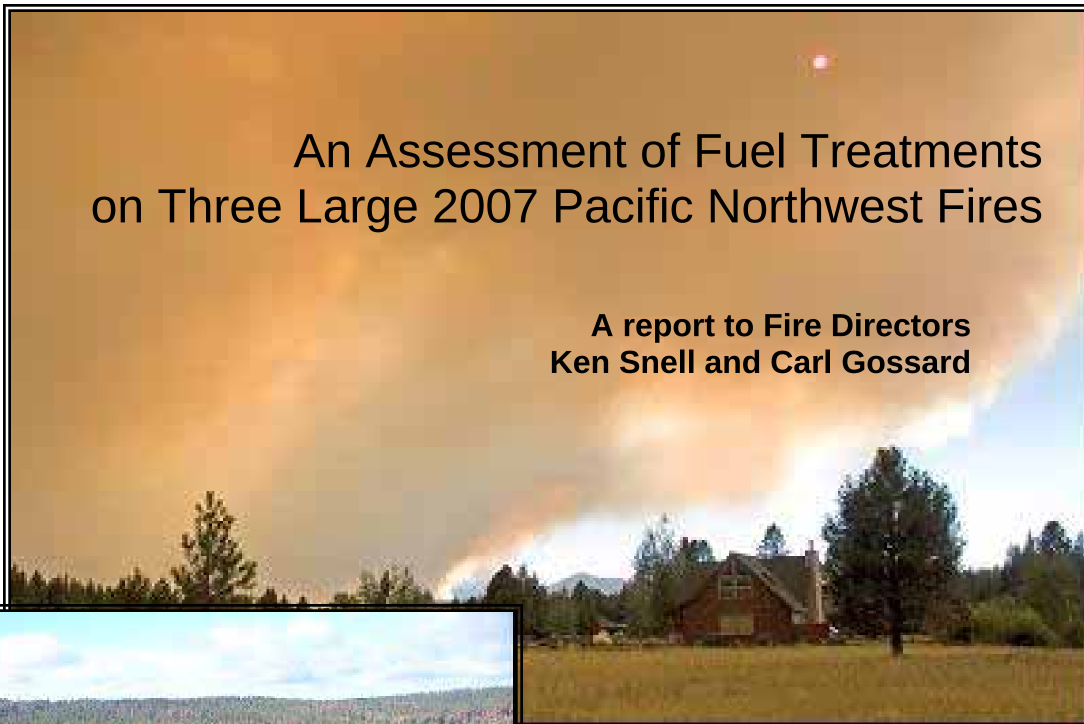

An Assessment of Fuel Treatments on Three Large 2007 Pacific Northwest Fires

A report to Fire Directors
Ken Snell and Carl Gossard

Pacific Northwest Region,
USDA Forest Service

Oregon State Office,
USDI Bureau of Land Management

December 2007

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Authors

Steve Harbert, Fuels Specialist, BLM, Portland, Oregon
Andrew Hudak, Research Forester, Rocky Mountain Research Station, Moscow, Idaho
Laura Mayer, Fuels Coordinator, USFS, Portland, Oregon
Tim Rich, Fuels Specialist, USFS, Portland, Oregon
Sarah Robertson, Operations Specialist, USFS, Portland, Oregon

Assessment Team Members

Monument Fire
- **Tim Rich**, Fuels
- **Brian Goff**, Operations
- **Bill Otani**, Vegetation Management
- **Gary Popek**, GIS Specialist

Egley Complex
- **Steve Harbert**, Fuels
- **Dave Lentz**, Operations
- **George Wynn**, Vegetation Management
- **Janet Braymen,** GIS Specialist

GW Fire
- **Laura Mayer**, Fuels
- **Sarah Robertson**, Operations
- **Jim Stone**, Vegetation Management
- **Jim Grace**, GIS Specialist

Cover Photos

Top: GW Fire approaching Black Butte Ranch, photo by Gary Miller; **Middle**: Mixed severity fire on Egley Complex, photo by Steve Harbert; **Bottom**: Monument Fire crossing road, photo courtesy Umatilla National Forest.

The intent of this report is to assess the effectiveness of past fuel and vegetation treatments on reducing hazardous fuels. Our hope is that this assessment will inform managers of possible adjustments in treatment prescriptions that can improve the overall hazardous fuels program now—and into the future.

Contents

Executive Summary

The National Fire Plan, signed in 2000, increased fuel treatment budgets. From 2001 through 2007, the Oregon State Office, USDI Bureau of Land Management, and the Pacific Northwest Region, USDA Forest Service—together—spent $280 million treating fuels. This represents fuel treatments on an estimated 713,000 acres.

The *10-Year Implementation Plan* (USDA, 2002; USDA, 2006) contains two fuel treatment goals: 1) Reducing wildfire risks to communities and the environment, and 2) Improving ecosystem resiliency to wildfire effects. Because these goals have provided the anchor for fuel treatment strategies in the Pacific Northwest, beginning in July 2007, the State Office and Regional Office initiated an effort to monitor the effects of fuel treatments impacted by wildfires.

Of the 21 Type 1 and Type 2 fires that burned on Forest Service and Bureau of Management lands in Oregon and Washington in 2007, five burned into—or adjacent to—fuel treatments.

Three Assessment Teams analyzed three of these fires:

- ❖ The Monument Fire on the Umatilla National Forest and Prineville District, Bureau of Land Management;
- ❖ The GW Fire on the Deschutes National Forest; and
- ❖ The Egley Complex on the Malheur National Forest and Burns District, Bureau of Land Management

On all three of these fires, the Assessment Teams used:

- ❖ Treatment data supplied by the units,
- ❖ Interviews,
- ❖ Field observations, and
- ❖ Burned Area Reflectance Classification (BARC) mapping.

Treatments Reduced Fire Behavior

The **Monument Fire** burned across a landscape with extensive but relatively low intensity fuel treatments that reduced severe fire effects. The area that burned in the **Egley Complex** included both extensive underburns and intensive, strategically located fuel and other vegetation treatments that improved suppression effectiveness. The **GW Fire** impacted a fuel treatment located between the fire and a high-value wildland-urban interface area that—with favorable weather and effective suppression effort—successfully stopped the fire's spread.

On the three fires studied, a higher proportion of acres burned severely on untreated lands than where fuel or other vegetation treatments had been applied (prior to the fires). More recent treatments and higher-intensity treatments reduced fire behavior and fire effects more effectively than older and less intense treatments.

On all three fires, fuel treatments seemed to increase suppression effectiveness. Additionally, when Incident Management Teams had knowledge of treatments, they used these treated areas to plan and implement suppression strategies and tactics. Intensive fuel treatments located along major ridge top road systems were particularly useful in increasing fire suppression effectiveness.

Conclusions

With so much land in need of restoration across the Pacific Northwest, treatment options are virtually unlimited. Decisions of where to treat are influenced by competing resource objectives and values-at-risk. Determining where the next damaging fire will occur and setting treatment priorities will continue to be significant management challenges.

Managers are challenged by deciding between implementing less intense, low-cost, landscape-scale treatments and more intense, high-cost, small-scale treatments. Budgets and other constraints will require agencies to be even more deliberate in selecting fuel treatment strategies. Continued landscape scale underburning and maintenance treatments should be part of future long term vegetation and fuel treatment strategies; and the need for maintenance treatments will continue to escalate as more lands are restored.

In the short term, the Burned Area Reflectance Classification (BARC) mapping proved useful in determining fire severity effects. Other factors, however, might have interacted with treatments to influence burn severity. A more systematic analysis of these data is therefore needed.

While the Assessment Teams found a surprising amount of treatment data available, the accuracy of these data needs improvement. In general, there was limited site-specific pre- and post-treatment data.

The number of small fires that might have been prevented from becoming larger fires due to fuel treatments is unknown. Studying this will require purposeful data collection and analysis that will provide a more complete picture of fuel treatment effectiveness.

Key Recommendations

National Forests and Bureau of Land Management Districts should:

1. Develop and articulate a clear strategy to guide hazardous fuel treatments.
2. Continue to implement the Regional/State Office fuel treatment effects monitoring process.
3. Use treatment data in developing wildfire strategies. Provide fuel treatment maps to Incident Management Teams.

The State/Regional Office should:

1. Develop a strategy for monitoring treatment effectiveness and validate fuel treatment performance when tested by wildfires. The objective is to rely *less* on anecdotal evidence and retrospective analysis and *more* on definitive conclusions drawn from data.

I Introduction

The National Fire Plan, signed in 2000, placed an emphasis on fuel treatment with increased funding. From 2001 through 2007, the Oregon State Office, USDI Bureau of Land Management and the Pacific Northwest Region, USDA Forest Service—together—spent $280 million treating fuels. This represents fuel treatments on an estimated 713,000 acres. These numbers do not include other vegetation treatments that also reduced hazardous fuels or that restored ecosystems.

In May of 2002, the *Implementation Plan* for the *10-Year Strategy* (USDA, 2002) was approved. This further defined two goals of fuel treatments:

- ❖ Reduce hazardous fuels to reduce wildfire risks to communities and the environment, and
- ❖ Restore and maintain fire adapted ecosystems.

These two goals are often interrelated, particularly in short-interval fire-adapted ecosystems. Fuel treatments designed to change fire behavior often improve both the ecosystem resiliency to wildfire as well as improve suppression options.

The primary intent of this report is to assess the effectiveness of past fuel and vegetation treatments on reducing hazardous fuels when these treatments are impacted by wildfire.

Secondary objectives of this report are to test:

- A process for evaluating fuel treatments,
- Whether Burned Area Reflective Classification (BARC) mapping can be used to determine fuel treatment effectiveness.

This assessment informs managers of possible adjustments in treatment prescriptions that will serve to improve the overall hazardous fuels program now—and into the future.

Methods

Across the Pacific Northwest in 2007, 21 Type 1 and Type 2 fires burned 403,608 acres on Forest Service and Bureau of Land Management lands. Five of these fires burned into, or adjacent to, fuel treatments. This assessment focuses on three of these fires.

For the purposes of this report, a distinction was drawn between fuel treatments and other vegetation treatments. The intent of fuel treatments is to change fire behavior for either of the two previously stated fuel treatment goals. Although other vegetation treatments may affect fire behavior, they are designed and implemented for different objectives.

Planning documents contain the intended goal of the fuel treatments. The Assessment Team did not systematically review planning documents, but relied on local experts to articulate these treatment goals.

Initially, the Assessment Teams intended to analyze only fuel treatments. However, because many projects were designed for both vegetation and hazardous fuels purposes, the scope was expanded to include projects with multiple objectives.

In addition to the Type 1 and 2 fires, approximately 1,300 Type 3, 4 and 5 fires ignited on Forest Service and Bureau of Land Management lands in the Pacific Northwest in 2007. Data on these 1,300 fires was incomplete, and therefore no analysis was performed.

The Three Fires Analyzed

Three Assessment Teams analyzed these three large fires:

- The **Monument Fire** on the Umatilla National Forest and Prineville District, Bureau of Land Management;
- The **GW Fire** on the Deschutes National Forest; and
- The **Egley Complex** on the Malheur National Forest and Burns District, Bureau of Land Management.

The Assessment Teams visited the three fires during the first week of October 2007. Each team consisted of a fuels specialist, an operations specialist, a vegetation manager and a GIS specialist. The Rocky Mountain Research Station also participated with the Monument Fire Assessment Team as part of a national fuels effectiveness assessment.

To best assess fire behavior and suppression effectiveness:

- Local firefighters and fuel and vegetation managers were interviewed,
- Field observations were made,
- Relevant photos were collected, and
- Final fire packages, operational plans, and burn plans were reviewed.

The Burned Area Reflectance Classification (BARC) maps produced by the USFS Remote Sensing Applications Center (RSAC) were used to make inferences about stand resiliency by testing differences in fire severity between treated and untreated areas within the three fires.

BARC maps were also produced for the respective fire Burned Area Emergency Response (BAER) Teams. These maps were categorized into four severity ranges representing the relative ecological changes from the wildfires. The final severity thresholds were used on each map as determined by the BAER team—as these thresholds likely represented the severity conditions validated on the ground.

When visiting these three fires, this study’s three Assessment Teams also validated their respective BARC maps as much as possible in the time allowed.

II The Monument Fire

1. Introduction

The Monument Fire, located 10 miles north of Monument, OR, started on July 13, 2007. The Blue Mountain Incident Management Team (IMT) and the Northwest Oregon IMT managed the fire.

