



## Long Term Assessment for Fires Managed by PNW2

August 25, 2017

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Update on Long Term Assessment for Whitewater Fire by Trevor Miller, LTAN and Josh O'Connor, LTANT

The Whitewater Fire started was reported on July 23<sup>th</sup> in the Whitewater Basin area on the northwest side of Mount Jefferson and west side of the Cascades. The fire in its entirety is currently within the Mt. Jefferson Wilderness. The fire is approximately 9,500 acres and has had ongoing suppression action. Early in the incident the majority of the perimeter was deemed high risk and inaccessible for fire personnel for direct attack operation. Focus since this strategic direction has been on containment along the western perimeter utilizing indirect tactics.

In early to mid-August, the Willamette National Forest experienced increased initial attack resulting from both human activities and lightning. As a result, PNW Team 2 has assumed command of the following ten incidents.

Fires included in this Long Term Assessment				
Incident Name	Unique Fire Identifier	Cause	Latest Perimeter Size (acres)	Discovery Date
Whitewater	2017-ORWIF-170123	Natural	8,141	7/23/2017
SRZ Little Devil	2017-ORWIF-170184	Undetermined	30	8/10/2017
SRZ 220	2017-ORWIF-170220	Natural		8/14/2017
Rebel	2017-ORWIF-170156	Undetermined	2,858	8/4/2017
MR Separation	2017-ORWIF-170177	Natural	208	8/10/2017
MR Roney	2017-ORWIF-170178	Natural	0.63	8/10/2017
MR 204 Pete	2017-ORWIF-170204	Undetermined	0.22	8/11/2017
MR 183 Olallie Lookout	2017-ORWIF-170183	Natural	0.2	8/10/2017
French	2017-ORWIF-170189	Natural	1.38	8/10/2017
Avenue	2017-ORWIF-170202	Natural	8.43	8/11/2017

Combined acreage as of August 24 is 13,735 acres. The majority of this area is due to the Whitewater, Rebel, Roney, Olallie, Little Devil, and Separation fires. One incident, Box Canyon, is not included in the above table or in this assessment due to successful suppression actions and very low probability of future growth. The French fire has not seen movement in nearly 10 days, and suppression efforts are proving highly successful.

Current strategic direction for the incidents is a values driven suppression response to protect firefighter and public safety, structures, timber, and other private property values. Combinations of direct, indirect, and point protection tactics are employed on the incidents.

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## Climatology

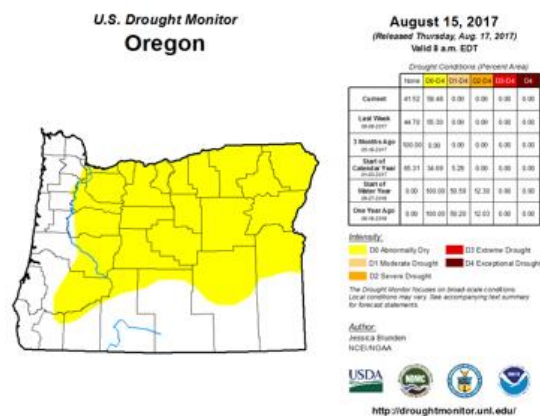
### Current and Predicted Fuels

Given the near record snowpack in the fire area combined with normal spring rainfall through may, the current fire situation may seem anomalous at first glance. Snowpack at Marion Forks SNOTEL peaked at over 200% of average, and on the whole the water year is nearly 110% above average. However, from May 1 to July 31, temperatures were 2-4° F above normal, and overall precipitation is less than 25% of normal. The influence from this three month period, combined with four distinct extreme minimum humidity events dried dead fuels to their current levels, while the overall above average precipitation has kept live fuels near average conditions for this time of year.

The fire is burning in three primary vegetation types. At high elevations (>5,400'), Mountain Hemlock stands dominate. These stands historically burn at high intensity, with frequencies varying between 400 and 1,500 years. Hemlock stands have been difficult to successfully burn out, with a dense, compact fuelbed of very short needles.

