

# *Long Term Assessment*

## *Bear Butte 2 - DEF 000318*

*Completed July 28, 2014 by: Trevor Miller (LTAN), Kirk Metzger (FOBS), Lisa Elenz (SOPL)*

On July 13, 2014, the Bear Butte 2 fire, caused by lightning, was detected in the Mt Jefferson Wilderness of the Deschutes N.F. The smoke jumpers initially deployed reported the fire burning in heavy dead and down fuels. On 7/15 after several days of poor humidity recovery the fire spread east with strong NW winds. This assessment provides more information regarding the current fire season, the fire potential and reference material for decision support. Efforts were spent on analyzing the fire's potential and long term strategies on the southern portion of the fire on the Deschutes NF because the northern portion of the fire on tribal trust lands has direct suppression tactics being deployed.

Prior to the Long Term Analysis Team being ordered, options were considered for managing the fire and evaluating the risks involved with suppression activities. These options were weighed by the Agency Administrator, Acting Fire Management Officer, Fire Staff, and Acting Assistant Fire Staff.

Option 1 – Completing direct line along the fire perimeter utilizing firefighting resources. This option is high risk due to working conditions within the lava flow, steep terrain beyond the lava flow along Bear Butte ridge, and limited extrication sites. Likely deployment of firefighters is via aerial means and likely requires an established spike camp and sling support/food. Tactics would also include water drops via helicopter. This option would mean high risk to firefighter and aviation resources short term.

Option 2 – Continue use of heavy helicopters to put water on hot spots as they arise or pose a threat to the current black edge. This option would potentially check fire spread but would not put out the fire. This option has less risk to firefighters but has equal or greater risk to aviation assets.

Option 3 – Allow the fire to burn itself out or spread into the wilderness area and build contingency line to the south using roads and trails, outside the wilderness. This would entail treating the north side of the roads and trails utilizing firefighters, dozers, and slash busters. There would be limited exposure to the firefighter given the distance from the current fire's edge and safe working distances from equipment. There would be limited dozer work (3 short segments); slash busters could complete preparations within a few days; and the contingency line could be completed in less than a week. There are two medi-vac sites available and all working areas are accessible via roadways. This option poses the least risk to fire personnel short term.

### **Risk Decision**

Option 3 was selected over the first two options to reduce risk to firefighters and aviation assets based on current and predicted fire behavior along the southern flanks of the Bear Butte 2 fire. This reduced risk would be realized through decreasing exposure to firefighters at the fire's edge in the lava flow, on steep terrain, and at spike camp. It also reduces aviator risk because it limits flights to hot spots and the need to insert/support firefighters is gone. This long term analysis was utilized to validate the decision given the fire's proximity the Warm Springs Agency and their highly valued lands. It also assists in determining fire's potential and completes preplanning related to that potential.

### **Fire Area Summary**

- The primary values within the planning area are the on the Warm Springs Agency to include active timber sales, historic structural remains on Bald Peter, a historic ranger station on the eastern slope of Bald Peter, and the WSA trail #7. On the Deschutes NF lands there is one private residence within the planning area and several values just outside the planning area such as the Candle Creek Campground, Lower Bridge Campground, Pioneer Ford Campground, Allan Springs Campground, and Wizard Fish Hatchery.
- Fire area received between 0.5-0.65 inches of precipitation over 7/22-7/23.

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- Heavy fuels conditions remain within large fire thresholds, significant deadfall associated with past fires in the area will continue to remain available to consumption. This same deadfall poses significant safety concerns for operational personnel.
- Significant fire scars and barriers to fire spread are present in the fire area. Significant suppression has taken place on Northern and Eastern flanks of the fire.
- The fuels within the area of most concern (Metolius Plateau) have been tested at high to extreme indices and were not overly conducive to extreme fire behavior.
- Above average temperatures and average rainfall are predicted in both the near and long term, fire indices are expected to rise and return to seasonal average over the next 3-7 days. August is the one month period with the greatest frequency of large fire starts.
- Live fuel moistures and minimal fines in dominant brush models through much of the fire area have limited spread. These fuel models historically have had short duration periods of growth associated primarily with wind events.

### Outlook

Much the western US remains relatively warm and dry. Severe to moderate drought (figure 1) is influencing the fire area which will affect fuel moistures and associated fire behavior (see related fuels figure 5). Forward drought predictions show these conditions persisting or intensifying well into Fall 2014.

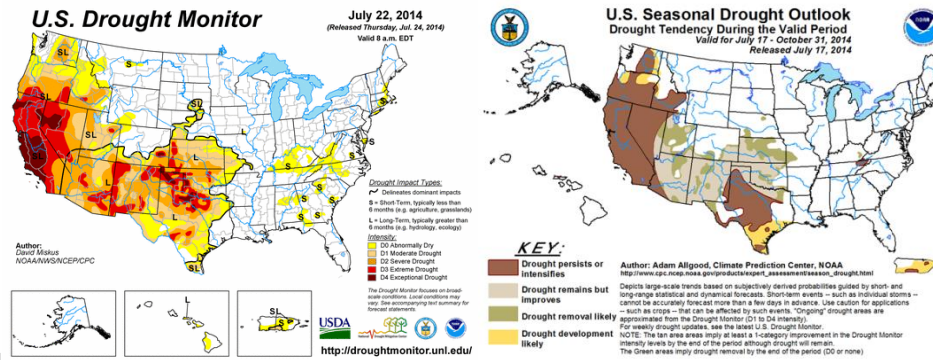


Figure 1: Current drought severity (left) and seasonal outlook (right).

Even with the recent relief in fire weather conditions, current projections for days 6-10 days by the Climate Prediction Center (CPC) indicate/maintain an expanded area of above normal temperatures across the fire area. Precipitation potential across the fire area is predicted to remain neutral with a slight chance of above normal, likely tied to increasing monsoonal moisture (Figure 2). This trend appears to be persistent as we move into August with, again, predicted above normal temperatures and neutral precipitation factors (Figure 3). We should expect a continuance of average to above average fire conditions across the local area. This will lead to the ability for unchecked fire to continue to actively burn in the Bear Butte 2 area.

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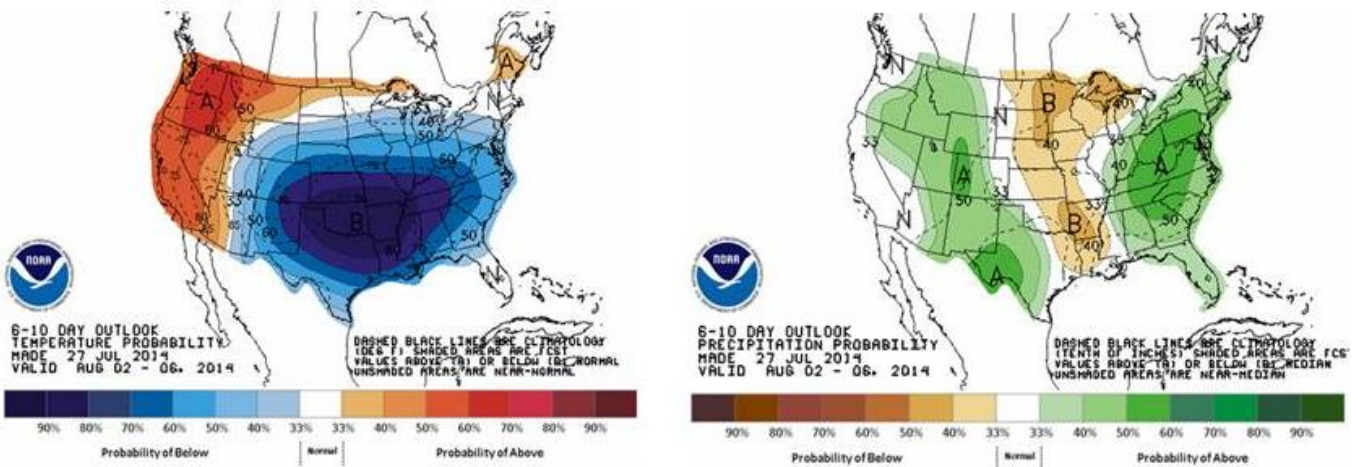


Figure 2: Days 6-10 (Valid Aug2-Aug6) Temperature and Precipitation Outlook.

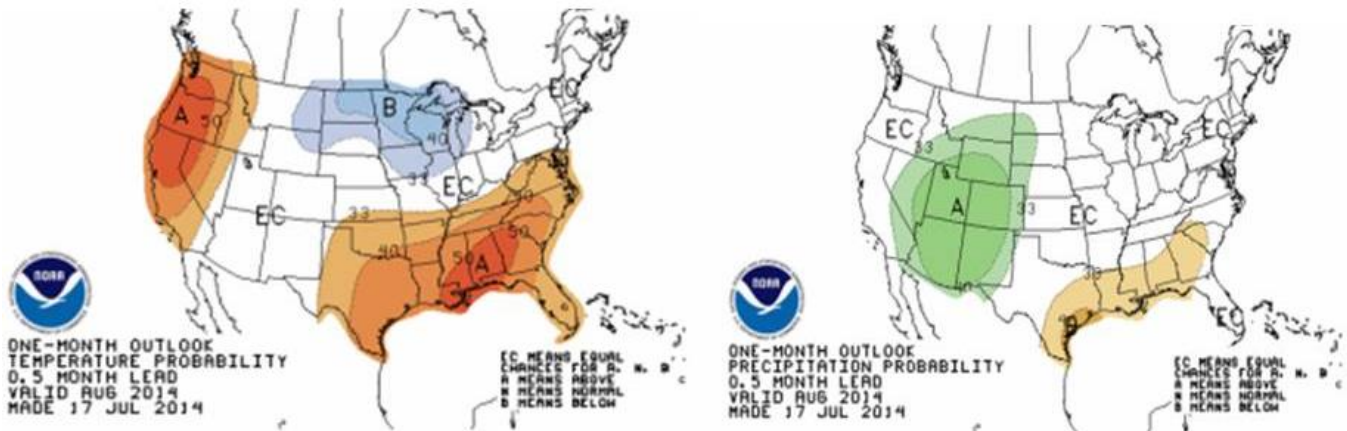


Figure 3: One month (Valid August) Temperature and Precipitation Outlook.

