BOZE INCIDENT

Umpqua National Forest
Tiller Ranger District

Long Term Implementation Plan

September 21, 2009

Important Note:

This plan should be considered a living document, and needs to be validated and/or modified over time given any changes in the fire situation. If actions or probability of success change consult with the hosting Agency Administrator(s) of the potential changes to this plan and make the necessary strategic and/or tactical adjustments. Use this plan as the basic guide for the management of this fire for the duration of this incident.

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Special note: This team extends a special thanks to Mike Brown and Gabe Dumm for their invaluable assistance in the preparation and presentation of this plan.

Executive Summary

- The purpose of this plan is to assist fire managers as they make decisions regarding the Boze Fire through the end of the current fire season. Included is an assessment of expected weather and fire spread, a risk assessment, and operational actions to address threats to values at risk.
- The current suppression strategy is an indirect approach, using roads, ridges, and constructed lines to develop a 4500 acre “box” or planning area in the head of the French and Boze Creek drainages. This approach, if successful, is predicted to cost $7.9 million, with a containment date of October 1 and a moderate probability of success. The next several days will determine if this containment approach is successful; predicted weather conditions are the same as those of large fire days for recent fires in this area.
- Fire growth days in this area should be most often associated with hot, dry air under a strong high pressure ridge, resulting in low overnight humidity recovery, atmospheric instability, and an easterly flow of air. Strong winds are less likely to cause large fire growth on this site.
- The current fire season has exhibited fire danger indices well above average, and indications are that this will continue for the next 10-14 days. While the average fire season ends before September 16th, 10% of fire seasons in the records lasted beyond October 7. Thirty and 90-day forecasts favor a late end to the 2009 season.
- Fire Spread probability modeling indicates that the Boze Fire, allowed to spread unchecked, would remain on National Forest land even 30 days from now. Fire spread is in all directions, but the eastern edge of the planning area is least likely to be breached by a free-burning fire.
- An action plan, in the form of a set of management actions with associated costs, resources and time required, was developed to assist the local unit in developing future actions. This plan is intended to inform thoughtful decision making, not to direct actions.

Purpose:

This long-term plan is intended to validate and implement the selected Wildland Fire Decision Support System (WFDSS) Course of Action to meet objectives from the Land and Resource Management Plan, Fire Management Plan and those plans developed by the hosting Agency Administrator specific to current local socio-political and economic concerns.

This plan is a compilation of information pertinent to the extended management of the Boze Incident. The information presented in this plan includes values at risk from the fire as well as a preliminary plan for their protection. This plan must be validated prior to implementation to account for changes in weather, fire spread, and resource availability; recent experience with similar actions; or other factors that may alter or negate the need for action.

<u>It is essential that this plan be updated continually as weather changes, fire spread continues, and new information becomes available.</u>

The intended outcome of implementing this plan is to:

- Provide for public and firefighter safety
- Assist in protecting values identified as at risk
- Show the commensurate cost estimates

Introduction

A Long-Term Plan for the Boze Incident was initiated on September 17, 2009. The primary improvement values at risk are the historical Boze shelter and the Mud Lake shelter. Anadromous fisheries habitat, late successional reserves, Northern Spotted Owl habitat, heritage resources and dispersed recreation are the primary natural resource values at risk. The WFDSS and Delegation of Authority have identified the values to be protected, objectives and requirements, courses of action, and cost projections for the fire. This plan supplements the existing documentation for the incident. The purpose of this Plan is to assist the agency administrator by considering management actions as a component of the informed decision making environment.

This plan is intended to include a range of potential actions available to fire managers. Consideration of a wide spectrum of management options is encouraged depending on current and expected fire behavior and forecast weather. Use of this concept ensures that the necessary discussions have occurred and different options to respond to a range of circumstances have been considered. It is based on safety, objectives, environmental and fuel conditions, constraints, and the ability to successfully accomplish objectives.

Objectives of the Long Term Implementation Plan

This plan addresses the following items with the level of analysis commensurate with the complexity of the event:

- It considers mid-term and long-term fire spread predictions and risk assessments, and supports informed decision making. It identifies threats from the fire and addresses operational actions to mitigate or eliminate those threats.

- The plan evaluates the values to be protected, hazards presented by the fire and the fire environment, those associated with management actions, and the probability of success as well as the consequences of failure of the selected strategy.
- Risk analyses consider the current risk. Managers should also be considering deferred risk, understanding that an acre protected from fire today will eventually burn, at a time and under circumstances that will present different challenges and opportunities than at present.

It is important to accumulate the best available information in order to discuss, compare, and evaluate alternatives during the decision making process. Good, informed decisions can limit potential for excessive or unnecessary long-term suppression expenditures, and unneeded firefighter exposure. The implementation stage is where decisions are fully carried out and goals of achieving management efficiencies do not stop once implementation starts. Feedback to the decision-making process can occur as a result of improved information and decision support outputs during the implementation phase. ***Continual monitoring, evaluation, and revision as needed contribute to improved management efficiency.***

Key Suppression Objectives

- **Provide for firefighter and public safety.**
- **Given the limited values at risk and time of season, manage the fire in a way that prioritizes cost containment, limits firefighter exposure, and reduces suppression related resource damage.**
- **Keep the fire north of Forest Road 28, south of Forest Road 2715, east of the 730, 430, and 431 roads; and west of the 28 and 460 roads.**
- **To the extent possible and consistent with land managements plans, allow fire to play its natural role in this fire dependent ecosystem.**

Fire Behavior

The Boze Fire was started by lightning on the night of September 12-13, 2009 on a ridge between Boze and French Creeks in the Black Rock Fork drainage of the South Umpqua River, Douglas County, Oregon. Initial attack began on Monday September 14, at a size estimated to be 10 acres. Attempts at direct attack with initial attack forces were not successful, and an indirect approach was soon selected. Direct attack was made difficult by lack of access, steep slopes, heavy fuels, and rolling material, and the indirect approach was chosen in order to take advantage of topography, roads, and fuel conditions more conducive to fire fighting.

Fire spread has been primarily by common ground fire spread, enhanced by short uphill crown runs, torching, and limited spotting (although one spot fire about ½ mile NNE of the fire was detected during initial attack). Rolling material starting spotfires down hill is another fire spread mechanism observed on the Boze Fire.

A 4377 acre planning area was developed by fire managers, using roads and ridges, with the intent of stopping the fire within this area. Using dozers, handcrews, and existing roads, indirect firelines have been developed around this perimeter. Fire was applied by handcrews, starting on the northwestern edge of this area first, in order to secure these firelines. So far, this has been a successful approach, and fire has been applied to more than 3 miles of this perimeter.

Topography

The topography in and around the Boze Fire is generally characterized by dissected drainages with steep slopes and multiple aspects. The fire is located in the upper reaches of the South Umpqua River Drainage in the French Creek and Boze Creek drainages. Boze and French Creek both flow into the Black Rock Fork which then flows into the South Umpqua. The fire area is up near the hydrologic divide between the South Umpqua and the North Umpqua Rivers burning in a basin just below the main divide.

The ridge line, which is the hydrologic divide, generally runs east and west, between the two major drainages. The ridge line is relatively narrow and allows good access along the road system, however this rapidly chances with steep slopes falling off either side. Most of these side slopes are extremely steep and dissected by spur ridges and associated multiple aspects. This description is typical of both sides of the divide. The Boze fire is generally oriented on a southerly aspect with variations based on the spur ridges and dissected terrain.

From a larger perspective there is little change from this description; with the exception that north of the main ridge the general orientation is then northerly. But the overall terrain is dissected with multiple aspects and extremely steep.

Weather

The fire is in fire weather forecast ORZ 617 (Umpqua National Forest), in the Medford, Oregon forecast area. Weather forecasts and outlooks specific to the management of wildland fires are available at http://www.wrh.noaa.gov/firewx/?wfo=mfr. Our analysis primarily uses several RAWS sites, but primarily relies on the Toketee and Buckeye RAWS sites. We created a Special Interest Group (SIG) of the Toketee and Buckeye RAWS sites, mixed 50/50, in an attempt to more accurately depict weather at the fire site. Mount Stella was used to capture wind information, as it is at higher elevation than other RAWS sites in the area, and we used Grandad RAWS to characterize weather during the Rattle Fire of 2008.

STATION	RAWS NUMBER	ELEVATION	DISTANCE
Buckeye	353040	2400	10mi SW
Toketee	353038	3376	8.4mi NE
Mount Stella	353209	4715	16mi SSE
Grandad	353036	2904	17mi N

Table 1: Identification and location of Remote Area Weather Stations (RAWS) used in this analysis

Fuels

The fuels discussion occurs in two sections: 1) the immediate fire vicinity and 2) the surrounding landscape.

Fire Vicinity

Large timbered mixed conifer forests dominate the fire vicinity. Past management activities scattered through out the area breaks up the fuel continuity a little, however these management areas are not extensive. Younger plantations seem to be more dominated by brush species and regeneration less then 20 feet tall. These younger plantations currently are acting more as a barrier to fire spread due to the higher live fuel moistures of the brush species. Older plantations, with trees taller then 20 feet have developed a closed canopy and have shaded out the brush species. These plantations are burning and do contribute to the spread of the fire. There is a small area to the northeast of the fire near French Junction that is a combination of young regeneration and wet meadows. This area should serve as an effective barrier to fire spread. While this area is not large enough too totally check the spread of the fire to the east, but it will serve as a partial barrier. There are pathways of available fuels that could get around this area under the right conditions.

The predominant fuel models (FM) that represent the area are FM 10, 8, and 5. FM 10, characterized by heavy timber with a heavy dead and down fuel component, is the most prevalent fuel model in the fire area. This fuel model typically exhibits low to moderate rates of spread but burns at a fairly high intensity and has a high resistance to control. FM 8 is characterized by closed canopy timber with a short needled timber litter layer. Typically FM 8 exhibits low rates of spread and low flame lengths. FM 5 is characterized by low brush and can exhibit low to moderate rates of spread and flame lengths. Aspect and live fuel moistures are important with FM 5 as it can either burn fairly readily or at other times not at all. Surface fuels are sheltered from the wind and shaded from the sun throughout the area. There are herbaceous and woody vegetation mixed into the fuel beds.

Surrounding Landscape
There is little change in the fuels surrounding the fire area as most of the area is well timbered with mixed conifer species as well as past management activities scattered across the landscape. The above mentioned fuels models are well representative of the surrounding area. The one exception is the Tiller Complex fire that burned in 2002. There are two areas where the Tiller Fire is near the Boze Fire, one is directly south of the fire area across the 28 Road where Boze Creek flows into the Black Rock Fork. The other is approximately four miles to the west and southwest of the Boze Fire in the Mink Creek drainage. These Tiller Burn areas are dominated by grass with a sparse over story, representative of a FM 2. There is also significant dead and down material as well as numerous snags with in the old fire area. If the fire were to reach this area you could expect a significant change in fire behavior as the grass is cured, the fuels are not shaded, and the snags and heavy dead and down would lend itself to a very volatile fuel profile with a high resistance to control.

The other main concern adjacent to the Boze fire area is the Copeland Creek area to the north. This is a rather large roadless area consisting of heavy timber, FM-10 fuels. Though a northerly aspect, once a fire is established it would be difficult to control with out a significant commitment of resources.

Boze Fire – Long Term Assessment

This portion of the plan is in intended to support longer-term decisions regarding the management of the Boze Fire with information related to fire season length and severity, outlooks for the mid and long-range weather, and an assessment of triggers for fire spread and fire slowing events. Data sources include: Western Regional Climate Center, National Weather Service Climate Prediction Center, historical and current year weather records, the 2008 Rattle Fire Long Term Assessment and updates, WFDSS, and local National Fire Danger Rating System (NFDRS) data.

The long term outlook and seasonal severity prognosis is based on weather records from several RAWS sites in the Predictive Services Area, as well as sources of climatological information including but not limited to the Climate Prediction Center, the Western Regional Climate Center, Natural Resources Conservation Service, and the National Climate Data Center. We also used several evaluation tools including Fire Family Plus, Fire Spread Probability (FS Pro), FlamMap, and the Rare Event Risk Assessment Process (RERAP).

Seasonal Severity - Climatology

Key Question: How typical is the fire season of 2009 for the Umpqua National Forest?

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, dropping through September and October. Some years, however, ERC values can reach the 97th percentile in mid-October. In 1987, for example, fires in southern Oregon burned into late October, and weather records show that the ERC was above the 90th percentile until October 28th.

In most years the ERC drops starting in mid-September as a result of cooler conditions, precipitation, lower sun angle, and shorter day length. This year (2009) was fairly typical through the first week in August; then an unusual rain event in early August caused a 10 day depression in ERC. Since then, seasonal severity has floated between the 90th and 97th percentile levels.

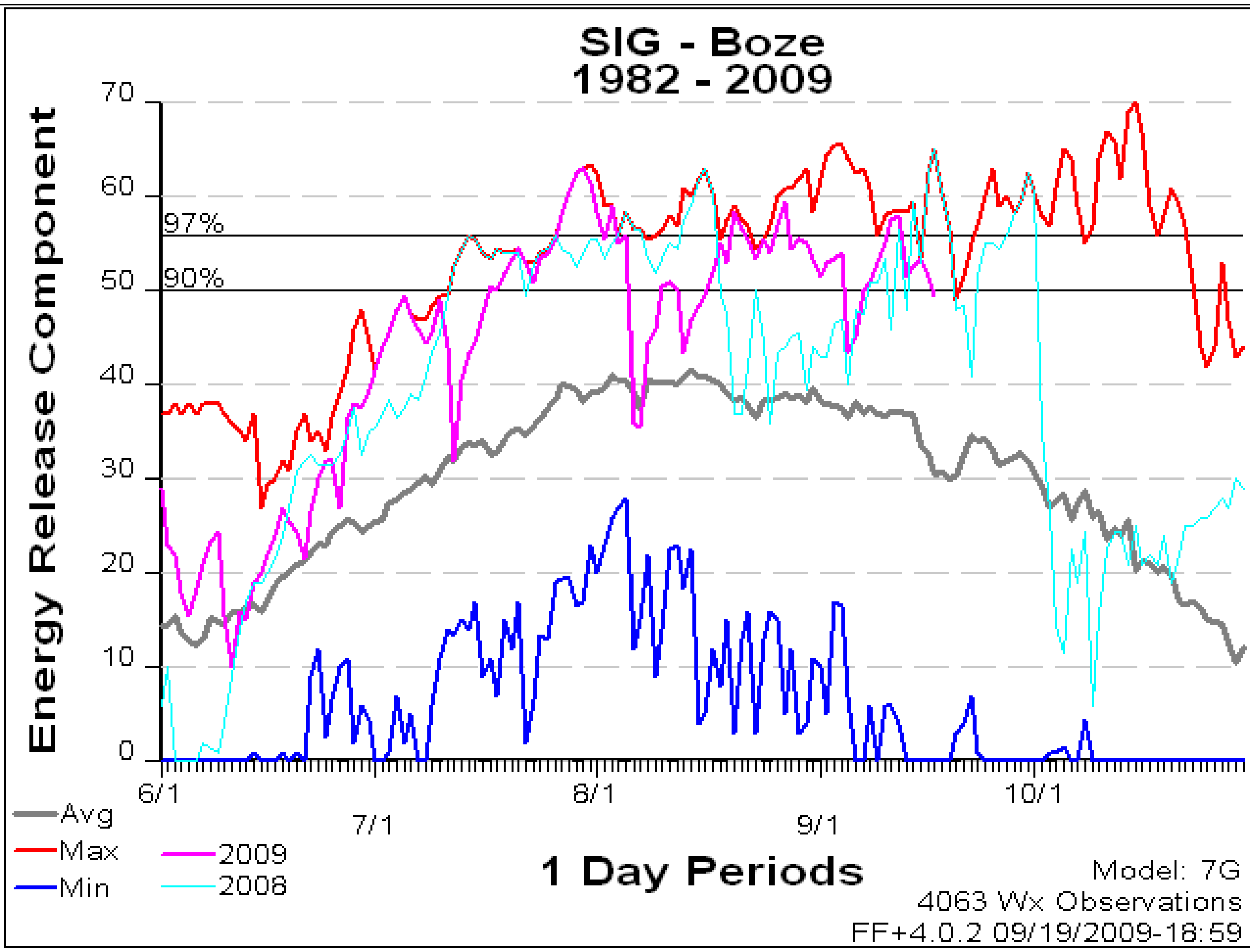


Figure 7 - ERC graph for the Boze SIG, highlighting 2008 and 2009 to date. Note that in 2008, record high ERC values were recorded in mid and late September.

Large Fuel Moisture
Other measures of seasonal dryness and potential fire behavior are the calculated hundred (100) and thousand (1000) hour fuel moistures (large dead woody fuels). Heavy fuels are slow to respond to moistening and drying, requiring extended duration precipitation to recover substantially. Fire season 2009 has been a dry season by this measure, with current fuel moistures setting records for the date.

In normal seasons, heavy fuel moisture stays depressed until the arrival of fall rains in October. This year, for the next 10 days at least, fire managers should expect these fuels to remain dry and available to contribute to ground fire spread, as a fuel bed receptive to spotting, and as a heat source for adjacent and overhead fuels.