In middle elevations (<5,400' to >3,500') silver fir dominates a community, with Douglas fir and mountain hemlock also present. The majority of fire spread to date has been in this vegetation type. Outside of wilderness areas, numerous logging areas have occurred, and in the regeneration patches, fire has been difficult to initiate and slow to spread. Historic fire frequency is >100 years MFRI with mixed severity, and >200 years between stand replacement events.

The lowest elevations (<3,500') are dominated by Douglas fir, and hemlock, western red cedar, grand fir, and lodgepole pine are all subdominant. Interestingly, even with a more frequent fire return interval than the silver fir community, fire has been relatively resistant to spread into this vegetation type. The Rebel and Olallie fires are primarily in this type,



**Figure 1 Current Oregon Drought Monitor**

being the exceptions to the previous statement. Historically this vegetation type burned at mixed severity between 50-150 years.

All of these vegetation types have a significant lichen component, especially in dense stands or on north aspects, which is very receptive to fire, frequently acting as a ladder fuel and contributing to isolated torching and short range spotting.

Weather early in the Whitewater fire was generally warm and dry with good nighttime humidity recoveries. A weak disturbance in mid-August moderated fuels for a brief time, but they have since recovered.

Figure 1 shows abnormally dry conditions over the fire area. Drought predictions do not show conditions intensifying into the fall 2017 however early summer rains have almost universally been below normal.

While baseline drought and relative greenness do not indicate significant departure from normal, current ERCs and dead fuel moistures are above and below average, respectively (Figure 3). Current ERC's are near historic maximums, and 1000-hr fuel moistures are currently setting record minimums.

ERC's in the fire area are following 2015 trends, but no current or historic fuel moisture samples are posted on the National Fuel Moisture Database. However, when comparing Live Fuel Index (a calculation of plant moisture content based on atmospheric, geographic, and phrenologic cycles), 2003 has the same trends in Live Fuel Index as well as the traditionally calculated NFDRS Live Woody and Live Herbaceous fuel moistures. In 2003, the area near the current fires experienced the Booth fire, which began on the Deschutes NF and crossed the crest onto the Willamette.

Fuel moistures associated with the PSA's of interest (NW03 & NW04) are approaching seasonal lows (figure 4) and tracking at or below other years with significant fires. Larger fuels will remain available for full consumption for the duration of fire season without a significant change in fire weather conditions.

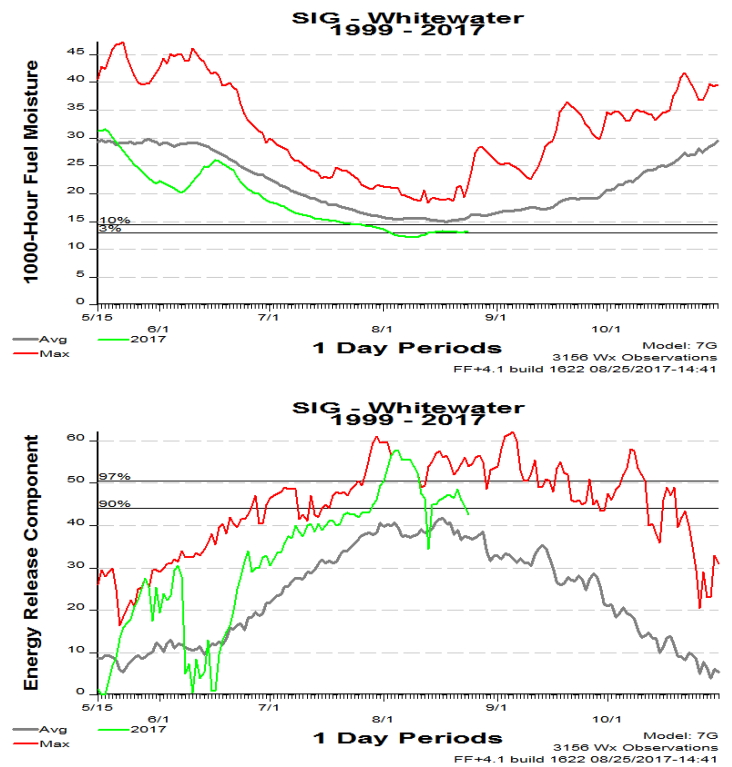
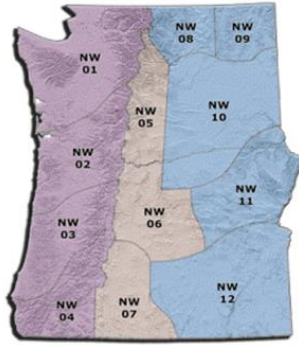