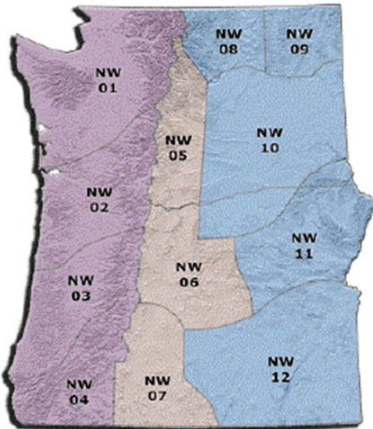
**Energy Release Component**

Energy Release Component (ERC, using Fuel Model G) is a measure of the longer term large fuel dryness, and is a good indicator of fire season severity. Local ERC values tend to approach the seasonal maximum around the middle of August, tailing off gradually into early September.

Current ERC values are climbing back to average after falling below, driven by recent cooling and precipitation events. Forecasted trends maintain this transition upward as the fire area continues to be affected by local drying trends. The 10 day forecast period suggests a continued upward trend with slight tapering towards the end of the week (Figure 4 and 5). Note that these ERC values are below values recorded during primary growth during the week of 7/14.

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## 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

Sunday, July 27, 2014  
10-day estimates of ERC & F100 by PSA based on expected weather

		Forecast										7/27 mean	Fire Season Percentiles		
		Obs yd	td	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon		Tue	85th	95th
PSA NW01	ERC	10	15	19	22	24	25	25	26	25	25	26	23	31	38
	F100	21	19	17	15	13	13	13	13	13	13	13	15	13	10
PSA NW02	ERC	19	24	28	30	31	31	32	33	32	31	31	29	38	45
	F100	19	17	15	14	14	13	13	13	13	14	13	14	12	10
PSA NW03	ERC	26	29	31	32	32	32	31	30	30	30	32	36	44	49
	F100	17	15	14	13	13	13	14	14	14	14	14	13	11	10
PSA NW04	ERC	45	49	52	53	54	54	52	50	49	49	50	51	59	64
	F100	12	11	10	9	9	9	10	10	11	10	10	10	9	8
PSA NW05	ERC	51	55	59	62	63	64	64	64	64	63	64	62	68	74
	F100	13	11	10	9	8	8	9	9	9	9	9	9	7	6
PSA NW06	ERC	59	61	64	66	67	66	64	63	63	63	62	68	73	77
	F100	11	10	9	8	8	8	8	9	9	9	9	8	7	6
PSA NW07	ERC	62	65	67	69	69	67	66	65	64	61	59	64	71	76
	F100	9	8	8	7	7	7	8	8	8	8	9	8	7	6
PSA NW08	ERC	Insufficient weather observations were entered into WIMS										70	77	82	
	F100	Insufficient weather observations were entered into WIMS										8	6	6	
PSA NW09	ERC	55	57	61	63	65	65	65	64	65	64	64	58	69	75
	F100	11	9	8	7	6	6	7	7	7	7	7	8	7	6
PSA NW10	ERC	75	77	79	81	80	79	77	75	74	74	74	75	78	82
	F100	8	7	7	6	6	6	7	7	7	7	7	7	6	6
PSA NW11	ERC	64	68	72	75	76	76	75	74	72	72	72	67	75	82
	F100	9	8	7	7	7	7	7	7	7	7	7	7	6	5
PSA NW12	ERC	77	81	83	83	84	83	81	79	78	78	77	80	88	93
	F100	7	6	6	6	6	6	6	6	6	6	6	6	5	4

Figure 4: Forecasted ERC and 100hr fuel moisture trends with applicable PSA (red highlight). Blue circle highlights higher values that may test fire environment conditions.

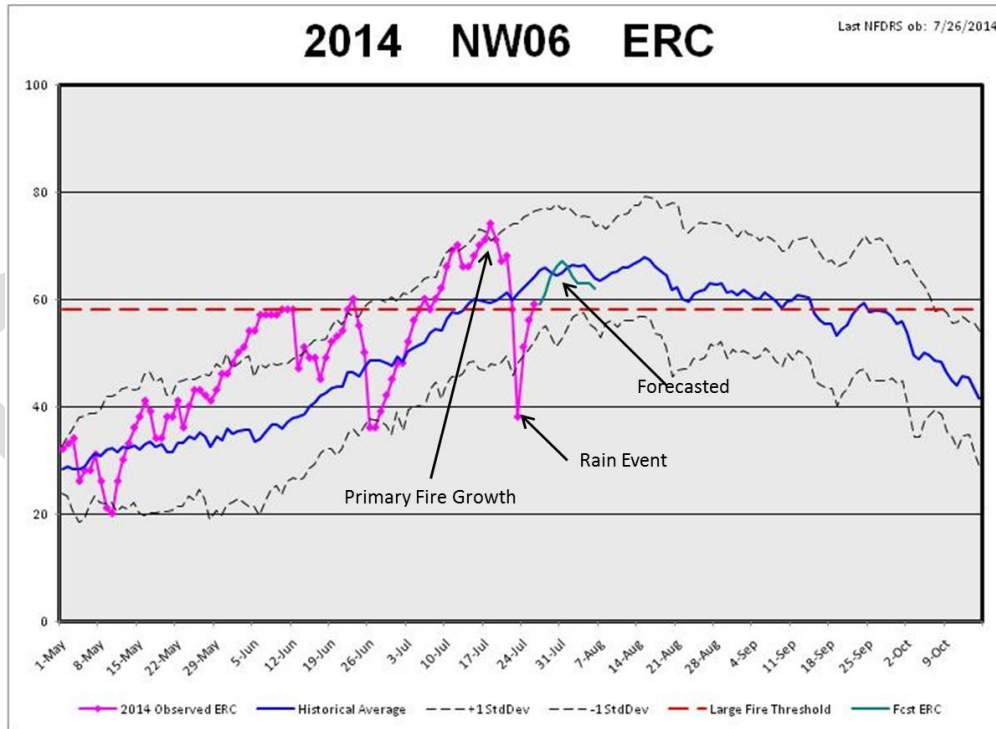


Figure 5: Forecasted ERC within applicable PSA SIG.

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A good indicator year has been established with 2012, with 2 similar rain events occurring in June and July. Based on this association it becomes apparent that, in a historical context, large fire growth potential can rebuild into August and September (Figure 6). 2012 was utilized to provide an applicable worst case scenario, with historical highs being set in late August and early September.

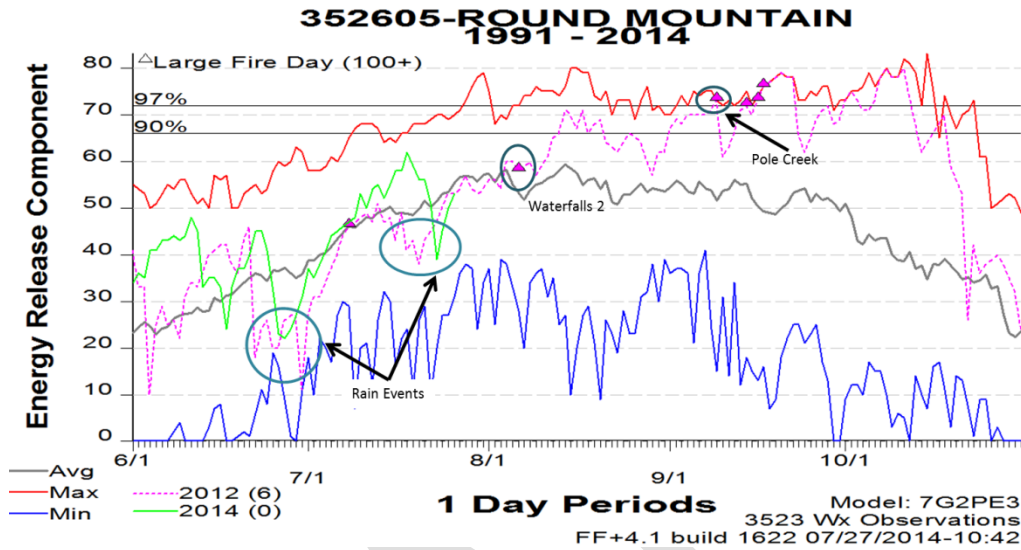


Figure 6: 2014 Round Mountain RAWS ERC stream with indicator year 2012 and associated large fire events. The RAWS, while distant from the fire area has been determined and validated locally to be most representative of crest and wilderness fires.

### Area Fuels and Fire Behavior

The fire area has been under the influence of dry conditions and extended moderate drought, allowing for dead fuel moistures to hover around and below the large fire threshold (Figure 7). While much of the fire area has been drastically affected by recent large fires (B&B, Jefferson, Lightning Complex), heavy fuels, associated with snag fall, have reached critical fuel moisture levels and are conducive to continued burning. Temporary relief will be realized in the smaller fuel classes with the recent wetting rains, however 1000+ hour fuels should continue to remain available for full consumption for the duration based on anticipated weather.

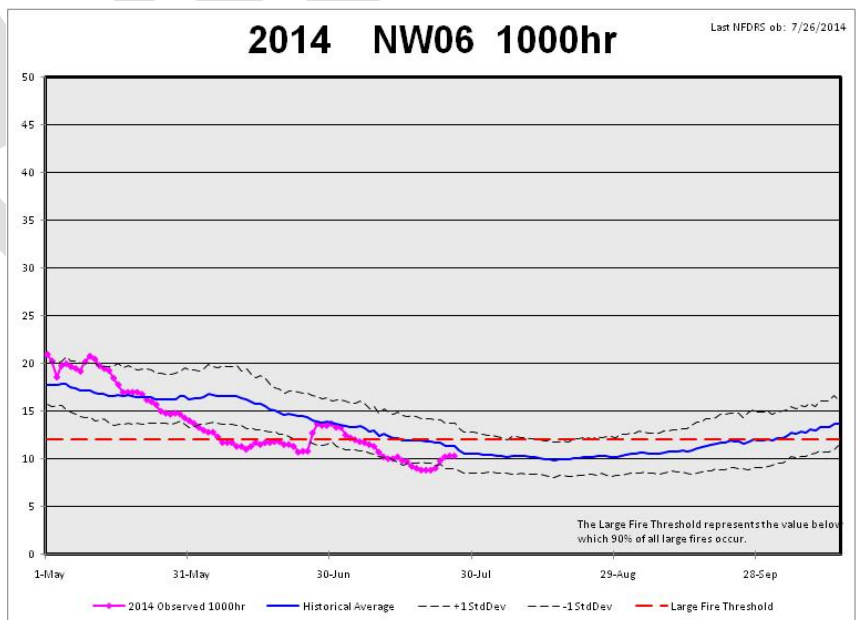


Figure 7: Heavy fuels maintaining below average conditions, minor relief expected in 100hrs, likely little change in 1000hr.