The Monument Fire burned a total of 53,556 acres on the following lands:

- 19,768 acres, Umatilla National Forest;
- 21,364 acres, Prineville District BLM (most of these lands were acquired by the agency five years ago); and
- 12,364 acres, private lands protected by Oregon Department of Forestry (ODF).

The fire threatened several structures on private and BLM lands. Only one structure burned.

Beginning in 1998, the Umatilla National Forest had implemented prescribed burns on 13,559 acres within the fire perimeter. While treatment activities occurred on BLM lands within the fire perimeter prior to 2002, records are incomplete. No fuel treatments funded with Federal dollars under the National Fire Plan were completed in the Wildland-Urban Interface adjacent to structures. Private lands burned by the Monument Fire were not analyzed.

Fire Behavior Chronology

Lightning ignitions from storms on July 12 and 13, 2007 started the Monument Fire. Two fires, the Red Hill Fire and the Wall Creek Fire, reported on July 13, merged into one fire.

Significant fire spread in the North Fork John Day River drainage was influenced by strong down canyon winds (locally referred as "*sundowners*")—usually between 1500 to 2000 hours. These wind events were not recorded at Remote Automated Weather Stations (RAWS).

Beginning in 1998, the Umatilla National Forest had implemented prescribed burns on 13,559 acres within Monument Fire perimeter.

To protect residences along the John Day River, initial suppression efforts were concentrated on the fire's south perimeter. This strategy left the fire's north perimeter without staffing for several days. Approximately 25,000 acres burned in the first three burning periods, with the remaining 30,500 acres burning over the next 10 days. (See Fire Progression map, Appendix 1.)

2. Description of Fire Environment

Fuels and Topography

Most of the area affected by the Monument Fire had previously been selectively logged. Formerly open stands dominated by ponderosa pine are now densely stocked with an abundance of grand fir and Douglas fir.

According to the Umatilla National Forest's data, Forest Service lands that burned in the Monument Fire are identified as:

- ❖ Eighty-eight percent Fire Regime I (short fire interval ponderosa pine),
- ❖ Five percent Fire Regime II (juniper shrub steppe), and
- ❖ Six percent Fire Regime III (mixed conifer).

By contrast, LANDFIRE data includes much more land in Fire Regime III. The Monument Fire Assessment Team determined that the Umatilla National Forest's data was better at the scale needed for this assesement. The Forest's data was therefore used for the severity analysis.

Much of the forested area that had been previously underburned is now two-storied stands with light to moderate woody fuels and grass in the understory. The lower story is typically pole size and lacks seeding or sapling-size classes. There is very little brush in the understory.

Conversely, the untreated areas are dominated by multistoried stands. Areas that received vegetation treatments for objectives other than fuels reduction are typically plantations of various ages from seedling/saplings to pole sized stands. The open meadows have light grass fuels.

The topography within the fire perimeter includes flat open ridge tops dissected by steep drainages running north to south. Slopes vary from flat on the ridge tops to greater than 40 percent in the drainages. Aspects generally face south, with west and east on either side of the drainages.

Fire Danger and Weather

Most of the significant fire spread occurred during the first four days of the fire. During this time the fire danger—as measured by Energy Release Component (ERC)—approached the 90th percentile. ERC was initially at record highs for the date, but well below the seasonal maximum typically experienced during the fire season (Figure 1). After the first four days, the ERC dropped to below the 80th percentile (considered the threshold for large fire growth on the Umatilla National Forest), but then steadily climbed to above the levels recorded at the beginning of the fire.

Fire behavior, particularly on the southern part of the fire, was strongly influenced by down-drainage winds that ranged from 20-25 miles per hour during the late afternoons. Here, on the fire's southern perimeter, live herbaceous fuels were cured. Grass fuels at the higher elevations did not cure until later in the month and, therefore, initially retarded the fire behavior.

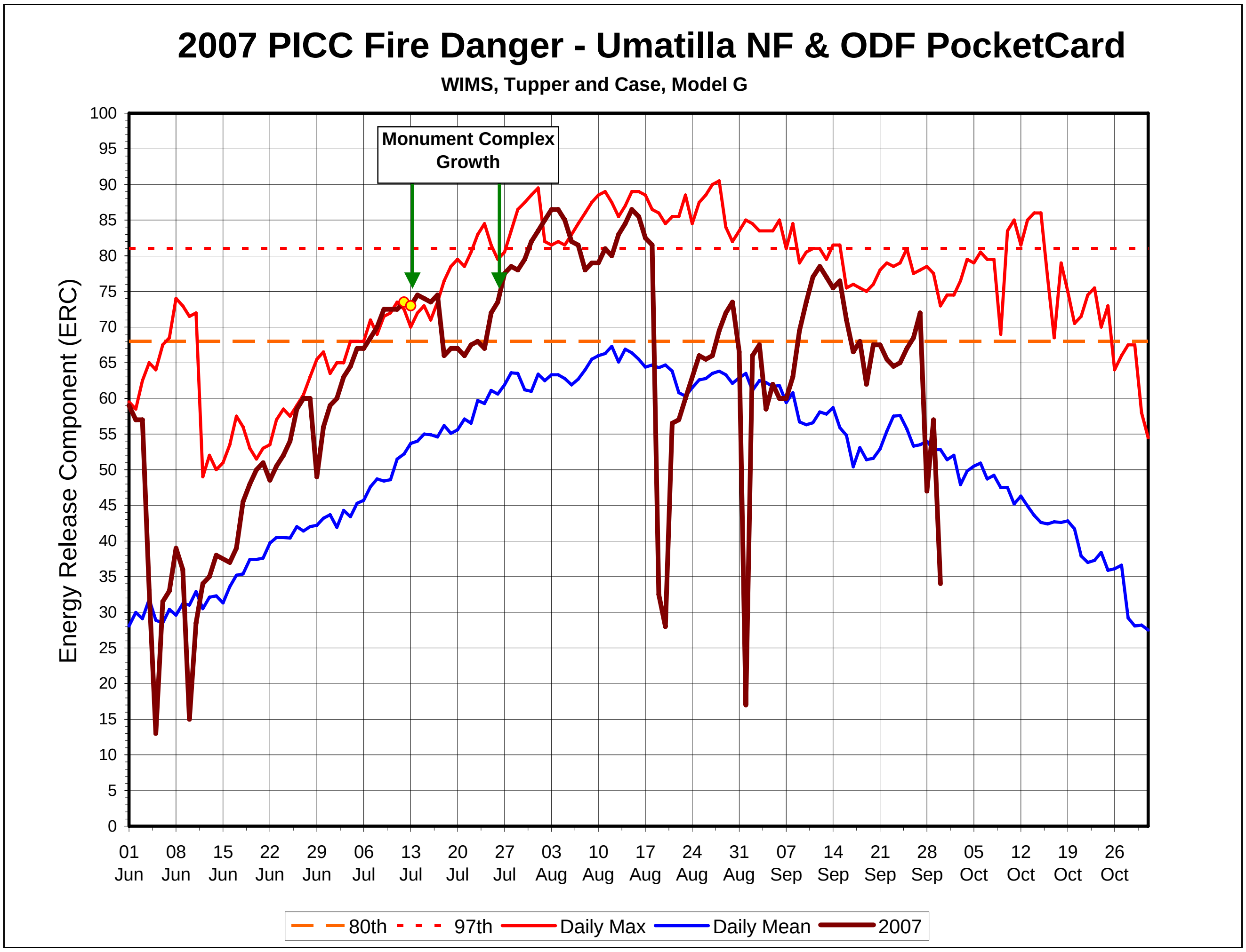


Figure 1 – Energy Release Component for a group of RAWS used to indicate fire danger on the southern Umatilla National Forest. Data includes 1986-2007. (Courtesy Brian Goff.)

3. Fire Effects of Fuel Treatments

Description and Prescriptions

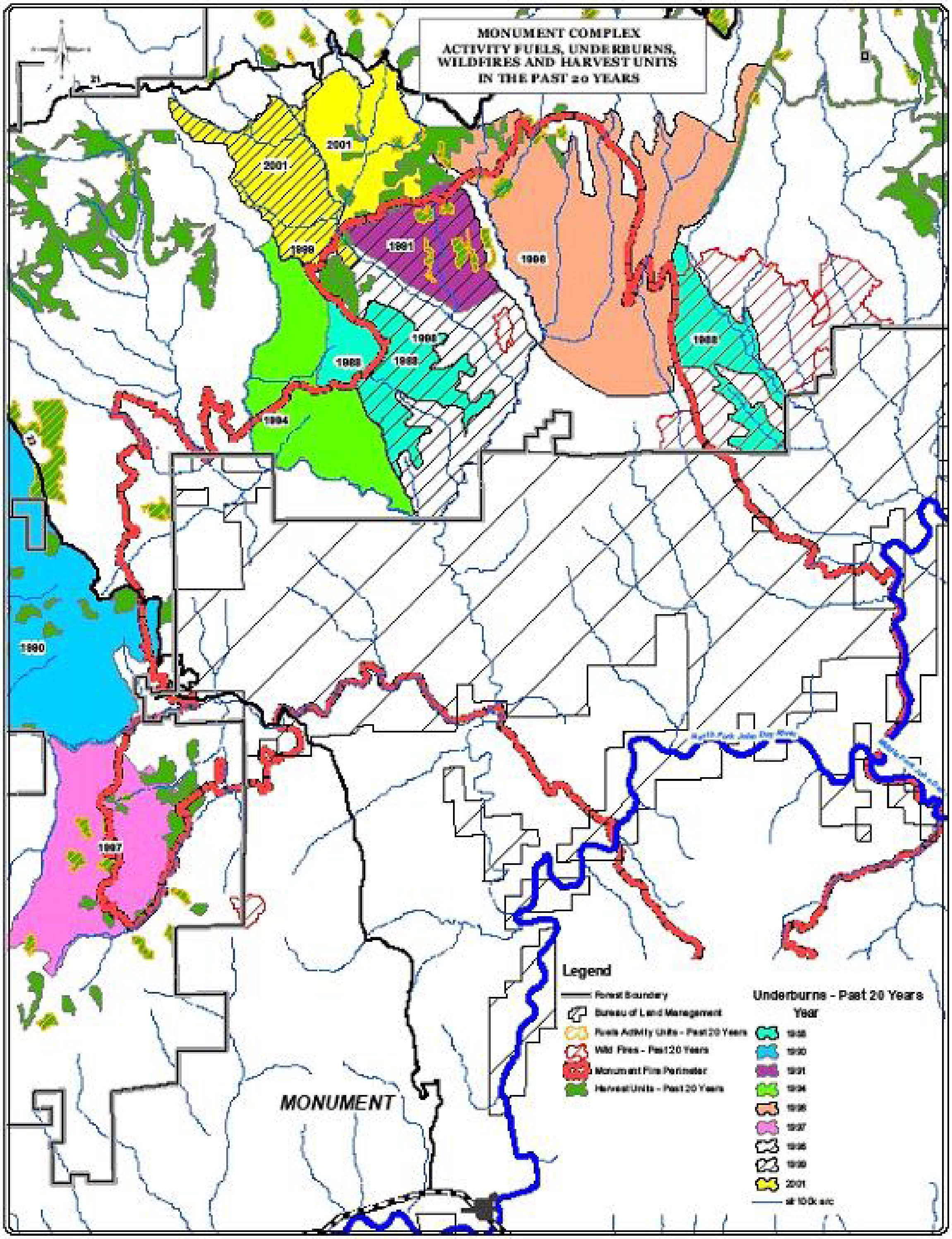
Prior to the Monument Fire, between 1988 and 2001, nine fuel treatments were completed on Forest Service lands. All treatments were underburns, encompassing 13,559 acres within the Monument Fire perimeter (see Map1).

Three of these underburns within the fire perimeter were less than 150 acres; the other six were greater than 1,000 acres. The 1998 underburn encompassed all of the 1988 and 1991 underburns. A portion of the 2001 underburn intersected a 1999 underburn. The 1997 and 1998 underburns were conducted in the fall. The others were burned in the spring—except the 1994 and 1999 burns that have no recorded burn date for day and month.