Figure 2 Current 1000 hour and ERC's

**10 Day Predicted ERC and F100 (Fuel Model G)**



These estimates of ERC and F100 are based on regression developed here at NWCC. The equations use gridded data from weather models as predictors  
 The historical percentile values are from a data sample from mid June thru September 2000 thru 2011

Thursday, August 24, 2017

10-day estimates of ERC & F100 by PSA based on expected weather

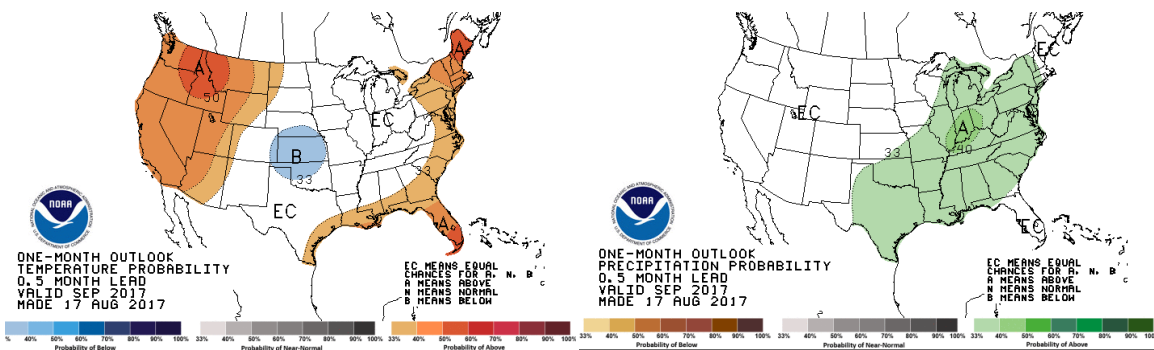
		Obs		Forecast							8/24 mean	Fire Season Percentiles			
		yd	td	Fri	Sat	Sun	Mon	Tue	Wed	Thu		Fri	Sat	85th	95th
PSA NW01	ERC	37	30	30	34	39	42	42	39	33	33	38	#N/A	31	38
	F100	13	15	15	14	12	11	10	11	13	13	12	#N/A	13	10
PSA NW02	ERC	41	34	35	39	43	45	44	41	36	38	43	#N/A	38	45
	F100	10	10	10	8	7	6	6	7	8	7	6	#N/A	9	8
PSA NW03	ERC	42	38	40	45	49	52	52	50	47	51	57	#N/A	44	49
	F100	12	14	13	12	10	9	8	9	10	9	7	#N/A	11	10
PSA NW04	ERC	59	58	59	63	65	68	67	66	64	67	71	#N/A	59	64
	F100	10	10	10	8	7	6	6	7	8	7	6	#N/A	9	8
PSA NW05	ERC	71	72	73	75	77	79	81	81	80	80	81	#N/A	73	77
	F100	7	7	7	7	6	5	5	5	5	5	6	#N/A	7	6
PSA NW06	ERC	69	68	69	73	76	78	79	79	76	77	80	#N/A	71	76
	F100	8	8	8	7	6	5	5	5	6	6	5	#N/A	7	6
PSA NW07	ERC	79	77	76	77	78	80	81	80	78	77	78	#N/A	77	82
	F100	7	8	9	9	9	10	10	10	11	11	11	#N/A	6	6
PSA NW08	ERC	75	73	71	71	72	74	76	76	74	73	73	#N/A	69	75
	F100	7	7	7	7	7	6	5	5	6	6	6	#N/A	7	6
PSA NW09	ERC	76	75	75	77	79	82	84	85	83	81	82	#N/A	78	82
	F100	7	7	7	7	6	6	5	5	5	5	5	#N/A	6	6
PSA NW10	ERC	78	75	74	75	77	80	82	82	81	80	84	#N/A	75	82
	F100	6	6	6	6	5	5	4	4	4	5	5	#N/A	6	5
PSA NW11	ERC	85	85	85	86	87	89	90	91	89	89	89	#N/A	88	93
	F100	5	5	5	4	4	4	3	3	3	4	4	#N/A	5	4