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While it is expected that fire will continue to burn in these 1000hr (+) fuels much of the surrounding fuels of concern have been tested under high winds, poor overnight RH recoveries, and 90<sup>th</sup> percentile conditions. Analyst feel that the current live fuel moistures of a significant brush component may be responsible for tempered fire spread on much of the fire perimeter, particularly the eastern flanks. Figure 8 shows the most representative available values for collected live fuels.

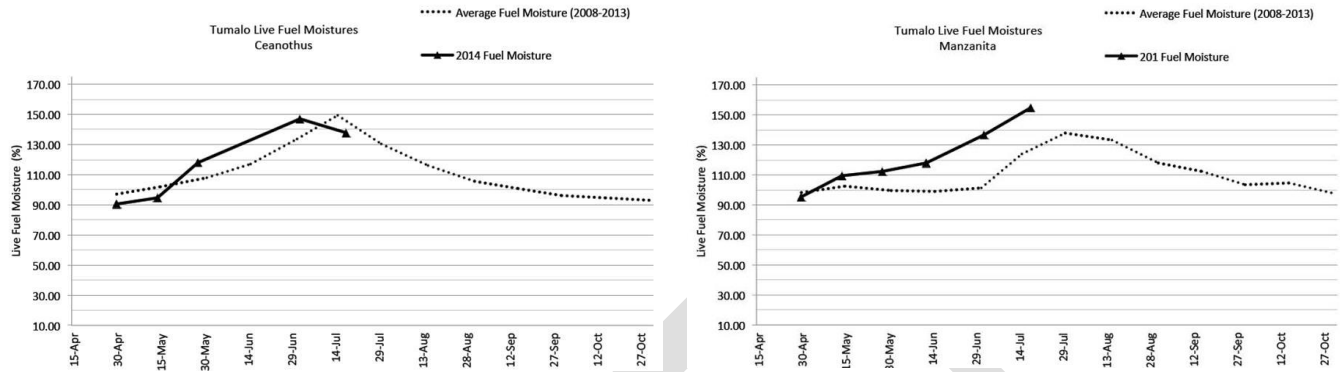


Figure 8: Live Fuel Moistures from most applicable permanent monitoring site (Tumalo Ridge). Last collection 7/18/14.

As the fire season moves into August it is expected that these Live Fuel Moistures will continue to trend downward allowing for greater spread potential. However, we have seen from historical fires (Wasco, Canyon Creek) in similar fire scar fuel models that spread and growth tend to be short in duration. Note: while Wasco and Canyon Creek were later season fires, live fuel moistures tend to be at their lowest seasonal values.

### Large Fire Growth Days

Typically, large fires in western forests gain most of their growth on relatively few days during the life of the fire with more modest or even minimal fire growth on most days. In recent large fires on the Sisters Ranger District, a strong correlation to nighttime relative humidity and large fire growth has been seen. Low overnight humidity recovery indicates a warm, dry air mass over the area resulting in decreases in live and dead fuel moistures. When coupled with high winds, ERC values approaching or above 60 the likelihood of rapid fire progression is increased. Recent weather streams indicate similar effect with large growth and holding issues on 7/16-7/17 coupled with prior poor recoveries.

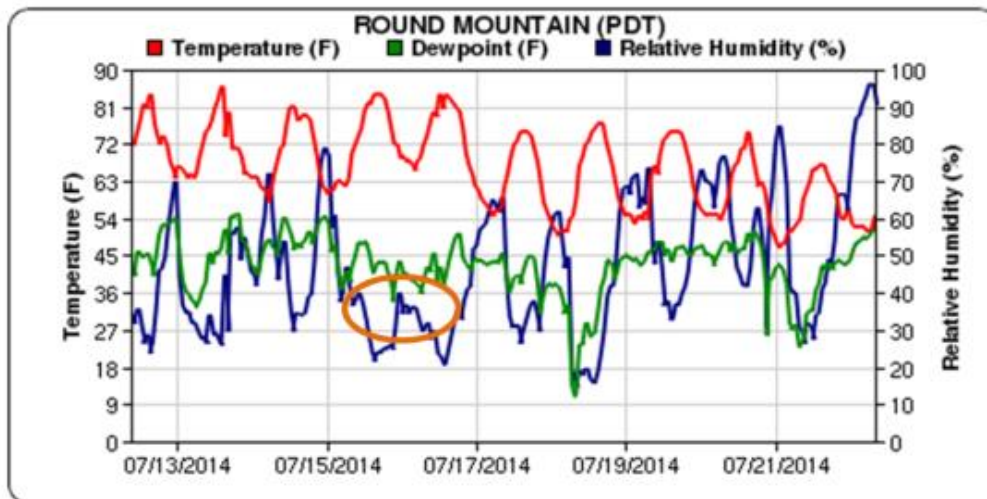


Figure 9: Trace RAWS for Bear Butte 2. Note poor recovery through morning of 7/16.

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Figure 10 and 11 shows temperature and relative humidity traces for the Round Mountain RAWS site during periods of fire growth for recent evaluation fires of interest, Pole Creek Fire and Wasco Lake. Note that nighttime relative humidity recovery was poor immediately prior to and during the periods of fire growth (orange circles). This trend can be seen even in late season time frames.

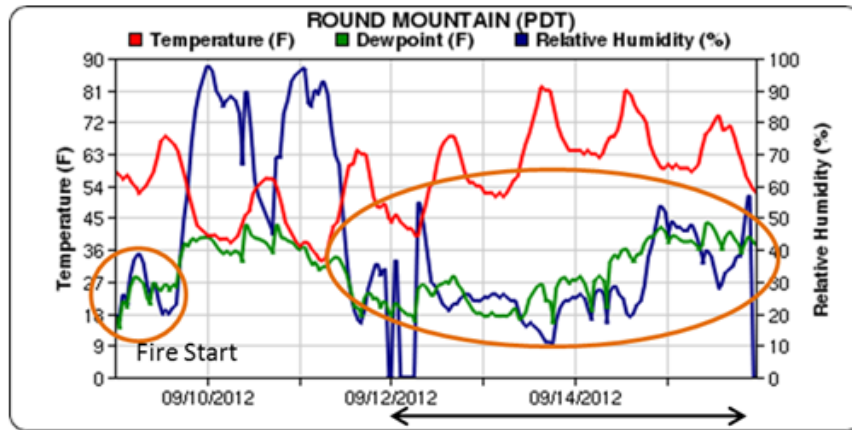


Figure 10: Pole Creek (2012) trace RAWS showing a period of low recovery followed large growth highlighted by black arrows.

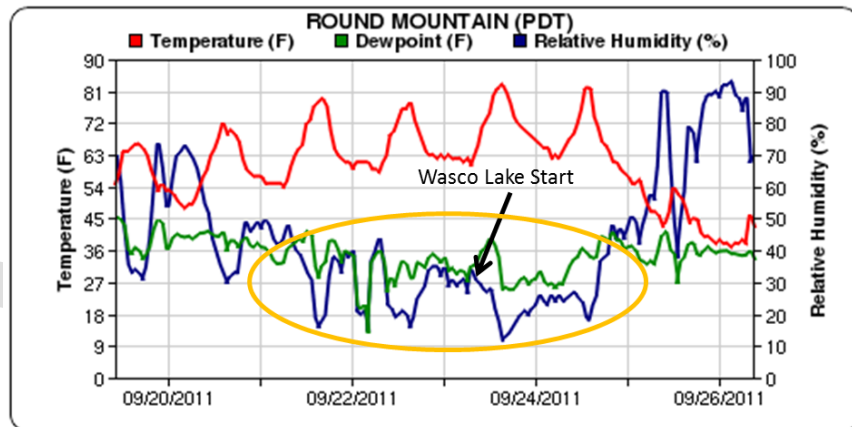


Figure 11: Wasco Lake (2011) trace RAWS showing a period of low recovery followed by large growth.

Using indicator criteria of nighttime humidity recovery below 50%, local ERC values greater than 60 (as measured by Round Mountain RAWS), and particularly a combination of the two, local fire managers can monitor and anticipate significant growth days in the future – we recommend managers monitor said indices and shift tactical and resource allocation decisions as appropriate based on existing location of active fire on the Bear Butte 2. Table 1 shows percentage probability of such events occurring before 90<sup>th</sup> percentile season end (Appendix A).

Measure	2 Day Period	1 Day Period
ERC >=60	18% (14)	33% (26)
MaxRH <= 50	8% (6)	21% (17)
Combined (ERC, MaxRH)	6% (5)	16% (12)

Table 1: Percentage probability (days) of combinations of large fire growth indices from July 25 to 90<sup>th</sup> percentile season end date of October 11.

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### Worst Case Fire Behavior

Worst Case – Spotting across Lava along southern flank. Figure 12

Unchecked fire along southern flank rapidly reinitiates and is able to spread through sporadic fuels in the Jefferson Lava flow reaching a more continuous fuel bed to the south. This spread occurs coupled with the large growth factors discussed above. To represent this scenario a four day NTFB was run utilizing retrospective conditions associated with fire initiation and growth the week of July 14, 2014. Such a scenario would closely mimic original spread characteristics but would likely be more broken and discontinuous due to the presence of heavier shrub models and broken terrain. West to East spread would be of primary concern with MAP 9 and 10 remaining critical action points. Closely following growth triggers discussed above should allow fire management personnel to anticipate and prepare for periods aligning to said conditions.

