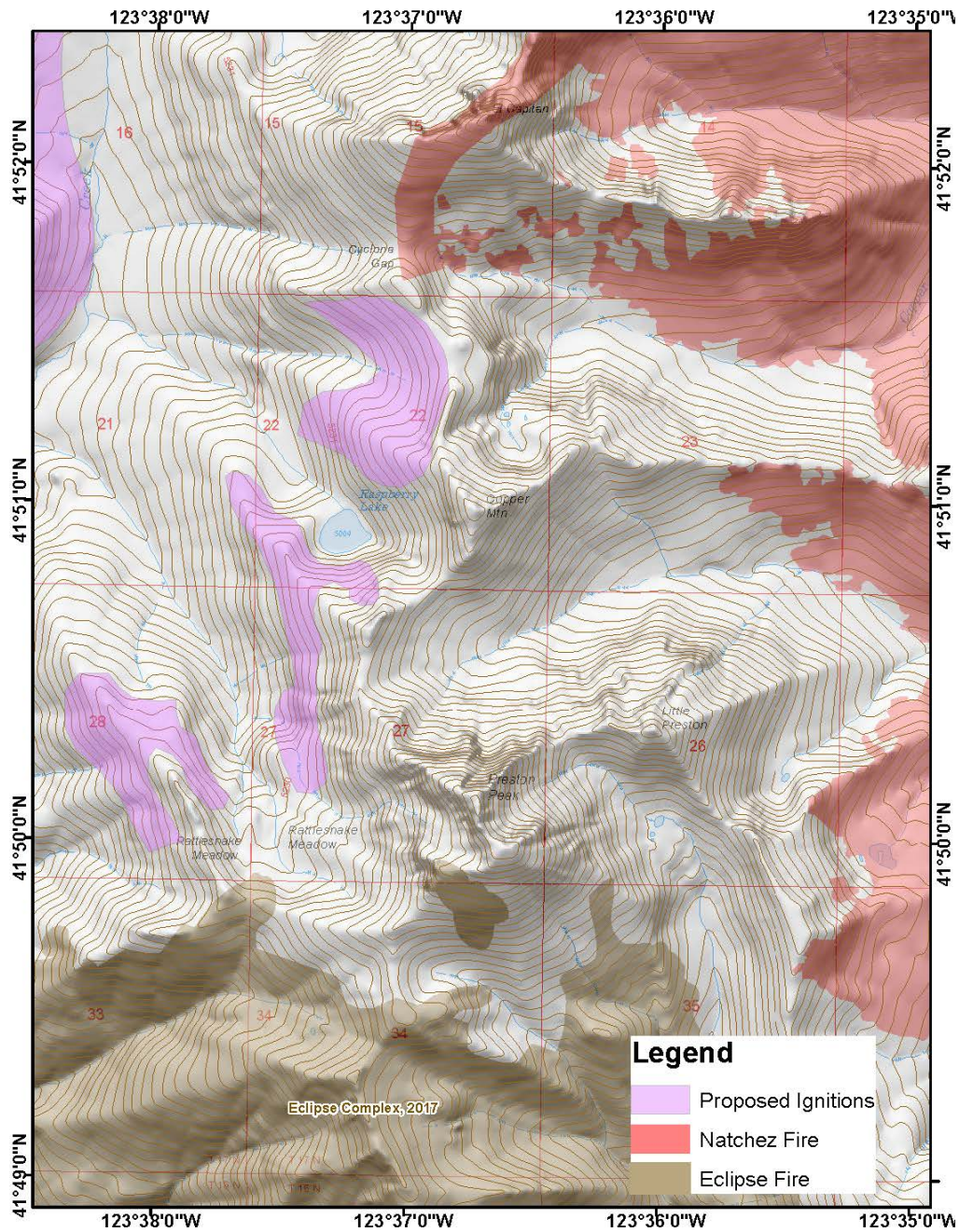
**Alternative 3:** Moderate fire behavior through tactical ignitions in Siskiyou Wilderness

This alternative would be implemented if unabated fire (Alternative 2) would result in excessive high severity fire or undesirable fire effects. Tactical firing patterns and natural features would be used to minimize negative fire effects associated with high intensity fire runs. The weather and fire behavior scenarios identified in Alternative 2 are applicable to Alternative 3.

Fire activity would be monitored and actions taken to minimize the frequency, duration, and intensity of head fire runs across the landscape. Actions would be taken to initiate backing fire on selected ridges to reduce fire intensity and the probability of stand replacement fire. Timing and location of firing operations would capitalize on periods of adventitious weather and alignment with topographic features. Smoke dispersion would be a factor in determining appropriate ignition timing. Pre-identified ignitions triggers include:

**Ignition trigger 1:**

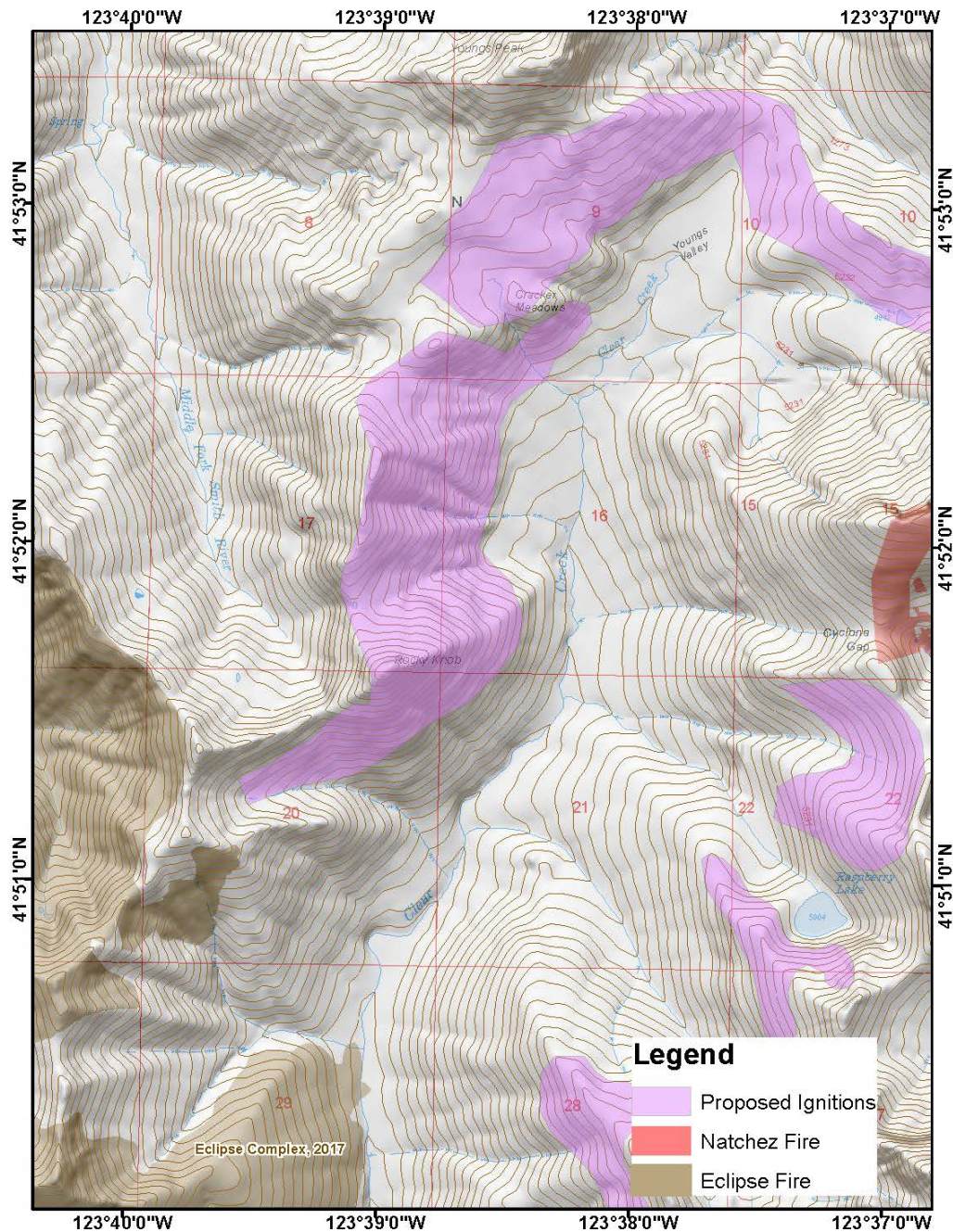
If fire crosses the ridge between Preston Peak and Copper Mountain above Raspberry Lake, then appropriate actions would be taken to maintain backing and flanking fire. Initiating backing fire on the series of ridges running from Clear Creek to the ridgeline connecting Preston Peak and Cyclone Gap would create an even line of backing fire with less potential to hook and run up adjacent drainages.



Targeted ignition areas (purple) Ignition trigger 1

**Ignition trigger 2:**

If fire threatens to back down the west side of the Preston Peak ridge system to Clear Creek, consider initiating backing fire on the steep slopes east of the Eclipse Complex burn scar and south of Rocky Knob (Siskiyou County – Del Norte County) before slope reversal and associated uphill runs to the west occur. Handline has been constructed south from the Youngs Valley Trailhead along the wilderness boundary. Opportunities to build handline through the wilderness on the ridgeline south to Rocky Knob and continuing to the Eclipse Complex have been scouted and determined to have a low probability of success due to dense shrub fuels and difficult terrain.

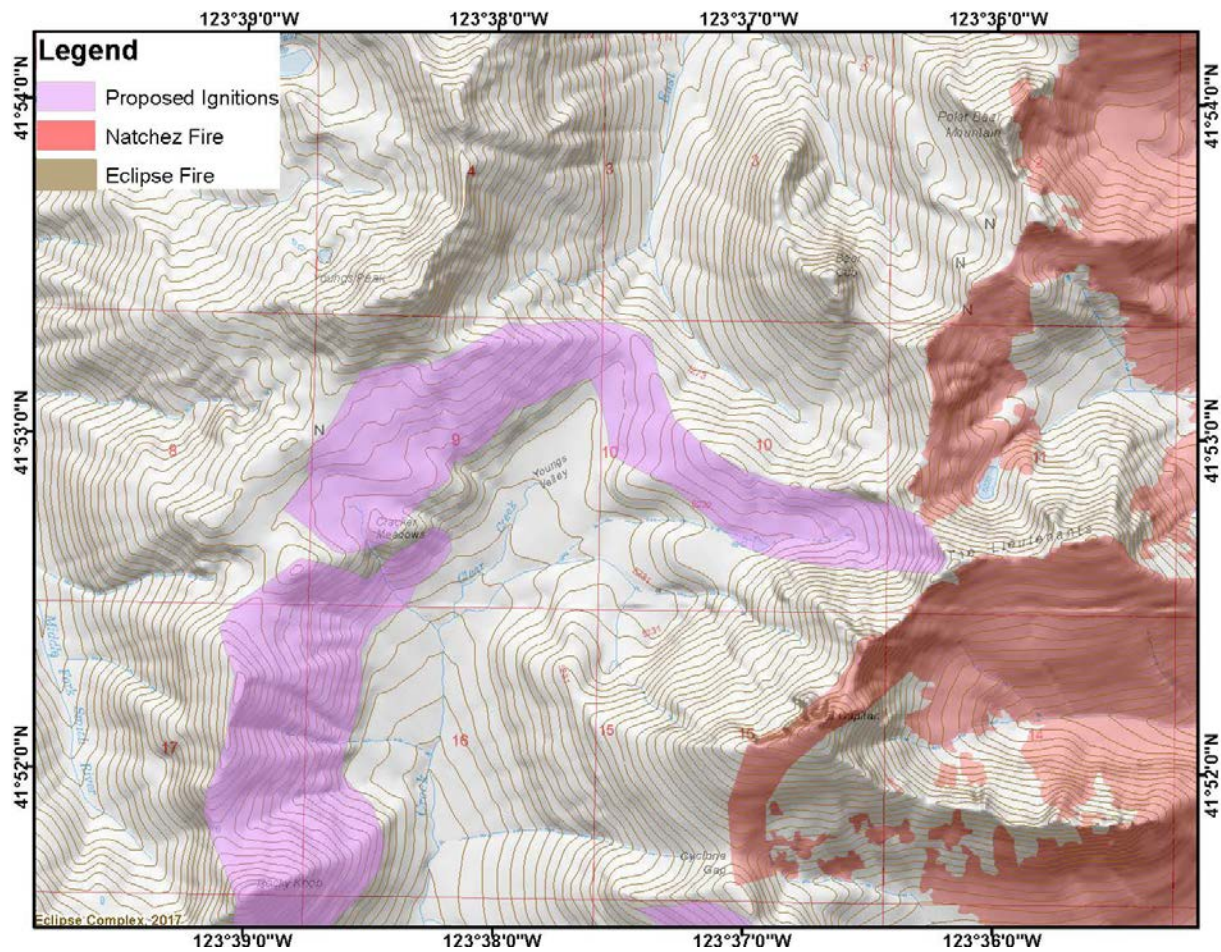


Targeted ignitions (purple) to establish fire on the east side of Rocky Knob (Ignition trigger 2)



### Ignition trigger 3:

If fire becomes established in the Clear Creek drainage, the threat of fire moving to the north and crossing into the East Fork Illinois River drainage at the Rogue River-Siskiyou / Klamath National Forest boundary exist. This landscape feature has been identified as Management Action Point (MAP) 8. Opportunities may exist to construct handline to connect the historic road below Young's Peak and natural barriers along Lieutenants Ridge. This handline could be used to initiate and hold backing fire at the top of the Clear Creek drainage preventing fire from spreading north of MAP 8.