The treatment goal of all of these underburns was to restore or maintain fire-adapted ecosystems. The treatment objectives in the six burn plans reviewed by the Monument Fire Assessment Team were to reduce surface fuels, kill trees in the small size classes, and reduce the risk of crown fire killing the larger trees. There were likely more treatments on Forest Service lands that were not recorded. Tom Jones, retired fuels specialist who worked on the Heppner Ranger District from 1980-1995, informed the Assessment Team that he directed several prescribed fires in the Monument Fire area that are not included in the available data.

Fire Behavior

Ground observations and interviews with firefighters assigned to the incident were used to assess fire behavior. For two days, the Assessment Team visited portions of six underburns, including those accomplished in 1988/1998, 1990, 1991/1998, 1994, 1996, and 1997. The team also examined one prior treatment area on BLM land. The Monument Fire Assessment Team visited one of the three past wildfires recorded within the Monument Fire perimeter, a small 2006 lightning fire on a non-forested, sage-brushed dominated ridgetop.



Map 1 – Past fuel treatments, other vegetation treatments, and wildfires within the Monument Fire perimeter.

Overall, the effects of the underburns on fire behavior were difficult to separate from other factors. First, the fire spread over a 10-day period during different fire weather conditions. A significant amount of the area burned on cooler days and during controlled burnout operations.

Figure 2 – Monument Fire Division O/M. This area had been underburned in 1996. The fireline appears in middle of photo; burned area is located on the right. Note lack of small reproduction in the understory. (Photo courtesy Tim Rich.)

Further, the time since the treatments varied. Treatments were conducted during different times of the year. Some areas were treated twice, which likely produced different treatment results. The Monument Fire Assessment Team found no examples in which fire behavior abruptly changed once the fire encountered a past fuel treatment area.

Very little crown fire occurred within areas previously underburned. However, the Assessment Team observed one area with 100 percent crown scorch within a 1990 underburn on the Monument Fire's western perimeter. This area burned during the first few days of the fire when fire weather was most severe. Additionally, the area is located on steeper slopes and it has been 17 years since this prescribed underburn was implemented—which could account for the observed crown scorch.

After the first four days, the northern part of the fire perimeter was located almost entirely within prior fuel treatment areas. Despite increasingly severe fire weather—where ERC exceeded the levels recorded at the beginning of the fire—the Monument Fire never again made significant runs.

Firsthand Fire Effect Observations

Brenda Wilmore, Task Force Leader working Divisions O and M on the north side of the fire, noticed the effects of past underburning, including standing dead trees, shallow litter and duff depths, and reduced surface fuels. She reported surface fire spread with occasional single-tree torching and very little spotting within the 1996 underburn.

Tom Jones, the Fire Behavior Analyst (FBAN), also worked Divisions O and M. He reported that where underburns had occurred, stand density was more open, and crown consumption from the burnouts was rare.

Suppression Effectiveness
The Monument Fire was contained along a road within the 1994 and 1998 underburns under relatively severe fire weather. The corresponding fire behavior and observed post-fire effects were modest.

Firefighters believed that burnout operations were more successful where stand density and fuel loadings had been reduced.

The northern spread of the fire was contained through indirect strategies and burnouts along roads with some fireline constructed to tie roads together. Much of this perimeter had been underburned or was adjacent to past underburns. A total of 63 percent of the fire's final perimeter was located within or adjacent to underburns on Forest Service lands.

Discussions with the IMTs suggest that while fuel treatment locations were not factored into strategically choosing fireline locations, they might have helped to determine actual "in-the-field" suppression tactics.

Most burnouts on the Monument Fire proved to be successful. Favorable winds played a part, but firefighters also believed that burnout operations were more successful where stand density and fuel loadings had been reduced. Most fireline constructed and then lost was due to the down-drainage winds that occurred almost every afternoon.

4. Fire Effects of Non-Treatment Areas

Description
Of the 19,768 acres of Forest Service lands burned within the Monument Fire perimeter, only 30 percent, or 5,839 acres, had received little or no management activity in the recent past. Most of these acres had either minimal commercial timber value, poor access, or adverse terrain for commercial logging.

Fire Behavior
Assessment Team observations, on the ground interviews with firefighters, and the BARC mapping all indicate that untreated areas burned with slightly greater intensity than burned areas. Tom Jones, FBAN on the Monument Fire, reported that upper tree canopies were consumed or severely scorched where underburns had not occurred in the past and where helicopter ignited burnouts occurred.

Suppression Effectiveness
One third of the Monument Fire's fireline constructed on Forest Service lands was located in, or adjacent to, untreated areas. Fireline construction success in untreated areas was likely because of favorable weather, favorable topography—or both. With the exception of the first few days and last few days of the fire, burning conditions were moderate, enabling successful fire suppression regardless of fuel conditions.

5. Fire Effects of Other Vegetation Management Areas

Description

Since 1987, 1,321 acres of other vegetation treatments were completed within the Monument Fire perimeter. These treatments included commercial harvests with or without activity fuels treatment and non-commercial thinning.

Figure 3 – Activity fuels were treated after harvest in 1989. Note reproduction thinned during Monument Fire burnout operations. (Photo courtesy Tim Rich.)

Previous wildfires had also burned small areas in 2001 (239 acres), 2002 (19 acres), and 2006 (67 acres). Wildfires and vegetation treatments were the most intensive treatments within the fire perimeter.

Other vegetation treatments and wildfires comprised 8.2 percent of the area burned. Almost all of these other treatments and wildfires were within later underburn boundaries. The Assessment Team visited two vegetation treatments: 1) A seed tree harvest that was burned and planted in 1989 and its surrounding area was underburned in 1996; and 2) A small clearcut harvested in 1995 that had not been underburned.

The BLM land included in the Monument Fire perimeter was acquired five years ago. This area was logged and dozer piled prior to this sale to the BLM. No activities, including grazing, have been completed on these BLM lands since the property was acquired.

Fire Behavior

The Forest Service seed tree unit was likely burned in burnout operations at low intensity with mixed severity effects. The regeneration was effectively thinned, and the overstory survived (Figure 3). The Monument Fire crowned in the reproduction in the clearcut and burned under severe conditions early in the fire.

Most of the BLM land burned during the first few days of the fire. Frequent torching with short crown fire runs was observed.

Suppression Effectiveness

Burnout operations were successful in the seed tree unit due to low fuel loadings.

The fire burned with intensity through the clearcut and spotted across an adjacent road. Due to the extreme weather experienced early in the fire, suppression efforts were ineffective there.

6. Fire Severity Comparisons

The Monument Fire, occurring early in the fire season, had very few areas that were severely burned. Most of the forested areas affected by the fire were low-severity underburns, similar to the fire effects expected from a prescribed fire.

The Assessment Team used the BARC map, as classified by the Monument Fire BAER Team, to test the differences in fire severity between: untreated areas and underburns, other treatments, and past wildfires.

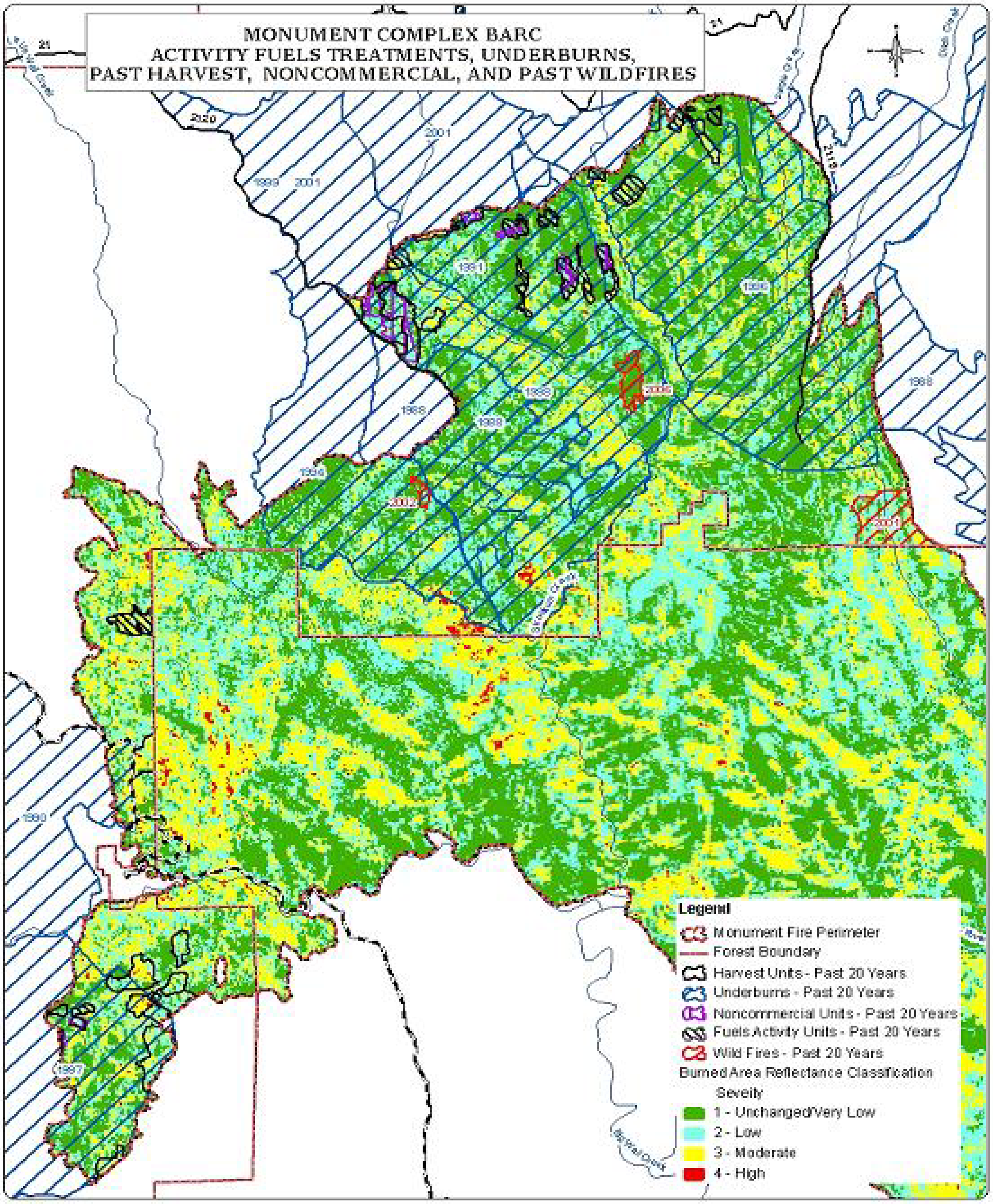
Only the underburn treatments significantly reduced the number of moderate severity acres burned compared to the untreated areas.

From the Assessment Team's field observations, the BARC map (Figure 5) appeared to accurately illustrate severity effects. Where the map showed moderate or high severity, there was total crown scorch or crown consumption, respectively.

Of the 19,945 acres burned in the Monument Fire, 11,172 acres (56.0 percent) burned at low, moderate, or high severity (Table 1). Since 1988—and prior to the 2007 Monument Fire—fuel managers had treated 13,559 acres (68.0 percent) with prescribed underburns, of which 7,088 acres (52.3 percent) burned in the Monument Fire at low, moderate, or high severity.

There were only 5,839 acres (29.3 percent) left untreated at the time of the Monument Fire, of which 3,667 acres (62.8 percent) burned at low, moderate, or high severity. Thus, the proportion of acres that burned at low, moderate, or high severity was 10.5 percent higher on untreated lands than on lands that had been previously treated with underburns.

Because so few acres burned at high severity (see Table 1 in Appendix 3), the moderate severity class was used for testing the significance of differences between treated and untreated areas. Of the fuel and vegetation treatments that had been applied on Umatilla National Forest lands prior to the Monument Fire, only the underburn treatments significantly reduced the number of moderate severity acres burned compared to the untreated areas (Hudak and Popek, unpublished report) .



Map 2 – Burned Area Reflective Classification (BARC) severity map with fuel treatments, other vegetation treatments, and wildfires within the Monument Fire perimeter.

7. Monument Fire Summary

Seventy percent of the Forest Service-managed lands that burned in the Monument Fire had been underburned in the past. Compared to untreated stands or older underburns, stands recently underburned lacked evidence of small trees (ladder fuels) in the understory. The great variability in burning conditions, terrain, vegetation, as well as the time since treatment made it difficult to determine the chief cause for the moderate fire behavior, fire effects, and increased suppression effectiveness within treated areas.

The BLM lands burned more intensely with higher severely and resisted suppression efforts—likely because of past management prior to acquisition. These lands were also lower elevation, drier sites, and were more exposed to the down canyon winds.