Likely Scenario –

Limited ignition sources along southern perimeter gradually smolder and creep under less conducive growth factors and are naturally checked by broken fuels. Spread can be monitored and established MAPs utilized with a greater decision space.

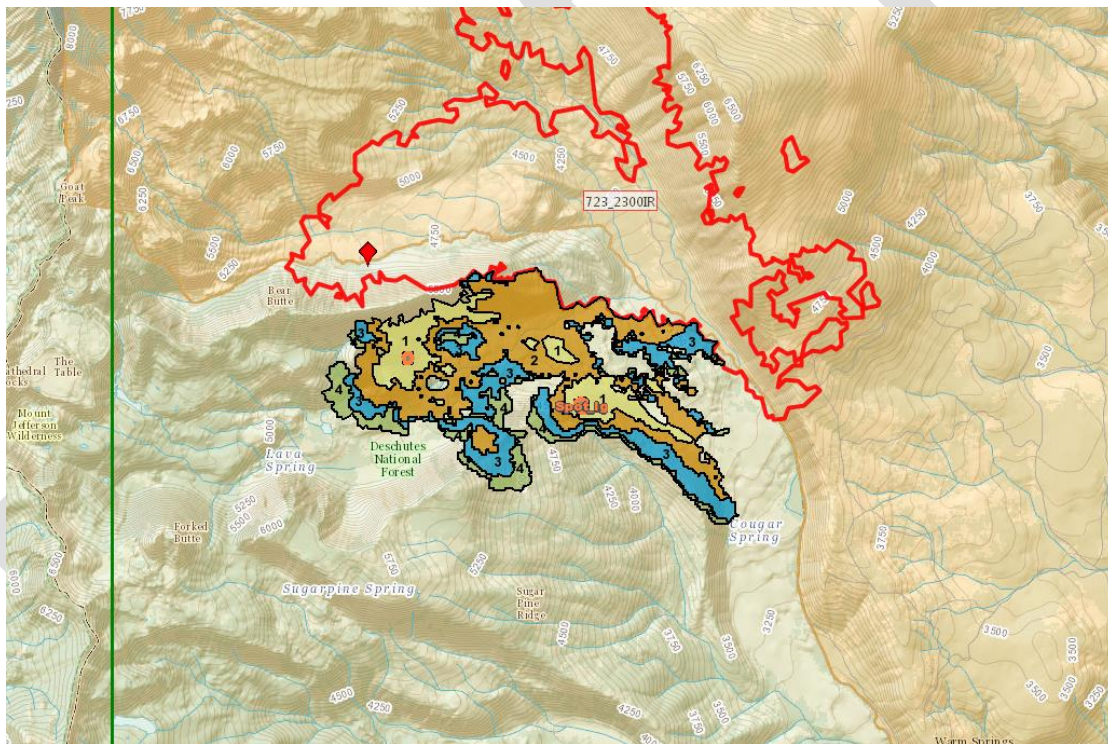


Figure 12: 4 day NTFB utilizing spot ignition south of current perimeter. Conditions run retrospectively utilizing fire weather conditions associated with initial fire growth and spread the week of 7/14.

Spotting into the Headwaters of Parker Creek (prior to western flank containment) - Figure 13. Much as would be anticipated, fire is dominated by two primary factors that include dominant wind flow that pushes fire back into existing perimeter and terrain and available fuels influence a northerly progression, allowing fire to finger to the North. Westward progression is limited to backing and gradual consumption of available fuels. These outputs closely resemble historical movement on the Bear Butte 2 with fire being dominated either by wind (west to east) or terrain and fuels (northerly). Fire shows a prevalence of flow up the main stem of Parker Creek. WSA Trail #7 would likely be a good candidate to check northerly spread.



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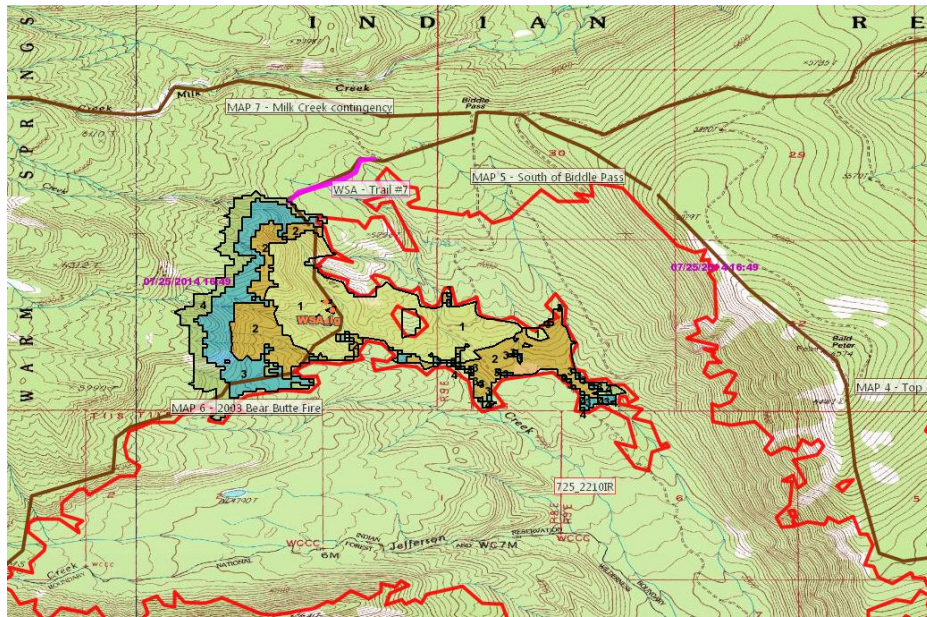


Figure 13: 4 day NTFB, start date of 7/28/14, utilizing hypothetical spot ignition in the Parker Creek Headwaters.

Spotting across SE containment line – Figure 14. Fire continues its southerly progression isolated primarily to fuels between lava flow and Metolius Plateau. Again a very similar pattern to what was seen during the week of 7/14. Easterly progression is limited by actively managed stands as well as past fire scars still dominated by brush models. Note, outputs are based upon forecasted conditions weather and wind conditions. If high winds become forecasted this easterly progression would likely increase. Numerous options should exist to limit spread using the established road network and suppression equipment.

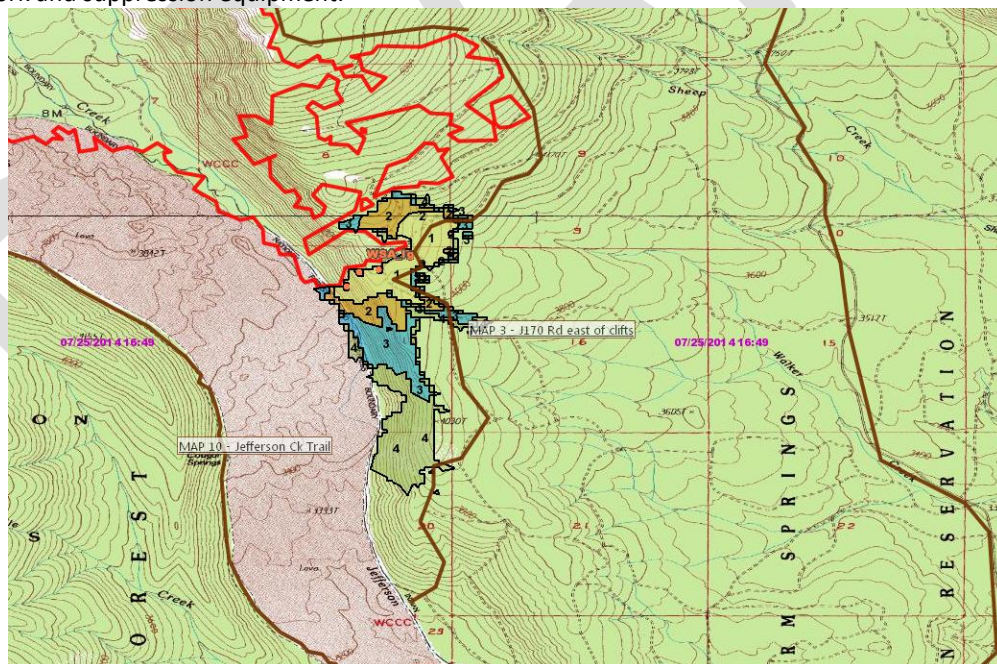


Figure 14: 4 day NTFB, start date of 7/28/14, utilizing hypothetical spot ignition along SE containment line.

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

- Active creep through Lava, southern progression of >20 acres, or a 7 day period has passed since last analysis.
- Active areas of fire along southern perimeter coupled with actual or forecasted overnight Rh recovery <50% and forecasted WNW winds >15 mph.

### **Risk Assessment**

The Fire Spread Probability (FSPro) model was used to evaluate fire spread potential for two hypothetical spot fires as if they had crept through the Jefferson Lava Flow to the south. FSPro is a spatial model that calculates the probability of fire spread in all directions from a current fire perimeter or ignition point. It models fire spread for thousands of weather scenarios based on local climatological records to determine the probability of a fire spreading through an area over a given time period. FSPro can be used to identify the probability that areas of concern could see fire. The outputs are helpful for developing priorities and analyzing risk to identified values. There are important assumptions in the FSPro analysis: 1) the fire is free-burning and 2) there is no suppression action constraining fire growth.

### **Fire Growth Projections**

Table 2 illustrates a combination of four 14 day runs (7/27, 8/11, 8/26, and 9/10) of 2000 fire combinations with no suppression actions initiated from a hypothetical spot ignition file (Appendix B). The analyst has made adjustments to burn period, live and dead fuel moisture, and spotting potential based on time of season and historical burning conditions. Of importance is that this is not a progression map but rather an aggregate of all the potential fire perimeters and associated probabilities. The 2012 fire season has been utilized for future ignitions as it nicely represents active burning conditions in August and September.

Under conditions that represent an extreme for the time of season (i.e., outside the historic norm) experience has shown that the fire may be driven into “lower probability” zones in a single day of large fire growth. As ERC values, temperatures, and dryness tract above historic norms anticipate the possibility and plan contingencies for the mid-low probability, high consequence events. Low occurrence, high consequence events (e.g. thermal trough) should also be key indicators associated with lower probability potential.