**Fire Danger Indicators**

The energy release component (ERC) is an indicator of the controllability of the fire and trends similar to the drought conditions in the area. Current and forecasted ERC values follow a trend indicative of the recent warm and dry conditions throughout the PNW. Steadily climbing from mid-June, values have set historical maximums, and are climbing steadily back up (Figure 2). This trend is expected to continue into the near term.

**Extended Weather Forecast (Climate Based)**

Over the past two months, persistent hot and dry weather (2-6 degrees above normal temperature and 1-2” below normal precipitation) has combined to move fire danger indicators to near maximum levels as discussed above. This is a common trend throughout the western US in 2017. The Climate Prediction Center calls for above average temperatures and equal chances of above or below normal precipitation for the next month (Figure 3).



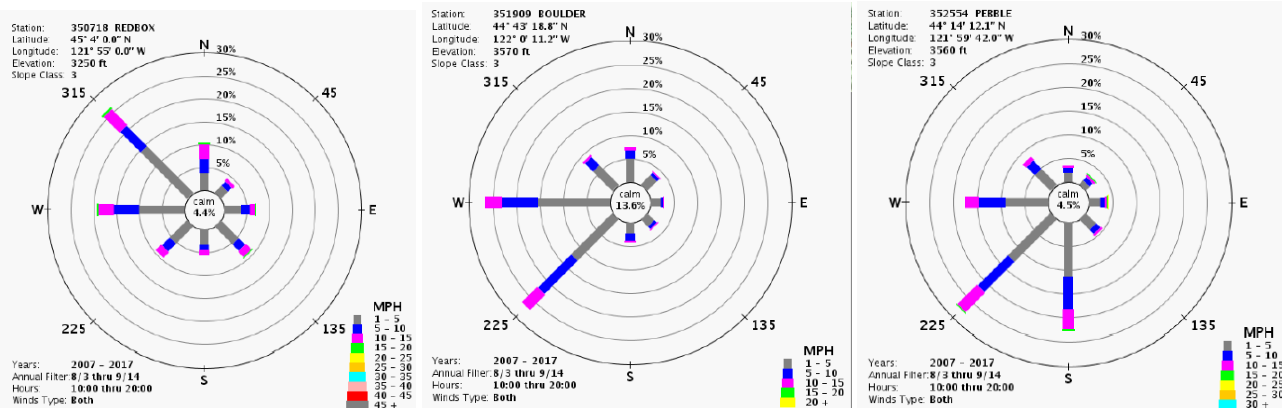
**Figure 3. Climate Prediction Center September Outlook**

Average precipitation in the fire area between June and August is below as well as the observed to date 2017 values.

	June	July	August	September	October	Total through August
<b>Average</b>	2.50"	1.11"	1.03"	2.26"	5.03"	4.64"
<b>2017 to date</b>	2.43"	0"	0.13"	n/a	n/a	2.56"
<b>2017 % of Average</b>	97.2%	0%	13%	n/a	n/a	55%

The above table is based on 38 years of data from two representative RAWS sites. While winter and spring of 2017 were very wet, an incredibly dry July and August are significant contributors to the overall fire outlook.

Wind climatology during July –September (daily observations) is referenced by the wind roses below. Three RAWS stations (Redbox, Pebble, and Boulder) are shown below. Wind direction in the fires’ area is dominated by westerly flow. Of particular concern to the fire area are east wind events, when either a thermal trough or Foehn set up causes low relative humidities and increased winds with an easterly component. Historical fires in the area have been heavily influenced by this phenomenon.



East wind events from the past 31 years were located using Fire Family Plus and Pebble and Boulder RAWS (for detailed event locator and RAWS selection criteria please see LTA Supplement) and found to occur around 15.8% of the time between August 1 and October 31 (Figure 6), making it a relatively common phenomenon.