Targeted ignitions (purple) to establish fire between Youngs Peak and Lieutenants (Ignition trigger 3)

### Management Implications (LTIP)

The following information captures current conditions and highlights critical information relevant to the remainder of the fire season based on historical fires in the area.

- Alignment of wind and slope has been a major contributor to fire spread so far, as well as poor overnight relative humidity recoveries, establishment of thermal belts leading to prolonged burning at night, and rollout due to steep slopes.
- The Natchez Fire is located in an area that has had few large fires that would affect fire spread with the exception of the Oak Fire of 2017 (Eclipse Complex) that is to the south of the Natchez

Fire. The Oak Fire has stalled fire spread to the south and is currently being used as an anchor for burnout operations.

- Historical large fires on the Klamath NF and Rogue-Siskiyou NF have experienced significant spread events from mid-August through September. Local experience especially highlights the potential spread that may occur with northeast winds.
- There are limitations in all of the long-term decision support models, outlooks, and other products. The models utilize forecasts and historical weather records and standardized fuel model mapping. Although expert opinion is used in making adjustments in much of this information, there is a lot of variability in natural systems that cannot be modeled.

**Predisposing conditions for problem fire behavior on the Klamath National Forest during September – October include: (Sexton)**

- Poor nighttime humidity recovery (maximum RH staying below 35) especially when recovery is poor on more than one night successively
- Frost-kill or shrubs and forbs
- Low 1000-hr timelag fuel moisture (<10%)
- High Energy Release Component (>70)

Poor relative humidity recovery (RH does not exceed 35%) will likely occur about 5-6 times during the Sept 1-Oct 15<sup>th</sup> period. Successive nights with poor RH recovery should signal extra vigilance the following day, especially if winds are forecasted for more than 5 mph.

**Indicators for Large Fire Growth (LTIP)**

With few exceptions, growth has been fuels and terrain driven and has also been moderated by smoke inversions which have contributed to limiting significant spread events. Therefore definitive key weather/climatic elements specific to the Natchez Fire have not been identified at this time. However, examination of hourly readings at Slater Butte RAWs and corroborated with incident FBAN's suggest:

- Temperature greater than or equal to 78 degrees F
- Relative humidity less than 30%
- Wind speeds greater than 5 mph with gusts greater than 12-14 mph
- Smoke inversions and the timing of their lifting should also be a consideration

Beyond these potential triggers, the KNF Westside NFDRS Pocket Card identifies greatly increasing fire behavior when the following conditions exist:

- Temperature greater than or equal to 79 degrees F,
- Relative humidity less than or equal to 22%
- Wind speed greater than or equal to 4 mph
- 1000-hr fuel moisture less than or equal to 12%

The recent Eclipse Complex (2017) identified the following combination as triggers for large fire growth:

- ERC greater than or equal to the 90<sup>th</sup> percentile ERC value
- Temperature greater than or equal to 85 degrees F
- Relative humidity less than or equal to 25%
- Wind speed greater than or equal to 7 mph

Large fires in this general area such as the Oak Fire 2017 (Eclipse Complex) have experienced major growth days through September. Changing weather conditions, deepening drought, and the approach of critical weather patterns will need continual assessment and evaluation through the life of this fire. Days when the inversion is forecasted to lift early or is weak will be a concern.

### **Conditions Associated With large Fire Growth: (Sexton)**

Review of past large fire activity on the Klamath NF indicates that sustained winds of 10 to 20 mph (20-ft height) coupled with RH less 20% are associated with fire growth of 1000 acres or more in a single burning period. John Snook (North Zone Predictive Services) estimated that the above listed threshold weather conditions occur on the Klamath NF on average twice in September and twice in October before rainy weather diminishes their impact on wildland fire.

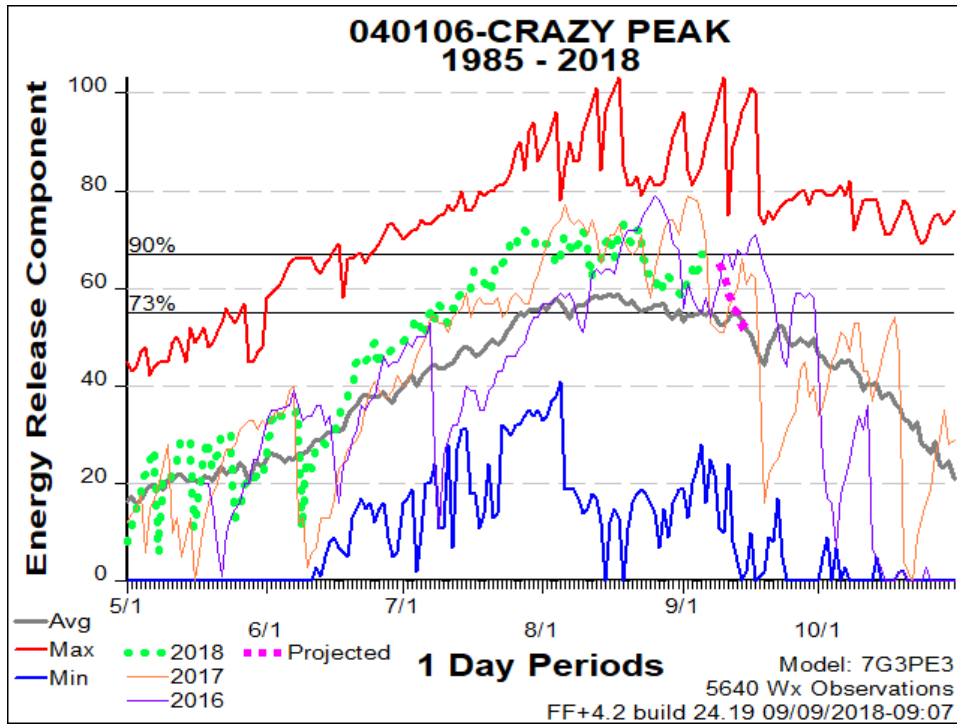
A recent example of threshold weather on a late-season wildfire is the Panther Fire run of October 1, 2008. This fire was located about 8 miles to the west of the Red Rock Fire and about 20 miles ESE of the Harrington Fire. It had been exhibiting very little movement and low fire intensity when strong dry winds pushed it more than 12 miles to the NNW, covering about 12, 000 acres. Most of the fire spread occurred in a six hour period from 1000 to 1600. ERC was 79 (about 97<sup>th</sup> percentile); 1000 FM was 8%; elevation where run commenced was about 6,000 ft, burning downslope to 3,000 ft; fuels were a continuous forest of mature to decadent true fir. The fuel and topography conditions are very similar to those conditions north of the Red Rock and Harrington Fires. Actual RAWS observations during the run reveal that from 1000-1600 winds were S at 20-27 mph (10 min avg) and RH was 21% at 1000, increasing to 27% by 1600.

### **Fire Environment:**

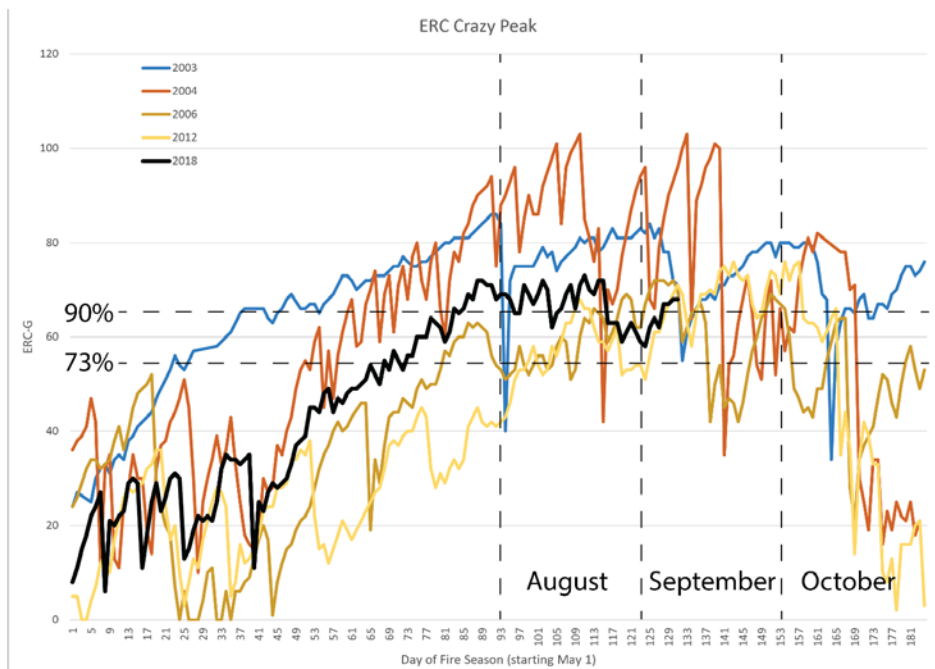
#### **Fire Danger Indices (ERC):**

Energy Release Component (ERC) is an index related to the potential energy of a fire at the flaming front and is generated from weather and fuels inputs. It is considered a good measure for seasonal dryness trends in large dead fuel, making this a good indicator for fire potential on the Natchez Fire. ERC is most often used with Fuel Models G and H which represent dense conifer stands with heavy accumulation of litter and downed woody material. (LTIP)

The Crazy Peak RAWS (040106) has been utilized as the representative station for the west side of the Natchez Fire. An ERC of 55 has been identified as a threshold for large-fire growth and is represented on the graph below as the 73<sup>rd</sup> percentile. This has been determined to be a relevant break point based on a FireFamily Plus analysis and referring to the local pocket cards. The Crazy Peak ERC was 68 on September 8, 2018, but forecast indexes indicate it is likely to drop to seasonal average values and below 55 during the 7 day period from September 9-16, 2018.



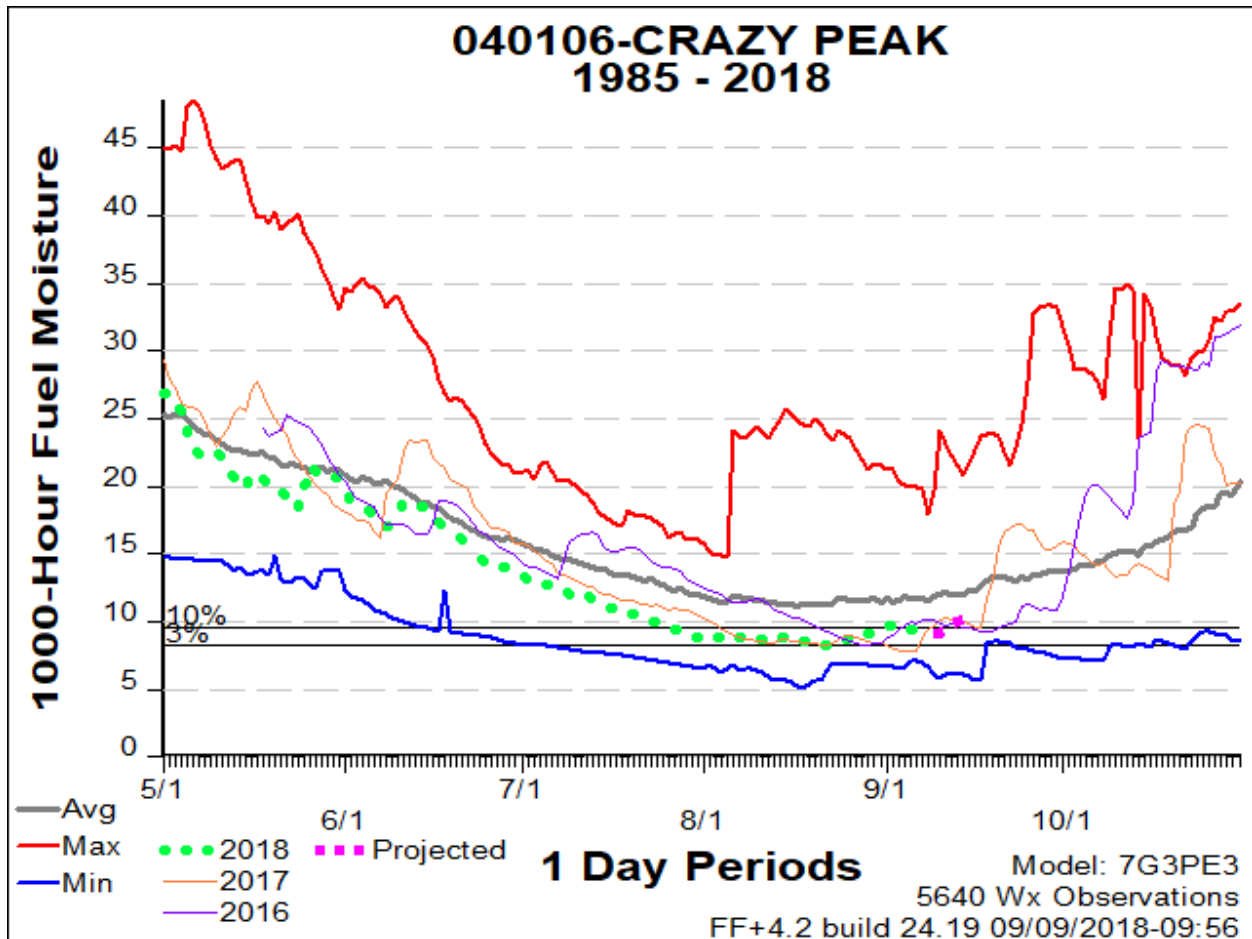
2018 Crazy Peak RAWS Energy Release Component



Crazy Peak RAWS (040106) ERC showing rapid recovery after season moderating precipitation events. Rapid declines in ERC followed by numbers returning to conditions capable of supporting large fire growth are observed in several years.