Management Action Points*	7/27-8/10	8/11-8/25	8/26-9/9	9/10-9/24
1	5-19%	5-19%	<5%	0
2	<5%	<5%	<5%	0
3	<5%	<5%	<5%	<5%
9	80-100%*	80-100%*	80-100%*	80-100%
10	80-100%	80-100%	80-100%	80-100%*
11	5-19%	5-19%	<5%	<5%
12	0	<5%	0	0
13	<5%	<5%	<5%	<5%
14	<5%	<5%	0	0

**Table 2: Probability of fire reaching identified MAP categorized by ignition initiation start date. \*Influence on MAP 9 is a result of spot ignition location.**

\* Management action points are defined in detail later in this document. MAP 4-8 were not assessed in this analysis because full perimeter control was being utilized on that portion of the fire.

### **Values at Risk**

There are several values within the planning area which can be viewed spatially based the FSPro analysis in Appendix A. There is less than a 5% probability of the fire reaching any of the values, some of which are less that 0.2%. Values include

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Warm Springs Agency’s active timber sales, historic structural remains on Bald Peter, a historic ranger station on the eastern slope of Bald Peter, and the WSA trail #7. Within the planning area, in and around the Deschutes NF lands there is one private residence and several values just outside the planning area such as the Candle Creek Campground, Lower Bridge Campground, Pioneer Ford Campground, Allan Springs Campground, and Wizard Fish Hatchery.

#### **Key Probability Trends**

- Fire spread is generally dominated by WNW flow.
- Dependent upon location of active spread, MAP 10 will likely be tested in most scenarios. Actions should be based upon current and predicted fire behavior.
- Low probability/High consequence events for each respective time period show feasibility that MAP 2 and 3 could be impacted by free flowing fire with no suppression action. Again MAP 10 remains a critical action point associated with such.
- Isolated or rare events consistently show a possibility of fire moving to the north and becoming established in the Hole in the Wall area. Opportunities to limit this spread should be feasible along the Bear Butte ridgeline if fire begins to progress in said direction.
- MAP 11 remains a key action point in which to assess current fire activity, remaining season, and resource needs. While a low probability, all scenarios show the possibility that the MAP will be tested.
- Little to no indication that the Willamette/Deschutes dividing boundary will be threatened.

#### **Management Action Points**

To define long term actions to be taken for managing this fire, the following management action points were developed. They can be viewed in WFDSS and are represented both spatially and with tabular information. Although these MAPs define resources they are initial evaluation and should be adjusted based on time of year and fire behavior.

<b>MAP 1– Mt Jefferson Wilderness</b>	Mt Jefferson wilderness boundary between the Bear Butte 2 fire progressing westward to the Cascade Crest.	
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Fire is actively spreading near the Mt Jefferson Wilderness Boundary.</li> </ul>		
<b>Action:</b>		
<ul style="list-style-type: none"> <li>• Notify WSA Superintendent and CTWS Natural Resource General Manager of increased fire activity on the forest and intended actions.</li> <li>• Analyze potential spread based on current and predicted weather to determine if action is needed on the fire or if resources should be modified.</li> <li>• Analyze risks and exposure to firefighting resources.</li> <li>• Suppress all spot fires north of the boundary and south of Waldo Glacier spring – consider Fire Module to suppress fire and evaluate activity. Limit northerly spread of the fire.</li> </ul>		
<b>Resources: (7 days)</b>		<b>Cost: \$160,000</b>
<ul style="list-style-type: none"> <li>• 1 Long Term Analyst</li> <li>• 1 Type 2IA Crew or Fire Use Module – depending upon actions needed.</li> <li>• 1 Type 1 Helicopter</li> <li>• 1 Type 2 Helicopter</li> </ul>		
<b>MAP2– J100</b>	J170 Road running north/south.	
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Fire crosses the J170 road and continues to spread eastward.</li> </ul>		
<b>Action:</b>		
<ul style="list-style-type: none"> <li>• Burn out from the J100 road.</li> </ul>		
<b>Resources:</b>		<b>Cost: \$200,000</b>
<ul style="list-style-type: none"> <li>•</li> </ul>		

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<b>MAP3 – J170 Road East of Cliffs</b>	J170/J176 road south of the Bear Butte 2 Fire above cliffs along the western boundary of the Warm Springs Agency and the Deschutes NF.	
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Fire continues to move south in the Forest Service wilderness.</li> </ul>		
<b>Action:</b>		
<ul style="list-style-type: none"> <li>• Utilize the J-170/J-176 road, jeep roads, and wildlife trails to prepare for burnout operations. Current Type 2 team is completing prep.</li> <li>• <b>Burnout operations is not the recommended course of action, only a last resort.</b></li> </ul>		
<b>Resources:</b>		<b>Cost: \$100,000</b>
<ul style="list-style-type: none"> <li>• Dozers</li> <li>• Type 2 crews</li> <li>• Logging equipment</li> </ul>		
<b>MAP 4 – Top of Cliff</b>	MAP defined to the NE of current fire area tying to MAP3 and MAP5.	
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Fire on cliff east of parker creek</li> </ul>		
<b>Action:</b>		
<ul style="list-style-type: none"> <li>• Establish dozer and handlines along the top of the cliff to contain fire from spreading any farther to the east.</li> <li>• IA any spot fires to the east minimizing acres burned.</li> </ul>		
<b>Resources:</b>		<b>Cost: \$50,000</b>
<ul style="list-style-type: none"> <li>• 2 dozers</li> <li>• 3 type 2 IA crews</li> <li>• 2 water tenders</li> </ul>		
<b>MAP 5 – South of Biddle Pass</b>	Fire’s edge from Biddle pass to Bear Butte Fire.	
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Fire continues to burn north unchecked.</li> </ul>		
<b>Action:</b>		
<ul style="list-style-type: none"> <li>• Go direct as safely possible with dozer or handline around the head waters of Parker Creek, just south of Biddle Pass.</li> <li>• IA any spot fires to keep the main fire south of Biddle Pass area.</li> </ul>		
<b>Resources:</b>		<b>Cost: \$250,000</b>
<ul style="list-style-type: none"> <li>• 2- IHC</li> <li>• 3 type 2 IA crews</li> </ul>		
<b>MAP 6 - 2003 Bear Butte Fire</b>	MAP progresses from MAP5 south along the 2003 Bear Butte Fire.	
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Fire continues to burn in high value Carbon Sequestration Project</li> </ul>		
<b>Action:</b>		
<ul style="list-style-type: none"> <li>• Construct handline as close as safely possible from South Biddle Pass M.A.P south toward the Deschutes NF boundary, into the 2003 Bear Butte fire.</li> <li>• IA any spot fires.</li> <li>• Use helicopter operations to minimize fire growth until secure line can be constructed.</li> </ul>		
<b>Resources:</b>		<b>Cost: \$1,000,000</b>
<ul style="list-style-type: none"> <li>• 5 IHC</li> <li>• 2 type 2 IA crews</li> <li>• 3 type 1 helicopters</li> <li>• 2 type 2 helicopters</li> </ul>		
<b>MAP 7 – Milk Ck Contingency</b>	Milk Creek from the base of Mt Jefferson east to MAP4	
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Should main fire cross direct suppression lines.</li> </ul>		

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<b>Action:</b>	
<ul style="list-style-type: none"> <li>Construct dozer/ hand line from Biddle Pass down into Milk Creek and use creek as a natural barrier. Prep line for contingency burnout, but burnout not preferred action.</li> </ul>	
<b>Resources:</b>	<b>Cost:</b> \$50,000
<ul style="list-style-type: none"> <li>1 type 3 dozer</li> <li>2- IHC</li> </ul>	
<b>MAP 8 – NW Bald Peter to Camp Creek Butte</b>	MAP ties to the NW side of Bald Peter and progresses NE to the Camp Creek Butte.
<b>Condition:</b>	
<ul style="list-style-type: none"> <li>Main fire moves north over direct attack M.A.P.s</li> </ul>	
<b>Action:</b>	
<ul style="list-style-type: none"> <li>Use Dozer/grader to open old jeep road just south of Camp Creek Butte, and prep NW Bald Peter Road for burnout.</li> </ul>	
<b>Resources:</b>	<b>Cost:</b> \$100,000
<ul style="list-style-type: none"> <li>2 dozers</li> <li>5-type 2 IA crews</li> </ul>	
<b>MAP 9 –Jefferson Ck Lava Flow</b>	Midpoint of east west portion of the Jefferson Creek lava flow.
<b>Condition:</b>	
<ul style="list-style-type: none"> <li>Fire has progressed south and is established mid-way through the lava flow, showing potential for spread.</li> </ul>	
<b>Action:</b>	
<ul style="list-style-type: none"> <li>Notify WSA Superintendent and CTWS Natural Resource General Manager of increased fire activity on the forest and intended actions.</li> <li>Analyze spread potential to the south and east based on current and predicted weather to evaluate threats to MAP 10 – Jefferson Ck Trail.</li> <li>Determine if a fire module could assist by monitoring growth of the fire to determine when holding actions would be needed. Or assign an engine to patrol and monitor fire spread daily from the J170 road.</li> <li>Evaluate location of a safe and effective spike camp. (in the wilderness or by camping on the ORWSA at road J170.)</li> <li>Ensure the communication plan is being followed to inform the staffs and the public of fire activity and smoke.</li> <li>If fire is well established south of MAP9 and west of MAP 10 consider area closures.</li> </ul>	
<b>Resources:</b> (7 days)	<b>Cost:</b> \$30,000
<ul style="list-style-type: none"> <li>1 Long Term Analyst</li> <li>1 Fire Module – if it is anticipated that fire spread will continue southward</li> <li>OR</li> <li>1 Type 6 Engine</li> </ul>	
<b>MAP 10– Jefferson Ck Trail</b>	The MAP starts from the heel of the fire on the south side of Bear Butte Ridge and progresses south toward the Jefferson Creek Trail then extends on the west side of the lava flow to the Jefferson Creek Trailhead.
<b>Condition:</b>	
<ul style="list-style-type: none"> <li>Fire spreads east toward this MAP and shows potential to spot and spread across the north/south section of the lava flow toward Mt Jefferson Wilderness eastern boundary and MAP 5 (J170).</li> </ul>	
<b>Action:</b>	
<ul style="list-style-type: none"> <li>Notify WSA Superintendent and CTWS Natural Resource General Manager of increased fire activity on the forest and intended actions. As needed obtain concurrence on taking action on the J170 road and coordinate closures.</li> <li>Analyze potential for fire spread to the east (beyond the Jefferson Ck Trail) based on current and predicted weather and modeled fire spread.</li> <li>Utilize bucket drops to stop easterly spread on the lava flow. <b>If buckets are unsuccessful after the first 24 hours of implementation reevaluate risk to air resources versus engines and crews firing the J170 road versus the damage to ORWSA resources.</b></li> <li>If potential exists or forecast project the fire will cross, order crews for burn out operation along J170 (MAP3) tying in from the Bear Butte 2 fire south to the Jefferson Creek.</li> <li>Ensure the communication plan is being followed to inform the staffs and the public of fire activity and smoke. Increase public outreach in Camp Sherman area, visitor use areas and follow communications plan left by the team.</li> <li>Evaluate the need to close Candle Creek Campground, Lower Bridge Campground, and Pioneer Ford Campground.</li> </ul>	