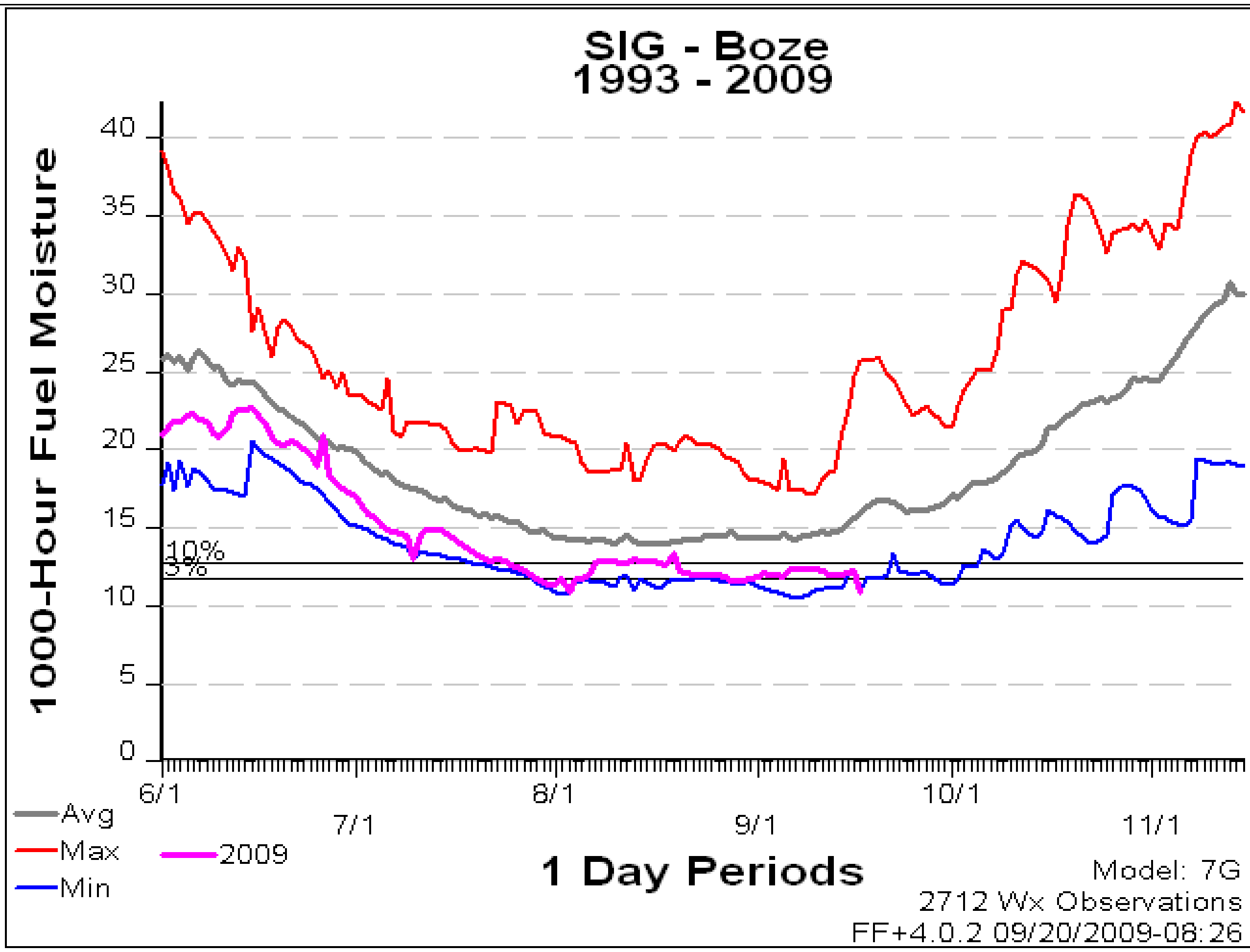


Figure 8: 1000 hour fuel moisture calculated from daily weather observations at the Toketee and Buckeye RAWS, highlighting 2009 data to date.

Fire Growth Events

Key Question: What weather events are associated with fire growth, and how many of these events should be anticipated before the end of the season?

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. These growth days can be associated with wind events, with warm and dry airmasses, with atmospheric instability, or simply the proper alignment of fuels, slope, and fire.

Winds

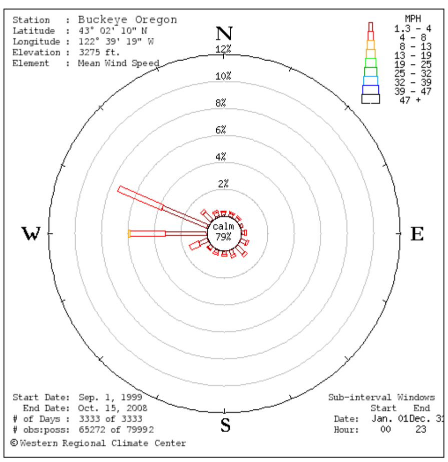
Key Question: What are the implications of typical wind events in this area for growth of the Boze Fire?

We evaluated the susceptibility of this fire area to problem winds by considering two different wind scenarios that are likely during the late summer and fall: east winds and southwesterly frontal passage winds. These wind events could support rapid fire movement through long range spotting. Three elements are involved 1) an ignition source, specifically lofted fire brands from group torching of conifer trees, 2) high wind speeds to carry fire brands to fuels outside the fire perimeter, 3) receptive and available fuel outside the control lines.

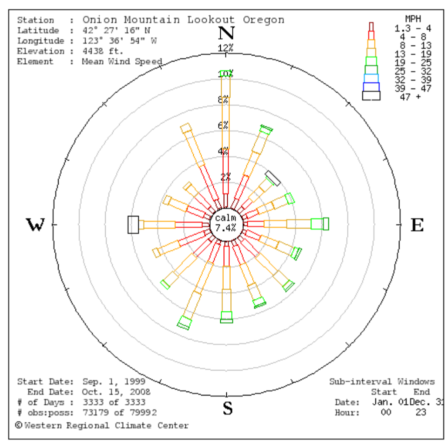
This analysis utilizes data from RAWS sites. Buckeye RAWS was used for frontal passage winds, but a wind rose analysis showed that east winds are not typical at this site. Therefore, the Onion Mountain RAWS station on the Rogue River National Forest was used to acquire necessary data to forecast an east wind event. Wind rose graphs were created for the months of September and October, for the years 1999-2008. All 24 hours were analyzed to capture wind speeds and direction for east wind event episodes.

Figure 1: Buckeye & Onion Mountain Lookout RAWS Windrose Data September 1 through October 15 1999-2008.

Buckeye Oregon



Onion Mountain Lookout Oregon



We used the WindNinja Model to show the effects of each wind event scenario across the landscape. WindNinja is a computer program that computes spatially varying wind fields for wildland fire application. It requires elevation data for the modeling area (in the form of an ASCII Raster DEM file, and a FARSITE landscape file (.lcp)), a domain-mean initial wind speed and direction, and specification of the dominant vegetation in the area. The diurnal slope flow model was optionally turned on to reflect the wind effects for a 24 hour period. Outputs of the model are ASCII Raster grids of wind speed and direction in a .kmz file format (for viewing in Google Earth). Diurnal slope winds are caused by warming of mountain slopes by daytime sunlight or cooling by nocturnal radiation. This heats or cools the air adjacent to the slope, causing buoyant forces that produce flow up or down the slope. These slope winds may induce valley winds that are aligned up or down the valley. During the daytime, a slope's orientation to the sun can affect its rate of heating and, therefore, the strength of the diurnal wind. Other factors affecting the diurnal wind strength are how well sun energy is absorbed by the ground surface and transferred to the air, how cloudy it is, and how steep the slope is. The diurnal slope flow model included in WindNinja simulates the effects of diurnal slope winds. It is designed to compute small scale slope winds, but not larger scale valley winds. The slope winds will have some effect of producing valley winds, but it will be slight. Also, the model does not simulate other buoyancy driven flows such as sea or land breezes. Use of the diurnal wind model in WindNinja adds additional input requirements. Most of these inputs (date, time, latitude/longitude, etc.) are the result of having to compute the solar angle at locations across the terrain.

WindNinja Data

	Input	Output
Surface	LCP file extracted by WFDSS	Vegetation/Elevation/Slope/Aspect
Diurnal Winds	Lat./Long./24 hr data	24 hr trend/terrain influence
Wind	20 ft winds/24 hr avg.	Vector(s)/Speed

Table 2: Inputs and outputs for the WindNinja Model

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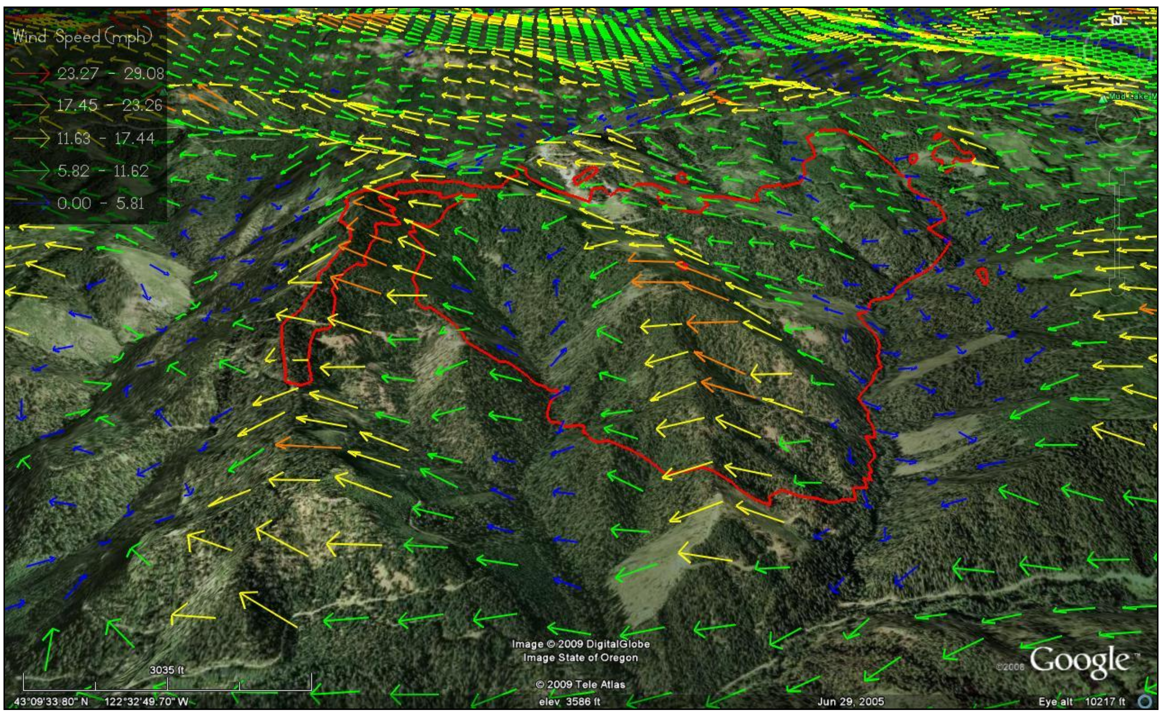

Figure 2: WindNinja Run E Wind (90° vector). View looking North

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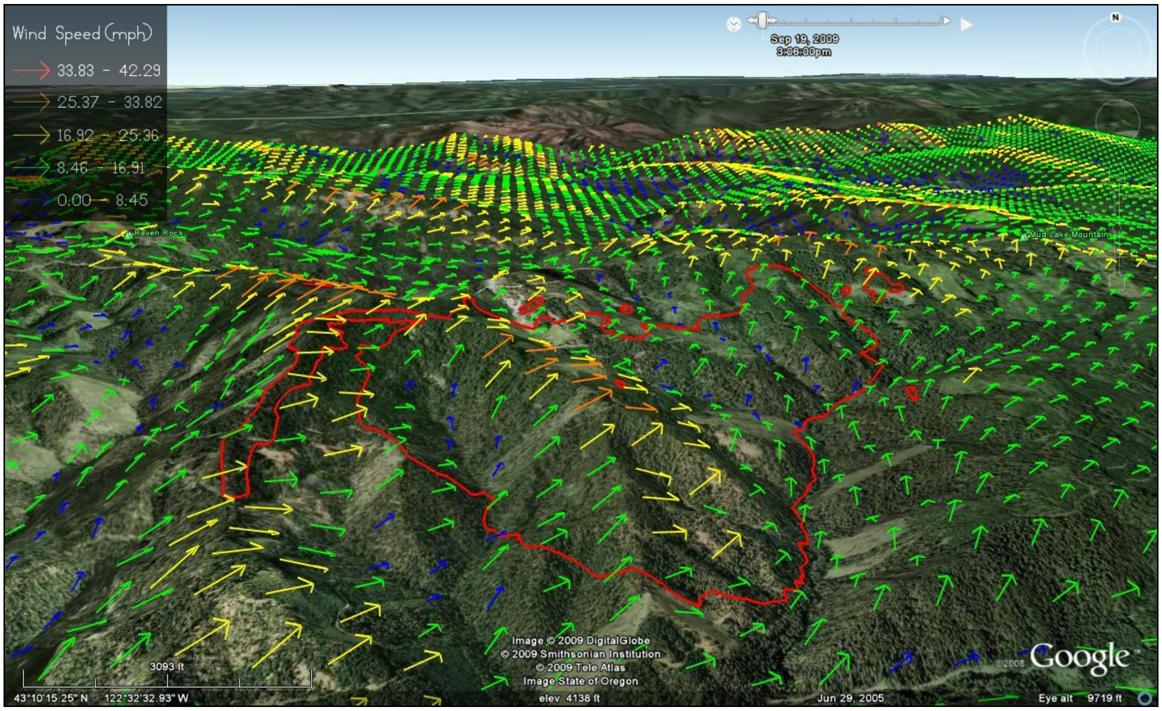


Figure 3: WindNinja Run Southwest Wind (225° vector). View looking North

Summary

Based upon historical weather analysis, input from local knowledge, and pc based modeling; there is little evidence supporting an east wind event occurring over the fire area (approx <2% occurrence). Historical data (1999-2008) suggests strong east wind events for the Buckeye RAWS fall between 3-8 mph and 95% of the east wind "events" have a sustained <6mph wind. No east wind event sustained higher than 13 mph. In the past 15 years, east wind events occur on average 7 times from September 1 through Oct 15. Models support empirical evidence that exposed ridges are most susceptible to east winds. Exposed ridgetops; (Mud Lake Mountain to the northeast, Raven Rock to the northwest, and Little Black Rock to the south) will see the greatest exposure to gusts and may produce some eddying effect down through the valley. Lower slopes and valleys are more sheltered from the east winds; the two main drainages Boze Creek and French Creek should be protected enough to only see localized terrain influence. The model also suggests that winds will primarily be terrain driven and diurnally enhanced but not expected to contribute to problem fire behavior.

The second wind analysis looks at the potential of a southwest wind (225° vector) and its effects given the slope orientation. Southwest winds are much more common and diurnally enhanced with daytime heating. Data suggests that the strength of these winds will generally be less than 8 mph and occur <3% of the time during the analysis period. The wind slope alignment with a sufficient heat source could potentially produce enough intensity to initiate short duration runs.

The Boze fire is positioned topographically in a very sheltered drainage. The topography is very dissected and fragmented and allows many areas of the fire to be protected from general winds. Local and diurnal influences (slope/valley) will have greater impacts on fire spread.

Dry, unstable air

Key question: What is the influence of strong high pressure systems on fire behavior of the Boze Fire?

A typical fall weather pattern in western Oregon is for a large high pressure ridge to move in, dominate weather for a few days and block the approach of systems from the west. This type of ridge will create hot, dry, and unstable conditions favoring fire growth across broad areas. Hot and dry air creates lower humidity, particularly low overnight humidity recovery, which rapidly dries out dead fuels and live vegetation and increases the number of hours of fire activity during the daily burn period.

In many ways, the Rattle Fire of 2008 provides a good indicator for what fire behavior can be expected from this fire for the rest of the season. The fire was located about 7 miles north of the Boze Fire, in the same elevation range, and with much of the same forest types. Two large fire growth periods in September are evident from the Rattle Fire progression records: one from September 14-16, and the second September 29-30. The earlier event saw the fire grow from 4100 acres to 14,000 acres and in all directions, indicating that wind did not have a significant influence on fire spread. In both events, fire growth was driven by low humidity (especially indicated by overnight humidity recovery less than 35%), followed by periods of relatively minor fire growth under moderating conditions (Figures 4, 5, and 6). Daytime temperatures were in the 90-100 range at Grandad RAWS, and daytime humidity in the low teens. The second event was followed by a season-ending rain starting on October 3.

Attribute	**9/16/08**	**9/29/08**	***Predicted* 9/22/09**
100hr fuel moisture	6%	7%	7%
1000hr fuel moisture	9%	10%	
ERC	73	71	65
Overnight humidity	28%	37%	

Table 3: Fire weather conditions during two periods of rapid fire growth, Rattle Fire, 2008, and compared to forecasted values for Tuesday 9/22/09

An evaluation of historical weather records indicates that about two episodes of dry, unstable air can be expected during between September 15 and October 31 on the Umpqua NF. These events generally last 2-3 days before the ridge is broken down by approaching low pressure from the west. We recommend fire managers monitor predicted overnight humidity recovery, using a relative humidity of less than 40% as a good indicator of large fire growth days.

One such event appears to be imminent during the period of 9/21-23/09. Figure 4 is an ERC trace for the Buckeye RAWS, with the projected PSA-wide ERC values for the next 10 days projected on this trace. With at or near record ERC values predicted during this period. this could very well be a period of active fire behavior, with a well ventilated fire, unstable atmosphere, and dry fuels directly adjacent to uncontrolled fire edges.