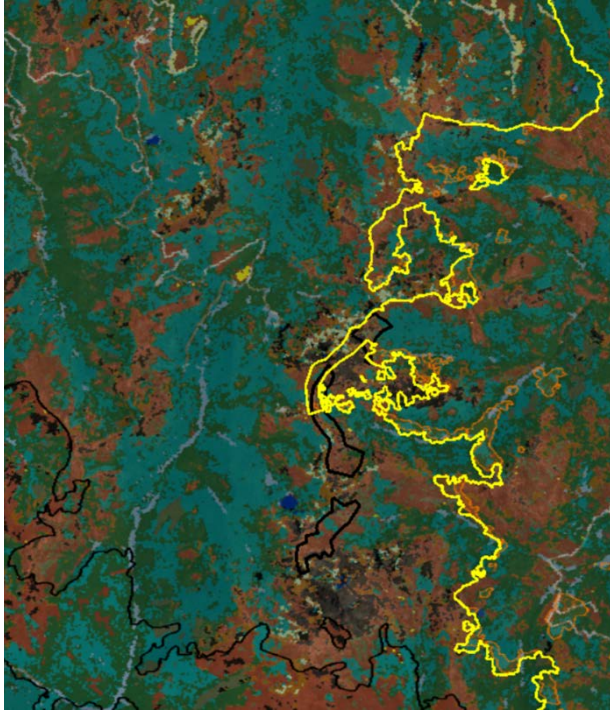
**1000-hr Fuels:**

Thousand-hour fuel moistures provide an indication of resistance to control due to fuel availability. Thousand-hour fuel moistures measured at Crazy Peak RAWS are tracking below average. This is consistent with the drought monitor and precipitation and temperature departure findings. The local NFDRS pocket card identifies 1000-hour fuel moisture values below 12% as a threshold for potential large fire growth when combined with wind, temperature, and RH. 1000-hour fuels were recorded at 9% on September 8, 2018.



2018 Crazy Peak RAWS 1000-hour Fuel Moisture

**Fuel Types:**



Primary Fuels include *Timber Litter (TL8)*, *Timber/Understory (TU5)*, and *Shrub (SH2)* fuel models. Timber litter fuels (turquoise) generally produces an underburn effect with moderate rate of spread and lower flame length. Timber/Understory fuels (green) burn with greater intensity, severity, flame length, and rate of spread. Shrub fuels (tan/brown) primarily burn with moderate upslope flame length and rate of spread, but have irregular backing characteristics due to continuity and patch size.

TL8: The primary carrier of fire in TL8 is moderate load long-needle pine litter, may include small amount of herbaceous load. Spread rate is moderate; flame length low.

TU5: The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory. Spread is moderate; flame length moderate.

SH2: The primary carrier of fire in SH2 is woody shrubs and shrub litter. Moderate fuel load, depth about 1 foot, no grass fuel present. Spread rate is low; flame length low.

**Weather Outlook for the Natchez Fire – 9/9/18:**

Following one more moderately dry day on Monday 9/10 with increasing clouds, increasing west to southwesterly winds and slightly cooler temperatures, an upper level trough approaching the coast will bring a more substantial pattern change for Tuesday 9/11 through Thursday 9/13. While measurable precipitation is not expected to make it as far south or inland as the Natchez fire, cloudy skies will prevail with cool temperatures, higher daytime relative humidities and very good to excellent humidity recoveries overnight lasting for a 3 to 4 day period. Towards the end of the week (by around Fri 9/14), the trough offshore will weaken and move inland over Washington and Montana with flat ridging building in over the southwest. This will bring a warming and drying trend back to the area through the weekend (9/15 – 9/16). Beyond next weekend, forecast uncertainty increases rapidly but no critical fire weather pattern are evident in current model runs.

### Natchez Fire Incident General Weather & Fire Behavior Outlook - 7-Day

\*\*\*For Planning Purposes Only, see the IAP for the Official Forecast\*\*\*

Outlook made 9/9/2018 - IMET Julia Ruthford

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Date	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep
<b>HIGHLIGHTS</b>	Breezy	Cooler	Occasional Sprinkles		Gradual Warming and Drying		
<b>Sky/Weather</b>	Increasing Clouds	Mostly Cloudy	Cloudy	Cloudy	Partly Cloudy	Mostly Sunny	Mostly Sunny
<b>Max Temp (F) - 4000 ft</b>	74	65	61	60	68	75	77
<b>Wind Direction</b>	W-SW -> N-NE	W -> E	SW	W -> NE	W-NW -> NE	E-NE	W-SW
<b>Ridge Wind (mph)</b>	17	14	8	5	4	5	11
<b>Ridge Wind Gusts (mph)</b>	25	22	15	10	8	10	18
<b>Min Humidity (%)</b>	40	45	55	50	40	30	27
<b>Max Humidity (%)</b>	70	80	90	80	70	50	45
<b>Haines Index</b>	3	2	2	2	3	4	4

Temp and RH representative of about 4,000 feet elevation (Happy Camp add 10-15 degrees, Div J Ridges subtract 5-10 degrees)

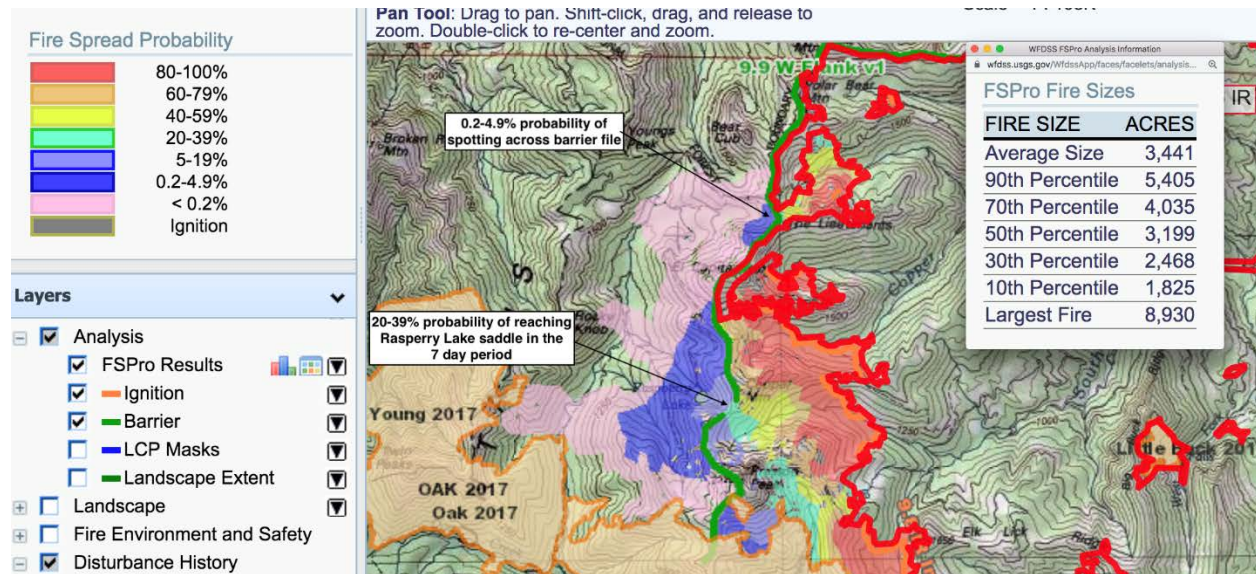
KEY:	Neutral - or Not Supportive for Burning	Caution - Values that support burning	Danger - Values that Promote Fire Spread
Maximum Temp	<70 deg	70-89 deg	>90 deg
Wind (sustained)	< 10 mph	10 to 14 mph	>= 15 mph
Min Humidity (day)	> 40 %	25 to 40 %	< 25 %
Max Humidity (night)	> 60 %	40 to 60 %	< 40 %
Haines Index	2,3,4	5	6

**If several "Danger" values line up, it could indicate potential for a Critical Weather Day**

### Potential Growth: (Probability of Fire Spread)

### Fire Behavior Modeling:

7 day Fire Spread Probability (FSPro) analysis for the period of September 9-15, 2018:



FS Pro, September 9-15, 2018. (See below for modeling parameters)

7 day FSPRO analysis modeling fire growth probability from September 9-15, 2018. Ignition file based on intense heat from the 9/8 2205 IR flight which matches with areas of recent fire growth. Barrier file used from Lookout Mountain south to Preston Peak to capture rocky areas. Break in barrier at Raspberry Lake saddle. Cyclone Gap and saddles further north have been secured. 2017 Eclipse Complex fires made non-burnable. Outputs do not represent fire progression but the probability of each 60 meter pixel burning over the next 7 days given 3,000 simulated fires. Model assumes no suppression action.

Modeling parameters:

- 7-day FSPRO simulation, September 9-15; using two days of forecasted weather and five days of climatology from Slater Butte RAWS.
- Ignition file based on the 9/8 2205 IR Intense Heat on W and SW flanks in areas of recent fire growth.
- Barrier file used from Lookout Mountain south to Preston Peak to capture rocky areas. Break in barrier at Raspberry Lake saddle.
- Cyclone Gap and saddles further north have been secured but outputs show low probability (0.2-4.9%) of spotting across barrier file north of the Lieutenants.
- 2017 Eclipse Complex fires (Oak and Young) masked as non-burnable.
- Average fire size for the 3,000 simulated fires was approximately 3,400 acres (decrease of ~1,100 acres from 9/6 analysis). This does not include any suppression actions or potential fire growth from rollout.

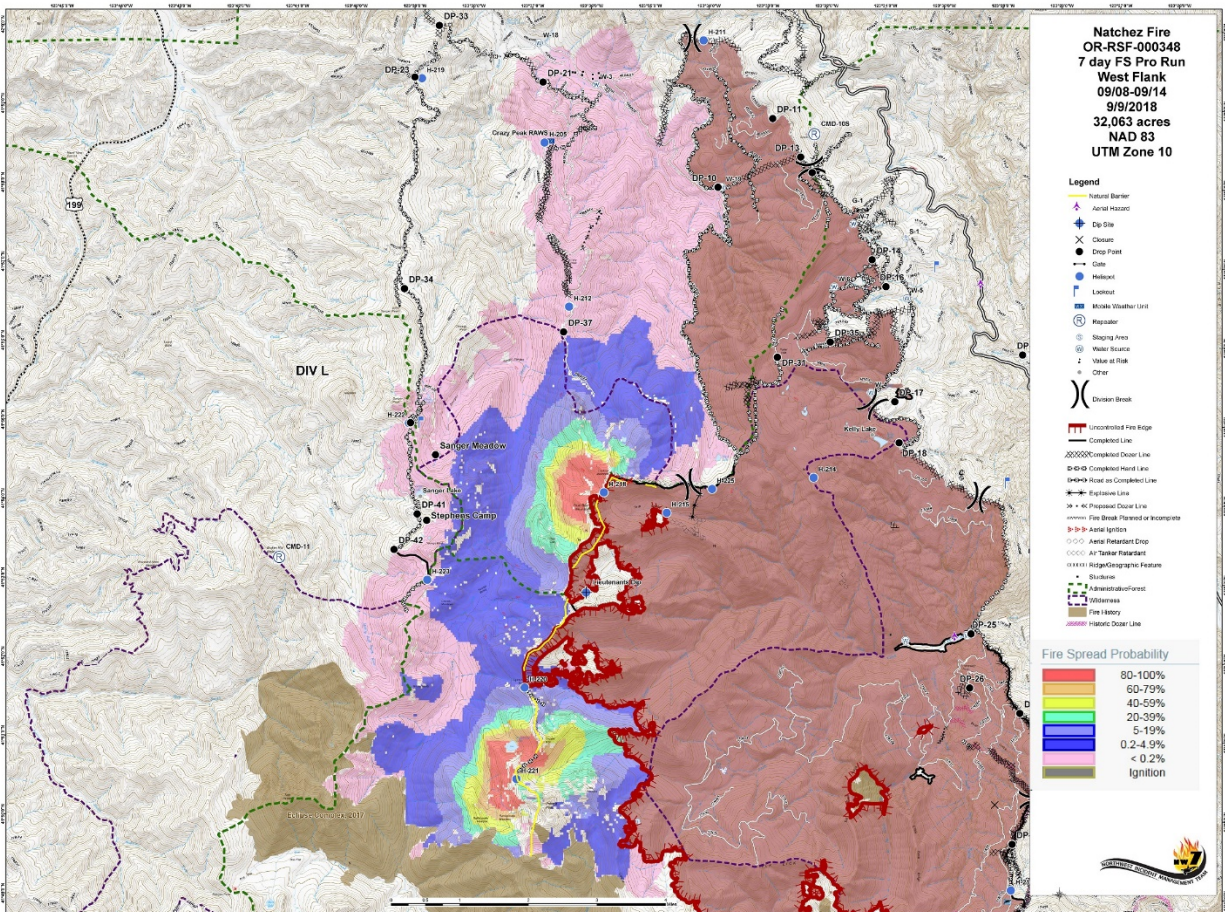
Model outputs predict:

- 20-39% probability of reaching Raspberry Lake saddle in the 7 day period. Note that this was reduced by 20% from the 9/6 analysis.
- 0% probability of fire reaching MAP 8, Sunstar and Takilma Notification or MAP 9, Sunstar and Takilma Evacuation.
- 0% probability of fire reaching Six Rivers N.F.
- Outputs do not represent fire progression but the probability of each 60 meter pixel burning over the next 7 days given 3,000 simulated fires.
- Model assumes no suppression action.

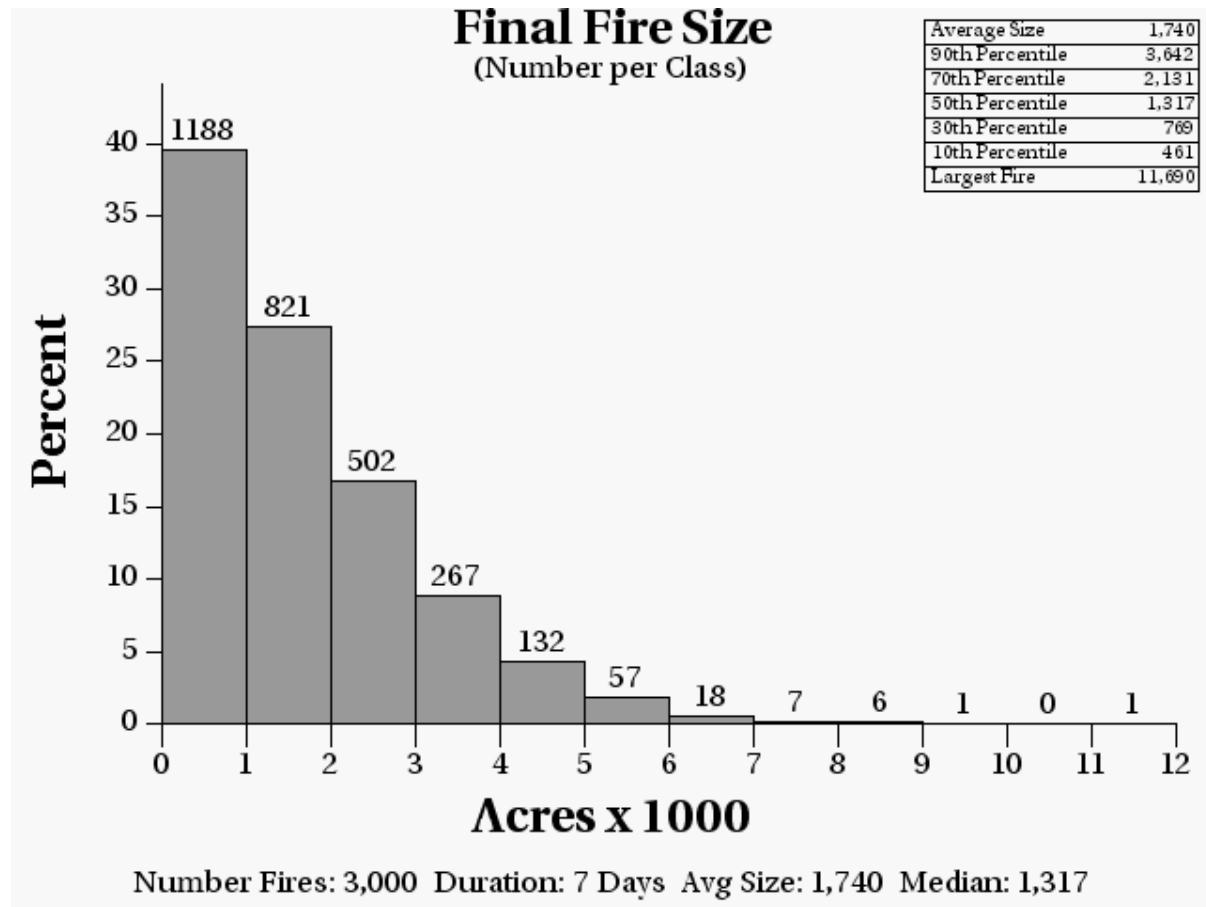


7 Day FS Pro Planning Scenario:

For strategic planning a 7 day analysis was created to model potential fire spread from September 8-14. The scenario introduces two hypothetical ignitions outside of the fire perimeter. One is north of Polar Bear Mtn. and the other south of Raspberry Lake. The purpose is to emulate fire spread potential that may occur from slop-over or spotting at a couple key locations. Outputs do not represent fire progression but the probability of each 60 meter pixel burning over the next 7 days given 3,000 simulated fires. Model assumes no suppression action.



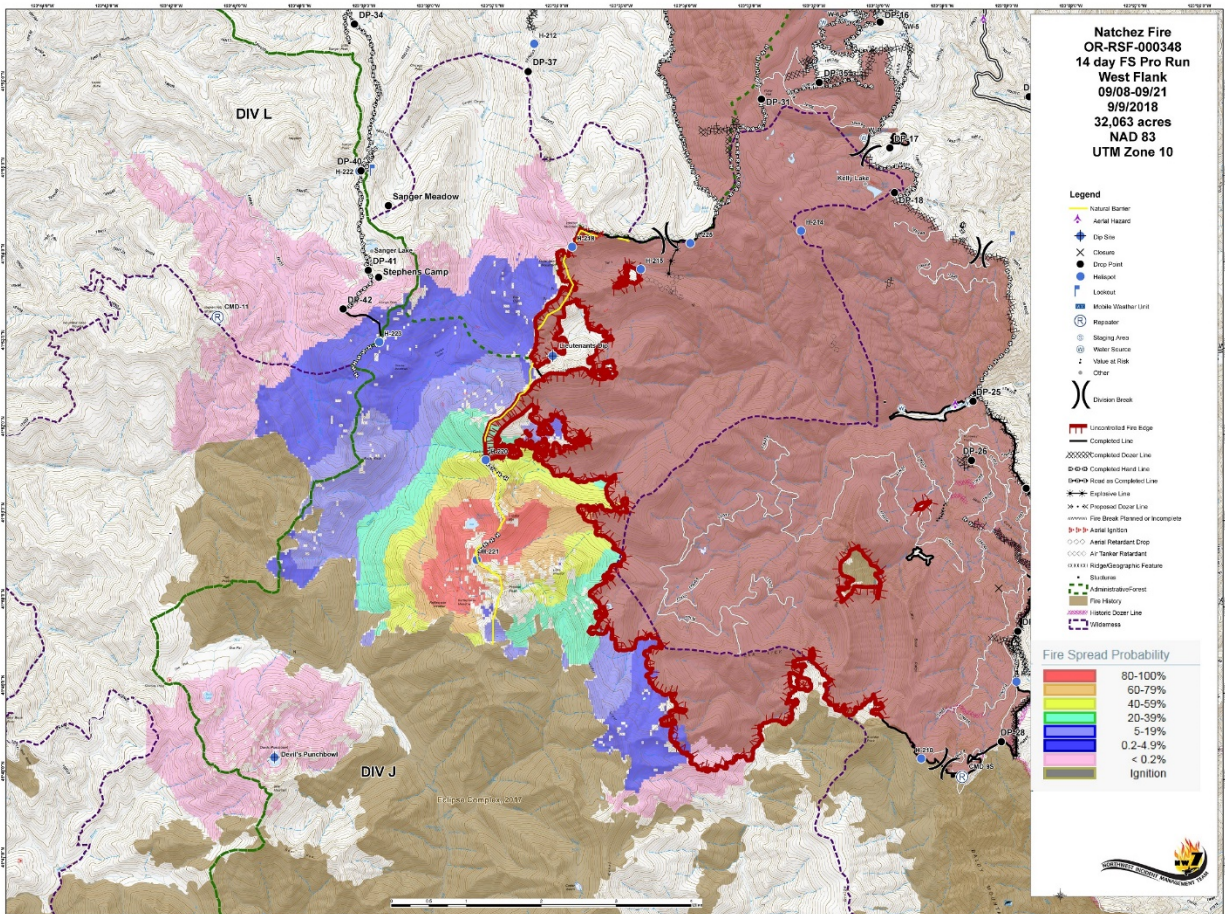
The 7-day FS Pro run indicates that in the absence of a significant weather event, fire established above Raspberry Lake is likely to remain on the west facing slopes above Clear Creek. Fire established on the northwest side of Polar Bear Peak is likely to remain within the Siskiyou Wilderness, but may approach MAP 9. Average fire growth from the dual ignition points is 1,740 over the 7 day period.



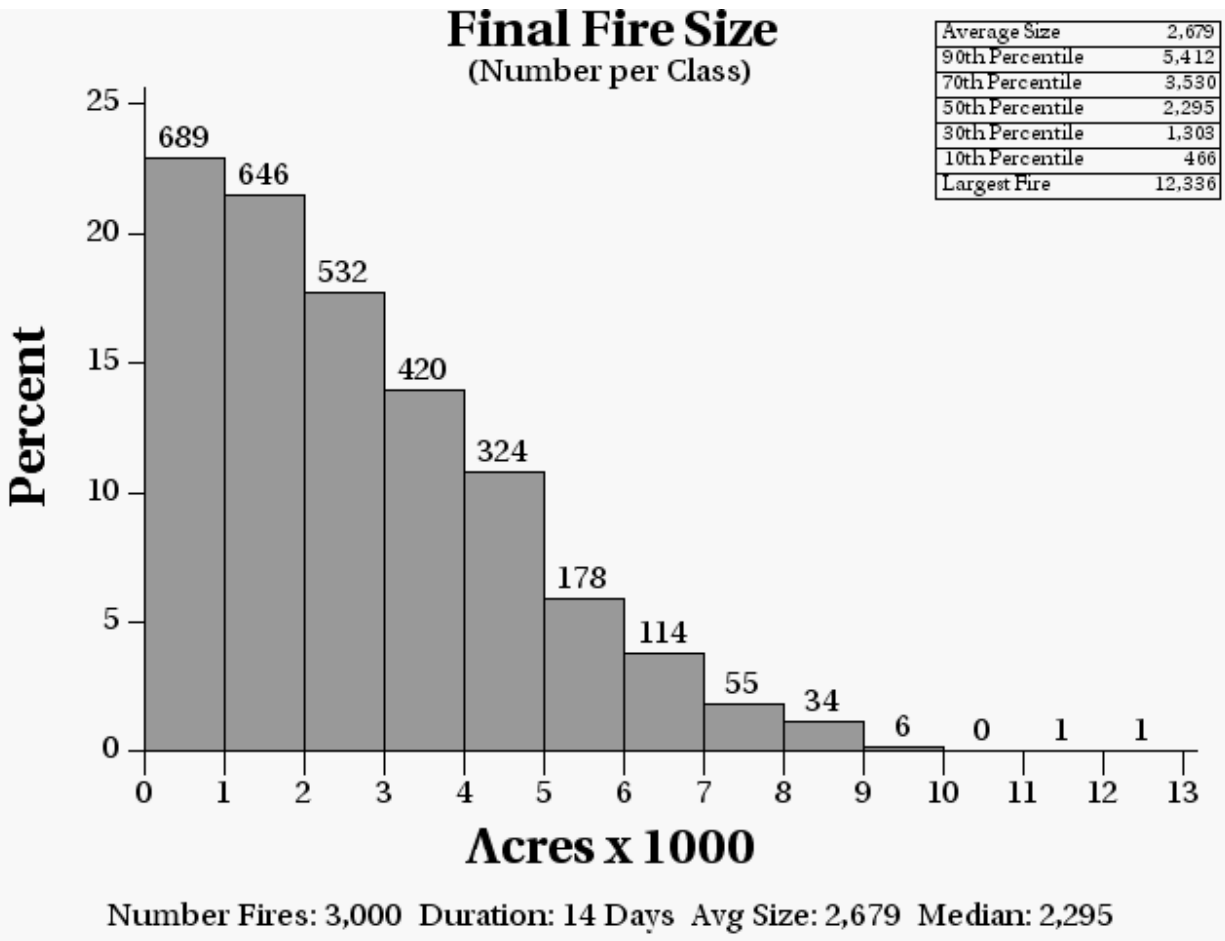
7 Day FS Pro Planning Scenario: Probability of Final Fire Size

14 Day FS Pro Planning Scenario:

For strategic planning, a 14 day FS Pro analysis was created to model potential fire growth from September 8-21, 2018. The scenario introduces a hypothetical ignition just south of Raspberry Lake. The purpose is to emulate fire spread potential that may occur from slop-over or spotting in this location. Outputs do not represent fire progression but the probability of each 60 meter pixel burning over the next 7 days given 3,000 simulated fires. Model assumes no suppression action.