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<p><b>Resources:</b></p> <ul style="list-style-type: none"> <li>• 1 Long Term Analyst (2 days)</li> <li>• 1 Type 2 or better Helicopter</li> </ul> <p>If fire progresses toward J170 Road Order.</p> <ul style="list-style-type: none"> <li>• 1 Type 3 Team (5 days)</li> <li>• 2 Type 1 hand crews (2 days)</li> <li>• 2 Type 2 hand crews (5 days)</li> <li>• 3 Type 3 Engines (5 days)</li> <li>• 3 Type 6 Engines (5 days)</li> <li>• 2 Type 1 helicopters (3 days)</li> <li>• 1 Type 2 or better Helicopter</li> </ul>	<p><b>Cost:</b> \$319,000</p>
<p><b>MAP 11 – Cabot Lava Flow</b></p>	<p>Follows a midpoint on the Cavot Lava Flow from the Jefferson Creek Trailhead to the west south of Sugar Pine Ridge ending at the Cascade Crest near Junction Lake.</p>
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Fire actively spreading south toward MAP and threatens to continue spread toward the contingency line or Brush Creek Trail.</li> </ul>	
<p><b>Action:</b></p> <ul style="list-style-type: none"> <li>• Analyze probability of the fire reaching the south wilderness boundary near Cabot Creek or the Brush Creek Trail.</li> <li>• Evaluate the feasibility of holding and burning out along the trail as tied to the contingency line and prep line as needed. If scenario likely, order crews for preparing the Brush Creek trail in advance of the fire if not complete to day.</li> <li>• Order resources to fire and hold the contingency line, the Brush Creek Trail or both as fire predictions indicate.</li> <li>• Develop a firing plan utilizing anticipating upcoming weather patterns and best possible scenarios.</li> <li>• Ensure the communication plan is being followed to inform the staffs and the public of fire activity and smoke. Increase public outreach in Camp Sherman area, visitor use areas and follow communications plan left by the team.</li> <li>• If fire spread is probable south of this MAP consider area closures such as campground areas along the Metolius River and trail closures within the wilderness.</li> </ul>	
<p><b>Resources:</b></p> <ul style="list-style-type: none"> <li>• 1 Long Term Analyst evaluate feasibility of fire reaching trail or upcoming conditions to fire brush creek trail to contingency line</li> <li>• 1 Type 3 Team</li> <li>• 2 Type 1 hand crews</li> <li>• 2 Type 2 hand crews</li> <li>• 3 Type 3 Engines</li> <li>• 3 Type 6 Engines</li> <li>• 2 Type 1 helicopters</li> <li>• 1 Type 2 Dozer</li> </ul> <p>Brush Creek Trail</p> <ul style="list-style-type: none"> <li>• 2 Type 1 crews – prep trail and burning ops</li> <li>• 2 Type 2 IA crews – holding &amp; mop up</li> <li>• 2 Type 1 helicopters</li> </ul>	<p><b>Cost:</b> \$1,281,000</p>
<p><b>MAP 12 – Cascade Crest</b></p>	<p>Cascade Crest from toe of Mt Jefferson South to the Mt Jefferson Wilderness boundary.</p>
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Fire is actively spreading within 1 mile (east) of the Cascade Crest.</li> </ul>	
<p><b>Action:</b></p> <ul style="list-style-type: none"> <li>• Analyze fire spread to the west based on current conditions to determine if the fire will cross the crest.</li> <li>• Notify Willamette District ranger that activity has increased on the east side of the crest and share the probability of it crossing and where.</li> <li>• Ensure the communication plan is being followed to inform the staffs and the public of fire activity and smoke.</li> <li>• Consider trail or area closures if fire is expected to impact the Pacific Crest Trail or other trails within the wilderness.</li> </ul>	
<p><b>Resources:</b></p> <ul style="list-style-type: none"> <li>• 1 Long Term Analyst</li> </ul>	<p><b>Cost:</b> \$15,000</p>
<p><b>MAP 13 – Contingency Line</b></p>	<p>Contingency line from Candle Creek campground to the Brush Creek Trailhead – <b>(prepped by the IMT except for far eastern edge).</b></p>
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Fire is readily spreading through the Cabot Lava Flow progressing toward the contingency line.</li> </ul>	

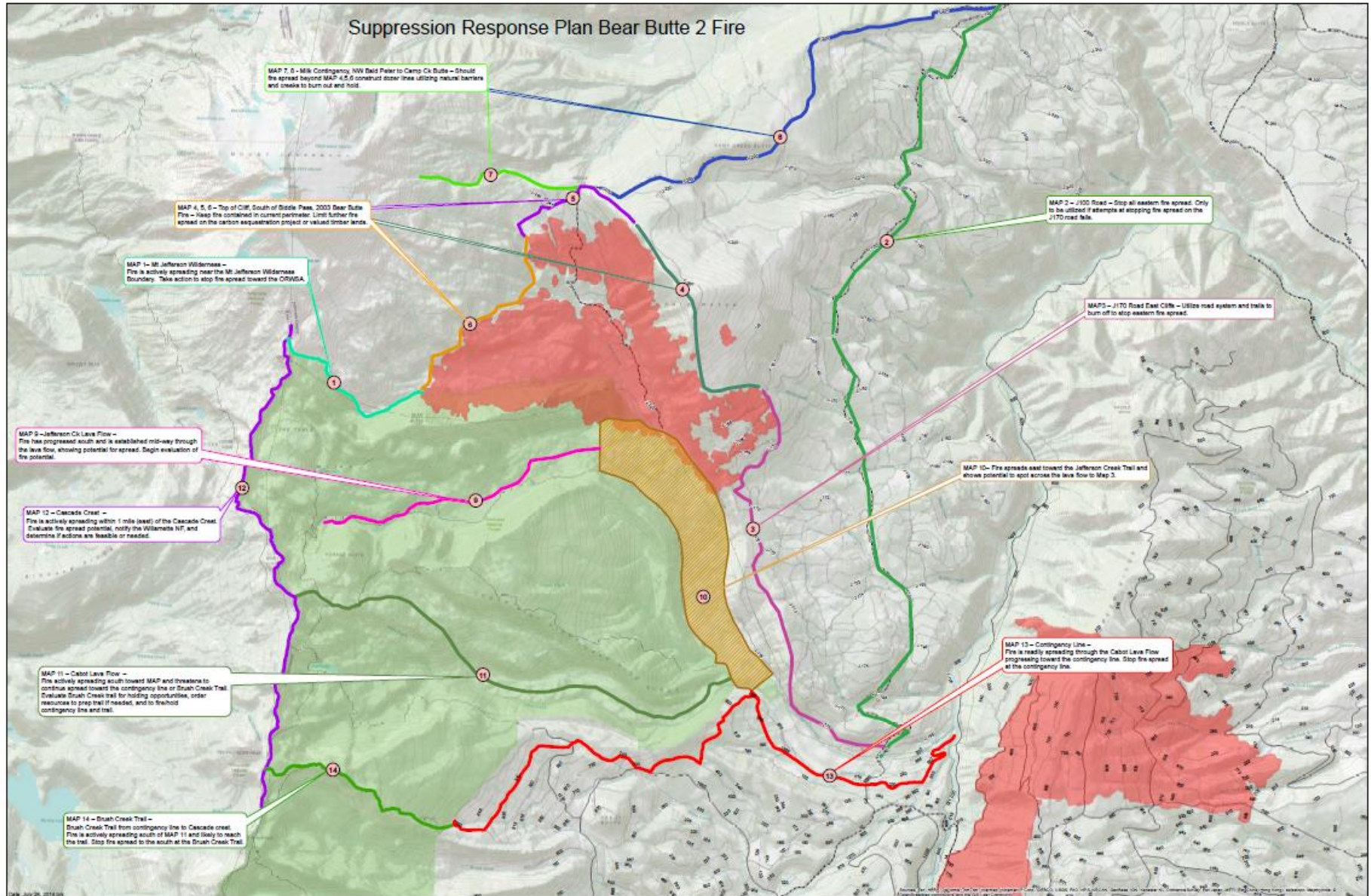
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<b>Action:</b>	
<ul style="list-style-type: none"> <li>Utilize resources to fire and hold the contingency line where necessary to stop fire spread to the south. This line has been prepped by the IMT with the exception of the far east side where dozer line must be implemented.</li> <li>Ensure the communication plan is being followed to inform the staffs and the public of fire activity and smoke.</li> <li>Close areas as needed to ensure safe operations.</li> </ul>	
<b>Resources:</b>	<b>Cost:</b> Calculated in the Cabot Lava Flow MAP
<ul style="list-style-type: none"> <li>Resources are identified in the Cabot Lava Flow MAP</li> </ul>	
<b>MAP 14 – Brush Creek Trail</b>	The southerly ridge line of Brush Creek ridge using a combination of trail and natural barriers from the contingency line to Cascade crest.
<b>Condition:</b>	
<ul style="list-style-type: none"> <li>Fire actively spreading south of MAP 9 and likely to reach the trail.</li> </ul>	
<b>Action:</b>	
<ul style="list-style-type: none"> <li>Complete prep of trail for burning operation. If this contingency line is to be utilized, significant work must be completed along the trail tying trail and natural openings together prior to implementation.</li> <li>Burn off trail to stop fire spread to the south.</li> <li>Close areas as needed.</li> <li>Ensure the communication plan is being followed to inform the staffs and the public of fire activity and smoke.</li> </ul>	
<b>Resources:</b>	<b>Cost:</b> Calculated in the Cabot Lava Flow MAP
<ul style="list-style-type: none"> <li>Resources considered in the Cabot Lava Flow MAP</li> </ul>	