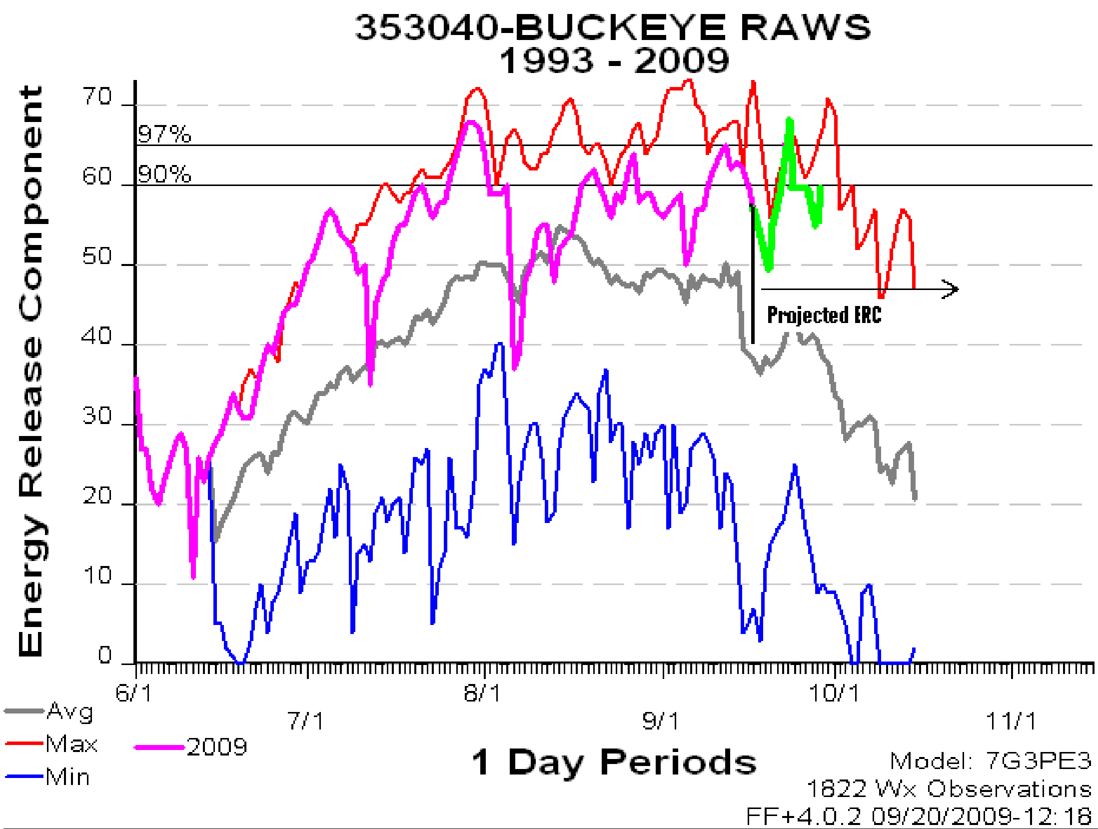


Figure 4: ERC trace for the Buckeye RAWS site, with 2009 values highlighted and projected out 10 days from 9/18.

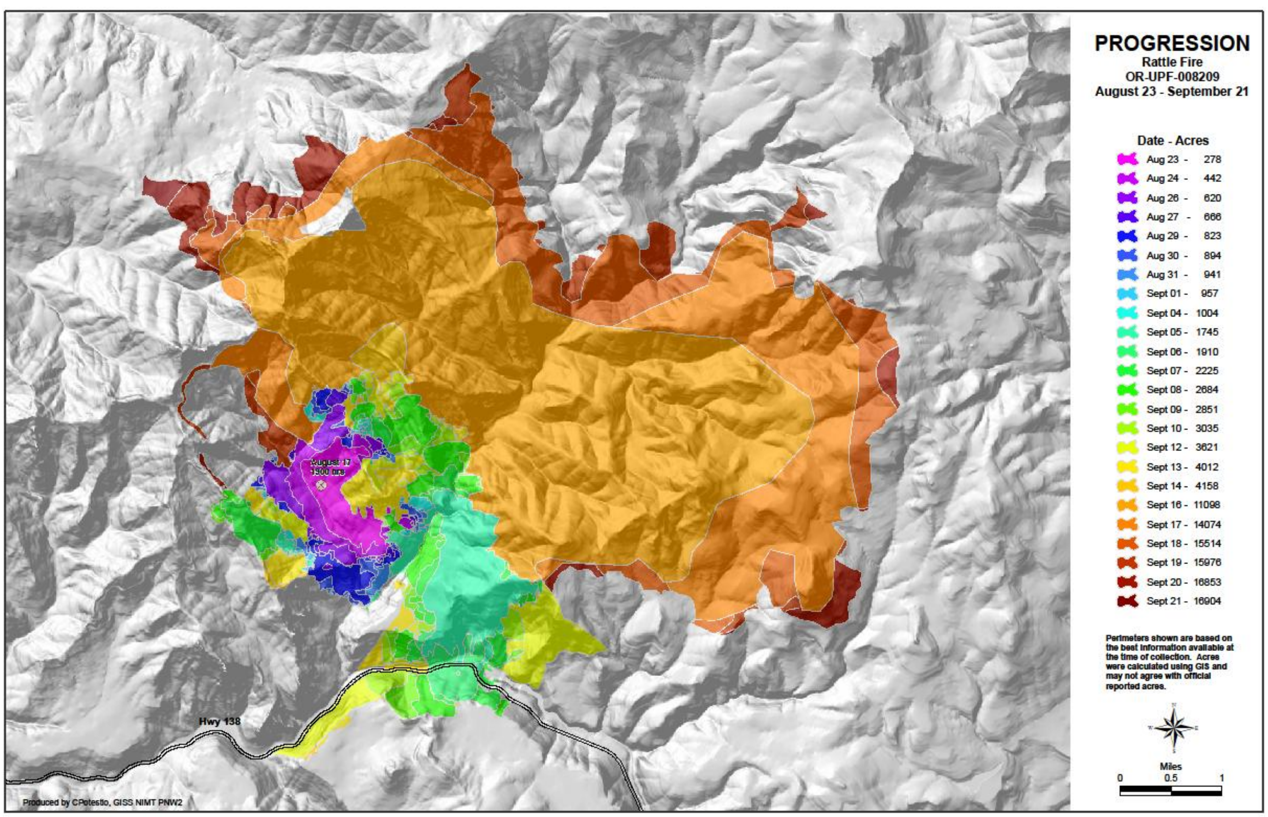


Figure 5: Rattle Fire progression map, 2008. A period of large fire growth Sept 14-16 with fire spread to the north, east, and west, indicating little wind influence.

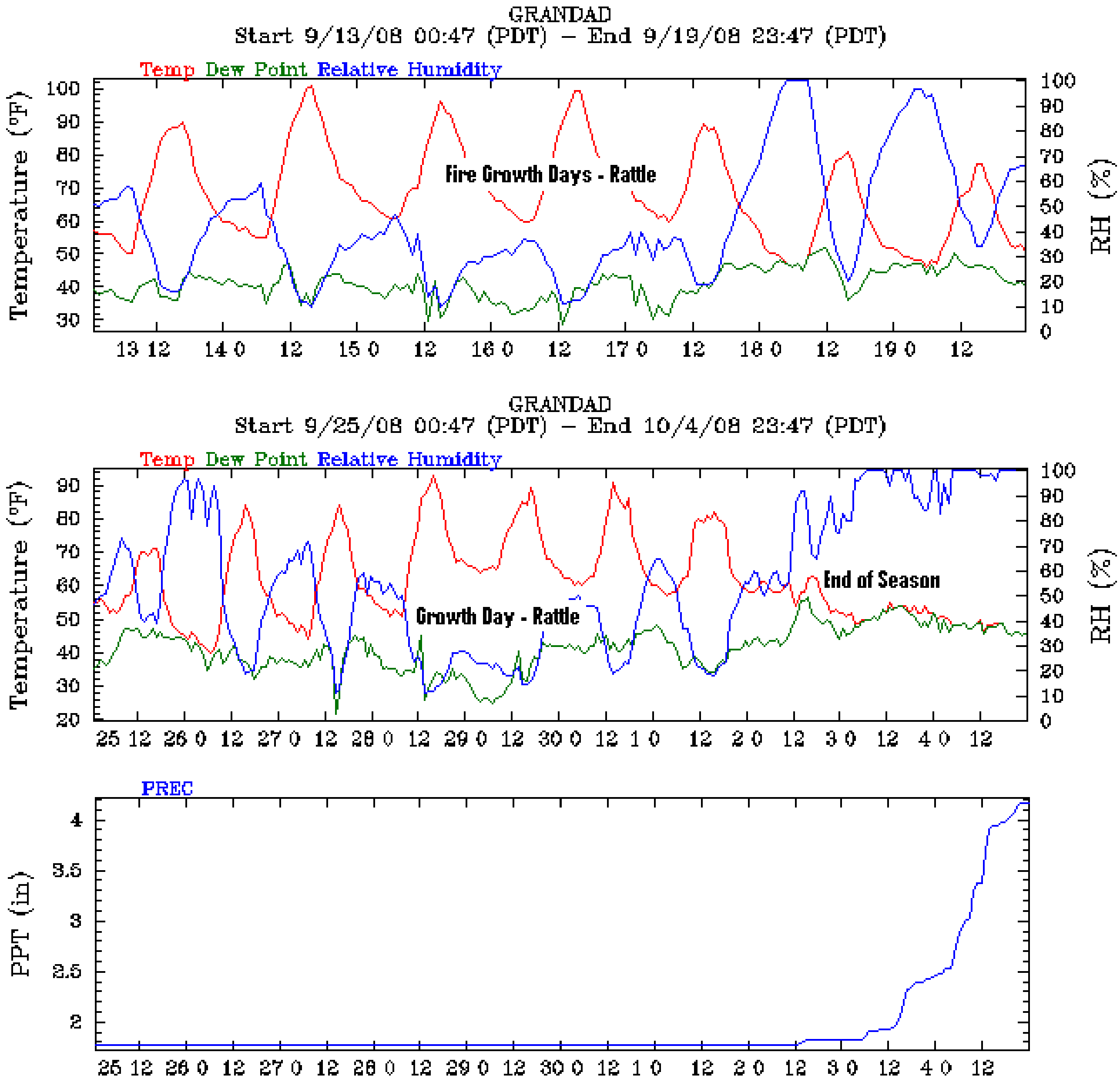


Figure 6: RAWS trace for temperature and humidity preceding and during large growth days for the Rattle Fire (2008), Umpqua NF, Diamond Lake RD. Note in both instances the poor overnight humidity recovery immediately prior to and during fire growth periods.

Long Term Outlook

Long Range Forecast

Key Question: What is the longer range weather forecast for the remainder of the fire season?

The 2009 long range forecast is for a warmer and drier than normal late summer and fall across the Pacific Northwest (figures 9 and 10). These predictions would favor a later than normal season-ending date this year.

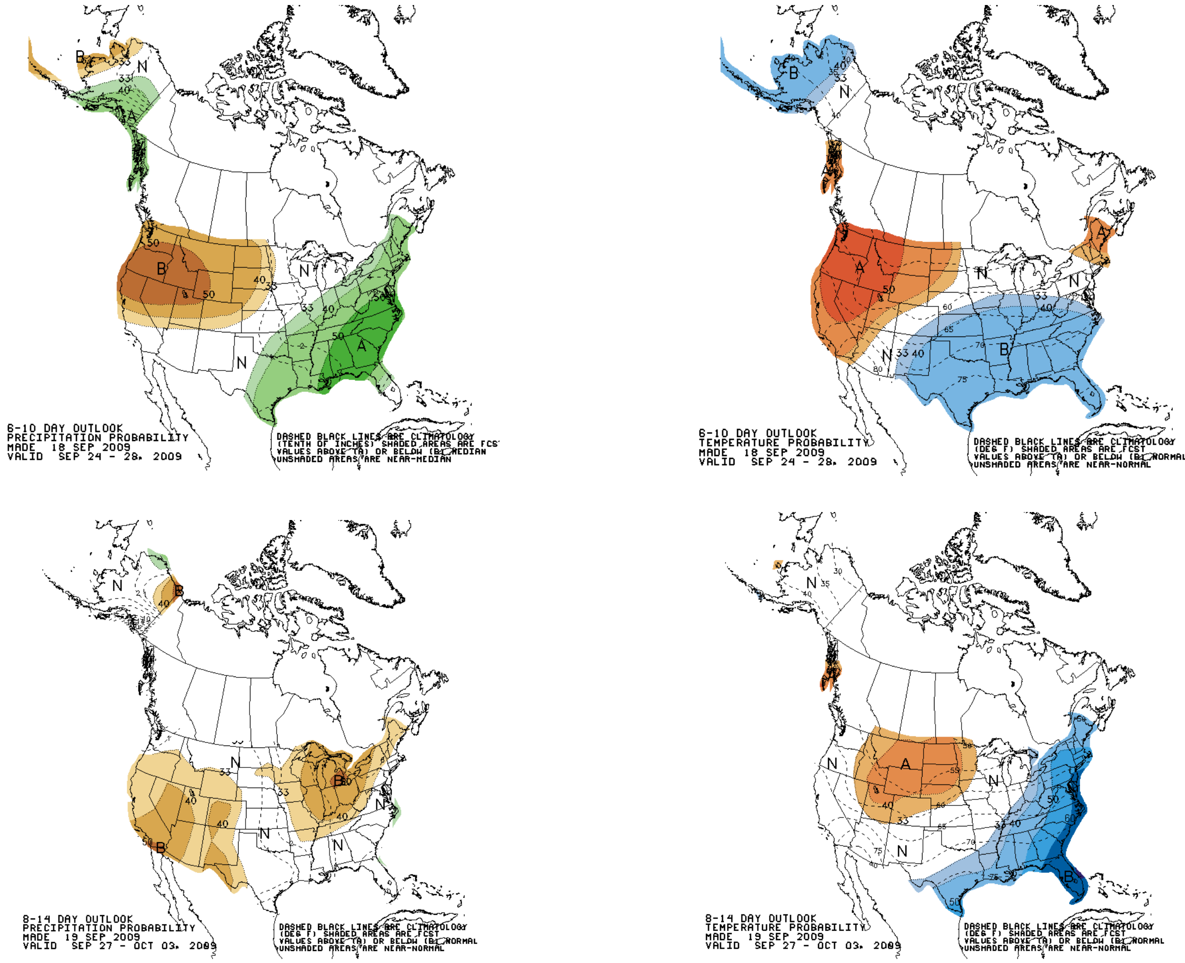
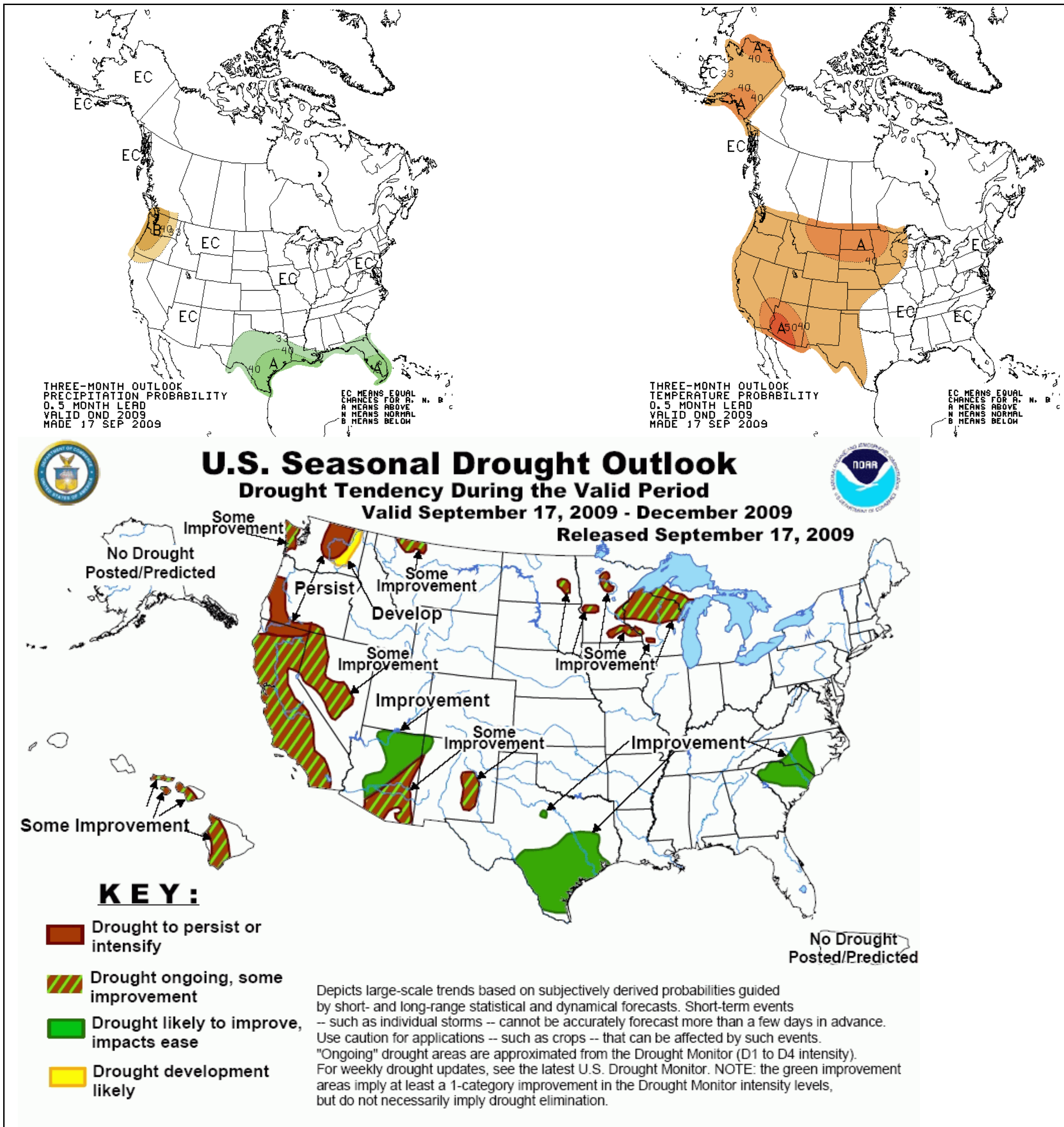


Figure 9 – 6-10 day and 8-14 day probabilities of temperature and precipitation for the continental US. Generally warmer and drier than normal conditions are predicted to persist through the period.