The 14-day FS Pro run indicates that in the absence of a significant weather event, fire established above Raspberry Lake is likely to remain on the west facing slopes above Clear Creek. Average fire growth over the 14 day period is 2,679 acres with an average daily growth of approximately 225 acres. The model indicates 20-40% probability of fire crossing Clear Creek during the 14 day period.



14 Day FS Pro Planning Scenario: Probability of Final Fire Size

**Season Ending Event/TERM File Information:**

The probability of a season ending event by a certain date was calculated based on 1998-2017 data from the Slater Butte and Crazy Peak RAWs (table 3 and figure 27). The season ending event criteria for this analysis included: the date after which the ERC dropped below the 60<sup>th</sup> percentile and did not rebound for more than one week with no large (>10 acre) fires occurring after this date that year. The Slater Butte station suggests season ending events approximately one week later than Crazy Peak. Both stations identify a 75% chance of a season ending event by October 20-22 and a 90% chance of a season ending event by the end of October.

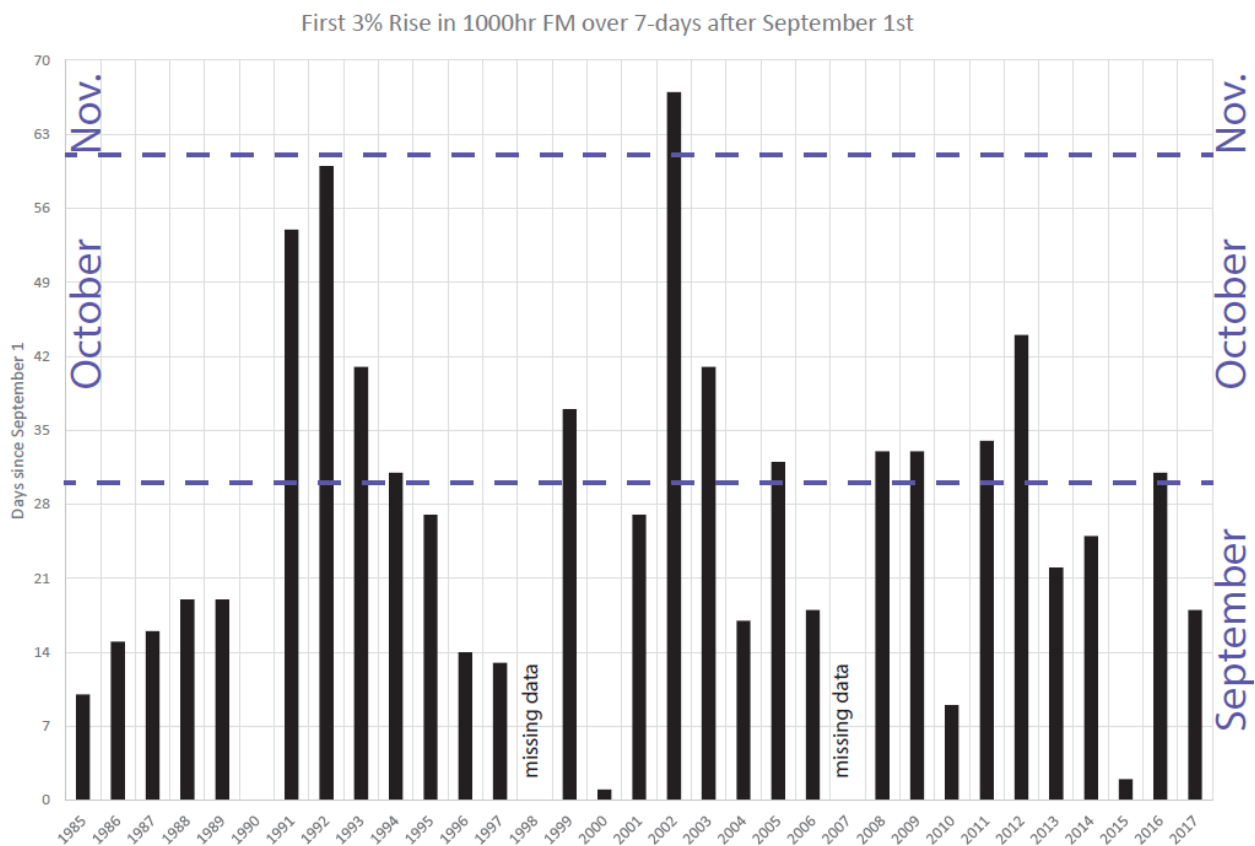
**Table:** Probability and date of season ending event for Slater Butte and Crazy Peak RAWs.

Probability	Date	
	Slater Butte	Crazy Peak
0.25	September 24	October 2
0.50	October 08	October 13
0.75	October 20	October 22
0.90	October 30	October 29
0.99	November 12	November 8

**Season Slowing Events:**

Season slowing events were analyzed to aid strategic decision making. Experience on the KNF has shown that the fire season often has a season slowing precipitation event prior to the season ending event. Season slowing event defined as precipitation received greater than or equal to 0.25 inch on a single day.

The bar graph below shows the first 3% rise in 1000-hour fuel moisture each year between 1985 and 2017 at the Crazy Peak RAWs. The rise in fuel moisture is historically associated with a precipitation event and in most cases represents at least .25 inch of precipitation. The graph breaks these events into 7 day and monthly periods. The graph demonstrates that the most probable timeframe that this event would occur is between September 14 (Day 14) and October 4 (Day 35) in any given year.



3% Rise in 1000 hour fuel moisture at Crazy Peak RAWs (040106)

**Smoke Projections:**

Daily acres burned over the course of the Natchez fire have averaged 581; while emissions have averaged ~380 tons PM2.5/day. These averages will likely decrease as the burn period shortens in September and October. No “FS-Pro”-type probabilistic forecast models exist for smoke, but we can look at September days where large growth has occurred on the Klamath as an indicator for 2018, which is turning out to be a similar year.

The Oak fire grew 3,330 acres on 9/14/2017. The table below shows the daily production of PM2.5 and the acres burned per day during this period of fire growth.

The following smoke dispersion model assesses daily emissions (tons PM2.5) as calculated by FOFEM using a newly developed spatial tool developed by the r5 Remote sensing lab (Long, Tarnay and North et al., 2017)

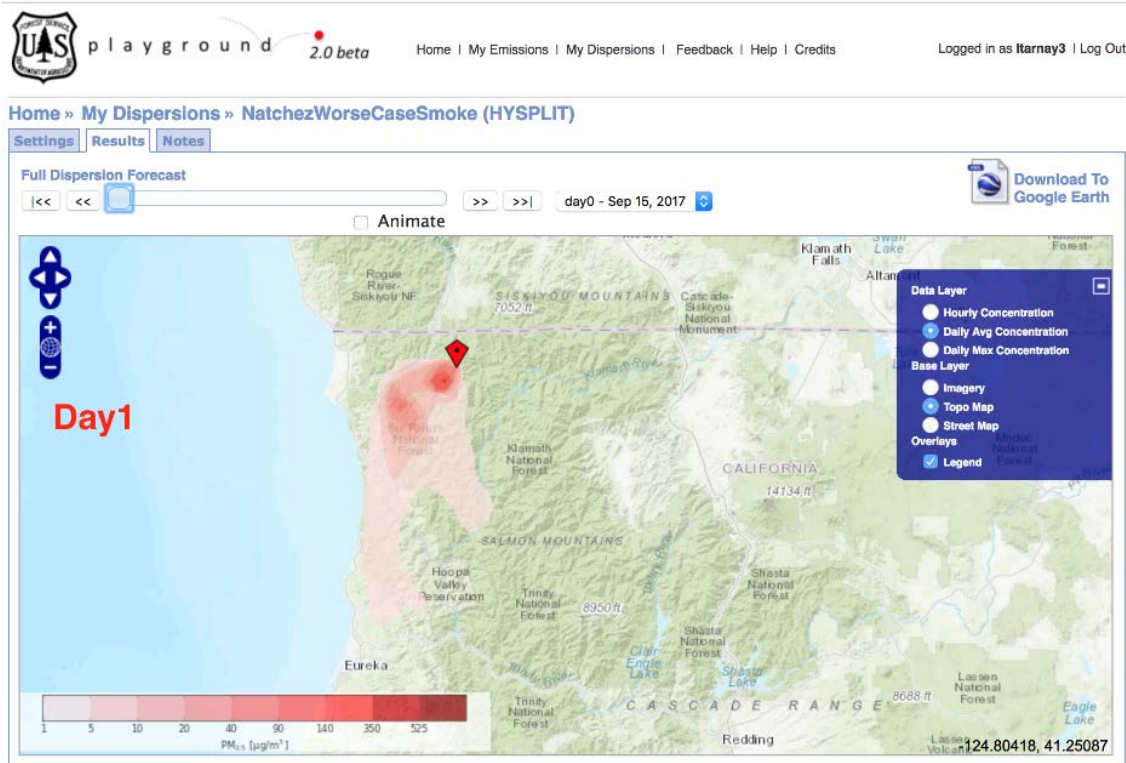
INCIDENT	alarm_date	co2e_sum.mT	Total Smoke (tons PM2.5)	pm10_sum.T	voc_sum.T	nox_sum.T	Total Acres	Total fuel Consumed	Fuel Load assumed (Ton/acre)	Scenario
OAK	9/14/17	361,643.61	3,591.96	4,238.56	5,326.49	238.85	3,330.28	314,421.38	94.41	Worse Case Smoke
HELENA	9/14/17	12,192.53	114.83	135.50	169.33	8.74	152.51	10,231.36	8.39	Worse Case Smoke
WALLOW	9/14/17	43,947.66	443.83	523.78	662.19	24.89	316.12	36,244.35	28.66	Worse Case Smoke
CEDAR	9/14/17	284.83	2.33	2.75	3.37	0.24	2.97	288.35	4.85	Worse Case Smoke
OAK	9/15/17	47,011.23	468.04	552.27	694.19	31.02	420.40	46,154.91	12.20	Worse Case Smoke
HELENA	9/15/17	12,192.53	114.83	135.50	169.33	8.74	152.51	10,231.36	8.39	Worse Case Smoke
WALLOW	9/15/17	10,377.61	106.56	125.74	158.52	6.50	81.47	9,011.48	110.61	Worse Case Smoke
CEDAR	9/15/17	284.83	2.33	2.75	3.37	0.24	2.97	288.35	4.85	Worse Case Smoke
OAK	9/16/17	47,011.23	468.04	552.27	694.19	31.02	420.40	46,154.91	12.20	Worse Case Smoke
HELENA	9/16/17	12,192.53	114.83	135.50	169.33	8.74	152.51	10,231.36	8.39	Worse Case Smoke
CEDAR	9/16/17	284.83	2.33	2.75	3.37	0.24	2.97	288.35	4.85	Worse Case Smoke
OAK	9/17/17	47,011.23	468.04	552.27	694.19	31.02	420.40	46,154.91	12.20	Typical seasonal conditions
HELENA	9/17/17	31,100.41	307.92	363.41	456.49	20.72	372.36	26,547.09	35.65	Typical seasonal conditions
CEDAR	9/17/17	284.83	2.33	2.75	3.37	0.24	2.97	288.35	4.85	Typical seasonal conditions
OAK	9/18/17	47,011.23	468.04	552.27	694.19	31.02	420.40	46,154.91	12.20	Typical seasonal conditions
HELENA	9/18/17	31,100.41	307.92	363.41	456.49	20.72	372.36	26,547.09	35.65	Typical seasonal conditions
CEDAR	9/18/17	284.83	2.33	2.75	3.37	0.24	2.97	288.35	4.85	Typical seasonal conditions
OAK	9/19/17	47,011.23	468.04	552.27	694.19	31.02	420.40	46,154.91	12.20	Typical seasonal conditions
CEDAR	9/19/17	284.83	2.33	2.75	3.37	0.24	2.97	288.35	4.85	Typical seasonal conditions
OAK	9/20/17	47,011.23	468.04	552.27	694.19	31.02	420.40	46,154.91	12.20	Typical seasonal conditions
CEDAR	9/20/17	284.83	2.33	2.75	3.37	0.24	2.97	288.35	4.85	Typical seasonal conditions

Figure 1 Emissions table as calculated by FOFEM from a spatial analysis of fire progression perimeters using the California Air Resources Board EES modeling framework, applied to daily progression polygons for Klamath fires

Using the period from September 14- Sept 16, 2017 to represent a day on the Klamath where large fire growth could occur (when the Oak fire burned 3330 acres in a day), we can model a worse case smoke scenario that approximates the growth. An Incident Meteorologist (IMET) was assigned to the Oak Fire during this period of fire growth. The following paragraphs detail the IMET's narrative of the weather event. Actual observed weather conditions from the Oak Fire on September 14-16, 2017 were used to develop smoke scenario 1.