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### Appendix A

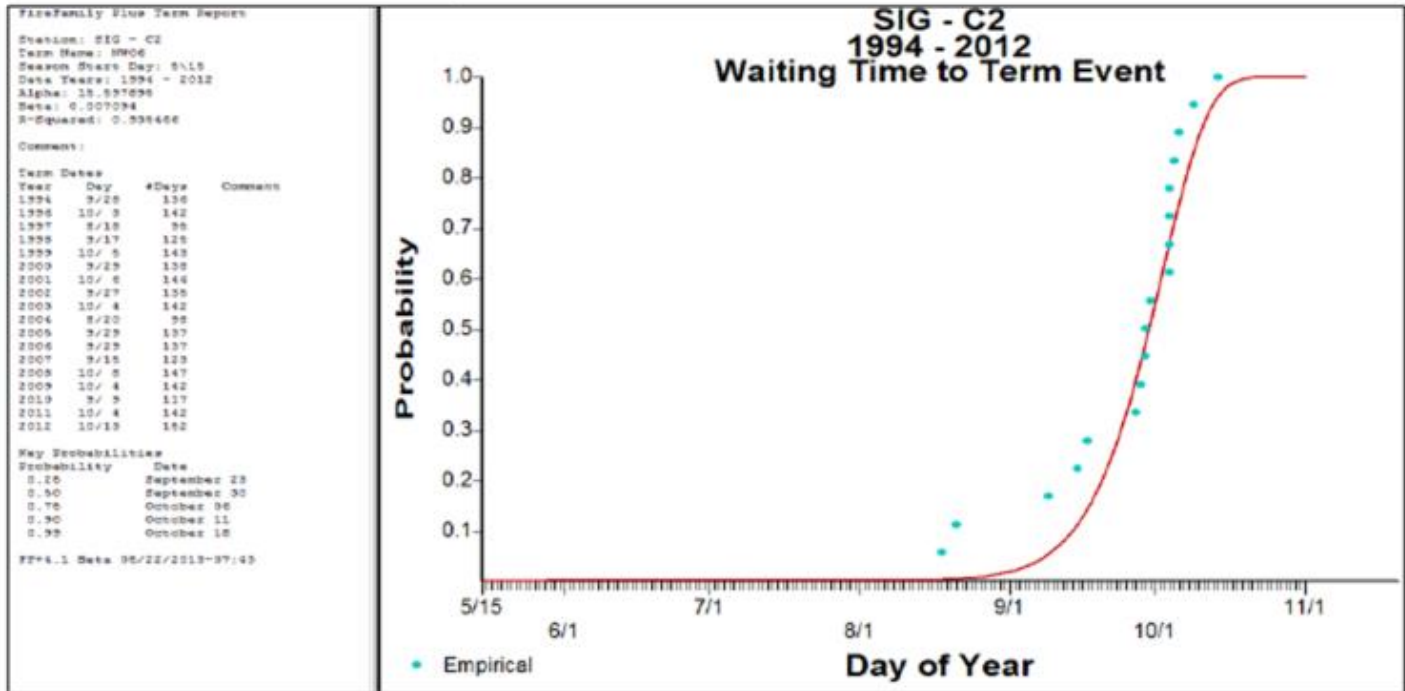
#### NW06 – Central Oregon

Season ending date estimates for central Oregon utilized the Predictive Services 7-day Significant Fire Potential Product. Given that the product determines the probability of a significant fire occurring, based on historical dryness levels and historic fire occurrence, the analysis results assume end of season when the product observed "green" (.1% probability of a significant fire event) for three or more consecutive days, and where periods of green were never separated by more than a single yellow and or brown day (5 to 10% probability of a significant event).

Large fire definition per NWCC predictive services for PSA NW06 is 1200 acres or more. The earliest large fire occurred June 30, 2008 and the latest large fire occurred October 11, 2009.

A TERM file was generated using FireFamily Plus v. 4.1. The season was set **May 15 to October 15** for the years **1994-2012** using the same rationale as above produced these results:

- 25% of the seasons end on or before September 23
- 50% of the seasons end on or before September 30
- 75% of the seasons end on or before October 6
- 90% of the seasons end on or before October 11
- 99% of the seasons end on or before October 18