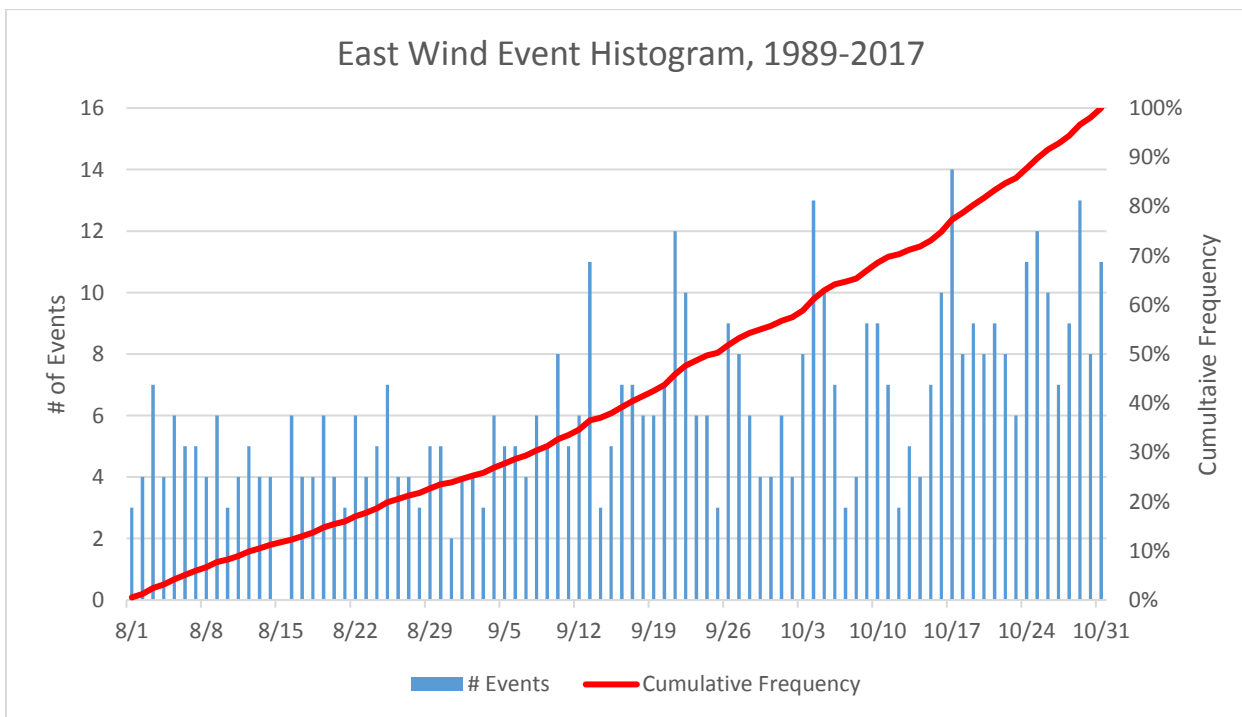


Table 2, below, shows the key frequency of east wind events by date. For example, between August 1 and October 31, only 12.3% of the east wind events are likely to have occurred by August 15.

Date	Cumulative Percentage	% Of 3-month Period (91 days total)
August 15	12.3%	16%
August 31	23.9%	33%
September 15	37.96%	50%
September 30	55.71%	66%
October 15	73.11%	82%
October 31	100.00%	100%

East wind events seem to occur relatively commonly in the three month period, but do increase in frequency in the month of October. This could be of concern if the fires do not experience significant precipitation prior to this date, because live fuels would be at critically low levels, increasing the likelihood of large fire growth days.

### Fire Slowing/Fire Ending Events

Northwest Coordination Center hosts seasonal fire activity timelines for each predictive services area. In NW03 and NW04, the criteria searched for in each year from 1994-2012 was based on predictive services outlook products in the green or low risk category without recovering for a set amount of time. These criteria results in the following key probabilities (Table 3).