Figures 10: outlooks for temperature, precipitation, and drought conditions for the continental United States, September-December, 2009. The inland Pacific Northwest is forecasted to have a drier than normal fall.

Potential for Fall Frost

Key Question: Will a killing frost change the availability of fine dead fuels before the end of the fire season?

Live green herbaceous and shrub vegetation are currently not available fuel. After a hard frost, followed by warm and dry weather, these fuels can become available, and this could increase fire spread potential, especially in the upper reaches of the French Creek drainage. The question to be asked, then, is whether or not this first killing frost will occur prior to the end of fire season.

We evaluated weather records at several RAWS sites looking for first hard freeze date (low temperature less than 28F). Most of the RAWS sites did not record a killing frost in the annual time period that weather data was available (generally Oct 15-Nov 1). The Toketee RAWS site is an exception, and figure 11 displays the term file graph for the first hard frost.

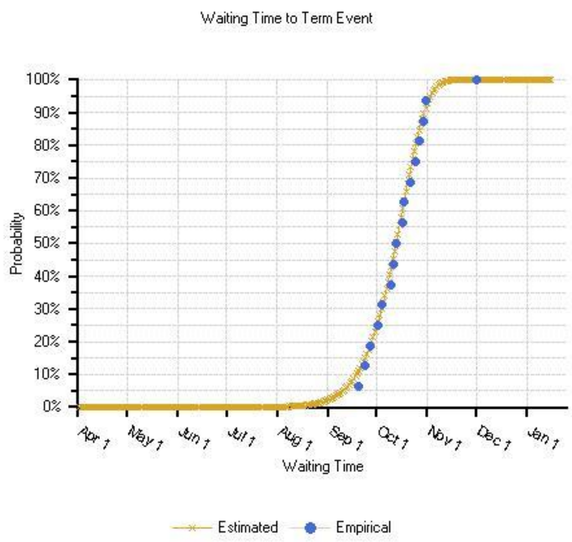


Figure 11: Term file graph for the first hard freeze recorded at the Toketee RAWS site.

The mean date of the first frost is about 10/13, and 90% of the time the first frost is before 10/30. While about 10% of the seasons had a killing frost by mid-September, it is likely that the first hard frost for the Boze fire will occur after the season-ending event.

Seasonal Severity Changes
Key Question: Is recent seasonal severity changed from historical seasonal severity?

ERC values are available for the past 27 years at the Grandad weather site, providing the opportunity to explore whether or not recent seasonal fire danger is trending to be more or less severe than the past. This comparison seems to indicate that, on average, ERC during fire season is about 15 points higher during the past 13 years than the 13 year previous, although the length of the season appears quite similar.

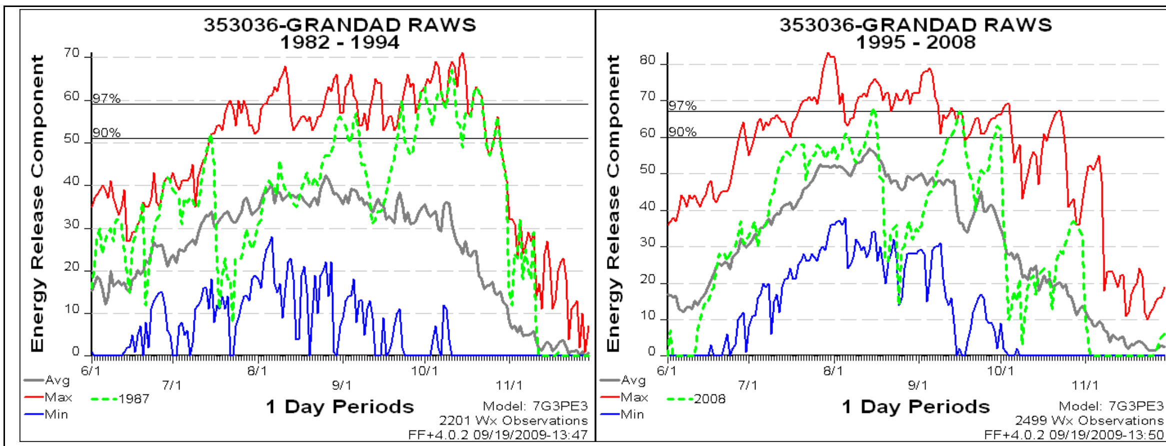


Figure 12: Comparison of ERC for the period 1982-1994 and 1995-2008 for the same RAWS site (Grandad) on the Umpqua NF. Note that the 90th and 97th percentile ERC value has increased about 10 points between the two time periods, and the peak average value is about 15 points higher.

Season Slowing Events

Fire season often continues into mid-October on the Umpqua National Forest. Several weather events including cool temperatures, seasonal rain showers and extended periods of high relative humidity temporarily reduce the fire risk and moderate fire weather indices. These events minimize the growth of ongoing fires and provide for a greater success rate for initial attack. It is not uncommon for weather to drastically transition to more summer like conditions bringing a return to very hot, dry unstable conditions. Fire behavior responds accordingly with a return of high to extreme burning conditions. We defined a fire-slowing (season-slowing) event as .25 in of precipitation over a three day period between September 1 and October 15 and the Energy Release Component (ERC) dropping below 80th percentile. On average, about 3 of these events occurred during the analysis period the past 16 years as recorded at the Buckeye RAWS site.

Example of season slowing events occurred in 2008 on the Rattle Fire (directly north approx. 7 miles). The Grandad RAWS recorded .5 inch of rain on 7/4, .9 inch on 8/17-21, .3 inch on 8/25 and .07 inch on 9/1 yet the Rattle Fire burned actively well into early October. These "fire slowing" events are to be expected, but often can be followed by periods of warming and drying.

Season Ending Events

The potential length of the fire season is important to operational and other management decisions, as the number of burn days left in the season have a direct effect on the likelihood that a free-burning fire will reach any point of concern. Local observations on the Umpqua National Forest indicate that active fire behavior and large fire growth are common until the middle of October and in some cases as late as the end of October (1987, 1991 & 1999).

Season ending dates were developed from the past 15 years of RAWS data collected at the Toketee and Buckeye RAWS stations. The decision to combine the two stations allowed us to get a much better representation of what we could expect this season. A season ending event was defined as a precipitation event of >.25 in of rain over any three day period after August 15, accompanied by a depression in the ERC to below the 80th percentile, and for which the ERC never again rose above the 80th percentile before October 30th.

Figure **13** displays the result of this analysis. September 16 is the midpoint date; by this date, 50% of fire seasons in the 27 years' records had ended. By October 9, there is a 90% chance that the season will be over. The Northwest Interagency Coordination Center Predictive Services group calculates season ending dates emphasizing 100hr fuel moisture and fire occurrence data, across the entire PSA (Predictive Services Area W4, encompassing southwestern Oregon). This measure differs somewhat, but is generally within a 7 day period with the analysis based on rainfall and ERC; September 26th is the 50th percentile date for season ending, and October 3 is the 90th percentile date. The season ending data range varied from August 17 to as late as October 28.

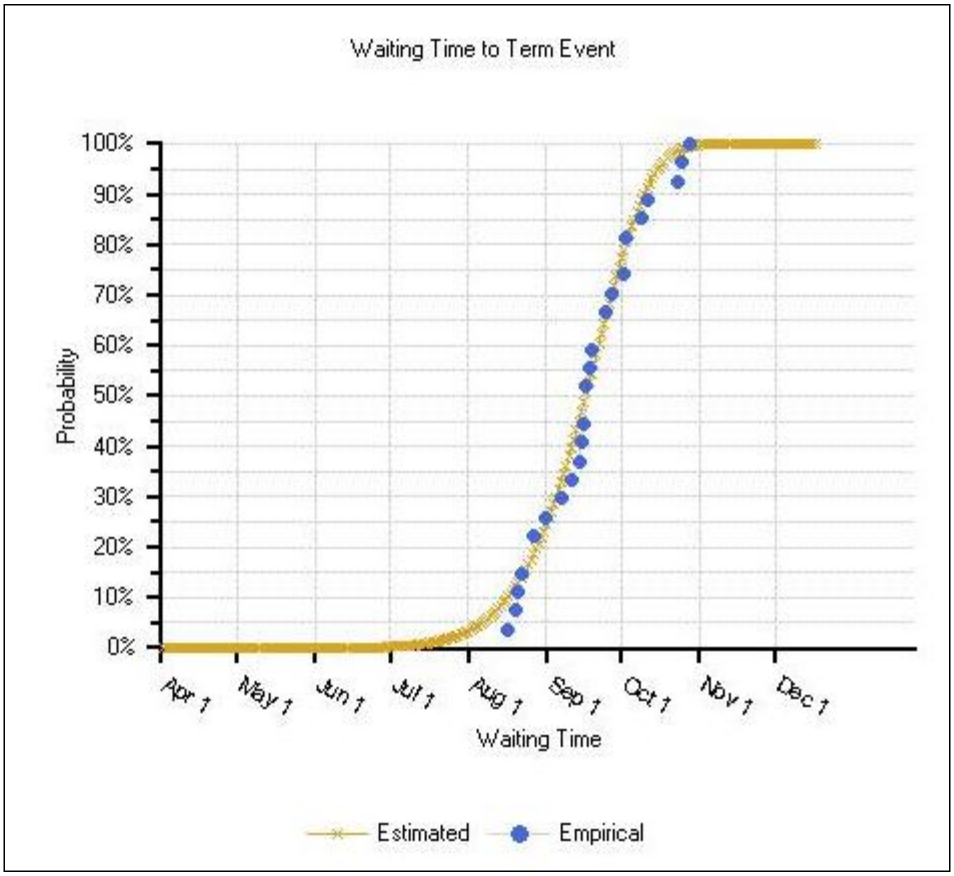


Figure 13: Term File graph for season-ending event for the Boze SIG. 50% of fire seasons are over before September 16.

Risk Assessment

Fire Growth Projections

Key Question: If the Boze fire was allowed to grow unchecked by suppression action, what areas would likely be involved by the end of the season? In which direction(s) would fire spread be most likely, and what values at risk would be threatened?

The Fire Spread Probability (FSPro) model was used to evaluate fire spread potential. FSPro is a spatial model that calculates the probability and direction of fire spread from a current fire perimeter or ignition point. FSPro models fire spread of hundreds or 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. The model can be used to identify the probability that areas of concern could see fire, and the outputs are helpful for developing priorities and analyzing values at risk.

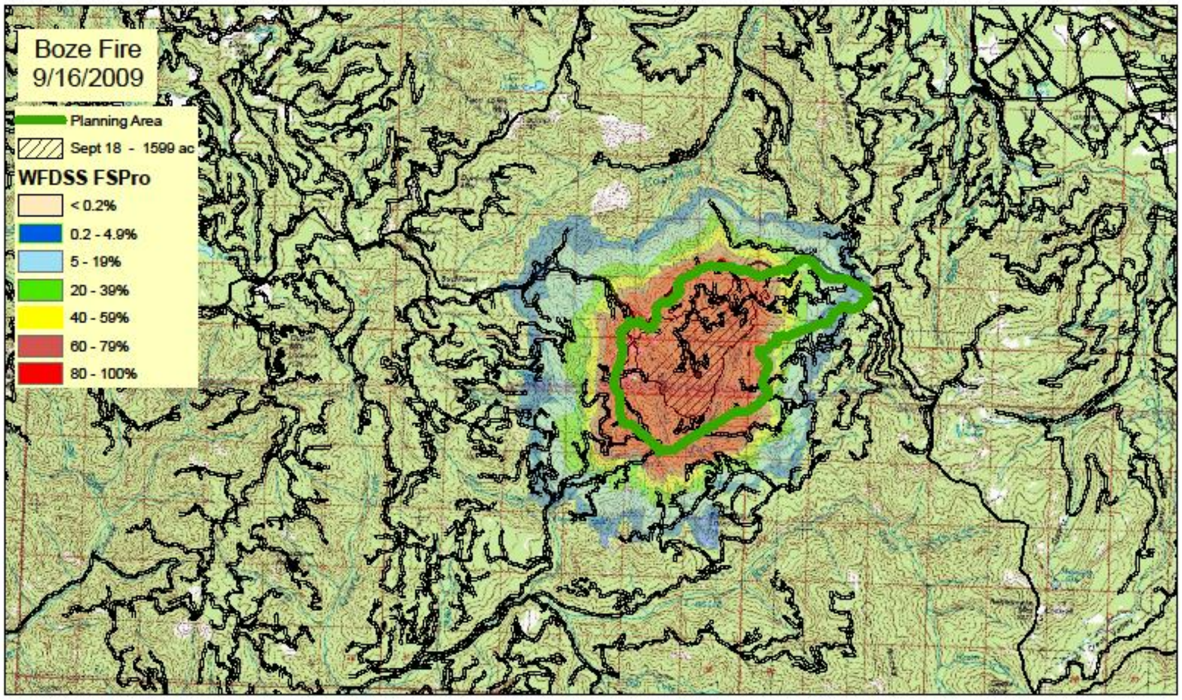


Figure 14: 14-day Fire Spread Probability (FSPro) analysis for the Boze Fire, Umpqua NF, for the period starting September 19. .

FSPro evaluates the likelihood that a free-burning fire reaches any given piece of ground during the assessment period. FSPro also provides a histogram of fire sizes from the simulations. The team conducted two FSPro analyses: one for 14 days and one for 30 days. The image of the 14 day assessment is in Figure 14.

The average fire size solution was 7277 acres for the 14 day run, with 90% of the simulations resulting in a fire size of 11,234 acres or less. The 30 day run predicted an average fire size of 11,160 acres, with 90% of the simulations at 16,010 acres or less (Table 4)

Percentile	30 day	14 day
Average	11,160ac	7,277ac
90th	16,010	11,234
70th	11,594	7,933
50th	9,681	6,469
30th	8,830	5,536
10th	8,506	4,868
Largest	48,153	15,982

Table 4: Fire Growth Projections for 14 and 30 day runs of Fire Spread Probability model

FSPro identified very little in the way of values at risk in either the 14 or 30-day assessments. Only federal land is included within even the lowest likelihood probability surface, and the only federal improvements appear to be recreation structures (Mud Lake and Boze Shelter, for example).

More detail on the FSPro Analyses is included in Appendix 1.

Boze Fire - Management Action Points

Purpose: The purpose of this analysis is to provide the Umpqua National Forest and the Tiller Ranger District's assigned IMT with an action plan and long-term analysis. It addresses the actions and decisions, along with the associated costs and resources, that are estimated to be needed if the fire becomes established outside of the primary containment lines. Each management action point (MAP) is unique in regards to size, complexity and estimated time to contain, as each flank of the fire is unique in regards to challenges and complexities.

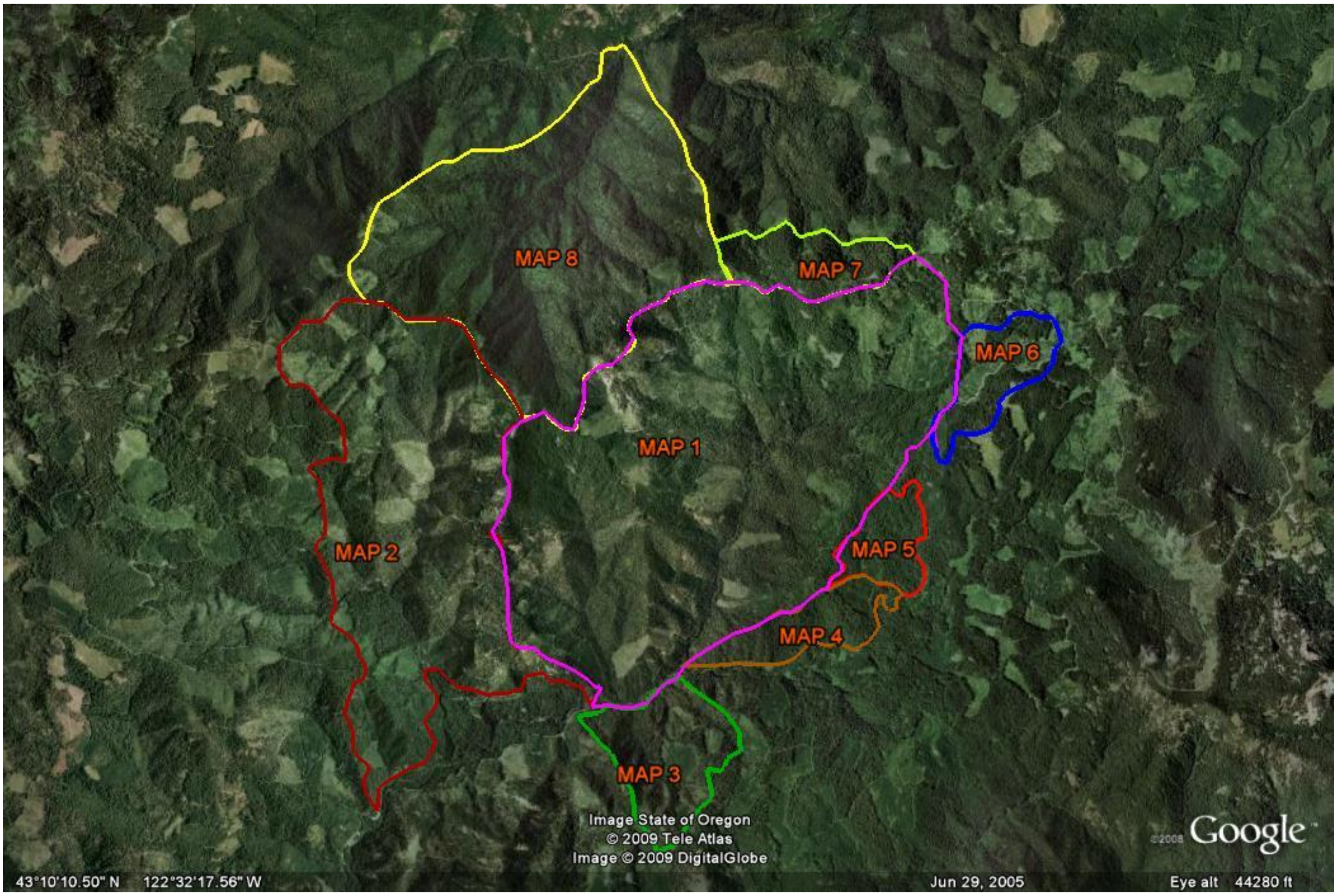
Introduction: Implementation of the stated actions should not occur without consideration of current and predicted weather conditions, fire behavior, and any other compounding factors associated with this incident. These factors will determine the need for implementation of the management actions as well as drive the location, urgency, and intensity of the actions. **All actions will be based on current and expected fire behavior as well as the time of year/season.** Refer to the map of the MAPs. As the fire grows in size and complexity throughout the remainder of the season, or new fires are added within the area, reassess the need to address contingency plans as well as the possible interaction of one fire to another.