Because fire danger indices were around the 80th percentile ERC for most of the fire, the majority of the treatments were tested by very high fire weather.

All of the treatments were designed to restore or maintain fire-adapted ecosystems; increasing suppression effectiveness was not an explicit treatment goal.

Fire operations personnel used fuel treatments for tactical control of the fire perimeter. On Forest Service lands, 63 percent of the final fire perimeter was located within or adjacent to previous underburns.

The BARC map illustrated 44 percent and 35 percent unburned/very low and low-severity classes, respectively, on Forest Service lands within the fire perimeter. When the Monument fire occurred in July, live fuel moistures were high, especially at the higher elevations. This introduces some uncertainty to the BARC analysis and is likely responsible for the large proportion of low-burn severity observed in the BARC map.

III The GW Fire

1. Introduction

Lightning ignited the GW Fire on August 31 in the Mount Washington Wilderness west of Sisters, OR. A strong west wind quickly pushed it east. The fire spread actively for four days, eventually forcing the evacuation of the community of Black Butte Ranch on September 3. The Central Oregon IMT managed the fire from September 1-12.

The GW Fire burned 5,887 acres of the Deschutes National Forest and 1,461 acres of private timberland. Twenty-five percent of the Forest Service lands that burned had received prior fuel or other vegetation treatments (Table 1). The fire burned into intensive fuel treatments designed to reduce wildfire threat to Black Butte Ranch. The GW Fire Assessment Team did not analyze the private lands affected by the fire.

Fire Behavior Chronology

The GW Fire spread was influenced by strong west winds common to the area. The fire resisted initial attack due extreme fire behavior and inaccessibility. Air resources were unable to operate—or be effective—due to the wind, estimated on the day of ignition at 10-20 mph with gusts to 30 mph.

The first day, the fire spread west three miles. The strong winds continued throughout the fire's first four days, driving it east another three miles (see Fire Progression Map, Appendix 1). During this time, fire behavior can be described as single-tree and group-tree torching with spotting up to ¾ miles and short, active crown-fire runs.

On the GW Fire's fifth day, September 4, the weather moderated significantly. This is also when the fire burned into intensive fuel treatments just west of Black Butte Ranch. After September 4, even though fuels dried over the next several days, fire spread was minimal.

Table 1 – Treatment Types and Approximate Acres within the GW Fire Perimeter.

General Treatment Types	Acres
Fuel Treatments	196
Other Vegetation Treatments	1,269
No Treatment	4,423
Private Lands	1,461
Total	**7,349**

2. Description of Fire Environment

Fuels and Topography

The GW Fire originated at 5,500 feet elevation and burned generally downhill in rolling topography down to 3,400 feet elevation. The location of the fire's origin within the Mount Washington Wilderness had not burned in recent times, although areas to the south and north had burned within the last 10 years.

Fire regimes here are classified as Fire Regime IV—high-severity, long fire return interval. Vegetation consists of multistoried mixed conifer stands with widespread mortality, particularly in the areas dominated by lodgepole pine. The understory consists of considerable dead, downed woody debris and shrubs.

Vegetation transitions to the east with decreasing elevation, from mixed conifer types, described by Fire Regime III, to ponderosa pine types at the lowest elevations, described by Fire Regime I. Overstory vegetation consists of Douglas fir and ponderosa pine, with brush in the understory. Ponderosa pine dominates sites at the lowest elevations. Where no treatments have occurred, dense, multistory stands dominate.

Areas that have had vegetation treatments are now mostly 18 to 28 year-old plantations with sapling to pole-sized trees and significant brush. These areas also have some grass in the understory, but lack downed dead fuel.

The intensive fuel treatments—in previously dense multistoried stands—were thinned to single story stands with forbs, grass, pine litter, and young shrubs in the understory. Small areas within these treatments were left for wildlife cover—these areas remained dense, multistored stands.

In the past four years, the Sisters Ranger District has experienced five large fires: Lake George, 2006; B & B Complex, 2003; Link, 2003; Cache Mountain, 2002; and Cache Creek, 1999. These fires tended to burn west to east with prevailing west winds. The winds increase in velocity and the air mass dries as winds move downslope. The 1999 Cache Mountain Fire burned west into the Black Butte Ranch community, forcing evacuations.

Fuels within these past wildfires are substantially different. Shrubs now dominate where the overstory was killed. Standing snags are now abundant.

Fire Danger and Fire Weather

At the time of the GW Fire, fuel moisture conditions, as measured by the ERC, were below normal. However, low humidity and 10-20 mph west winds—with gusts of 25-30 mph in the late afternoon and early evening hours during the fire's first four days—intensified fire behavior. This condition and effect is illustrated by the Burning Index (Figure 4) which climbed to near the 90th percentile levels during the fire.

On September 4 a low-pressure system and associated cold front brought .25 to .30 inches of precipitation to the fire area, significantly reducing fire danger. While this was a fire-slowing event, it was not a *season-ending* event. After September 4, for eight straight days the ERC climbed to above average levels.

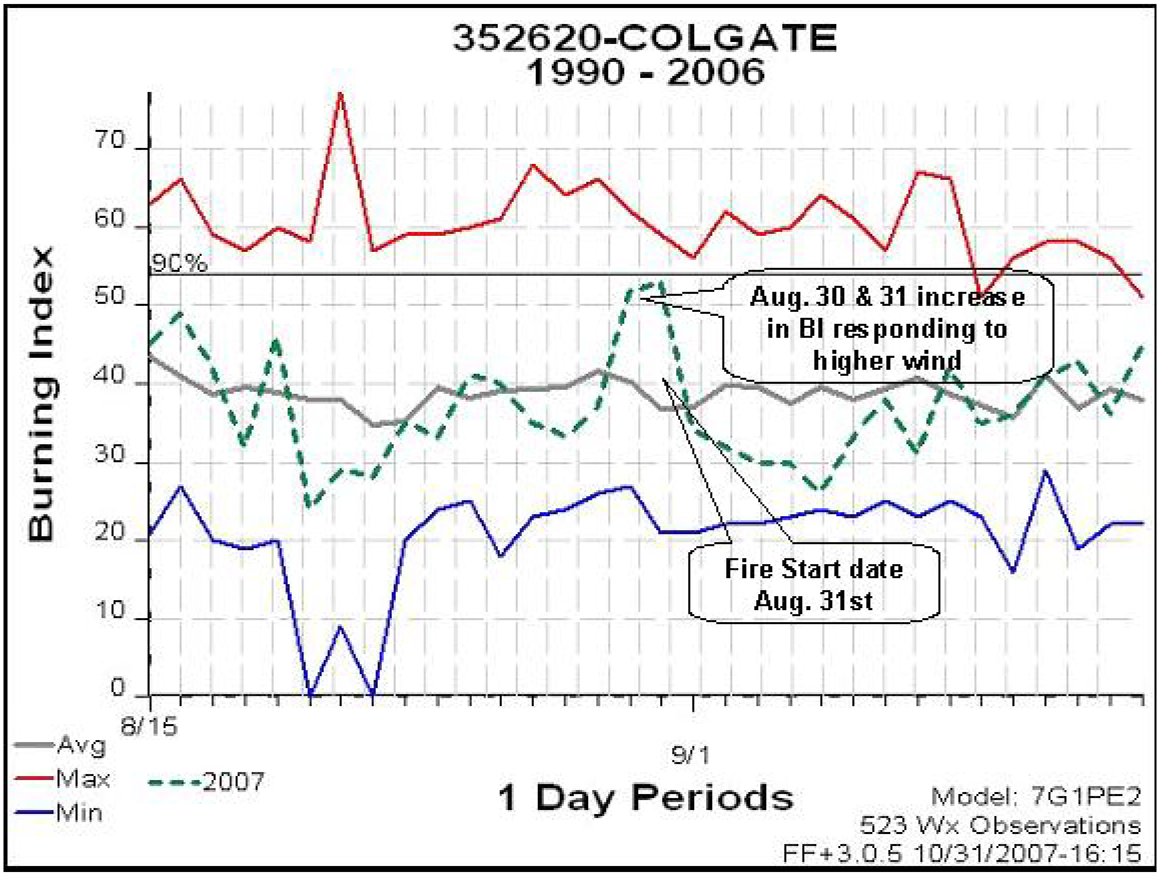


Figure 4 – Burning Index (BI) from Colgate RAWS. Burning index is heavily influenced by wind speed and fine fuel moisture. Note BI approaching the 90 percentile during the days of significant fire spread.

3. Fire Effects of Fuel Treatments

Description and Prescriptions

Two units, totaling 196 acres of fuel treatments, burned in the GW Fire. These treatment areas were located on the fire's eastern perimeter on Forest Service lands west of Black Butte Ranch. Because of this wildland-urban interface location, these treatment units were specifically designed to change fire behavior and provide effective suppression of wildfire approaching Black Butte Ranch.

These intensive treatments consisted of thinning, hand-piling, and burning hand-piles, followed by underburning. The treatments had been implemented and completed between 2003 and 2006.

Fire Behavior

Fire behavior within fuel treatments was assessed using ground observations and interviews with firefighters. Fire behavior within fuel treatments was quite different from untreated areas (Figure 5). Surface fire with flame lengths from 1-3 feet was observed by firefighters. The only crown fire behavior observed occurred in the areas that had been left for wildlife cover. These areas readily torched and spotted—none survived intact.

Figure 5 – Fuel treatment unit boundary at the very eastern edge of the GW Fire. Treated area is on the right. (Photo courtesy Jason Loomis.)

The weather change occurred when the GW Fire reached the fuel treatments adjacent to Black Butte Ranch. Therefore, these treatments were not tested by severe, windy weather experienced during the three previous days. Firebrands landing within the treated areas resulted in spot fires with low fire intensity and slow rates of spread. Consequently, minimal amounts of the treated areas burned (Figure 6).

The BARC map indicates that only three acres, or 1.4 percent, that burned within fuel treatments resulted in high severity fire effects (Appendix 3, Table 2). Sixty-six acres resulted in moderate severity; 126 acres were classified as low, or very low/unburned, severity. This mapping is consistent with the GW Fire Assessment Team's ground observations.

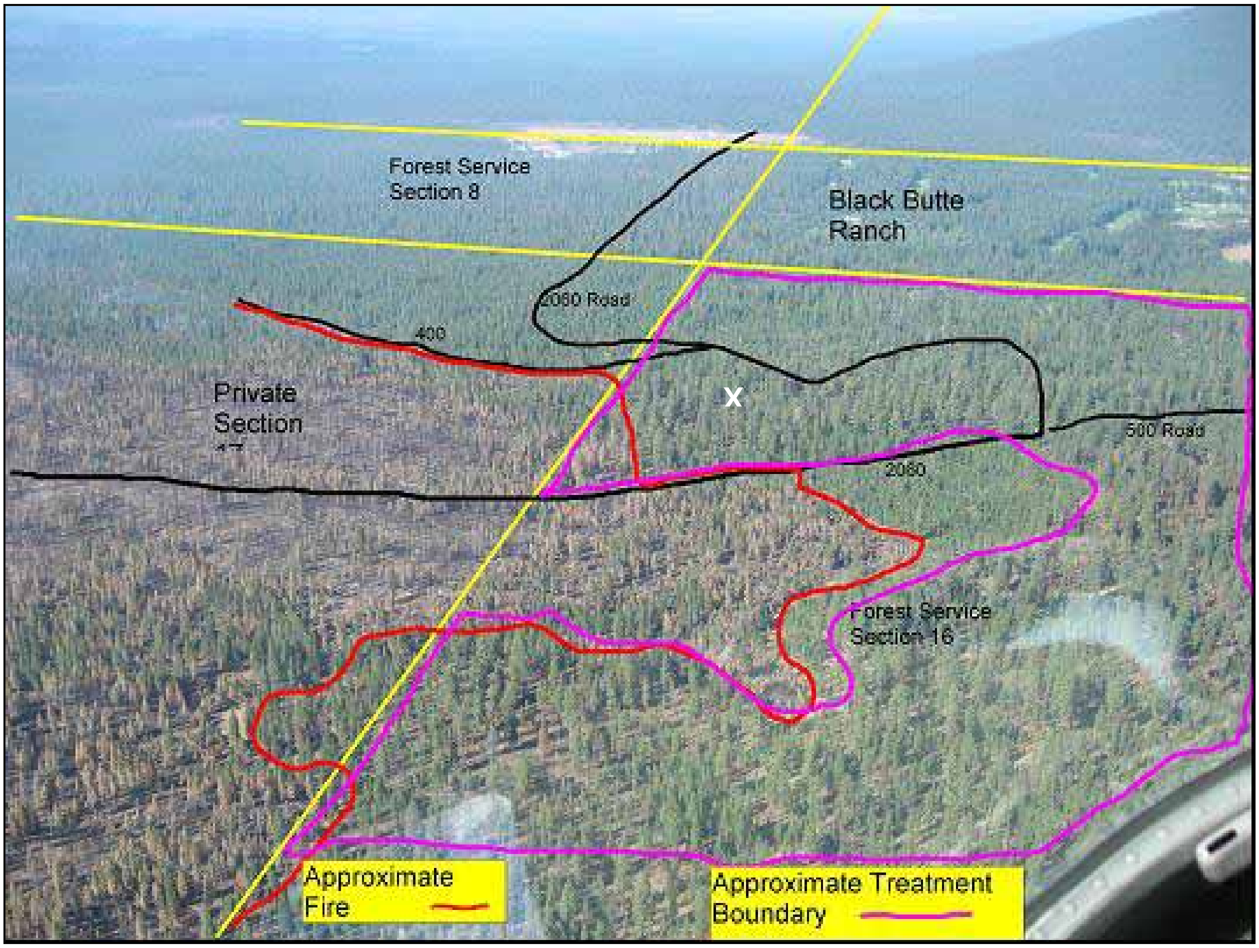


Figure 6 – Extreme eastern perimeter of the GW Fire, showing approximate locations of land ownerships, fuel treatment boundaries, and the fire perimeter. Figure 5 photo (on previous page) was taken at the location marked "X". Note very little of the fuel treatment areas burned. (Photo courtesy Mark Rapp.)