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Appendix B

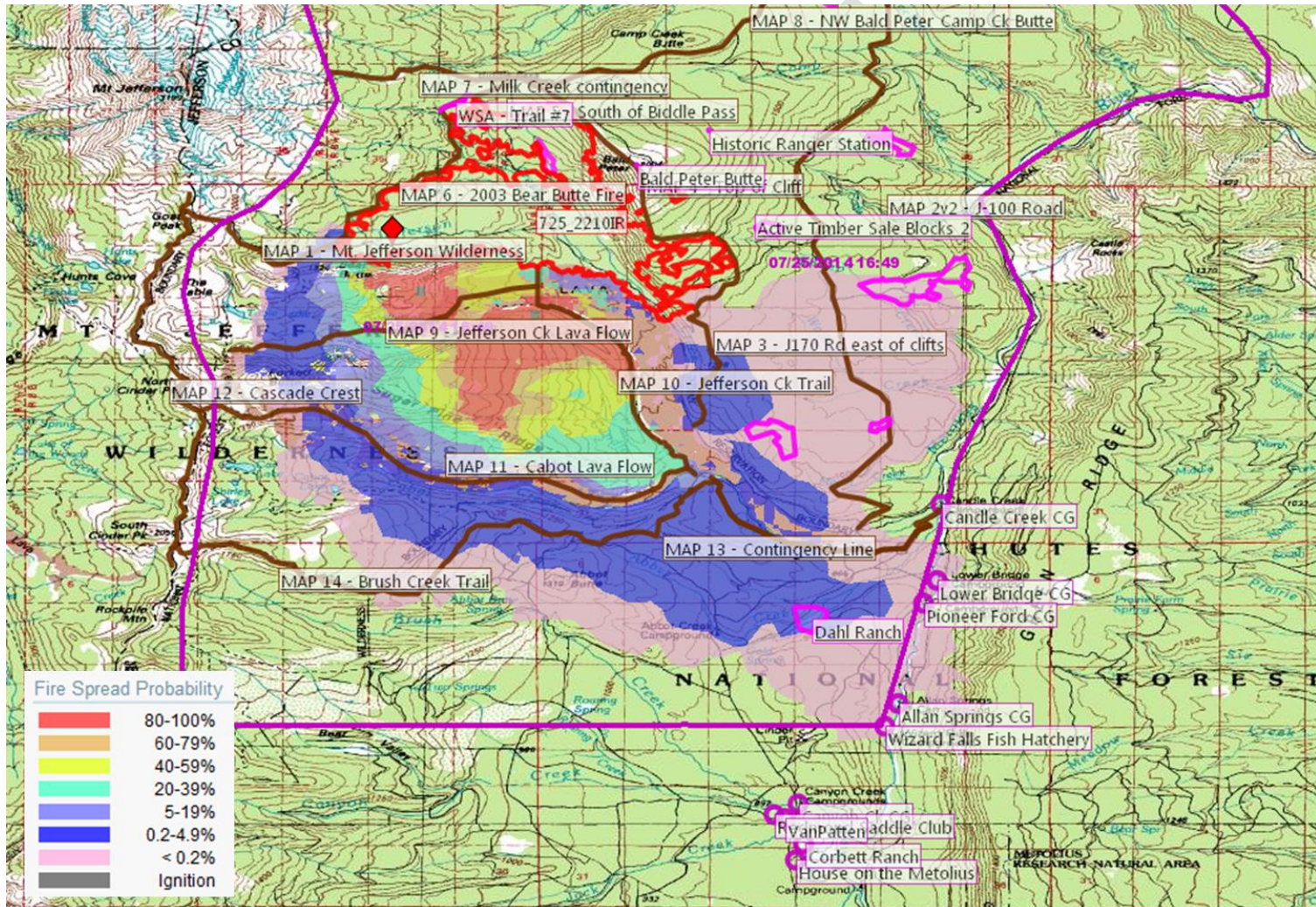


Figure 1: 14 day FSPro run starting 7/27

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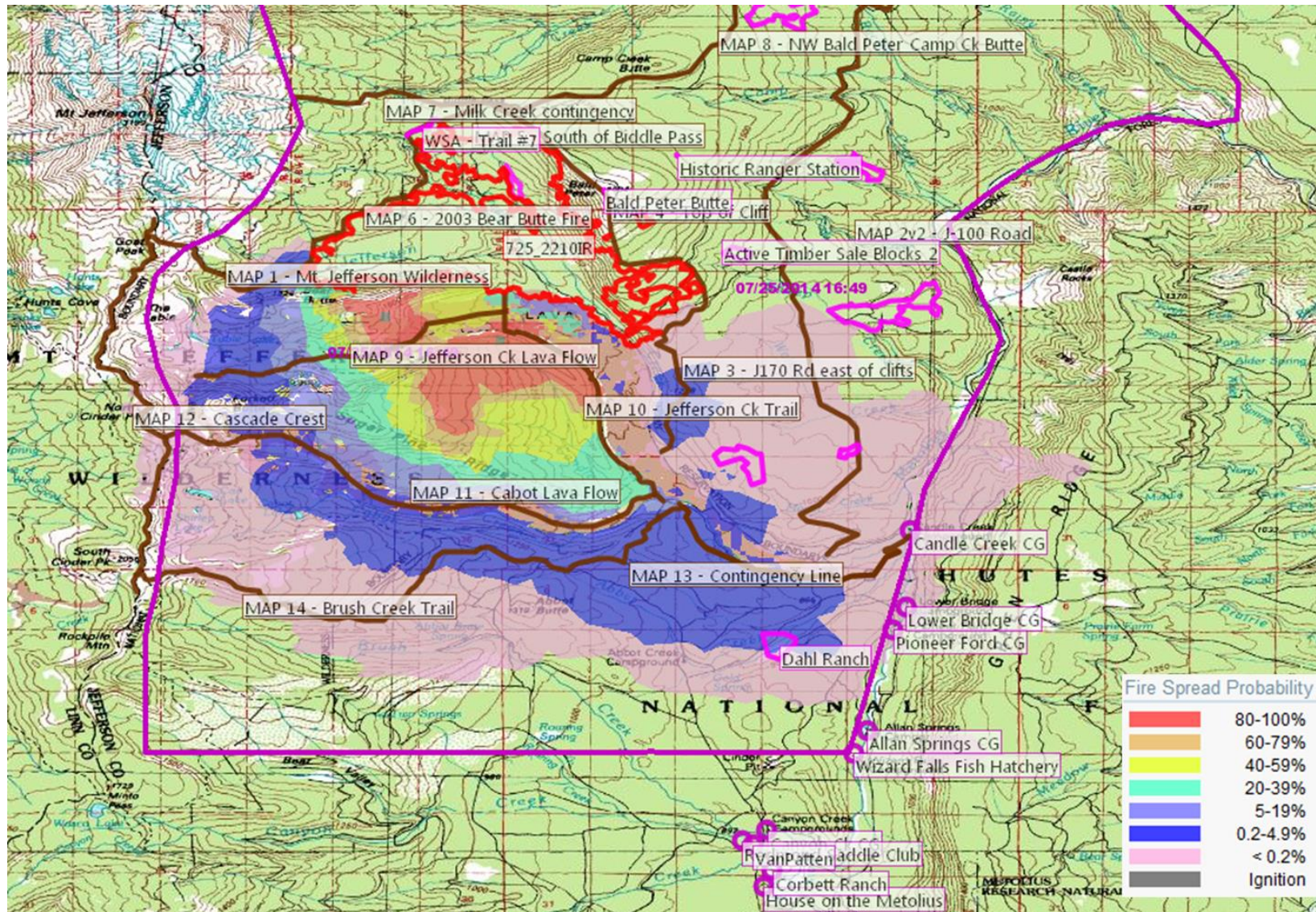


Figure 2: 14 day FSPro run starting 8/11.

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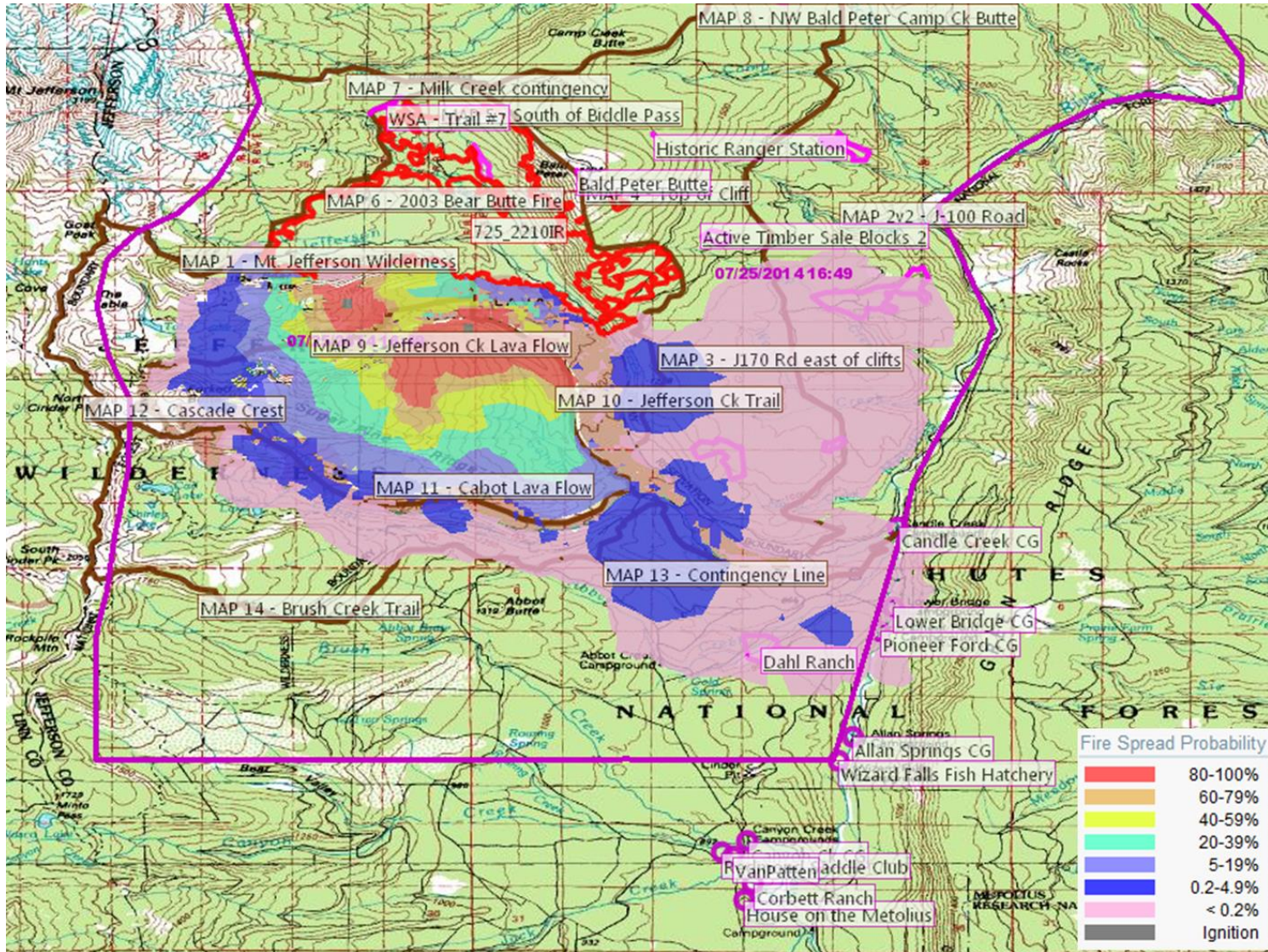


Figure 3: 14 day FSPro run starting 8/26.

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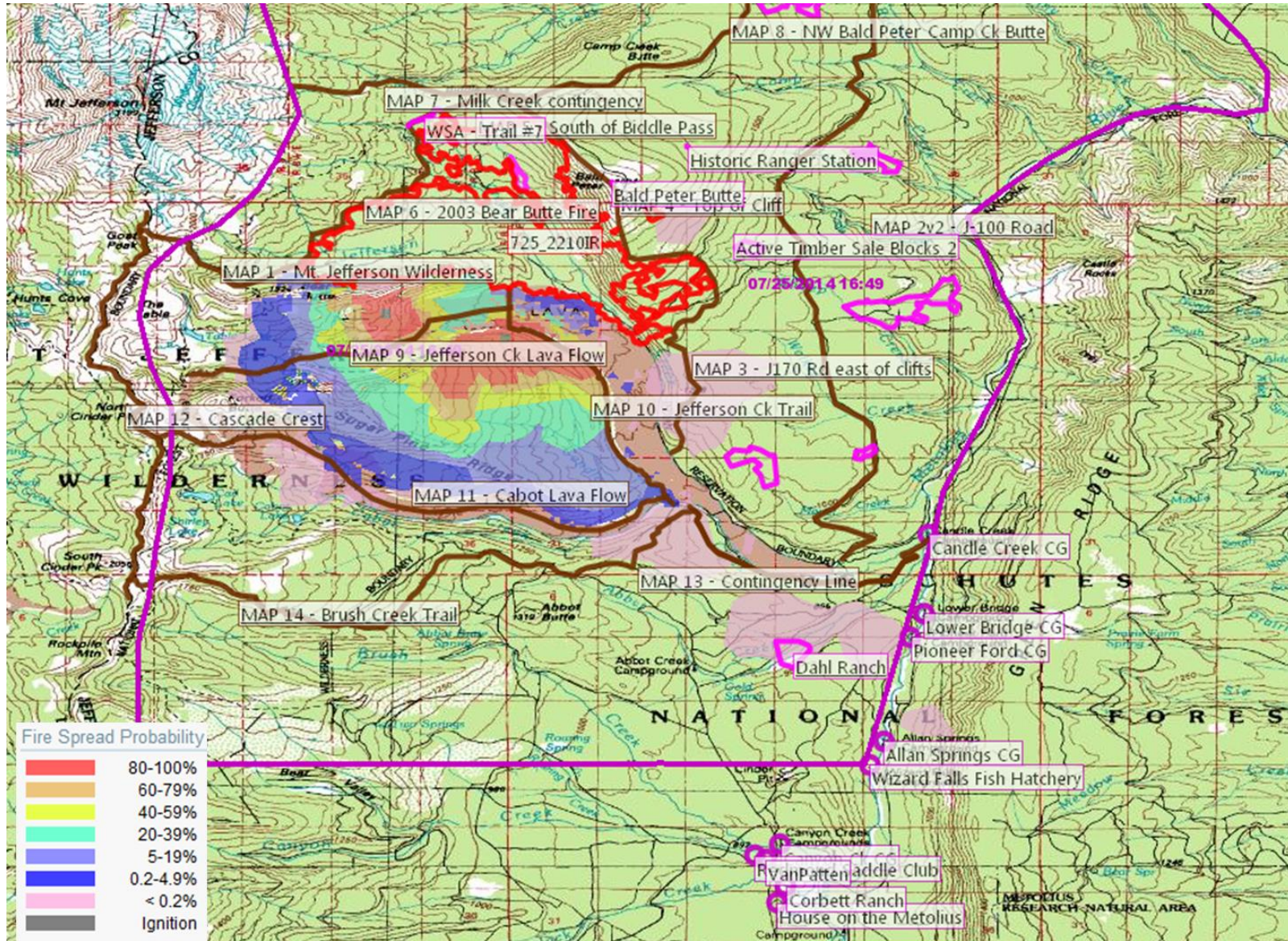


Figure 4: 14 day FSPro run starting 9/10