Elevations around 5000 ft. above sea level experienced dry air early the morning of September 14th, with early morning humidity dropping into the teens, and temperatures in the middle 50s. Slightly cooler temperatures were observed in the lower elevations, with good humidity recovery to greater than 80 percent. A dry cold front moved across the fire area September 14th, with breezy northwest winds resulting on the ridgetops, with gusts to 15-20 mph. Afternoon temperatures were in the 50s and 60s on the ridges, with humidity values gradually increasing through the afternoon to 30-50%. At lower elevations, temperatures were in the 70s to mid-80s, with humidity dropping to around 10-15%. Slightly drier air was present again early Friday morning, September 15<sup>th</sup>, above around 4500 ft. above sea level, where humidity recoveries were moderate, to 45-55%. Lower valley elevations had good recoveries again, generally in the 75 to 85% range. Temperatures above the inversion were only slightly warmer with a weaker inversion in place and 45-50 deg. F. Lower elevation areas cooled to the lower 40s in most locations. While the air mass was drier based on dew points overnight, temperatures were also cooler with the clear skies and high pressure in place. The surface high pressure and thermal trough developing near the coast helped enhance northeast winds across the fire area overnight as expected. Gusts during the early morning hours of 15-20 mph were observed in favored northeast to southwest drainages and across the ridges above about 4500 ft. The lower level surface inversion appeared to be about 2500 ft. elevation this morning with dew point temperatures remaining around 40 below this level, with a decoupling from the winds higher up also observed. Temperatures by afternoon warmed into the 70s and lower 80s across valley locations, with ridgetops reaching temperatures generally in the 60s. Humidity values lowered to around 20-30% across the fire area.

Recoveries were poor to moderate across much of the fire area above about 2500 feet elevation Saturday morning, September 16, 2017. Temperatures only dropped into the lower to mid-50s at the higher elevations, with humidity values in the 35-45% range. Lowest elevations saw less recovery than recent nights to around 50% at 2200' and near 80% at Happy Camp at around 1100.' Temperatures at the lowest elevations were warmer as well and around 49-55 deg. High clouds moved over the area during the night ahead of the short-wave disturbance. High level cloud cover limited daytime heating today slightly and kept temperatures at the ridgetops in the lower to mid-60s, with mid to upper 70s observed across the valley locations. Humidity dropped to about 20-30 percent on most mid-slope and ridgetop locations before beginning to increase during the late afternoon. Lowest valley locations remained more moist with humidity values only dropping to 30-40 percent. The high clouds moved out of the fire area by around 1530, and temperatures responded rapidly warming to for the last few hours of daylight. However, the burning period was impacted significantly by the cloud cover through much of the afternoon. Winds were generally terrain driven throughout the day, with the highest ridges experiencing the southwest winds around 6-10 mph with gusts to around 14 mph. (Carpenter)



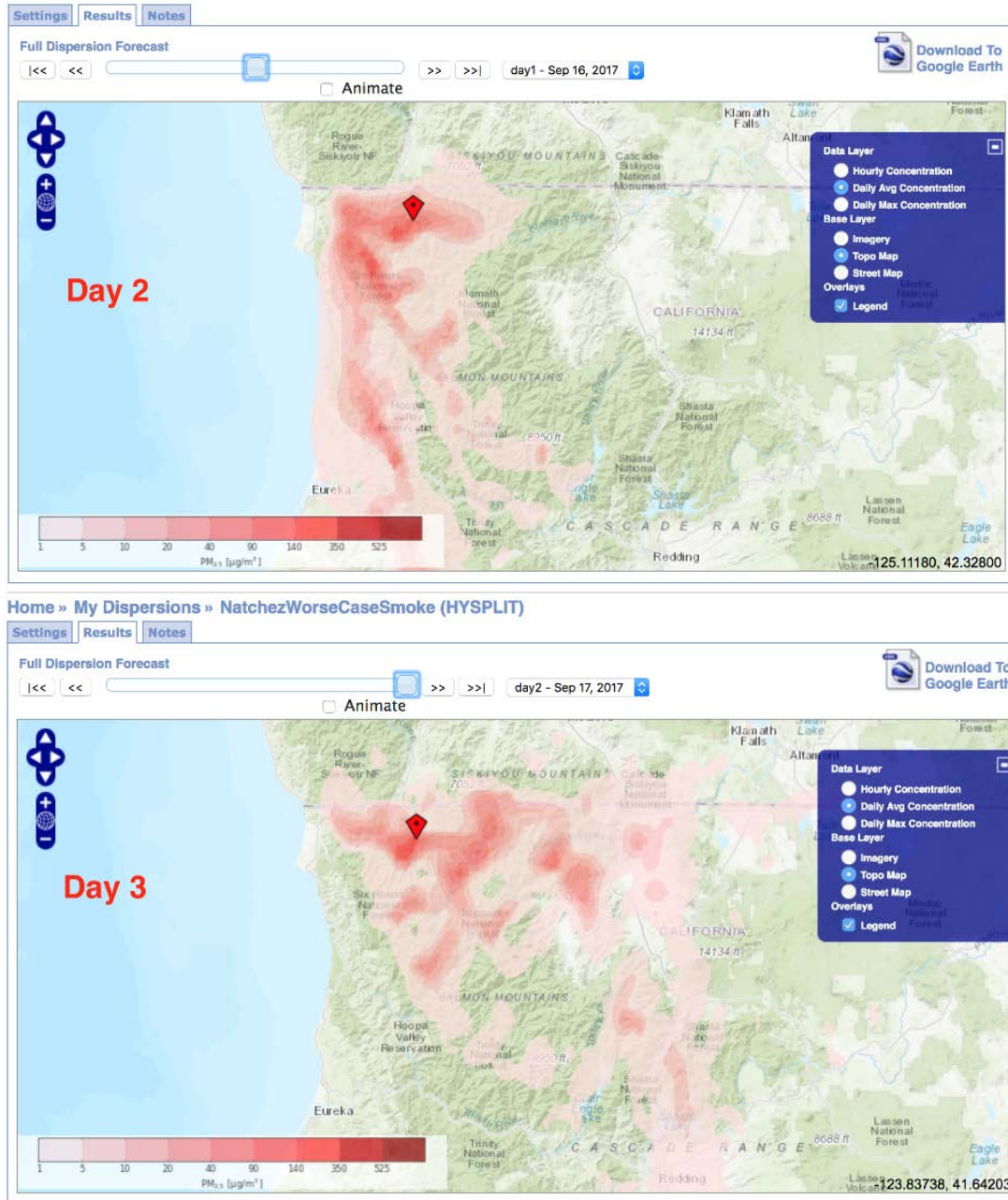


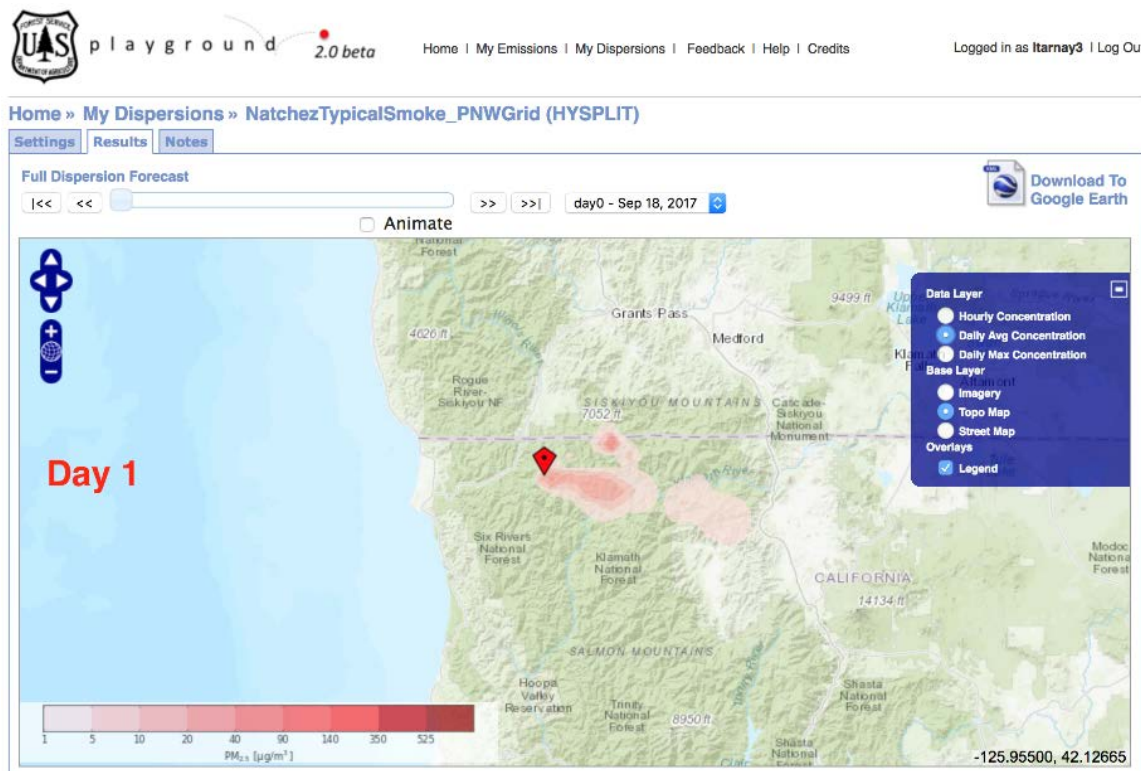
Figure 2 Daily average smoke for 3 days of the modeled worst case impacts on surface smoke concentrations, showing a NE wind driving smoke to the SW of the fire, toward Gasquet and Eureka on Day 1, transitioning to more terrain driven and intense surface smoke impacts as the NE winds subside. The concentrations in the scale bar reflect relative, not actual potential PM<sub>2.5</sub> 24 hr averages, which are not necessarily directly comparable to AQI values from direct observations at smoke monitors. In general though, heavier red color on the map in the darkest red ranges likely would correspond to an AQI in the USG or worse range, while the lighter pinkish shades would represent more moderate to good or hazy conditions.

The subsequent period, 9/17-9/20, can then be used to represent a more moderate, typical period of growth. For this smoke scenario, we can model about 200 acres/day of growth (about half of current rates). An Incident Meteorologist (IMET) was assigned to the Oak Fire during the corresponding period in 2017. The following paragraphs detail the IMET's narrative of the weather event. Actual observed weather conditions from the Oak Fire on September 17-20, 2017 were used to develop smoke scenario 2.



Poor recoveries were again observed across elevations above about 4000 ft overnight in Sunday, September 17, 2017. Minimum temperatures there were around 50 degrees, with humidity generally 25-35% during the early morning hours. Dew point temperatures in many of those locations dropped into the teens, even with prevailing NW winds of 4-10 mph with gusts to 15 mph. Lower valley locations were able to recover to around 80-90% overnight, with low temperatures dropping into the lower 40s with nearly calm conditions. Several layers of cloud cover began to stream in off the Pacific Ocean through the day, with brief periods of sunshine through the day. High temperatures were generally in the 50s and lower 60s at the ridges during the burning period, with humidity values only dropping to around 35-45% during the early afternoon before increasing during the afternoon. A few very light rain showers passed over the fire during the early and middle part of the afternoon, with only a trace of precipitation reported across the fire area. Winds at the ridgetops were generally light from the west-northwest during the afternoon with gusts to around 15 mph.