4. Fire Effects on Non-Treatment Areas

Description

Approximately 4,393 acres within the GW Fire perimeter have had little or no management activity in recent history. Approximately 1,362 of these acres were in the Mount Washington Wilderness. In addition, 429 acres represented past wildfire areas that the GW Fire burned through.

Fire Behavior

During the GW Fire's first four days, fire behavior was extreme within areas that had not been treated. Torching and short, active crown fire runs with spotting up to ¾ miles was observed (see Figure 7).

Approximately 10 percent of the non-treatment areas that burned were classified by the BARC map as high severity. Tree crowns were either consumed or almost entirely scorched, and most of the surface vegetation was consumed. Virtually all of the burned area within the Wilderness was classified as moderate to high severity.

Figure 7 – Fire behavior on the GW Fire's third day, September 2, 2007. (Photo courtesy Gary Miller.)

As the fire burned into areas previously burned in wildfires, fire behavior moderated considerably. Surface fire with slow spread rates was observed with occasional single tree torching. Only 18 acres, or 4.1 percent, were classified as high severity according to the BARC map.

5. Fire Effects on Other Vegetation Management Areas

Description and Prescriptions

Approximately 1,269 acres of other vegetation management treatments were burned within the GW Fire perimeter. Beginning in the mid-1980s through 2001, 51 treatment units, ranging in size from 7 to 41 acres, were treated (see Appendix 2).

Vegetation treatment prescriptions consisted of small clearcuts and commercial or pre-commercial thinnings. Dozer piling, pile burning, and tree planting generally followed these clearcut and commercial thinning harvests. Precommercial thinnings were usually followed by hand-piling and hand-pile burning.

Fire Behavior

Fire behavior within the other vegetation treatment areas was very different from the fire behavior exhibited in the untreated areas. Firefighters reported flame lengths up to three feet in plantations that had considerable brush. They said that while group torching was uncommon, it did occur. Other plantations only burned when ignited in burnout operations.

Firebrands were less likely to find receptive fuel and develop into spot fires due to the lack of dead, down woody material from prior fuel treatments following harvest, and because of more open canopies.

The BARC map indicates that only 21 acres of the other vegetation treatments burned with high severity. This is significantly less than what would be expected for the number of high-severity acres burned on untreated lands (Hudak and Grace, unpublished report).

However, this fire burned within several fire regimes, and the analysis did not include intersection with fire regime data.

6. Fuel Treatment Considerations in Suppression Strategies and Tactics

Due to extreme fire behavior, suppression resources—both air and ground—could not safely or effectively engage the GW Fire in the untreated areas. Treatments and previous wildfire areas provided the only places from which the fire could be safely engaged.

The presence of fuel and other vegetation treatments contributed to the development of suppression tactics. The Incident Commander had extensive professional knowledge of the treatment history within the fire area and had been directly involved with much of their planning and implementation.

In addition to treatment areas, several large historical fires adjacent to the GW Fire were also incorporated into planning and operational tactics as anchor points for line construction. These old burns allowed suppression resources to focus on the eastern fire perimeter—that posed the greatest threat to Black Butte Ranch.

The presence of treatments adjacent to the eastern perimeter of the fire also provided a margin of safety for direct attack on the fire. Suppression resources were staged at key anchor points and engaged in line construction throughout much of the treated areas. Suppression resources were also able to capitalize on the reduced threat of crown fire and torching by choosing to construct line throughout the treated areas along the GW Fire’s eastern perimeter. Modified fuel profiles enhanced firefighter safety in successful direct line construction.

The small untreated (wildlife clumps) imbedded within the fuel treatments were problematic, being a source of firebrands and compromising suppression effectiveness.

7. GW Fire Summary

Twenty-five percent of the Forest Service lands burned in the GW Fire had received fuel or vegetation treatments in the past. The small amount of fuel treatments, 196 acres, were intensive and included thinning, handpiling, and burning. These treatments were designed to reduce wildfire risk to Black Butte Ranch, an area that has been threatened by wildfire in the recent past.

At approximately the same time that wind speeds significantly moderated, the head fire ran directly into a 2006 fuel treatment area. Fire behavior was dramatically reduced from crowning, torching, and spotting to a slow, surface-spread fire that was safely suppressed with direct attack.

Clumps of unthinned trees remained within some of the fuel treatment areas as mitigation measures for wildlife cover. These areas burned severely and were sources of spotting. This phenomenon reduced suppression effectiveness, especially when these wildlife cover vegetation areas were located near firelines.

The local Central Oregon IMT managed the fire. Several individuals on this team had intimate knowledge of the terrain, weather, and locations and design of fuel and vegetation treatments. This provided an advantage in development of strategies and tactics for the suppression effort.

Previous large fires successfully aided suppression efforts by providing safe anchor points for fireline construction and allowed resources to focus at the head of the fire—that was threatening Black Butte Ranch.

Previous large fires adjacent to the GW Fire limited spread on the fire’s flanks. These recent wildfires successfully aided suppression efforts by providing safe anchor points for fireline construction and allowed resources to focus at the head of the fire—that was threatening Black Butte Ranch.

The fire burned through 1,269 acres of other vegetation treatments consisting of commercial and non-commercial harvests of various ages. BARC analysis results indicate that untreated areas had statistically more severely burned acres than the other vegetation treatment areas. However, this fire burned within several fire regimes and the GW Fire Assessment Team’s analysis did not consider other fire regime data.

IV The Egley Complex

1. Introduction

The Egley Complex started from a lightning storm on July 6, 2007 that ignited 17 fires within the fire complex. Four days later, three major fires were burning: Egley, Bear Canyon, and Silver. The complex was contained on July 22 at 140,360 acres. Suppression costs as of July 24 were $15.8 million (as reported on the ICS 209 form).

The fires were initially managed by the Type 2 ORCA Incident Management Team. The PNW3 Incident Management Team assumed command of the East Zone on July 10—with the ORCA IMT in command of the West Zone.

The Egley Complex fires burned under some of the most severe fire danger conditions experienced here in the last 20 years. The Egley Fire (one of three fires of the Egley Complex) spread rapidly in grass and brush fuels. It threatened the dispersed community of Riley and the towns of Burns and Hines, OR.

The Egley Fire burned primarily on BLM and private lands. In contrast, the Bear Canyon and Silver Fires were predominantly on Forest Service lands and threatened private in-holdings, ranches, and Federal administrative sites.

The last major fires to occur in this area were the 1990 Pine Spring Basin and Buck Spring fires (see vicinity map on next page). The boundary of the 22,400-acre Buck Springs Fire overlaps the southern-most portions of the Silver Fire. The 74,000-acre Pine Spring Basin Fire overlays a substantial part of the Egley Fire.

A total of 98,525 acres burned in the Egley Complex are being analyzed in this assessment. To simplify this assessment, approximately 40,000 acres of BLM and private lands located on the southern part of the Egley Fire were not analyzed. Within this primarily grass-dominated environment, minimal fuel treatments had been completed. Because they have received some fuel treatments, the smaller blocks of BLM lands north of the Egley Fire *were* analyzed by the Egley Complex Assessment Team.

2. Description of Fire Environment

Fuels and Topography

A variety of fuel conditions occur throughout the Egley Complex area. One fire behavior analyst characterized them as:

- **Open Grass and Brush –** lower elevations, south slopes, often with cheat grass or low sage;
- **Grass and Brush –** often with some juniper component;
- **Open Pine –** grass or brush at the surface; and
- **Dense Pine –** generally with timber litter at the surface.

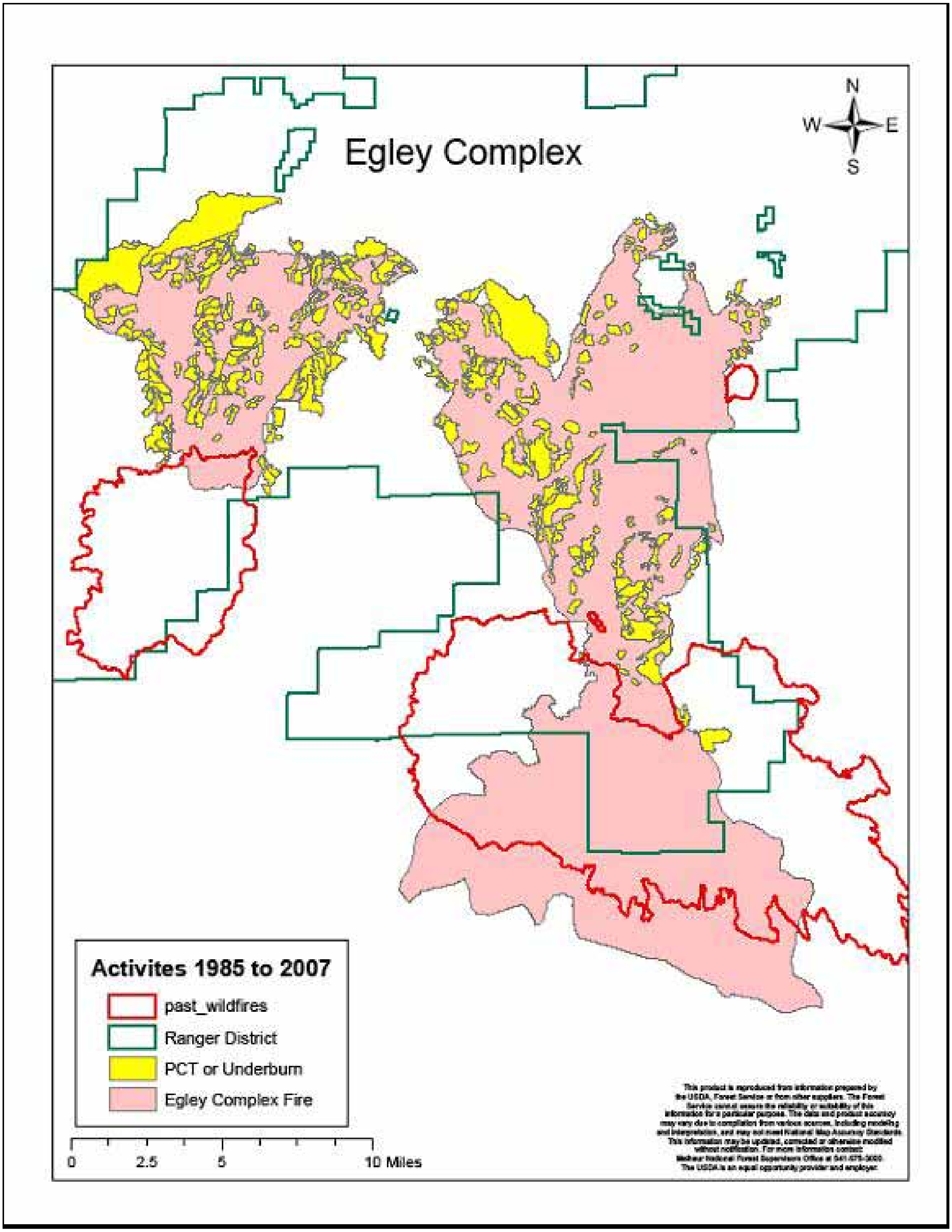


Figure 8 – Egley Complex Vicinity Map.