The key factor in all of these possible management or mitigation actions is ***anticipation,*** identifying and executing the action(s) ahead of time. The amount of time and space available to establish the containment lines will vary by each MAP. There will often be opportunities to go more direct and contain the fire to a smaller area than what is shown as the primary MAP line. The MAP line represents a conservative estimate of an indirect line that would be needed should fire become established outside the primary containment line. It is assumed that spot fires that can be picked up successfully within an operational period would not cause the primary containment line to be abandoned.

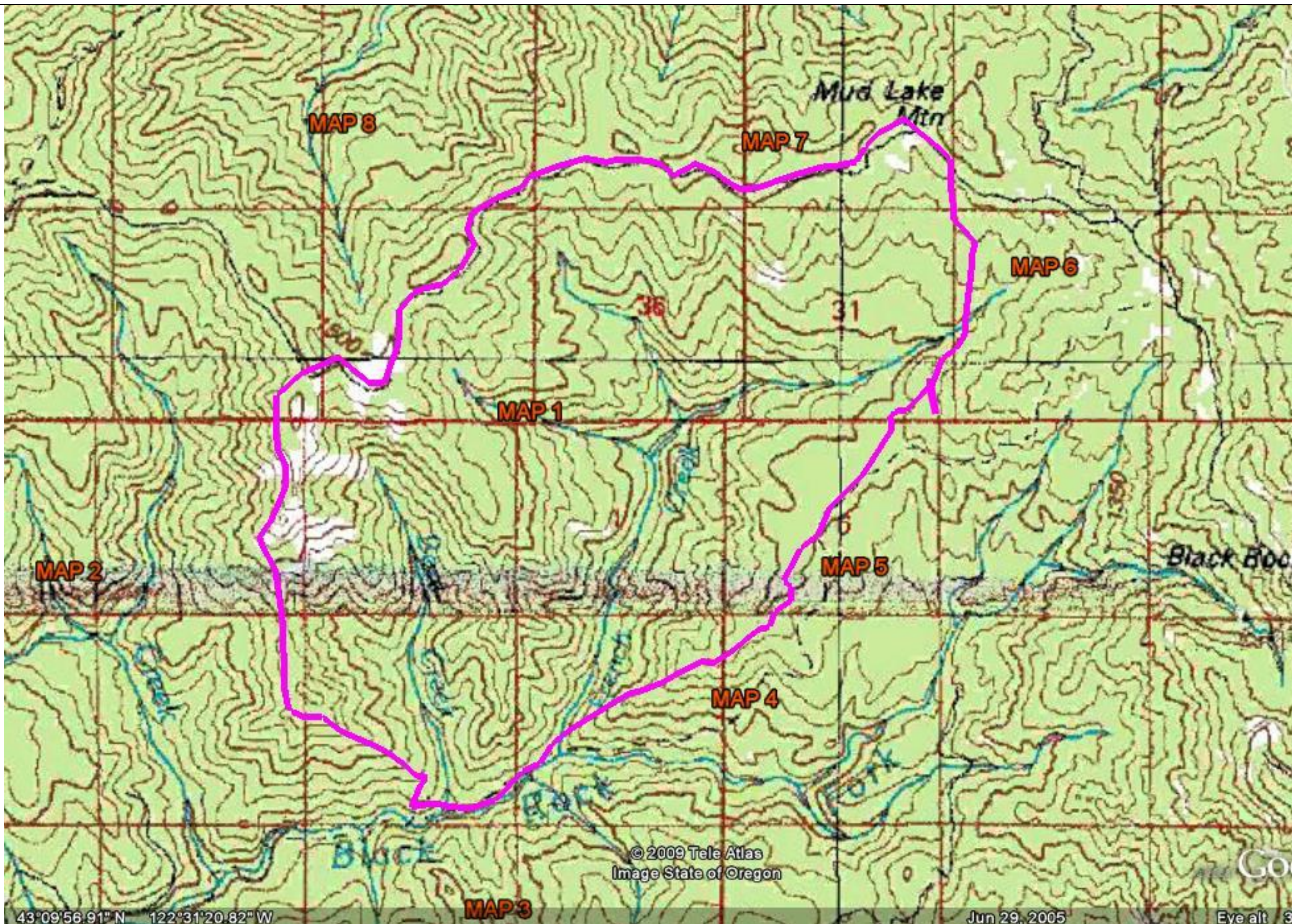
Refer to the Management Action Point map for location of each MAP addressed below. If more direct tactical opportunities present themselves, different than the actions identified in the MAPs, those opportunities should be implemented as long as those actions are safe and have a high probability of success. Indirect actions should utilize existing roads/trails, ridges, natural/man-made barriers, and changes in vegetation/fuels as much as possible.

On a daily basis, all strategic and tactical actions should be assessed against the leading edge of the fire's perimeter and the MAPs, and the respective management actions. Based upon the difference between the planned actions and the tactical actions the necessary adjustments will need to be made in a timely manner.

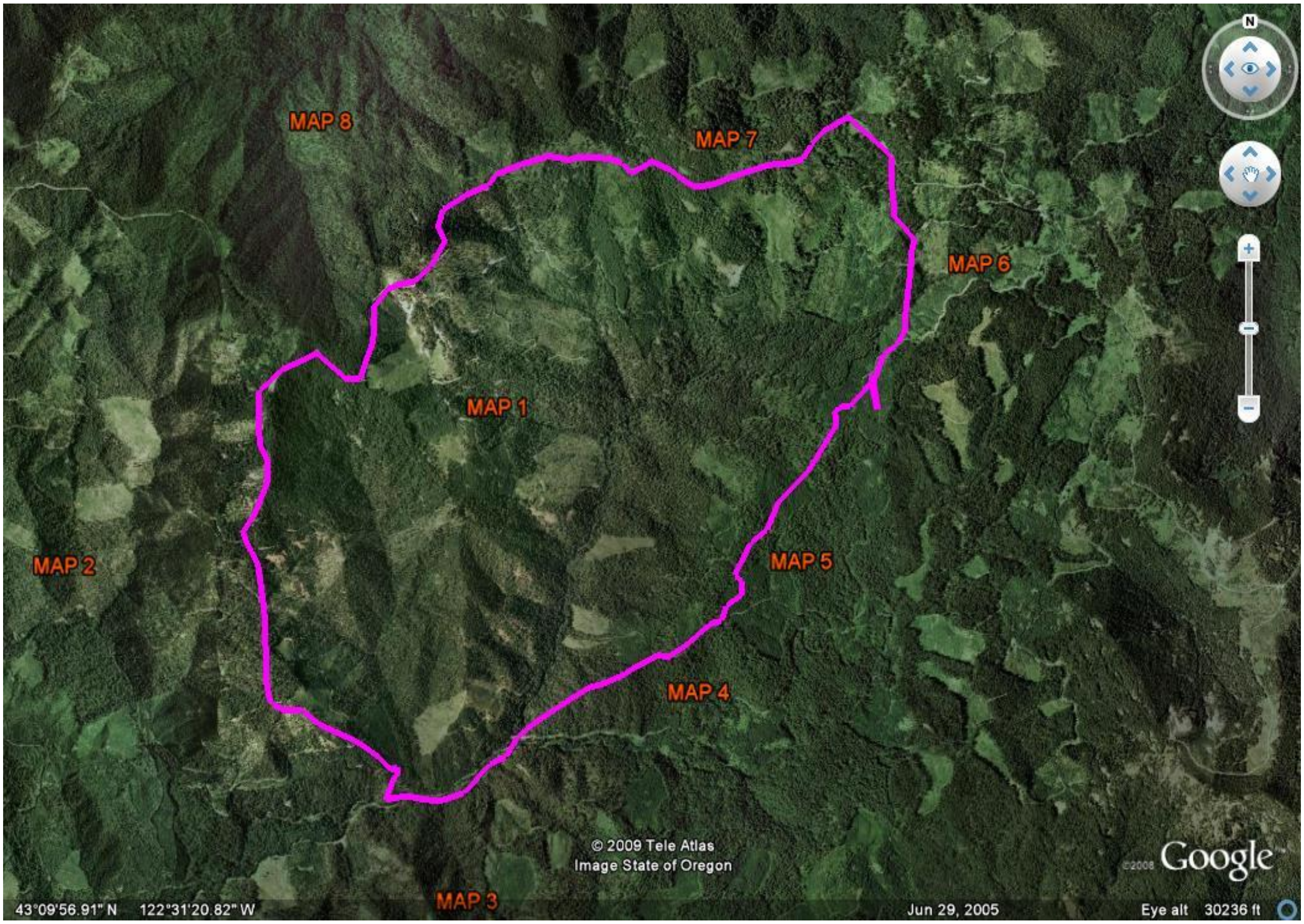
Management Action Points
Master



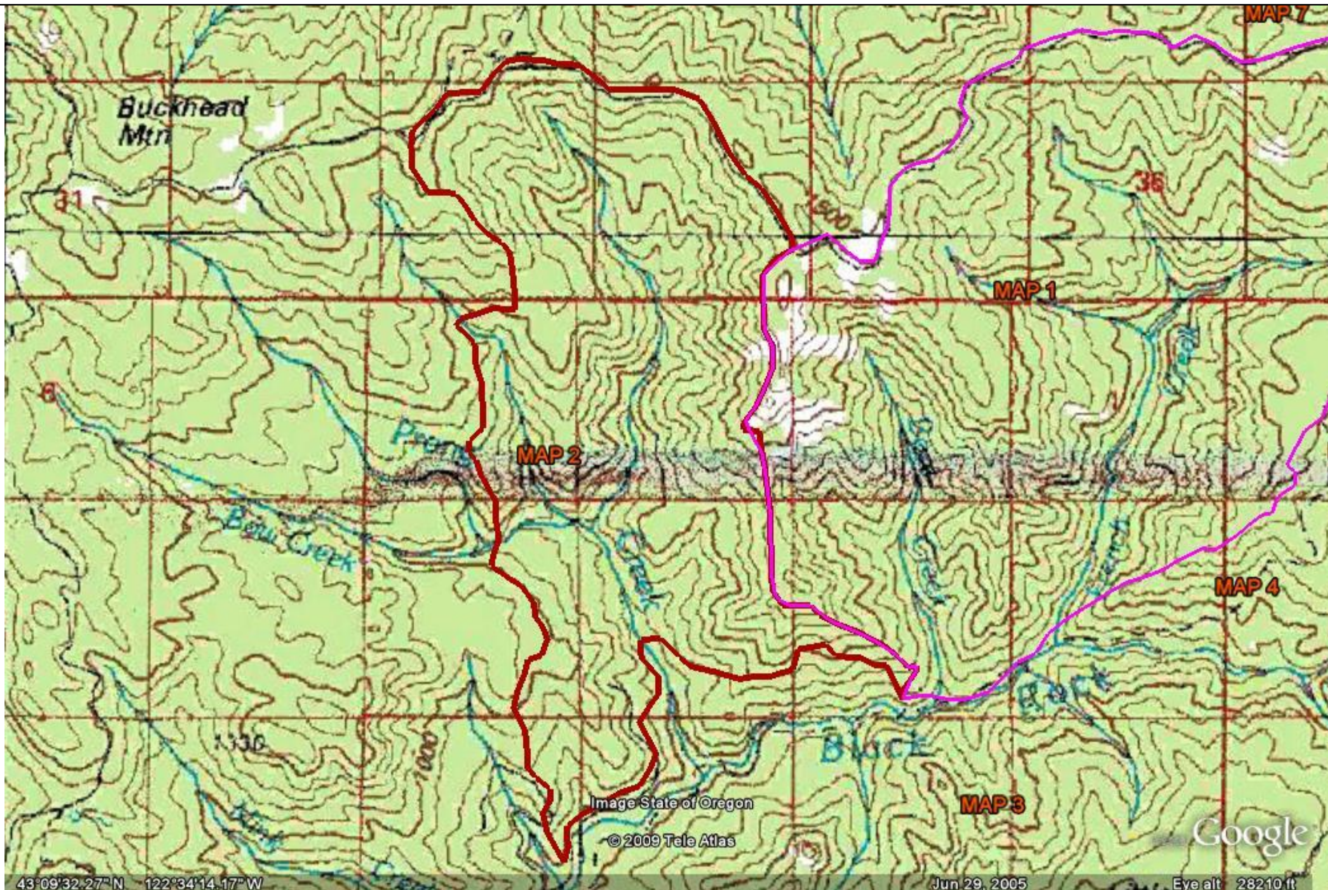
MAP 1



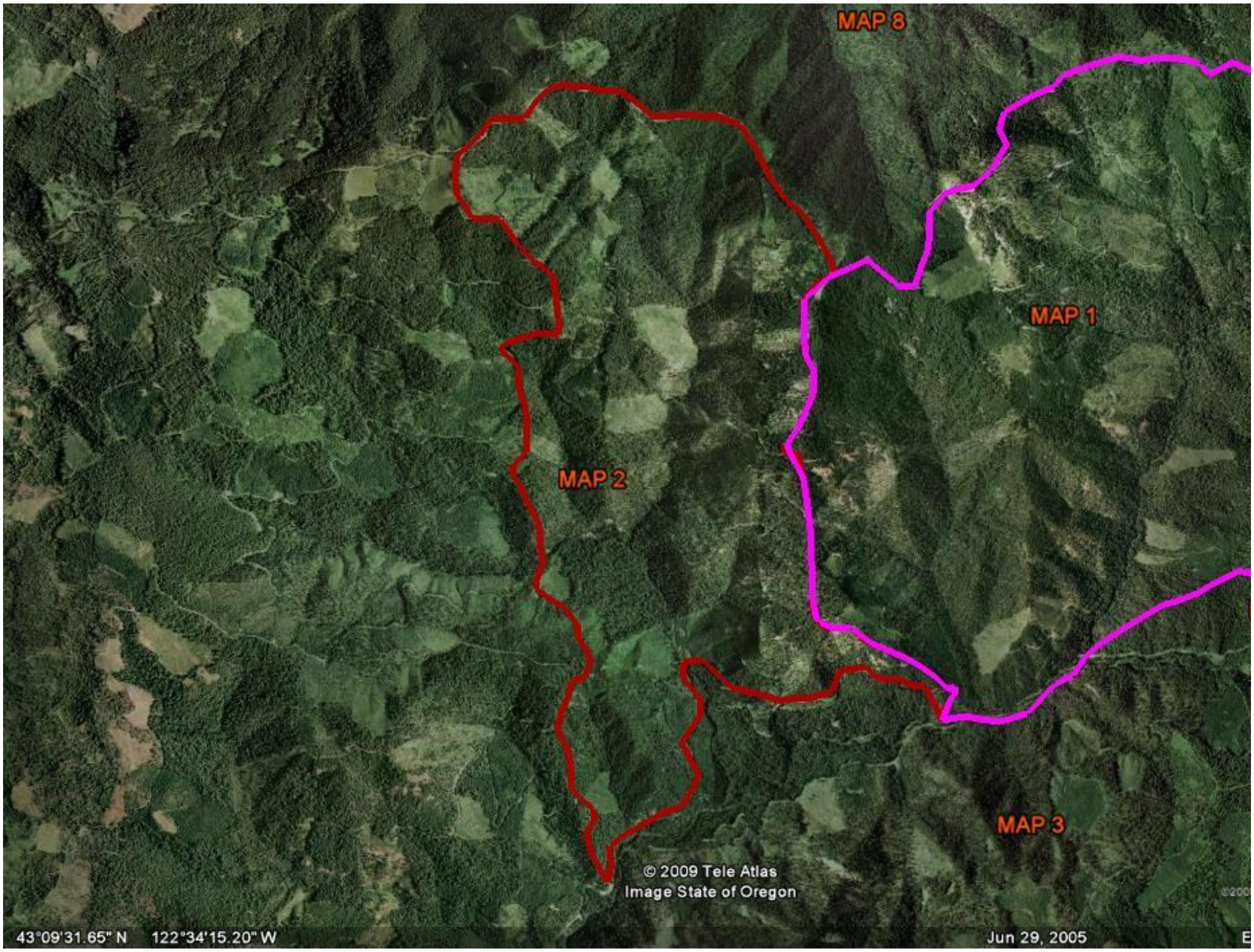
Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost
This is the current strategy being implemented by the Type 3 IMT. The MAP lines reflect the indirect firelines the IMT has been establishing and preparing for burning.	**A.** Hold the fire north of Forest Road 28 and Black Rock Fork Creek. **B.** Hold the fire south of Forest Road 2715. Keep the fire from spreading on to the Diamond Lake Ranger District. **C.** Hold the fire west of Forest Road 28 and French Junction. **D.** Hold the fire east of Forest Roads 730 and 430, and the Prong Creek drainage.	**Resources:** All of the resources currently assigned to the Type 3 IMT as of September 19, 2009. **Estimated time to complete:** Current estimated containment date for this strategy is October 1, 2009. **Probability of success:** Moderate	**Size of MAP:** 4,377 acres **Cost:** $7,900,000* *if additional days are needed to reach containment beyond the estimated date of October 1st, it will add approximately $500,000 per day to the above cost estimate