NW03 PSA Key Season Ending Probabilities		NW04 PSA Key Season Ending Probabilities	
Probability	Date	Probability	Date
0.25	September 13	0.25	September 12
0.5	September 26	0.5	September 24
0.75	October 7	0.75	October 5
0.9	October 16	0.9	October 13
0.99	October 28	0.99	October 25



NW04 season ending probability dates are from 1-3 days earlier than NW03. Season ending patterns typically set up in west or northwest flow with large low pressure systems from the Gulf of Alaska, or in Pineapple Express scenarios from low latitudes in the Pacific ocean. The minute differences between the PSA's in key dates likely reflects the northern or southern genesis of these systems.

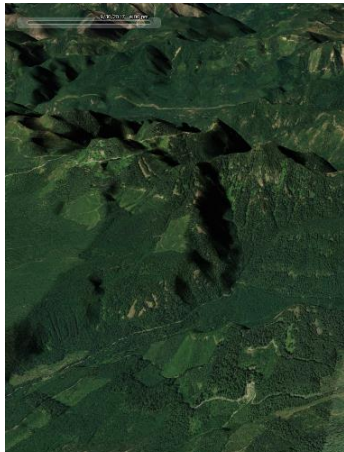
Often times season ending events cannot be fully captured by a set precipitation duration or amount. Rather, a combination of reduced solar angle, sporadic precipitation events, and lack of wind can contribute over the duration of a fire to allow it to effectively burn to natural barriers, however slight, and stop spreading entirely well before the actual precipitation event occurs.

### Shorter Days and Changed Solar Angles

At this latitude, days shorten and the angle of the sun declines significantly as we transition into Fall (see Table 4). This has a noticeable effect on the burning period and translates into a reduced potential for fire, fuels, and weather alignment to develop into extreme fire behavior. North and east aspects are affected more by these changes than south and west aspects. Positions on the lower third of the slope are also more affected than those on the upper third. These slope positions are also less likely through time to dry out sufficiently to carry fire should a precipitation event occur. By the end of October, the burning period will be limited to just a few hours in the afternoon.

**Table 4. Changing Day Lengths and Sun Angles**

Date	Solar Angle	Sunrise	Sunset	Daylight	Images
8/20/2017	12.33	6:16	20:04	13:48	
9/30/2017	2.92	7:05	18:49	11:44	

10/30/2017	-13.88	7:43	17:58	11:55	
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## Air Quality

Smoke from the Willamette Fires had the potential to affect air quality for several types of management area, as well as adjacent communities. Adding to the complexity of the fires and forecasted smoke impacts was the occurrence of the solar eclipse, for which thousands of people were traveling into the area for viewing. Visibility and air quality was of particular concerns for those planning to view the totality of the eclipse.

The State of Oregon has identified Smoke Sensitive Receptor Areas (SSRAs) in its Smoke Management Plan. In the vicinity of the Willamette Fires, Bend and Redmond were identified as SSRAs. In addition, the communities of Detroit, Oakland, and Sisters were identified as being most impacted by smoke from the fires. The resort community of Breitenbush Hot Springs, also expressed air quality concerns, and offered to host a particulate matter monitor on the grounds of the resort. And lastly, the Willamette Forest contains several wilderness areas that are designated Class I air sheds which were impacted by the fires and smoke. The Three Sisters, Mt. Washington, and Mt. Jefferson wildernesses all experienced poor air quality and degraded visibility due to the fires.

The Whitewater, Little Devil, and French Fires primarily affected air quality in the communities of Detroit and Breitenbush. A particulate monitor located in Detroit, routinely measured small particulate matter (PM2.5) in excess of health based standards. Likewise, the temporary monitor placed in Breitenbush also routinely measured air quality that did not meet health-based standards. The Rebel, Jones, and Avenue fires primarily affected the community of Oakridge, which also experienced poor air quality on a routine basis. And lastly, the communities of Sister, Bend, and Redmond experienced air quality impacts from the Willamette fires. However, air quality in these communities and SSRAs were later dominated by impacts of the Milli Fire.