Humidity recovered to 90-100% overnight into Tuesday, September 19<sup>th</sup>, 2017 with storm total rainfall amounts at Ship Mountain RAWS up to 1.19" as of this morning and around 0.10-0.20" across the Abney Fire area so far. Early morning temperatures were generally in the mid-30s to lower 40s at mid-slopes and ridges, with upper 40s to around 50 in the valley locations. Numerous rain showers occurred across the fire area through the day. Afternoon temperatures warmed into the lower 60s in the valley locations with some brief breaks of sunshine. Mid-slopes and ridges had temperatures rise into the lower to mid-40s. Humidity values remained around 100 percent on the mid-slopes and ridges, with generally 65-75 percent in the valley locations. Happy Camp Snow Level Radar information indicated snow levels were around 7000 ft. This was confirmed by crews coming back into ICP during the evening hours that were working between 6500-7000 ft elevations. (Carpenter)



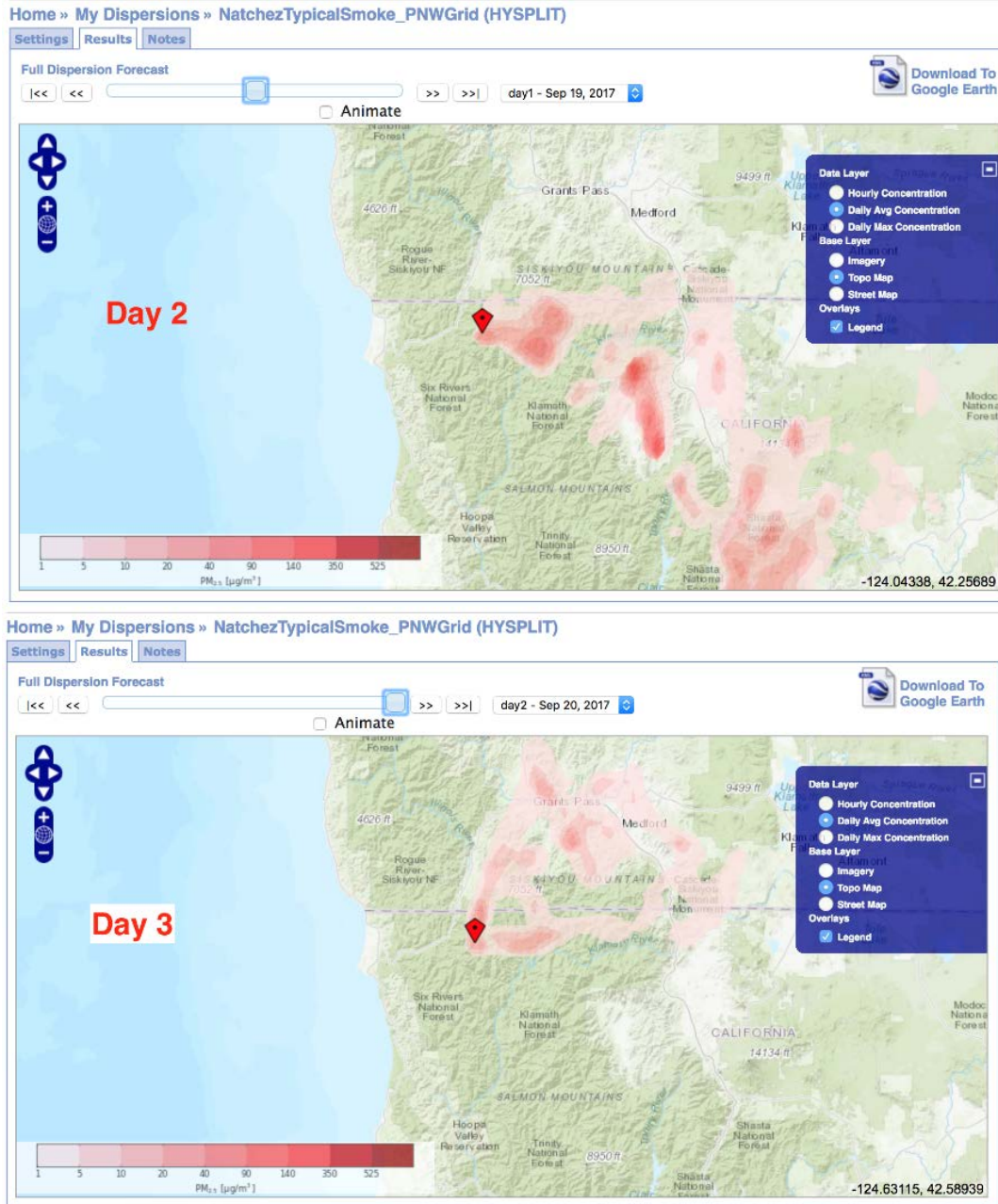


Figure 3. modeled 24 hr average surface concentrations for three days of typical growth, under SW/NW winds. These vignettes mirror those actually experienced from Natchez during the past week. The concentrations in the scale bar reflect relative, not actual potential PM<sub>2.5</sub> 24 hr averages, which are not necessarily directly comparable to AQI values from direct observations at smoke monitors. In general though, heavier red color on the map in the darkest red ranges likely would correspond to an AQI in the USG or worse range, while the lighter pinkish shades would represent more moderate to good or hazy conditions.

Together, these two scenarios reasonably bracket the range of smoke impacts likely to be experienced at the surface due to Natchez Fire alone, but don't necessarily reflect total impacts if other fires, like the Klondike to the north, affect the area as well. The following graphic summarizes emissions, modeled using the same spatial FOFEM framework (Long et al., 2017), from other fires contributing smoke to the Natchez forecast area:

### AQI vs Acres Burned from Fires that Influenced the Natchez Forecast Area, Last 45 Days

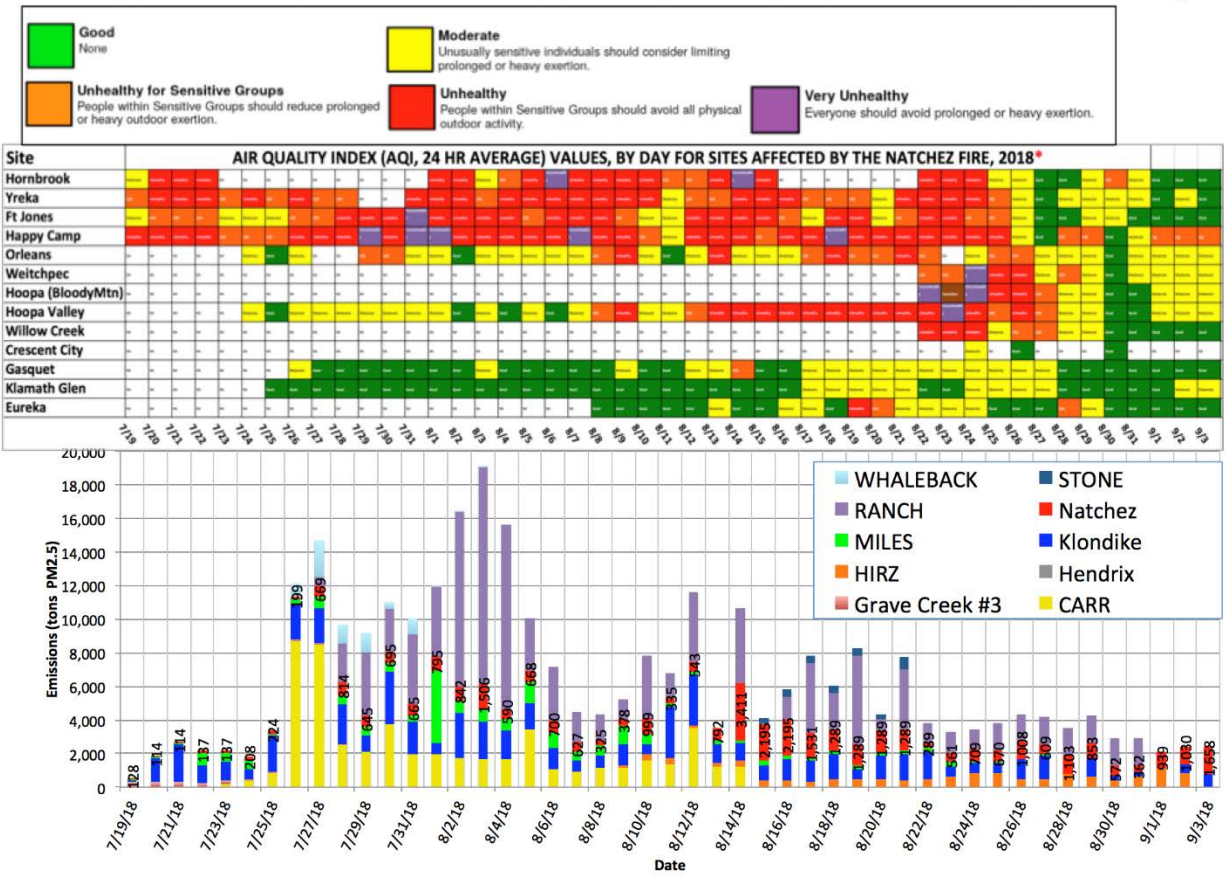


Figure 4. Emissions from selected fires contributing smoke to the Natchez Forecast Area vs. AQI impacts at Natchez Fire forecast sites. The major feature of the graph to note is that AQI values were able to recover to good/moderate levels once the emissions from surrounding fires subsided, even though Natchez emissions remained relatively high. This suggests that the airshed can often absorb on the order of 200-500 tons PM2.5 with relatively localized and transient impacts, as long as other fires aren't adding more smoke to the mix, and dispersion is fair to good. Of course, some dispersion regimes not in the historical example above could still produce more intense impacts at these emissions levels.

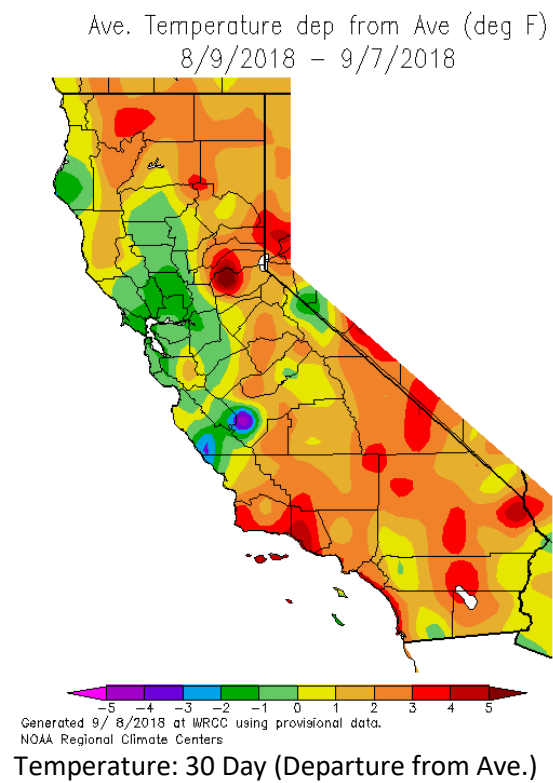
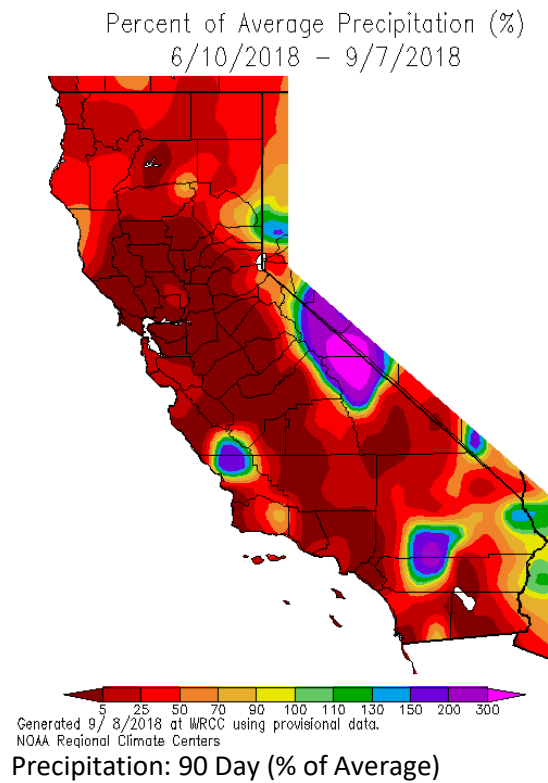
### 2018 Seasonal Outlook:



Northern California Significant Fire Potential:

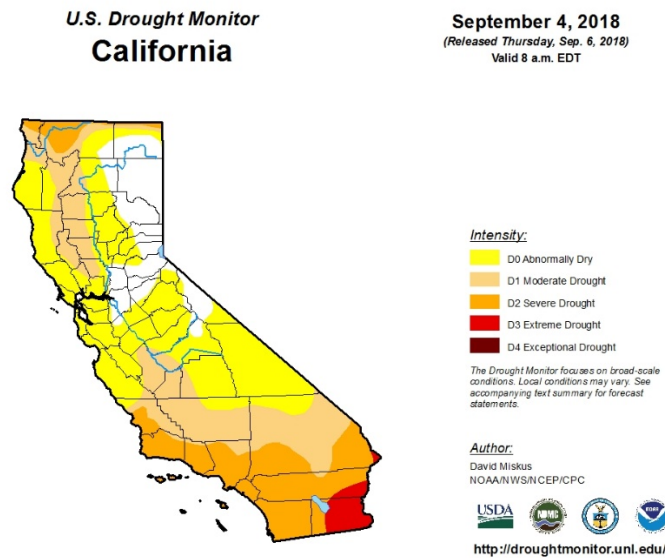
**Northern California Weather Discussion:**

The Northern California region was very dry in August. The region saw more time spent under the influence of dry low pressure troughs in August than usual. That, and persistent thick smoke from active wildfires, contributed to fairly mild temperatures and another quiet month in terms of lightning activity. Northern and eastern areas tended to be warmer than normal and areas from the Sacramento Valley to the coast were generally near to cooler than normal. The wet spring across the majority of the region led to heavy fine fuel and brush growth at lower and middle elevations. However, the overall 2017-2018 rainy season has been drier than normal, especially west to the Cascade-Sierra ranges, allowing the current dry fuels situation. Deeper dry low pressure troughs started arriving in late August, a few weeks ahead of usual. Without moisture, the resulting windy weather accompanying and following the increasingly stronger troughs in September will lead to frequent periods of high fire potential.