MAP 8
MAP 7
MAP 6
MAP 1
MAP 2
MAP 5
MAP 4
MAP 3
© 2009 Tele Atlas
Image State of Oregon
Google
43°09'56.91" N 122°31'20.82" W
Jun 29, 2005
Eye alt 30236 ft

MAP 2

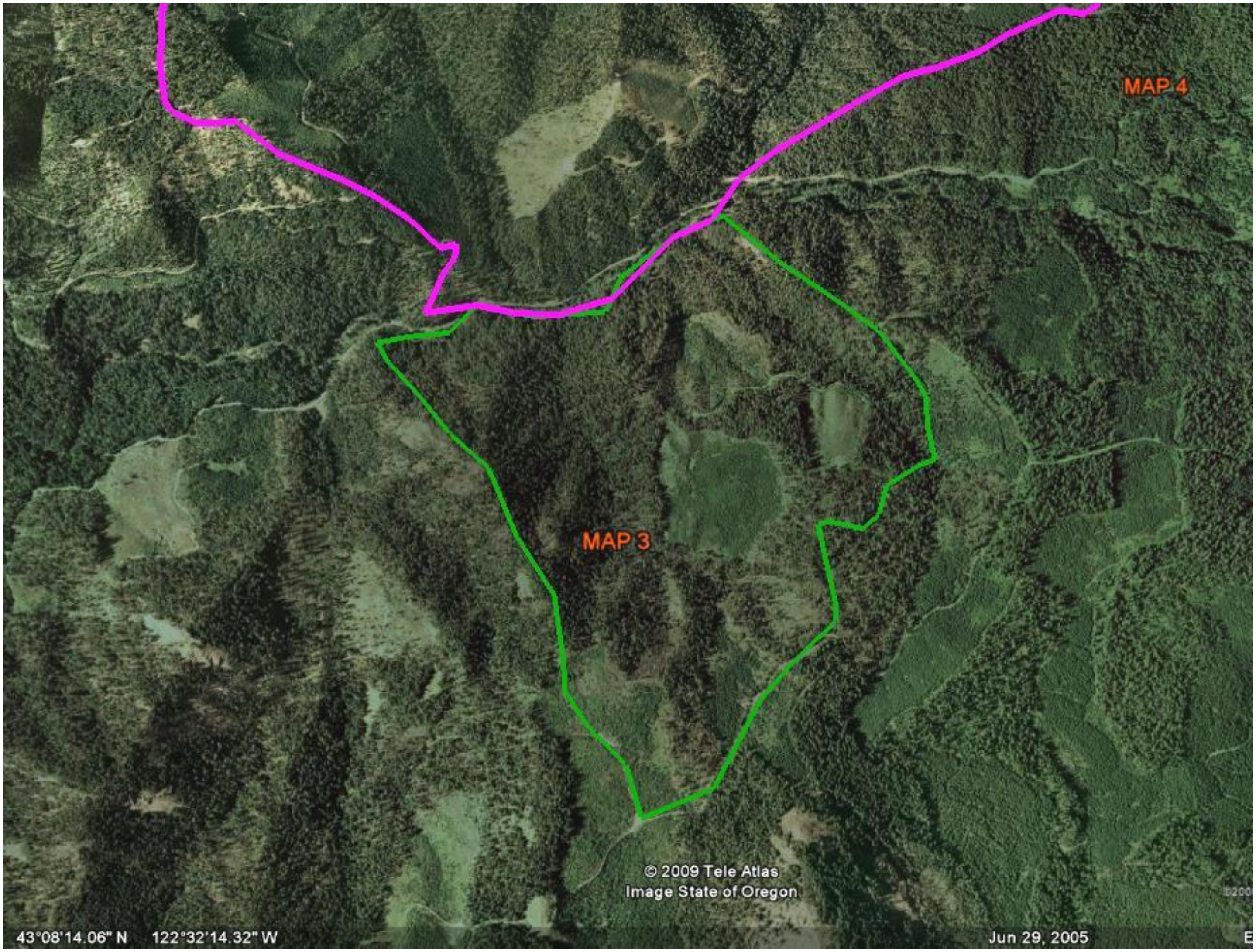


Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost
MAP 2 is the area west of the primary ridge that divides the Boze Creek drainage from the Prong Creek drainage. It is south of Forest Road 2715, north of Forest Road 430 and east of Forest Roads 720, 721, 750,748, 401, 406 and 408.	Indirect attack: utilize road systems as much as possible as primary containment lines. Construct dozer line and handline to connect gaps in the spur road network found on the westside of the MAP. Prep and burnout indirect firelines. Keep fire south of Forest Road 2715, north of Forest Road 430 and east of indirect line using Forest Roads 720, 721, 750, 748, 401, 406, 408, and constructed fireline connecting gaps in this road network.	**Resources:** All of the resources currently assigned to the Type 3 IMT as of September 19, 2009. In addition: * 2 Type 1 crews * 2 Type 2 crews * 6 overhead positions * l Type 2 helicopter * 6 Type 6 engines **Estimated time to complete:** 6 Days **Probability of success:** Moderate	**Size of MAP:** 2,541 acres **Cost:** $3,368,220

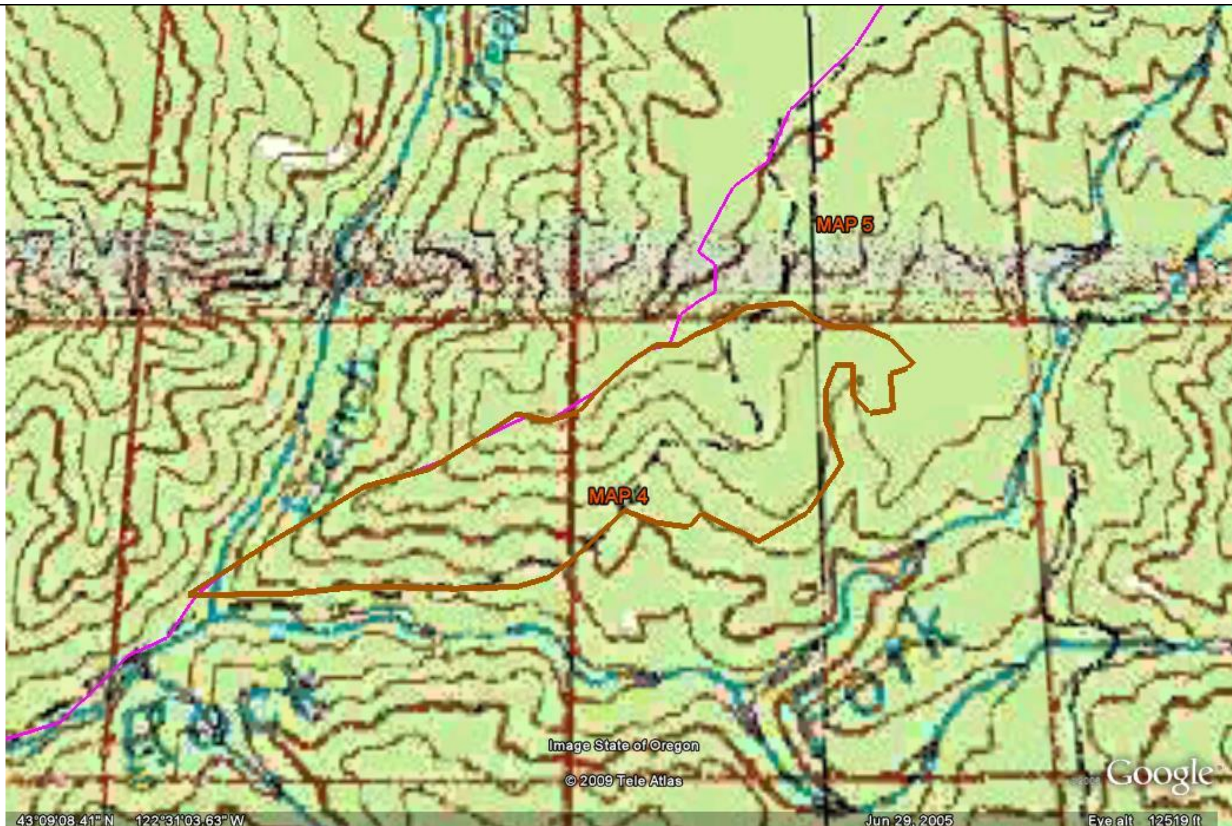

MAP 8
MAP 2
MAP 1
MAP 3
© 2009 Tele Atlas
Image State of Oregon
43°09'31.65" N 122°34'15.20" W
Jun 29, 2005

MAP 3

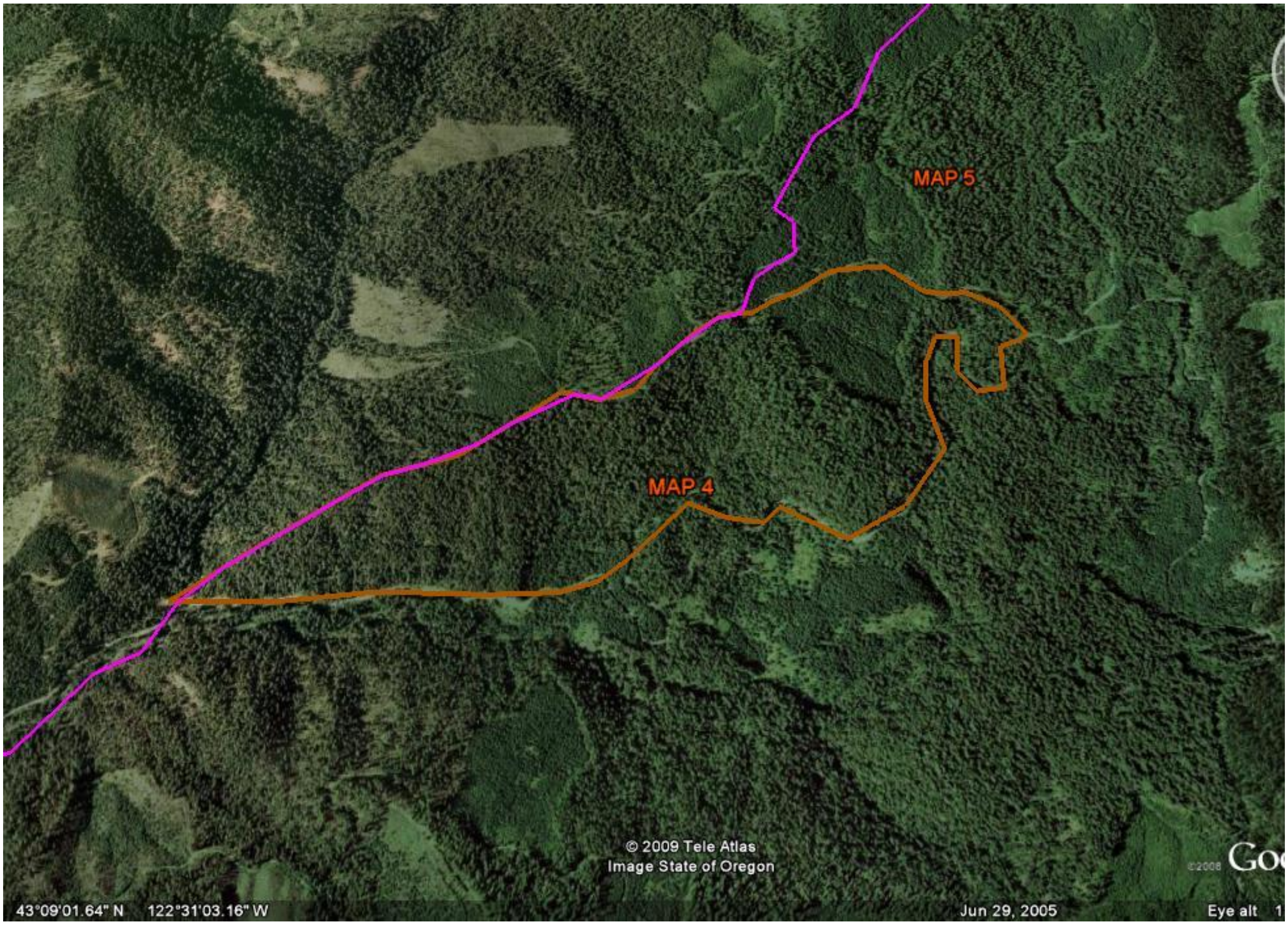
Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost
MAP 3 is an area south of Black Rock Creek and Forest Road 28 in Sections 11, 12, 13 and 14.	Construct, prep and burn out indirect dozer and/or handline on the major ridge between Forest Roads 28 and 552, and the major ridge between Forest Roads 28 and 580. Hold fire north of Forest Road 500, south of Forest Road 28, and in between constructed line on the two major ridges on the east and west flanks.	**Resources:** All of the resources currently assigned to the Type 3 IMT as of September 19, 2009. In addition: * 1 Type 1 crew * 2 Type 6 engines * 3 overhead positions **Estimated time to complete:** 3 days **Probability of success:** Moderate	**Size of MAP:** 483 acres **Cost:** $1,540,317


MAP 4
MAP 3
© 2009 Tele Atlas
Image State of Oregon
43°08'14.06" N 122°32'14.32" W
Jun 29, 2005

MAP 4



Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost
The area in MAP 4 is north of Forest Road 28 and south of the primary containment line in MAP 1 that utilizes constructed dozer line and Forest Roads 460 and 466.	**A.** Hold fire north of Forest Road 28. **B.** Hold fire south of Forest Road 460.	**Resources:** No additional resources over what is currently assigned would be necessary. **Estimated time to complete:** 1 day **Probability of success:** High	**Size of MAP:** 288 acres **Cost:** $500,000


MAP 5
MAP 4
© 2009 Tele Atlas
Image State of Oregon
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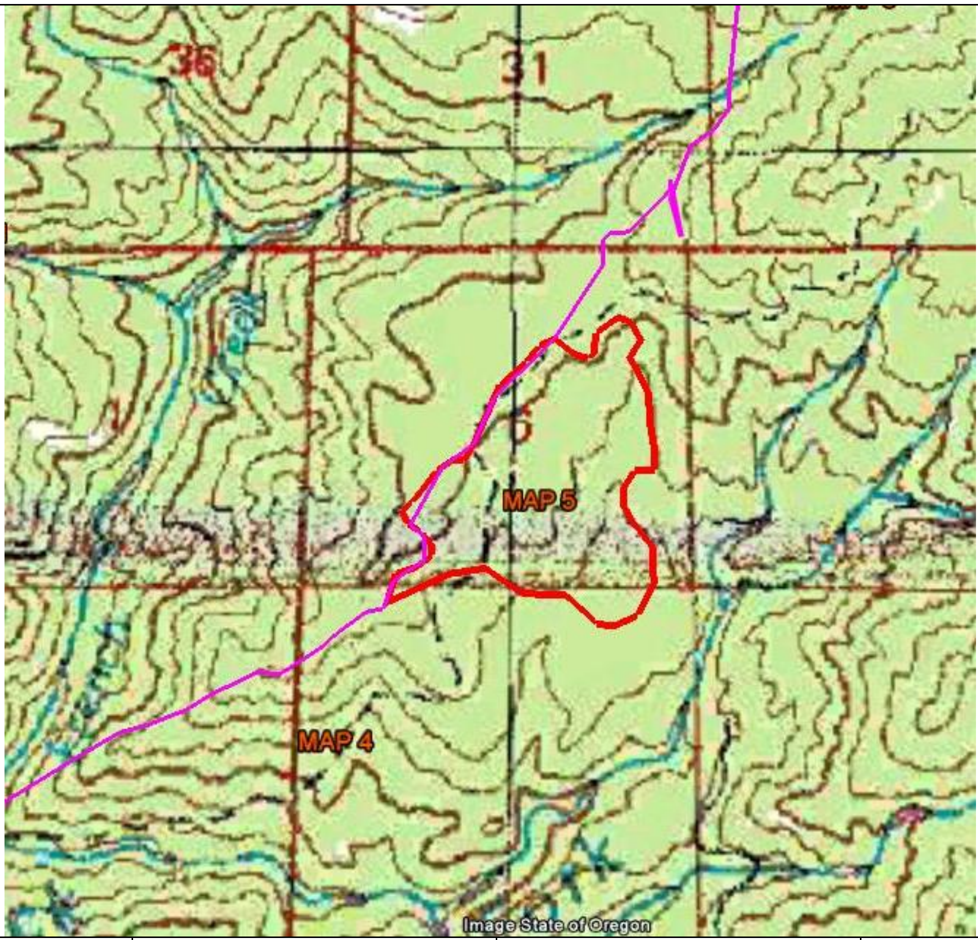
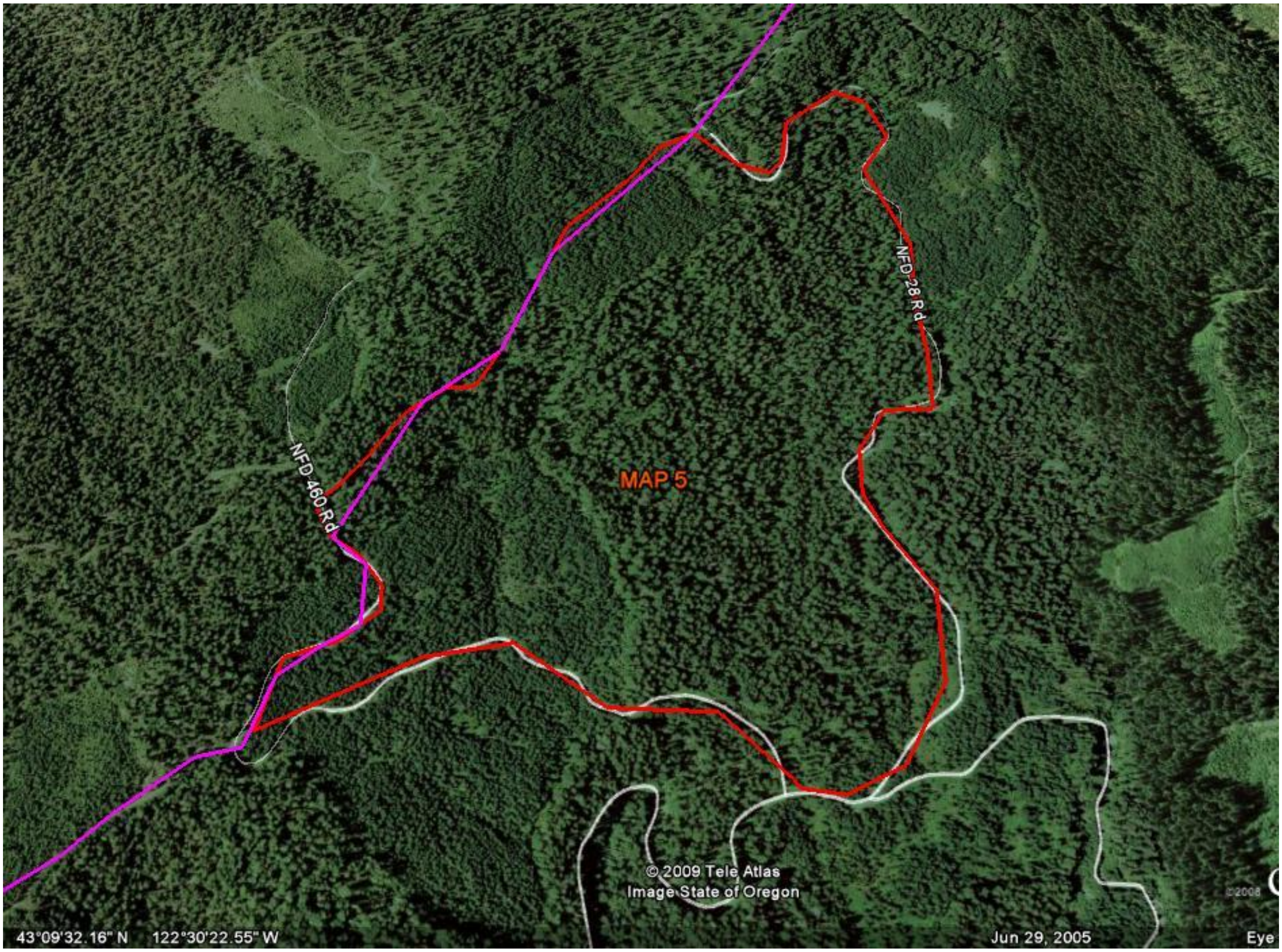
Jun 29, 2005
Eye alt