Data for the air quality monitors of interest can be found at the following websites:

- State of Oregon Air Quality Index: <http://www.deq.state.or.us/aqi/>
- Environmental Protection Agency, AirNow: <https://www.airnow.gov>
- US Forest Service Air Fire: <https://tools.airfire.org/monitoring/v3>
- Oregon Smoke Information: [oregonsmoke.blogspot.com](http://oregonsmoke.blogspot.com)



## Worst Case Fire Behavior

### Worst Case Scenario

Continued hot, dry, and unstable conditions continue with no significant relief for several weeks. NWCC and NICC Preparedness Levels remain at 5 for an extended period of time, limiting available resources. Olallie, Roney, and Separation fires burn nearer one another within the wilderness and are influenced by a strong marine inversion combined with an east wind event generating winds 7-10 mph from the SE for two days, triggering some level of evacuations and structure protection measures in the McKenzie Bridge area. The same weather impacting these fires has had the same effect on fuels and fire behavior near the Little Devil Fire, which moves northwest and causes evacuations at Breitenbush Hot Springs and Resort. Limited resource availability to the incidents from higher priority fires makes aviation prioritization difficult between fires threatening values at the same time.

**Worst Case Scenario Probability:** Short Term Fire Behavior indicates that in a two day period following extreme heat, low humidity, and poor humidity recovery that the worst case scenario would still not directly impact the values mentioned above, even with high SE winds under the next two weeks' anticipated low fuel moisture conditions. FSPro runs with completely cured live fuels like those that were present in 2015 indicate that there is still no predicted impact to either Breitenbush Resort or McKenzie Bridge and the surrounding area during the modeled two week period. As fuels continue to dry into September and October, special attention must be paid to any remaining areas of unsecured fireline, which could be heavily impacted by even a moderate east wind event.

### Likely scenario

Wilderness fires experience continued persistent growth, with a 40-59% probability of Olallie leaving the wilderness in the next two weeks. There is a 80-100% probability of Olallie leaving the wilderness in this timeframe. Rebel is modeled to leave the wilderness over 60-79% of the time and cross the 19 road; however, ongoing suppression efforts, which cannot be incorporated into the model, may significantly reduce this risk. Little Devil Fire eventually backs to South Crag Creek and Devils Creek, where suppression actions will likely be effective, or it will be within a larger fire footprint generated by burnout operations. There is a <0.2% probability of fire spreading across the North Fork of the Breitenbush River. Spread to the northwest by Little Devil will continue, but it is not anticipated to reach the Breitenbush River in the next two weeks. Marine inversions keep fuels conditions moderate in low elevations repeatedly prior to S or SE winds, and some measurable precipitation occurs within the next month. Winds from S or SE will cause fire growth on the majority of fires, but most substantial growth remains within wilderness areas. This does not account for continued preparation of contingency lines and increasing their depth through burn operations, which further limits the probability of Little Devil affecting Breitenbush.

**Likely Scenario Probability:** Moderate live fuel moistures will continue to fall to seasonal lows while dead fuels continue a slow decline. Likely scenario FSPro indicates that given drier conditions than currently exist, high value areas will not be impacted in the next two weeks. Ongoing burnout operations taking advantage of favorable winds will largely be successful, and fires which are currently within wilderness areas will likely exit onto USFS administered land during this timeframe. There is a 80-100 % probability that the Olallie fire will exit the wilderness to the north, but it will stay on USFS administered lands. There is a modeled 80-100% probability of the Whitewater fire leaving USFS lands and impacting private lands in DIV H, but ongoing suppression efforts will likely minimize this probability prior to it being realized.

It's important to recognize that the FSPRO runs utilized to generate these inventories were made to use lower than observed live fuel moistures as well as increased windspeeds than forecast. The FSPRO runs were also instructed to burn 4 days under the most high end conditions before reverting to climatology. **There is high confidence in these results over the next two weeks.**

In both FSPRO runs, the <0.2% probability was created from 8 of the 4,000 simulated fire scenarios. There is a <0.2% probability of fire impacting McKenzie Bridge in the two week period. The ERCs and three days of forecasted weather were amended to bump conditions to the 97<sup>th</sup> percentile with live fuel moistures decreased well beyond current observations throughout the run. FSPRO results are attached in separate interpretive map sets.

**Indications for re-analysis of fire behavior/spread and notification of the assigned resources:**

- Growth on any individual fire or total combined fire growth of over 20% in a one-day period.
- 14 Days has passed since this analysis.
- Any fire perimeter exits FSPRO probability curve before its' 14 day utility