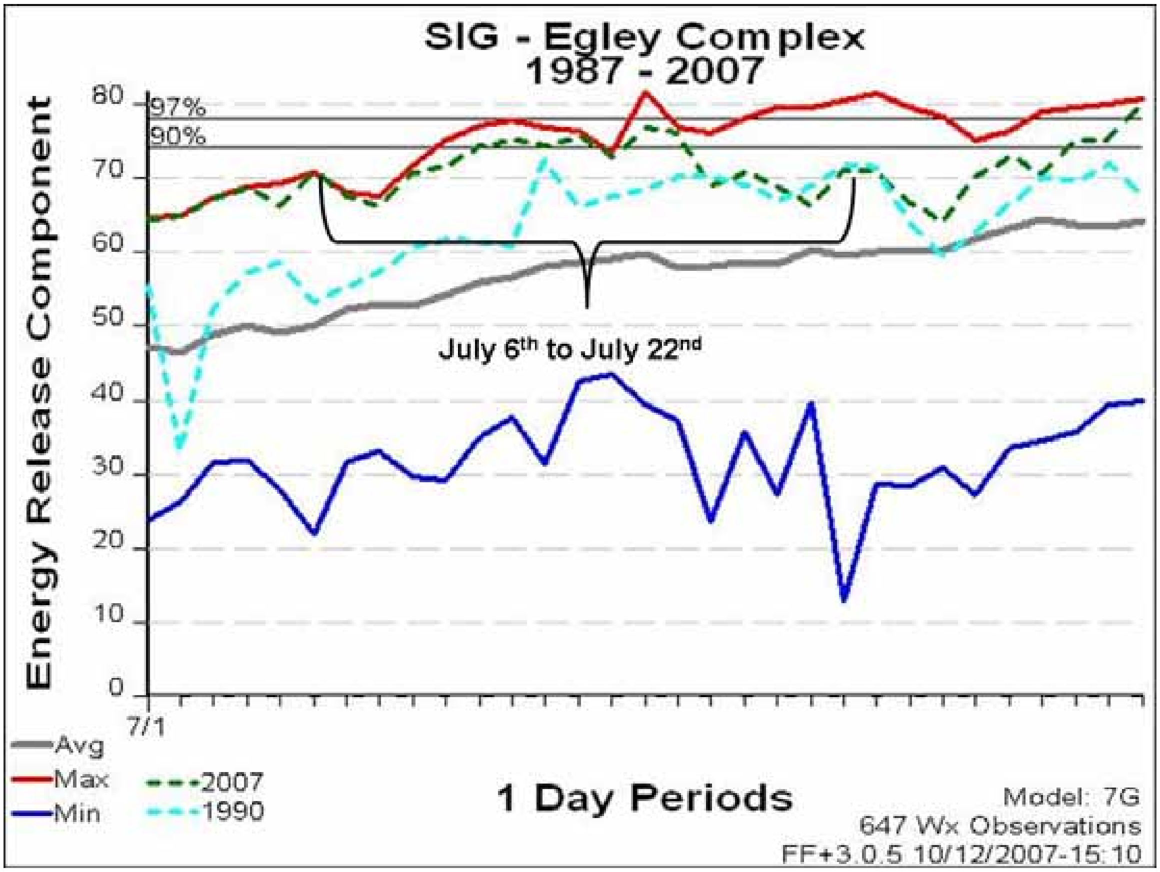


Figure 9 – Energy Release Component for Allison, Sage Hen, and Crow Flat RAWS, Fuel Model G. Note ERC was well above average for that time of year and above the 90th percentile for many of the fire spread days between July 6 and July 22.

The Fire Management Plan for the Malheur National Forest characterizes 65 percent of the entire forest as Fire Regime I—in either Condition Class 2 or 3. Ponderosa pine is the dominant overstory species that occurs over most of the Egley Complex's Forest Service lands.

Topography within the fire perimeter consists of broad ridges dissected by drainages running north to south. Slopes range from flat on the ridgetops to over 40 percent in the drainages. Aspects are south, with west- and east-facing slopes on either side of the drainages.

Fire Danger and Weather

Prior to July 6, the weather was exceptionally hot and dry. Fire danger from July 6 through July 22 was "very high" throughout the period when the Egley Complex burned (Figure 9).

In addition, the plot of 2007 ERC values was well above average. ERC values established the new maximum highs for six of the first seven days of July. In mid-July, the ERC values were generally above the 90th percentile. The 2007 plot was always higher than the 1990 plot. In fact, ERC values were significantly drier than when the Pine Springs Basin and Buck Springs Fires had burned in 1990.

Table 2 –Acres of Fire Spread by Date for the Three Largest Fires of the Egley Complex

	Fire Spread Date													
	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19
Egley Fire	613	8995	8500		**18090**	**17832**		1193				148		
Bear Canyon Fire		492	2339	1896	931		**7350**	**8340**	**17409**	2145	5622	1644	1605	1048
Silver Fire		1372	**6111**	2794	1309		**4474**	**4209**	884		**7372**	2919	230	

The bolded cells are the days of greatest fire growth. These days also relate to periods of highest Burning Index and days with noticeably stronger winds. Source of acreage data is the Fire Progression Map. The Fire Progression Map lagged the fire chronology by one day.

The Burning Index (BI) includes both fuel moisture and wind speed as a measure of fire danger. During the Egley Complex the BI was well correlated to fire spread days. On July 11, 14, and 16, it correctly identified three of the largest fire growth days.

Fire Behavior Chronology

The Egley Fire

The largest growth on the Egley Fire occurred July 10 and 11. On July 10, the fire spread to the east—with a fire front greater than ten miles in length.

Two riparian sites are located where fire intensity on the uplands was so intense that willow along the creek was completely consumed. Live and dead willow stems were 100 percent consumed.

This fire effect can be attributed to low fuel moistures and severe burning conditions. Similarly, the loss of private structures at the Sermeus Ranch can be attributed to this rapid and intense fire movement.

Surface fire intensity, torching juniper, and high winds produced significant fire spread to the west. The Egley Fire was active early in the complex's duration. After July 11, it displayed minimal growth.

The Bear Canyon Fire

Bear Canyon Fire actively spread on three consecutive days, July 12-14 (see Table 2). At this time, the fire moved strongly west, then east, influenced by a change in wind direction. During these three days, aggressive crown fire behavior was observed that resulted in some of the highest-severity effects incurred by the fire.

In the later stages of the Bear Canyon Fire, the fire growth pattern was in a northeasterly direction, influenced by the predominantly southwesterly winds—the fire spread direction that typically occurs in the Pacific Northwest.

The Silver Fire

The Silver Fire had a less distinct pattern. Its major spread days were July 8, 12, 13, and 16—that all correlate well with high BI days.

Fire Behavior Analyst John Heckman reported fire growth to the north and east driven by southwesterly winds.

The northern perimeter was a free-fire edge burning down a ridgeline. To the east, very active fire behavior in timber with group torching, crowning, and spotting was observed. Each of these separate spread events contributed 2,000 to 3,000 acres of growth.

There is good correlation between fire danger indexes and observed fire behavior. Observed fire behavior and post-fire effects to vegetation indicate that fuel and vegetation treatment burned under severe conditions.

Table 3 – Treatment Types and Approximate Acres

Treatment Types	Acres
Underburn Treatments	3,869
Fuels Treatments (piling and pile burning)	16,933
Commercial Harvest Treatments	17,990
Pre-commercial Treatments (thinning)	16,940
Wildfires	15,087
Total	**70,849**

3. Fire Effects of Fuel Treatments

Description and Prescriptions

Within the Egley Complex, fuel and other vegetation treatment prescriptions were designed to meet one—or both—of two goals: ecosystem restoration and improved firefighting effectiveness.

Because practically all treatments within the Egley Complex were designed to meet these goals, the Egley Complex Assessment Team did not differentiate between fuel treatments and other vegetation treatments. Over all, these prior treatments reflected the implementation of three general prescriptions: thinning with fuel treatment, commercial harvests, and underburning.

This was accomplished through vegetation treatments that: reduce surface fuel, increase crown base height, and reduce crown bulk density. These treatments are not intended to "stop" fire spread, but, rather, to keep fires on the surface and enhance firefighter effectiveness.

Following the 1990 wildfires, the Malheur National Forest updated treatment prescriptions to better meet vegetation and protection objectives.

The most common treatment sequence in the Egley Fire Complex area is a silvicultural thinning, followed by piling of debris and pile burning. Often, the maintenance underburn would be scheduled to occur about five years after this pile burning.

Additionally, a wide variety of commercial timber harvests have also occurred in the assessment area. The intensity of these harvest treatments span from very light selective cuts to regeneration harvests. (None of these specific harvest treatments were analyzed or assessed for this study.)

Hazardous fuel underburns have been implemented in several locations associated with the Egley Fire Complex—both at the stand scale and, more recently, at the landscape scale. The Rimrock and Spring Canyon prescribed underburns are recent landscape scale treatments that were more than 1,000 acres.

Treatments from 1985 to 2006 (available in GIS on the Malheur National Forest and the BLM's Burns District) were analyzed. Treatment types and approximate acres within the Egley Complex assessment are outlined in Table 3 (on previous page). Although 70,849 acres had been treated, due to overlap, the total extent of treatments within the Egley Complex is significantly smaller, representing 41,070 acres—or 42 percent of the entire fire area. A total of 57,455 acres were untreated.

4. Fire Behavior and Suppression Effectiveness

The Assessment Team visited many fuel treatment sites on the Egley Complex fire area. Three specific examples of the effects of fuel treatments on fire behavior and suppression effectiveness were analyzed.

Figure 10 and 11 (below) – Egley Fire perimeter, Division I in Branch IV, along the 4500 Road. Both sides of the road were previously treated. In Fig. 10, note low crown scorch, indicating low surface fire intensities. Note the younger stand in Fig. 11 also had low crown scorch.

Example 1

Silver Fire
Road 4500-150

Extensive areas along Road 4500 had been treated specifically to facilitate fire suppression efforts in the event of a wildfire. In most places, both sides of this ridgetop road had been treated with pre-commercial thinning, debris piling, and pile burning.

During the Egley Complex, more than 10 miles of the 4500 Road was successfully backfired or burned out. Due to the terrain and the intensive past fuel treatments here, this area was chosen as the fire control line.

Despite high fire danger, along the fire perimeter, surface fire behavior predominated with only occasional torching—resulting in little firebrand production and little overstory mortality (figures 10 and 11). In addition, due to lack of torching near the fireline during burnouts, outside of the fire perimeter, there was minimal evidence of spot fire occurence. The spot fires that did occur were safely and easily suppressed. The assessment team observed a similar example along the 4100-800 Road.

In conclusion, treating both sides of the road allowed firefighters to safely engage. Similar fire behavior was observed on the interior of the fire in this area where previous fuel treatments had occurred.

Figures 12 and 13 – Figure 12 (above) shows untreated stand along the 4500-220 Road, Silver Fire. Figure 13 (below) shows a treated stand along the 4500-220 Road that also burned in the Silver Fire. (Photos courtesy Tim Sexton.)

Example 2

Silver Fire – Road 4500-220 Spur

This example provides a contrast in fire behavior and effects between treated and untreated stands in the same area that burned under the same fire weather.

The objective of these treatments was to restore pine-dominated ecosystems.

Many additional examples of effects between treated and untreated stands occurred along several spur roads located off the 45 Road (spurs 105, 190, 210, and 250).

The untreated stand (Figure 12) experienced intense surface fire behavior with some torching, as evidenced by the high level of crown scorch. This resulted in a high level of overstory mortality. Seedlings and saplings—providing ladder fuels for fire spread—were plentiful in the understory.

In contrast, the treated stand (Figure 13) had noticeably lower crown scorch and fewer torched trees. As a result of prior treatment, surface fuel loadings were lighter. The thinning of small trees reduced stand density and raised crown base heights—resulting in reduced torching.