MAP 5

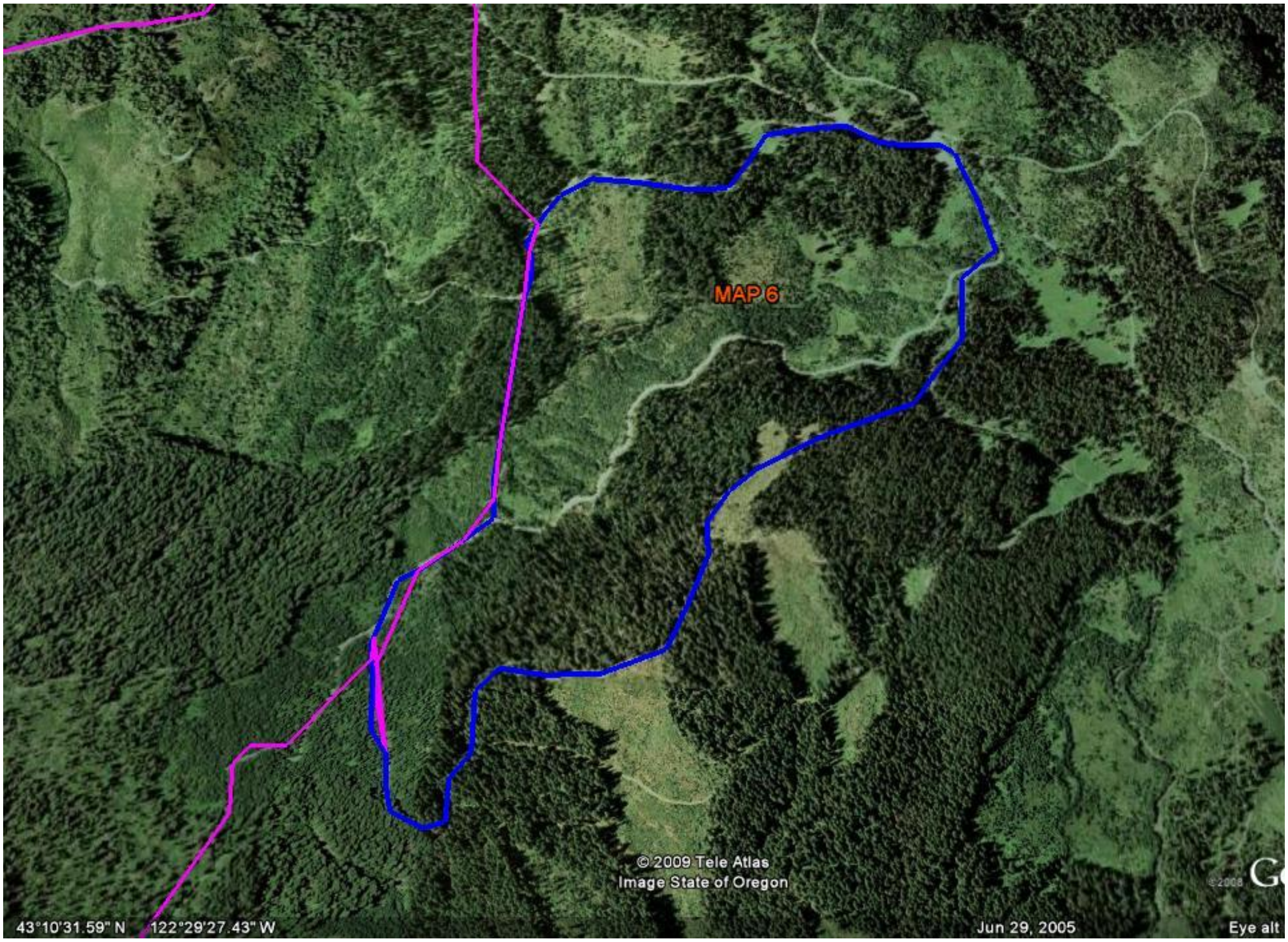


Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost
MAP 5 is on the east side of the Fire and comprises the area north of Forest Road 460, west of Forest Road 28, and south and east of Forest Roads 462 and 475.	**A.** Hold the fire north of Forest Road 460. **B.** Hold the fire west of Forest Road 28.	**Resources:** No additional resources over what is currently assigned would be necessary. **Estimated time to complete:** 1 Day **Probability of Success:** High	**Size of MAP:** 219 acres **Cost:** $500,000


MAP 5
NFD 460 Rd
NFD 28 Rd
© 2009 Tele Atlas
Image State of Oregon
43°09'32.16" N 122°30'22.55" W
Jun 29, 2005
Eye

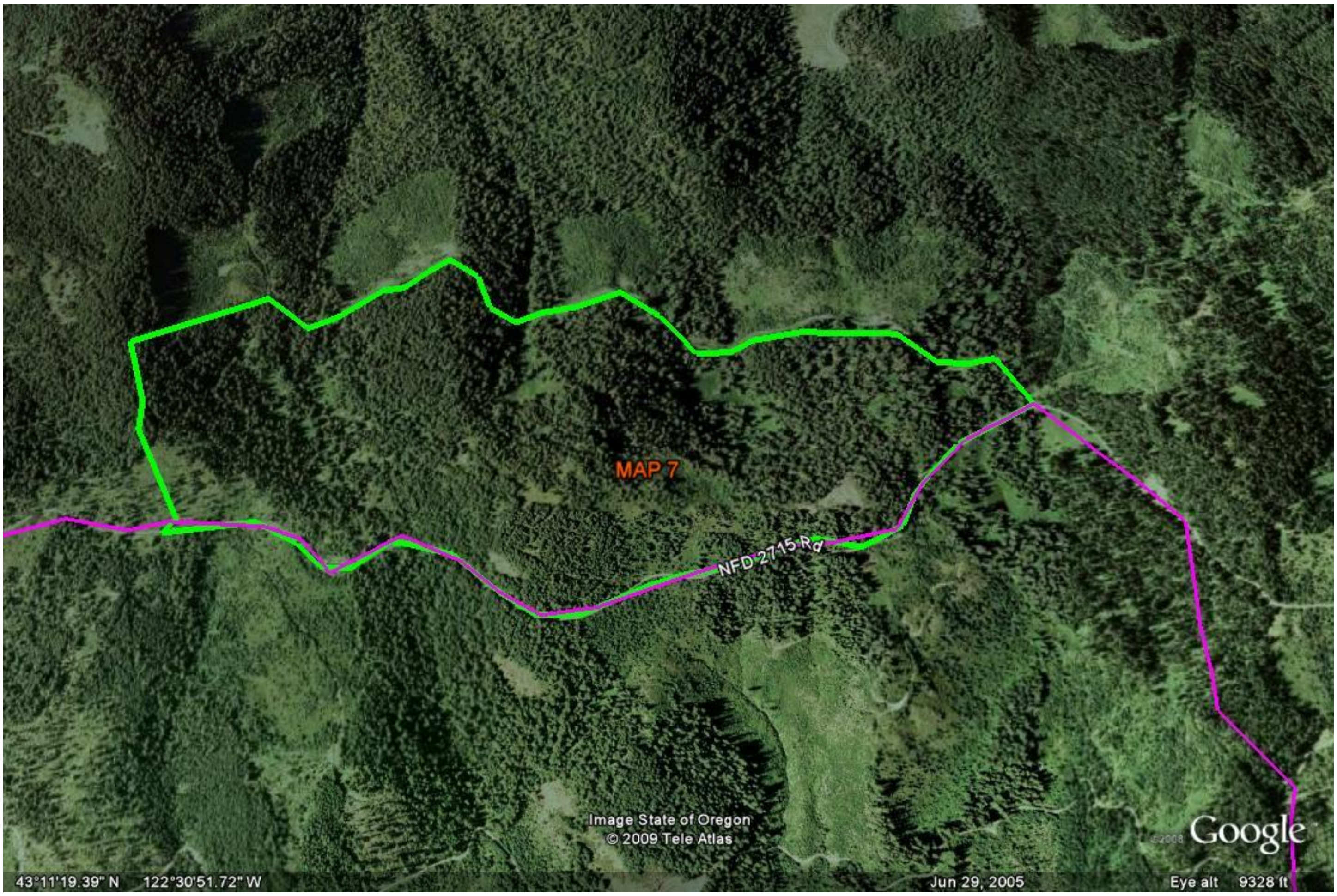
MAP 6

Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost
MAP 6 is located on the northeast portion of the fire in the French Junction area. The MAP lines are generally bounded by roads in Section 32.	**A.** Hold the fire west of French Junction and Forest Road 500. **B.** Hold the fire north of Forest Road 482. **C.** Hold the fire south of Forest Roads 900 and 2715.	**Resources:** All of the resources currently assigned to the Type 3 IMT as of September 19, 2009. In addition: * 2 Type 6 engines * 3 overhead positions **Estimated time to complete:** 1.5 days **Probability of success:** High	**Size of MAP:** 303 acres **Cost:** $758,943


MAP 6
© 2009 Tele Atlas
Image State of Oregon
43°10'31.59" N 122°29'27.43" W
Jun 29, 2005
Eye alt

MAP 7

Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost to Contain
MAP 7 is on the north side of the fire between Forest Roads 2715 and 850 in Sections 25 and 30. The west boundary of the MAP would be a constructed dozer line on a ridge north of the 2715 road that is also common to a portion of the east boundary of MAP 8.	**A.** Hold fire south of Forest Road 850. **B.** Construct, prep and burnout dozer line on ridge in Section 25 north of Forest Road 2715.	**Resources:** No additional resources over what is currently assigned would be necessary. **Estimated time to complete:** 1 Day **Probability of success:** High	**Size of MAP:** 325 acres **Cost:** $500,000


MAP 7
NFD 2715 Rd
Image State of Oregon
© 2009 Tele Atlas
Google
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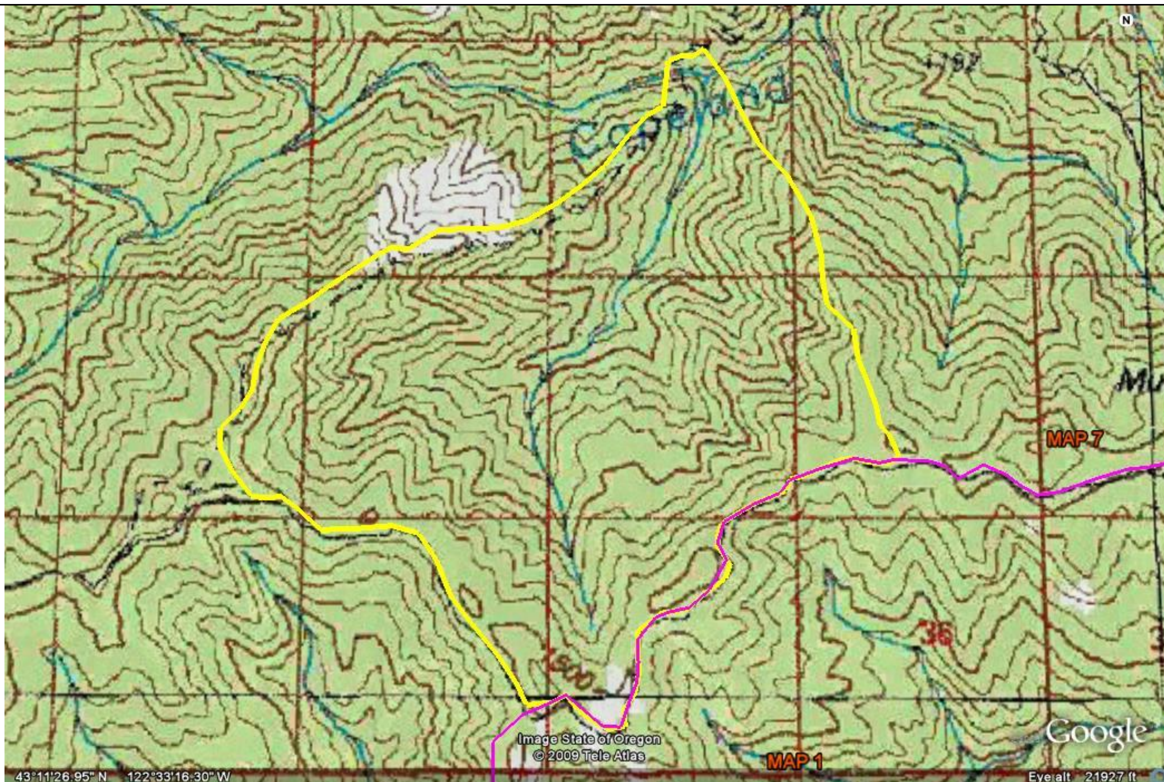
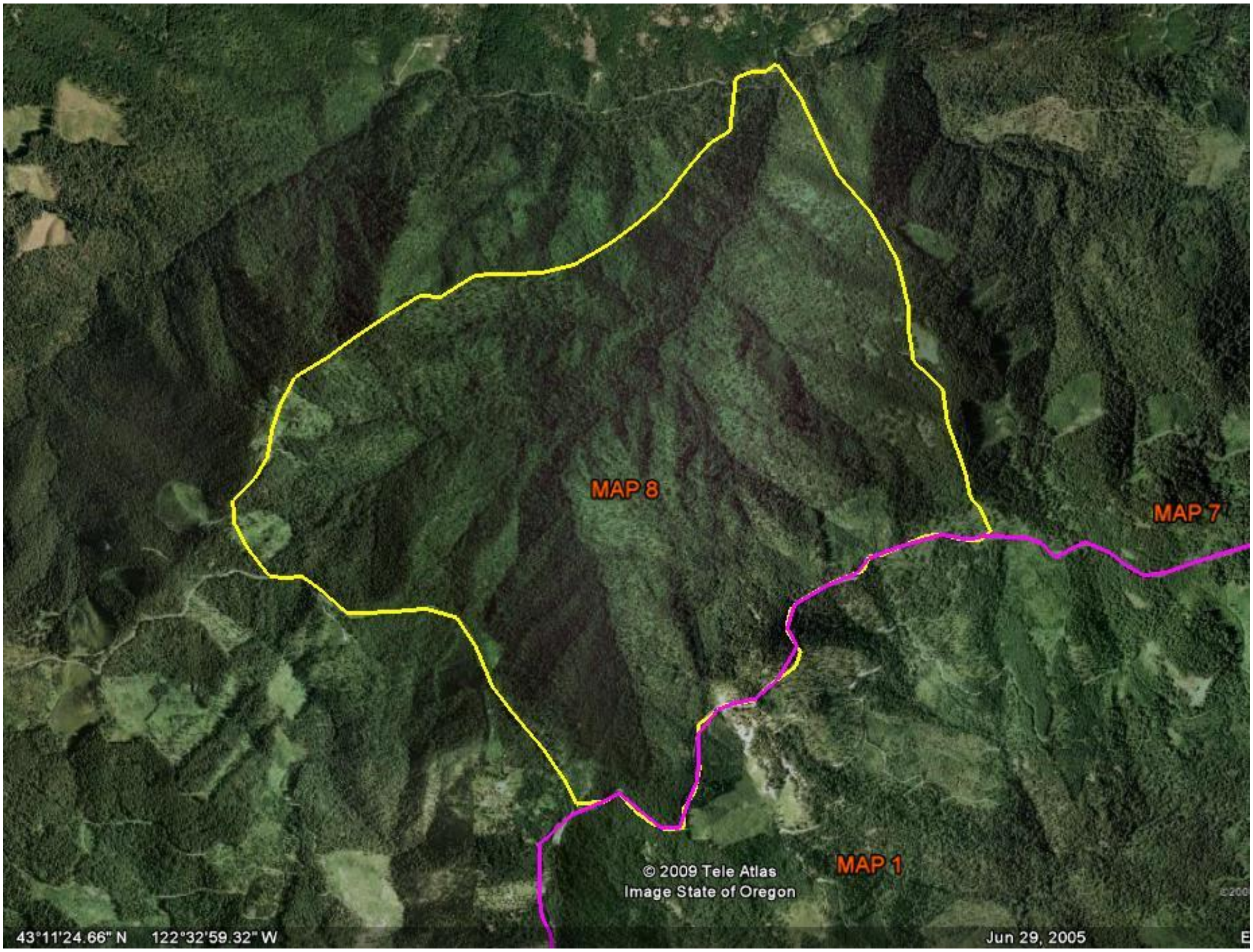
Jun 29, 2005
Eye alt 9328 ft