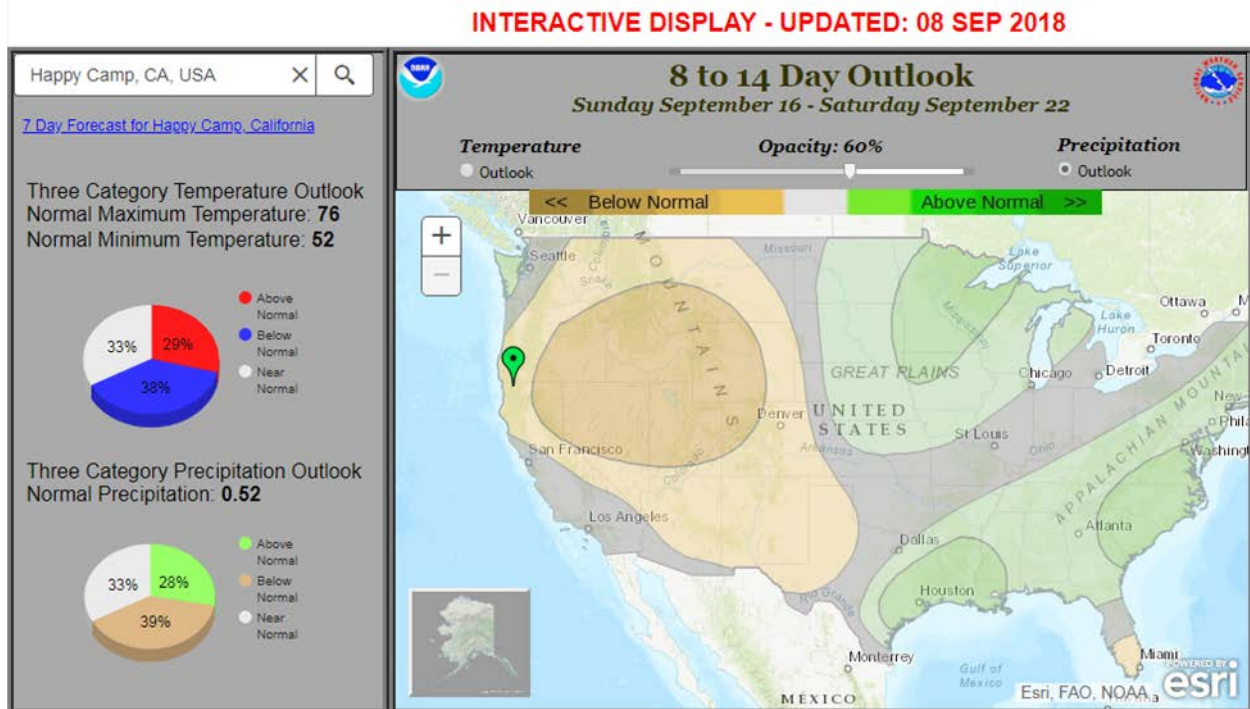


**Fuels and Drought:**

The dry rainy season led to a rapid drying of fuels and soils across the region by late spring and early summer. The U. S. Drought Monitor product now shows a large area of "Abnormally Dry" conditions with a growing area of "Moderate Drought" to the west of the Cascade-Sierra crest. The wet spring weather was ideally timed to produce a heavier than normal crop of fine fuels and brush growth at mid and lower elevations and a near to slightly above normal green-up phase among perennial live fuels.

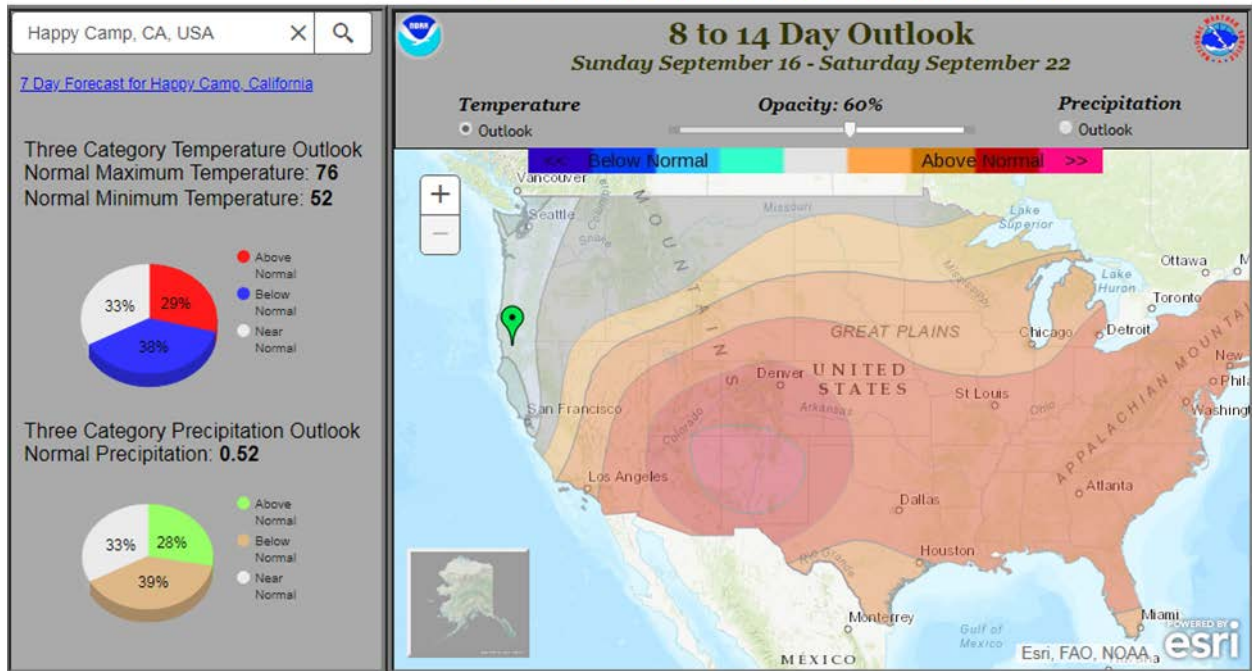


**Climate Prediction Center Outlooks:**



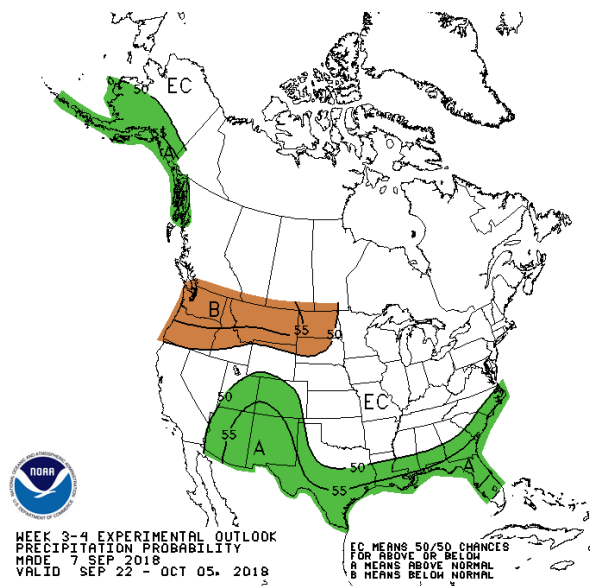
Day 8-14 precipitation outlook for Happy Camp, CA

**INTERACTIVE DISPLAY - UPDATED: 08 SEP 2018**

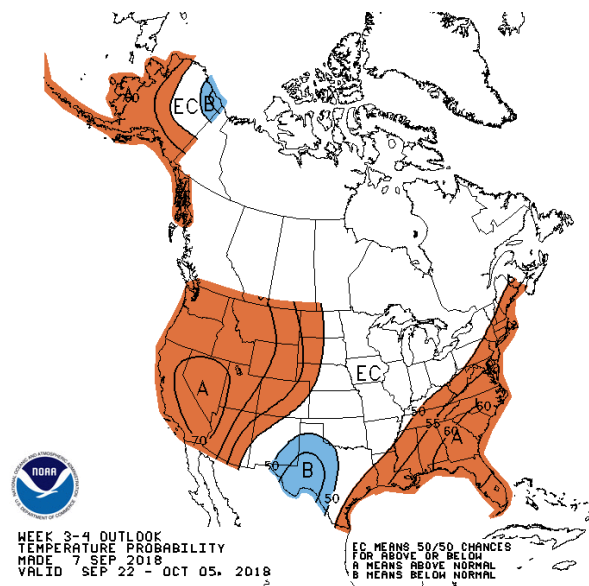


Day 8-14 temperature outlook for Happy Camp, CA

**3 to 4 Week Climate Prediction Center Outlooks (September 22<sup>nd</sup> to October 5<sup>th</sup>)**

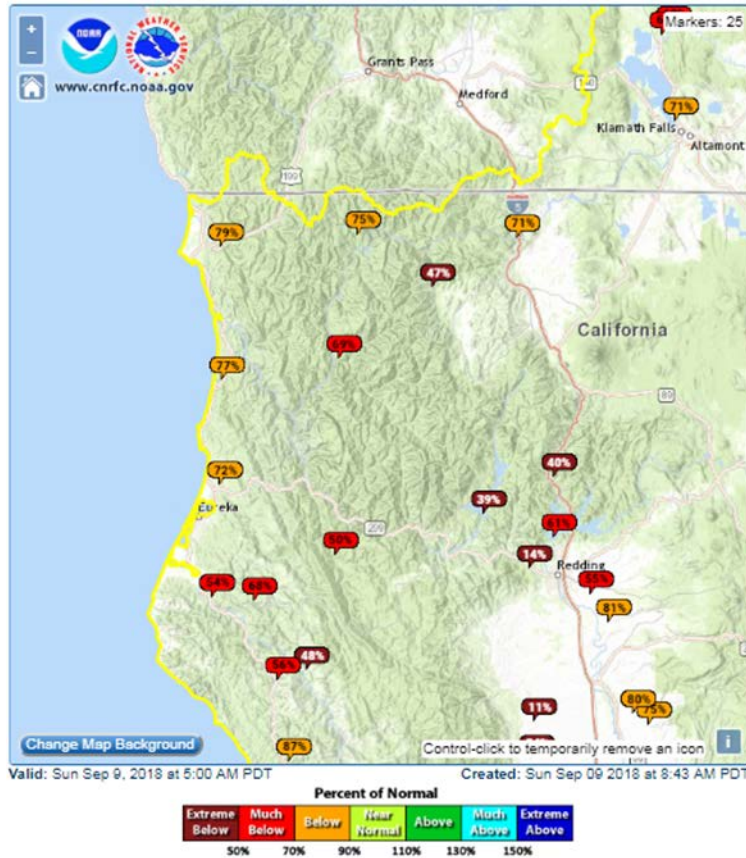


Week 3-4 precipitation outlook



Week 3-4 temperature outlook

**Percentage of normal cumulative water flow since Oct 1, 2017:**



**Summary of Findings:**

Fire season commonly ends with a large scale rain event in the Klamath Mountains, but they can also end with the onset of shorter days and cooler/moister conditions. Often, a fire season fades away due to a combination of scattered, smaller precipitation events and changing day length and sun angle which, in turn, translates into lower maximum temperature higher relative humidity, and a shorter burn period.

Along with season ending events, there is a possibility of fire-slowing precipitation events prior to the end of the fire season. Precipitation of at least 0.25 inches in a day might be expected to at least slow fire spread for two or three days, while greater amounts of rain (over 0.5 inches) could slow or check fire spread for several days. The likelihood of such events increases significantly in the latter part of September with the return of frontal systems moving in off the Pacific Ocean.

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