Example 3

Egley Fire
Carlton Treatment Area

The Carlton Treatment Area project was implemented on BLM lands. This example illustrates fire behavior effects observed on steeper slopes when treatments have not been completed.

The intended treatment sequence was: 1) pre-commercial thin, 2) pile, 3) pile burn, 4) underburn five years later, and then 5) commercially thin five years following.

Figure 14 – The Carlton Treatment Area on Bureau of Land Management lands. Note completely consumed crowns at the top of the slope.

Treatments areas were scattered over the landscape and implemented at the stand scale, matching the ownership pattern. Within the Carlton Treatment Area (Figure 14), pre-commercial thinning and piling had occurred, but the piles were unburned at the time of wildfire.

During Egley Fire suppression efforts, a burnout operation was initiated from the road across the creek. Note good conifer survival on the lower slope (Figure 14). However, as the burnout gained momentum, crown scorch increased as the fire progressed up the slope.

Conifer crowns were completely consumed on the upper third of the slope and beyond. The burnout was successful due—to some degree—the partial fuel treatment. Most likely, however, favorable slope and wind direction were most likely the significant contributors.

5. Fire Effects of Non-Treatment Areas

Description

Fifty-eight percent of the Egley Complex, or 57,455 aces, had no record of previous vegetation treatments. Most of these areas either had little commercial timber value, or were inaccessible. Within the complex's Bear Canyon Fire boundaries, the Egley Complex Assessment Team visited and analyzed the Ant Planning Area, representing previously untreated lands covering 17,000 acres that were proposed for treatment. (The proposed plan called for treating 12,000 acres with pre-commercial thinning, piling debris and burning piles, followed by underburning—with maintenance underburning to be implemented in the future.)

The Assessment Team selected this proposed Ant Planning Area because BARC fire severity mapping indicated extensive areas of high severity fire.

Fire Behavior and Suppression Effectiveness

The fire progression map indicates that the Ant Planning Area area burned on July 17 or 18, with ERCs less than the 90 percentile. Even so, fire behavior was extreme. (Note in Figure 15 the high density of saplings that provided ladder fuels for fire to progress into the crowns of larger trees.) Because of extensive crown fire behavior covering more than 1,000 acres (Figure 16), suppression resources could not—and did not—safely engage the fire here.

Figure 15 – Ant Planning Area untreated stand that burned in the Bear Canyon Fire. Note many saplings that provided ladder fuels for crown fire.

On the Silver Fire, the branch director and fire behavior analyst both reported that crown fire crown behavior burned through untreated and treated stands. This fire behavior might have been due to the fire's momentum, the severity of the fire weather conditions, or the time elapsed since treatment. The Egley Complex Assessment Team was unable to verify which of these effects proved to be the major influence.

6. Fire Severity Comparisons

Figure 16 – Extensive crown fire behavior in the untreated Ant Planning Area that burned in the Egley Complex's Bear Canyon Fire.

The Assessment Team used BARC mapping for the entire Egley Complex to assess fire severity differences between treated and untreated areas (Figure 17). According to the BARC mapping, some of the largest areas of high fire severity fire occurred on the Bear Canyon Fire. The local silviculturist contends that these areas of high fire severity correlate to Forest Plan management areas in which active vegetation management is discouraged or prohibited. The Assessment Team's field observations anecdotally confirmed this assertion.

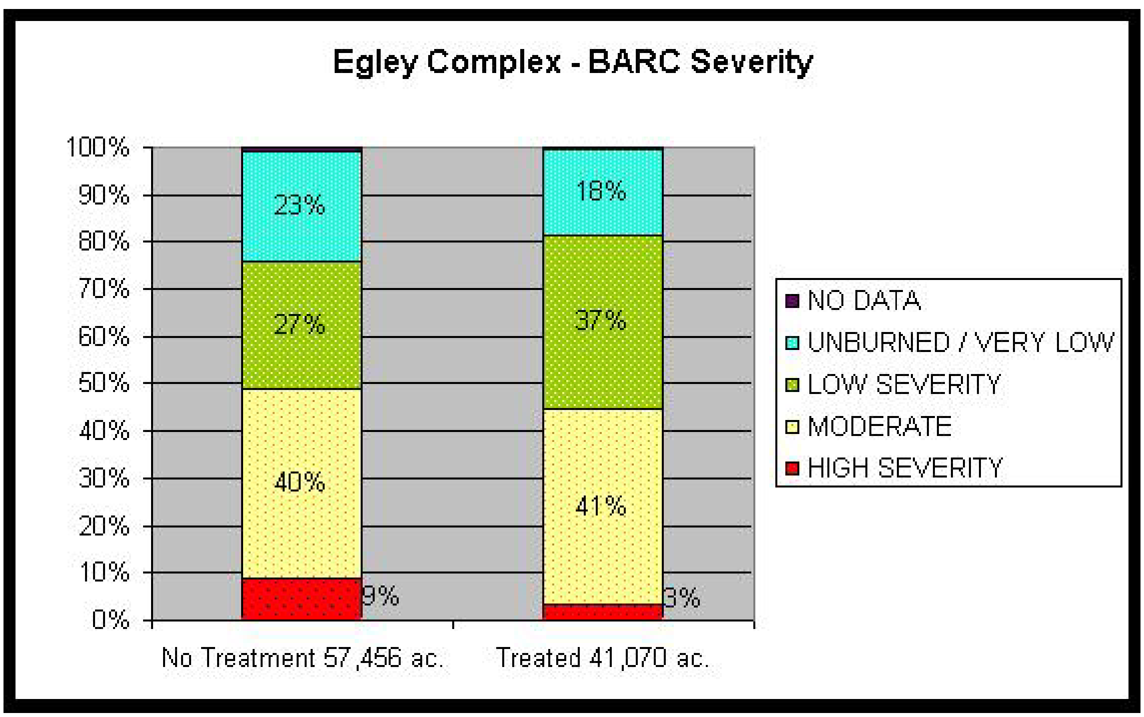


Figure 17 – Comparison of fire severity percentages between treated and untreated areas within the Egley Complex.

The amount of high severity effects were greater in the non-treatment areas compared to the treated areas. A total of 9 percent of the non-treatment area received high severity fire effects, compared to 3 percent in the treated areas. This difference is statistically significant (Hudak and Braymen, unpublished report).

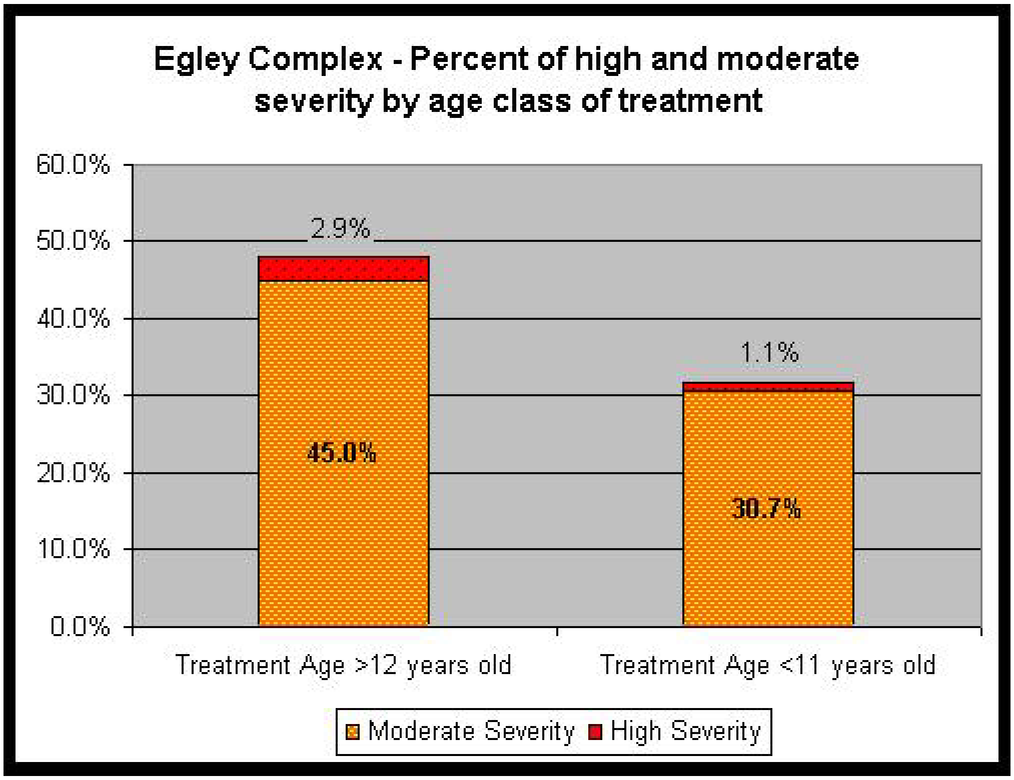


Figure 18 – Time elapsed since treatment is compared to the percent of moderate and high severity fire effects. Areas treated 11 years prior or less had 15 percent less moderate and high-severity fire effects than areas treated 12 or more years before. Data includes all fuel and vegetation treatments.

The percentage of moderate severity treated in non-treated areas was essentially the same—40 and 41 percent, respectively (Appendix 3, Table 3). Additionally, the treated areas had a higher percentage (37 percent) of low severity fire effects when compared to the non-treated areas (27 percent).

The Assessment Team also compared fire severity between two treatment age classes: 11 years and less since treatment, and 12 years and greater since treatment. These two treatment age classes were overlain with the BARC severity mapping.

Figure 18 confirms that areas treated 11 years ago and less exhibited 15 percent less high and moderate fire severity effects. This is likely because the older treatments had more vegetation growth and therefore more available fuel. The more recent treatments also had more aggressive prescriptions that removed more vegetation and fuel than the older vegetation and fuel treatment prescriptions.

7. Egley Complex Summary

A surprisingly high percentage (42 percent) of the entire landscape within the Egley Fire Complex assessment area received treatment. A large amount of these treatment areas had received intensive treatments.

The three general treatment prescriptions were: 1) underburning, 2) pre-commercial thinning followed by piling and pile burning, and 3) commercial harvest with a variety of cutting prescriptions. The underburning treatments were the least intensive.

Areas that received no vegetation or fuel treatments experienced the greatest fire severity. The treatment prescriptions were statistically significant in reducing high severity fire effects when compared to the untreated areas. Underburning treatments were barely significant in reducing severity.

Recent fuel treatments were more effective than older treatments in reducing fire intensity and severity. This effect is likely because of the more recent aggressive prescriptions coupled with a shorter time period available for vegetation re-growth.

In many instances, vegetation and fuel treatments reduced fire behavior intensity and provided opportunities for successful suppression actions at the fire's perimeter. For example, treatments that had been concentrated along the 4500 and 4100-800 roads successfully provided a large contiguous area for effective suppression operations.

In other areas, even well-designed and well-implemented fuel treatments were ineffective and passive, or active crown fire caused significant mortality. This is likely a function of the very high or extreme fuel dryness, winds, slope—or combinations of all three of these factors.

V Findings, Conclusions, and Recommendations

Three Success Stories

Three large fires burned into past fuel treatment areas in the Pacific Northwest in 2007. Within these three fires, three quite different treatment strategies had been implemented. All approaches were useful in restoring or maintaining ecosystems, or improving suppression effectiveness.

The **Monument Fire** burned across a landscape with extensive but relatively low intensity fuel treatments. The **Egley Complex** burned over treatment areas that included both extensive underburns, and intensive, strategically located fuel and other vegetation treatments. The **GW Fire** impacted a fuel treatment located between the wildfire and a high value wildland-urban interface area.

In all three cases, a higher proportion of acres burned severely on untreated lands than where fuel or other vegetation treatments had been applied (prior to the fires). More recent treatments and higher-intensity treatments reduced fire behavior and fire effects more effectively than older and less intense treatments. However, fuel treatments on steep slopes or under high wind conditions were less effective in changing fire behavior or reducing fire severity.

Fuel treatments increased suppression effectiveness on all three of these fires. Additionally, when Incident Management Teams had knowledge of treatments, they used these treated areas to plan and implement suppression strategies and tactics. Intensive fuel treatments located along major ridge top road systems were particularly useful in increasing fire suppression effectiveness.

Data and Analysis Needs

In analyzing these three 2007 fires, the Burned Area Reflectance Classification (BARC) mapping was useful in determining fire severity effects in the short term. Other factors—such as fire regime, terrain, and fire weather—might have also interacted with treatment effects to influence burn severity. A more systematic analysis of these data is therefore needed.