MAP 8



Description	Action	Resources Needed and Estimated Time	Estimated Size and Cost
MAP 8 is in a steep, unroaded branch of Copeland Creek on the northwest side of the fire. It is bounded on the south by Forest Road 2715, on the west by Forest Road 675 and a major ridge that runs between Road 675 and Copeland Creek. Trail 1512 is on this ridge. It is bounded on the east by a ridge that runs between Forest Road 2715 and Copeland Creek in Sections 23, 24 and 25. The north end of the MAP is on Forest Road 2801.	**A.** Construct, prep and burnout dozer and/or handlines on ridges that connect Forest Road 2715 and Copeland Creek. Hold fire between these two lines. **B.** Hold fire north of Forest Road 2715 between the junction with the 730 Road in Section 34 and to where the constructed dozer line intersects the 2715 Road in Section 28 south of Raven Rock. **C.** Hold fire south of Forest Road 2801 in the Copeland Creek drainage.	**Resources:** All of the resources currently assigned to the Type 3 IMT as of September 19, 2009. In addition: * 4 Type 1 crews * 2 Type 2 crews * 11 overhead positions * 2 Type 1 helicopters * 2 Dozers **Estimated time to complete:** 7 Days **Probability of Success:** Moderate	**Size of MAP:** 2,468 acres **Cost:** $4,245,696


MAP 8
MAP 7
MAP 1
© 2009 Tele Atlas
Image State of Oregon
43°11'24.66" N 122°32'59.32" W
Jun 29, 2005

Recommended Monitoring Actions:

The following monitoring actions are recommended for the duration of this season.

- Continue to record daily perimeter, fire behavior parameters, fuel moistures, etc.
- Continue to monitor weather observations using the Toketee and Buckeye RAWS sites.
- Monitor predicted fire weather, both short term and long term, in order to better inform decisions regarding commitment of resources to suppression actions.
- Validate or refine this long term assessment after 14 days, if fire activity is continuing.

Conclusions and Recommendations:

The next 5 days are predicted to be hot, dry, and unstable, conditions that are remarkably similar to those experienced on the Rattle Fire in 2008 when said fire more than tripled in size over a 3 day period (4,000 to 14,000 acres). These are the conditions usually associated with large fire growth in this area, and fire managers need to be prepared for the possibility that the Boze Fire escapes the current planning area. NWCC Predictive Services forecasting of ERC and 100hr fuel moisture should be monitored to anticipate fire growth days.

The end of fire season, while getting closer by the day, is probably still several weeks away. Fire danger indices will remain high until a significant rain event, and so far none is seen in the forecast.

If the Boze fire were to burn from now until the end of the fire season, fire spread probability modeling indicates that the fire would remain on National Forest land, and would not threaten private improvements or structures before the end of the season. As time goes on, the burn periods will continue to get shorter and active burn days less frequent; this gives fire managers even more reason to evaluate the costs of actions against the values at risk and exposure to firefighters.

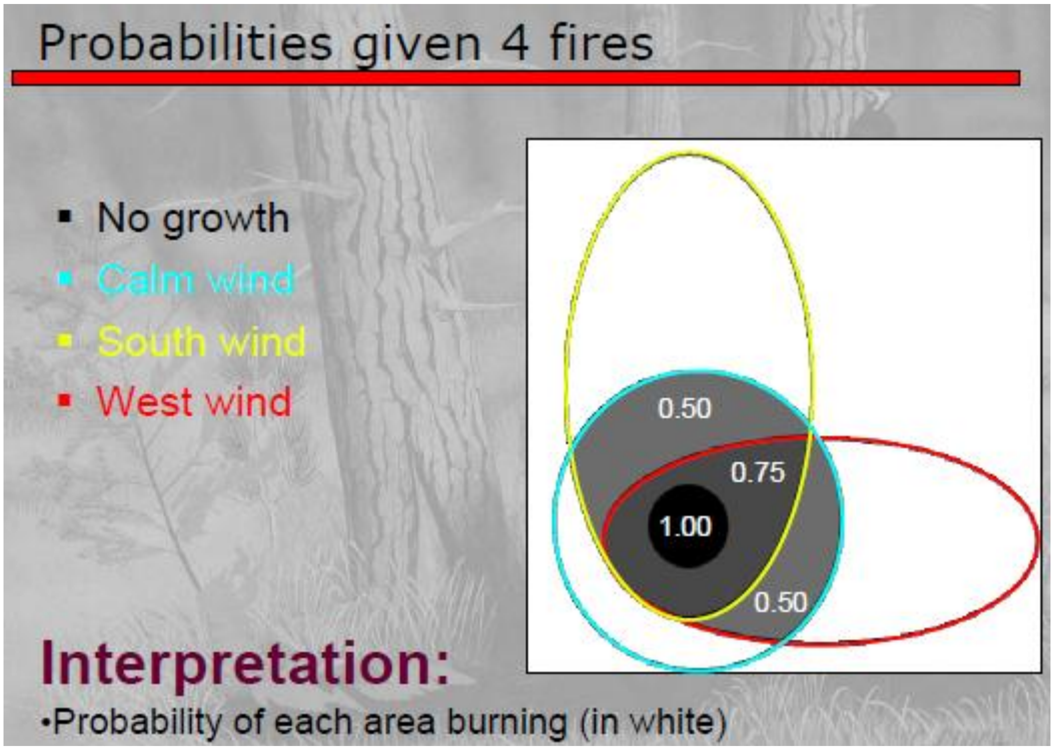
Fire spread to the north and west of the planning area would be more problematic than spread to the east or south, based on access, fuels, and terrain. However, immediately to the southwest of the fire area is a fire of the Tiller Complex, which has regrown into a fast-spreading fuel model 2. Fire behavior in this fuel will be remarkably different from that of the timber fuel models within the planning perimeter.

Management Action Points, in the form of locations for fallback control lines, are provided for different points on the current fire planned perimeter. These fallback lines, with resources, costs, and time needed to complete, can be placed to contain the fire should it threaten to escape the planning area. However, it is important to evaluate forecasted weather before undertaking one of these fallback lines, considering that a cool and moist airmass can slow fire growth considerably this time of year.

FSPro is a Monte Carlo fire spread probability simulation program that is used to produce "ensemble" fire simulations. Monte Carlo means that it has a stochastic or random component. Stochastic simulations are use to account for variation in the model inputs in this case future weather. Ensemble means that the results are assembled from many separate simulations to allow us to see the variability as a probabilistic outcome (not a single model result).

What FSPro does:

- Simulates fire growth under thousands of weather scenarios
- Runs for a specific time period (14 and 30 days)
- Assumes constant wind and weather for each day
- Uses Minimum Travel Time over the digital elevation model for simulating 2 dimensional fire growth
- Probability is calculated based on how many times a cell burned divided by the number of simulations.



FSPro calculates fire spread differently than RERAP in two ways:
1) Straight line calculation: RERAP calculates fire growth in a line. A straight line to a point of interest may not be the fastest path of fire spread.
2) Time-series for weather is generated using weather forecast information and climatology data.

- RERAP DOES NOT account for what kind of season you are experiencing (the seasonal trend). For example, if a fire starts on June 25th, RERAP uses the historical average for that date. However, in FSPro, if it is an unseasonably cool year the model knows.
- FSPro has an auto correlation function (a way to look back), that in FSPro calculates how much today's ERC value depends on tomorrow's artificial season's value.
- A daily standard deviation of ERC is calculated for each day.

The discrete FSPro probability zones do not represent a fire progression, a fire perimeter, or fire sizes or shapes. These are common misinterpretations because of the distinct categories and colored shading. The source of this confusion may be that maps of fire progression or output from other geospatial fire modeling systems are often displayed as concentric contours. However, the discrete FSPro probability zones (80-100%, 60-79%, 40-59%, 20-39%, 5-19%, 0.2-4.9%, and less-than 0.2%) cannot be interpreted as related to fire progress since there is no assumption about how long simulated fires take to reach each zone. An important point to remember is that any area in the probability output can be reached on the first day of the modeled period or the last day, and it could reach that point as a head, flanking, or backing fire. Because of these issues, FSPro output can be used to make informed decisions regarding strategy, but not tactics.

As the actual fire position changes due to successful suppression activities or significant weather events that could affect fire movement (for example a dry cold front); these probability zones may expand and contract. The take-home point is that as new and better information becomes available, these probabilities will change. New FSPro simulations would be required accounting for changing conditions, which would likely affect the probabilities associated with the point of concern.

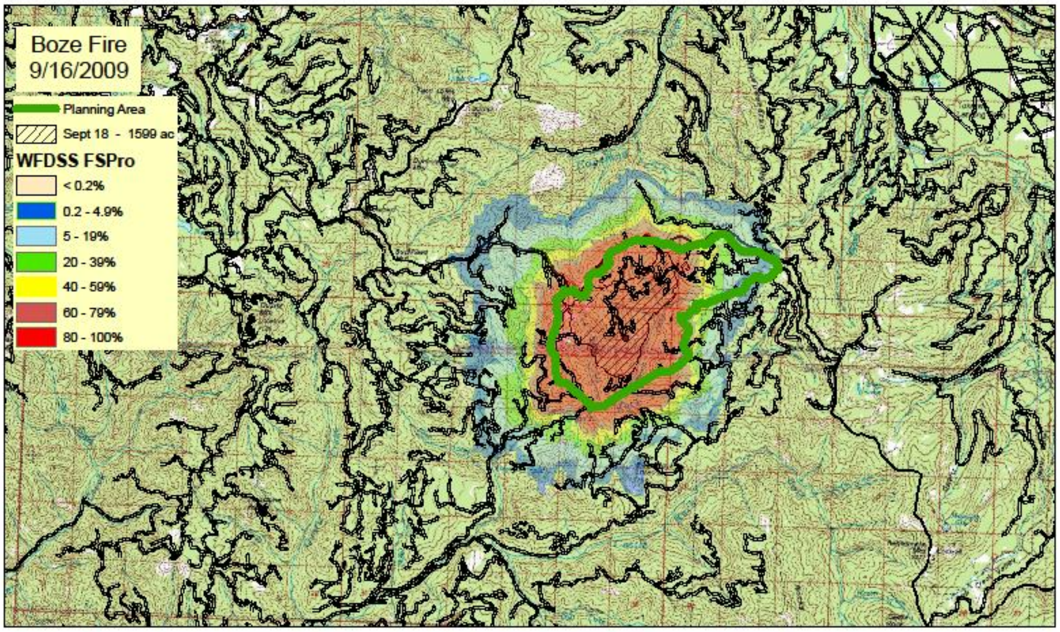
FSpro Inputs

The simulation was set for 1000 fires for a 14 day period, and another for a 30 day period. The September 16 fire perimeter shapefile was used as an ignition input. No barriers were modeled, so the fire was free to spread through either a ground fire or a spotting fire, as long as fuels were available. This means that the fire is assumed to be freely burning, with no effect of suppression.

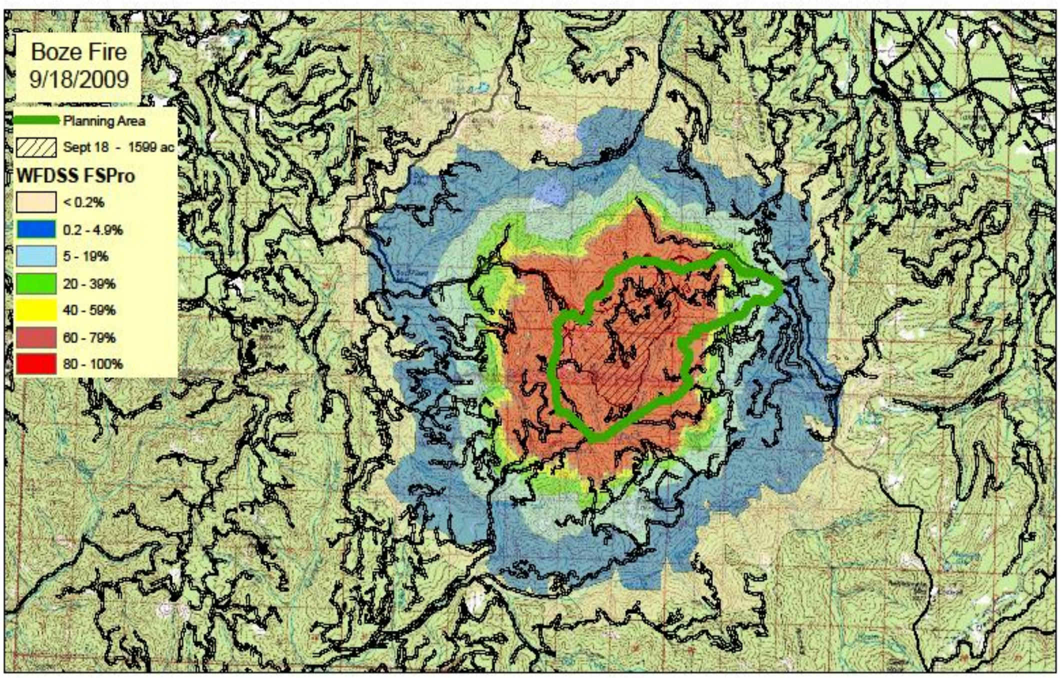
The weather forecast stream for ERC, wind direction and wind speed available for September 17 was used for both the 14 and 30 day runs. Ten forecast days were used, and after that time the the model used climatology data from the Buckeye remote automated weather station for the years 1985 thru 2009. Fuel models used for the runs were the 40 fuel model LANDFIRE Rapid Refresh national standard data layer.

Areas of interest/concern include the roadless areas to the north of the current management area, the Tiller Fire area south of the Black Rock Fork, and the area to the west of the management area

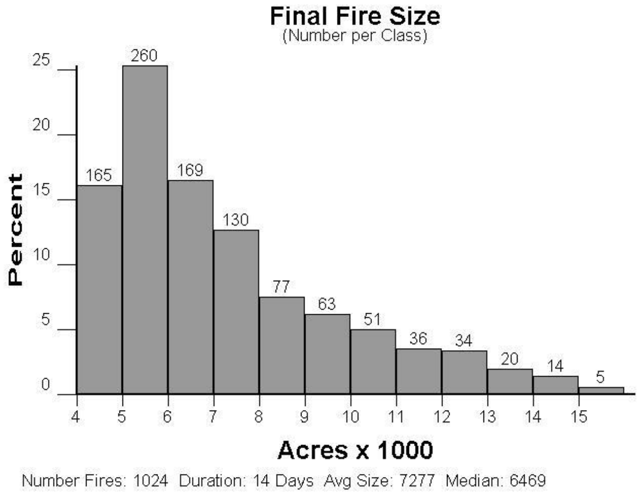
FSPro Results

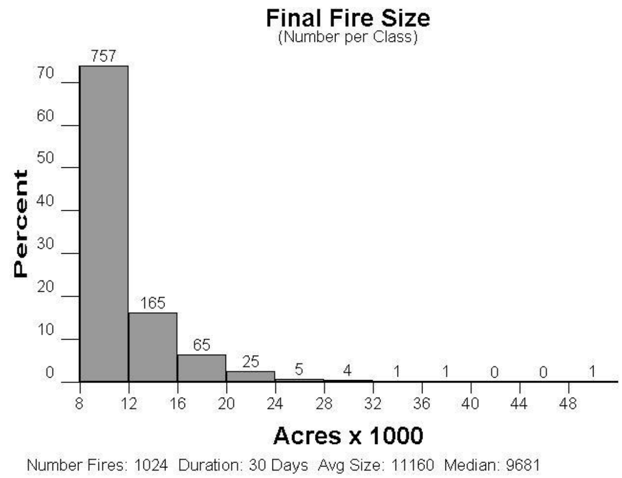


FSPro Analysis map for a 14-day run



FSPro Analysis for a 30-day run





Percentile	30 day	14 day
Average	11,160ac	7,277ac
90th	16,010	11,234
70th	11,594	7,933
50th	9,681	6,469
30th	8,830	5,536
10th	8,506	4,868
Largest	48,153	15,982

Both the 14 day and 30 day runs fail to place any private lands within even the lowest probability band. All directions from the current perimeter are predicted to be included, with a somewhat inhibited tendency for the fire to move to the east (up drainage). The planning area boundary is exceeded with >80% probability in both the 14 and 30 day runs on the north, west, and south, , with lower probability to the east.