While the Assessment Teams were surprised by the amount of treatment data available in GIS, data accuracy needs improvement. For example, some treatment polygons had no treatment date assigned, and polygons were different from burn plan maps. In general, there was limited site-specific pre- and post-treatment data.

The number of small fires that may have been prevented from becoming larger fires due to fuel treatments is unknown. Studying this will require purposeful data collection and analysis that will provide a more complete picture of fuel treatment effectiveness.

Monitoring Treatment Effectiveness

Validation monitoring of fuel treatments is critical to learning. Testing a fuel treatment monitoring process was therefore a secondary objective of this assessment.

The composition of the three Assessment Teams was appropriate and the GIS specialists were essential. Including research personnel was also beneficial. The field discussions were highly beneficial to both the Assessment Teams and local units. However, the time allowed for data collection and field review was too short.

In retrospect, monitoring three fires was perhaps too ambitious. Producing this report required a large amount of effort. Local units invested a considerable amount of time collecting data.

Conclusions

With so much land in need of restoration and risk reduction across the Pacific Northwest, treatment options are virtually unlimited. Decisions of where to treat are influenced by competing resource objectives and values-at-risk. Determining where the next damaging fire will occur and setting treatment priorities will continue to be significant management challenges.

Managers are challenged by deciding between implementing less intense, low-cost, landscape-scale treatments and more intense, high-cost, small-scale treatments. Budgets and other constraints will require agencies to be even more deliberate in selecting fuel treatment strategies.

Landscape-scale underburning and maintenance treatments should be part of future long-term vegetation and fuel treatment strategies. As more lands are restored, maintenance treatments will increase, requiring this need to be included in project plans.

Key Recommendations

Based on this report's conclusions, the authors recommend that National Forests and Bureau of Land Management Districts:

1. Develop and articulate a clear strategy to guide hazardous fuel treatments. These strategies will identify:
   - Critical, high values-at-risk from wildfire.
   - Locations where treatments could improve suppression effectiveness, such as roads on ridges.
   - A clear plan for maintaining treatments over time.
   - Priority landscapes or watersheds—especially in short-interval fire regimes—that would benefit from extensive, low-cost treatments.
   - Define quantifiable treatment objectives for projects linked to the hazardous fuel strategy.

2. Continue to implement the Regional/State Office fuel treatment effects monitoring process.
   - Map all vegetation and fuel treatments using standards developed by the Pacific Northwest Wildfire Coordination Group (PNWCG).
   - Collect site-specific pre- and post-treatment data to ensure less reliance on retrospective analysis and anecdotal evidence.

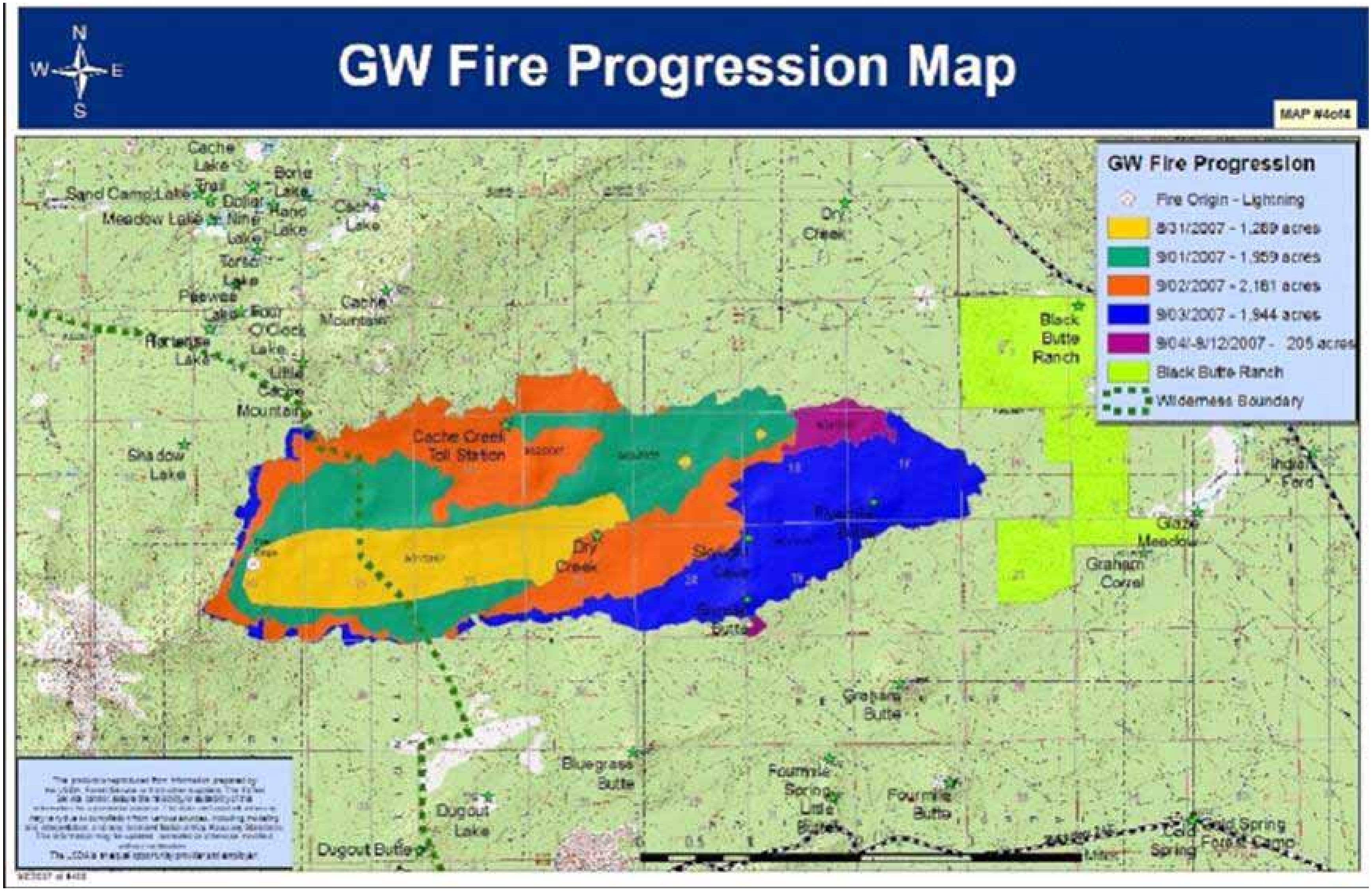
3. Use treatment data in developing wildfire strategies. Treatments should become an integral part of Wildland Fire Situation Analysis development. Treatment maps should be a part of the briefing package given to Incident Management Teams.

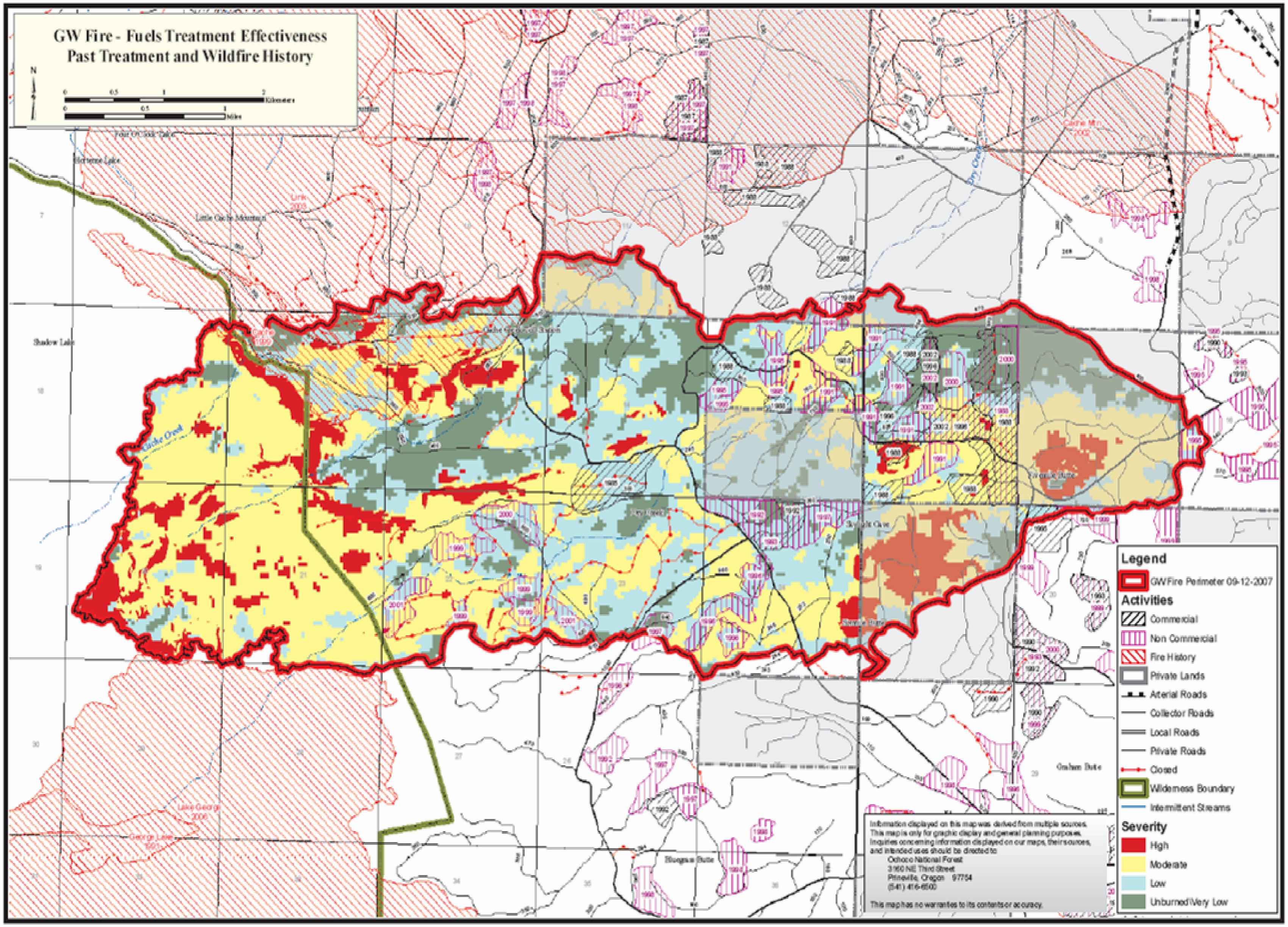
In addition, the State/Regional Office should:

1. Develop a strategy for monitoring treatment effectiveness and validate fuel treatment performance when tested by wildfires. The objective is to rely *less* on anecdotal evidence and retrospective analysis and *more* on definitive conclusions drawn from data. Some suggestions include:
   - Require Incident Management Teams to collect data and document treatment effects.
   - Use Continuous Vegetation Survey (CVS) plots.
   - Select one wildfire per year to monitor as part of the regular program of work for the Regional/State Office. Carefully choose which fire to monitor.
   - Require yearly inventory of small fires that impact treatments.
   - Make use of programmatic implementation, effectiveness, and validation monitoring as described in *A Consumer Guide: Tools to Manage Vegetation and Fuels.*

VI Appendices

Appendix 1 – Maps


GW Fire Progression Map
MAP #4of4
GW Fire Progression
Fire Origin - Lightning
8/31/2007 - 1,289 acres
9/01/2007 - 1,959 acres
9/02/2007 - 2,181 acres
9/03/2007 - 1,944 acres
9/04/-9/12/2007 - 205 acres
Black Butte Ranch
Wilderness Boundary
Cache Creek Toll Station
Black Butte Ranch
Dry Creek
Shadow Lake
Cache Mountain
Graham Corral
Graham Butte
Bluegrass Butte
Dugout Lake
Dugout Butte
Fourmile Spring
Fourmile Butte
Cold Spring
Indian Ford
Glaze Meadow


GW Fire - Fuels Treatment Effectiveness
Past Treatment and Wildfire History
Legend
GW Fire Perimeter 09-12-2007
Activities
Commercial
Non Commercial
Fire History
Private Lands
Arterial Roads
Collector Roads
Local Roads
Private Roads
Closed
Wilderness Boundary
Intermittent Streams
Severity
High
Moderate
Low
Unburned/Very Low
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(541) 416-6500
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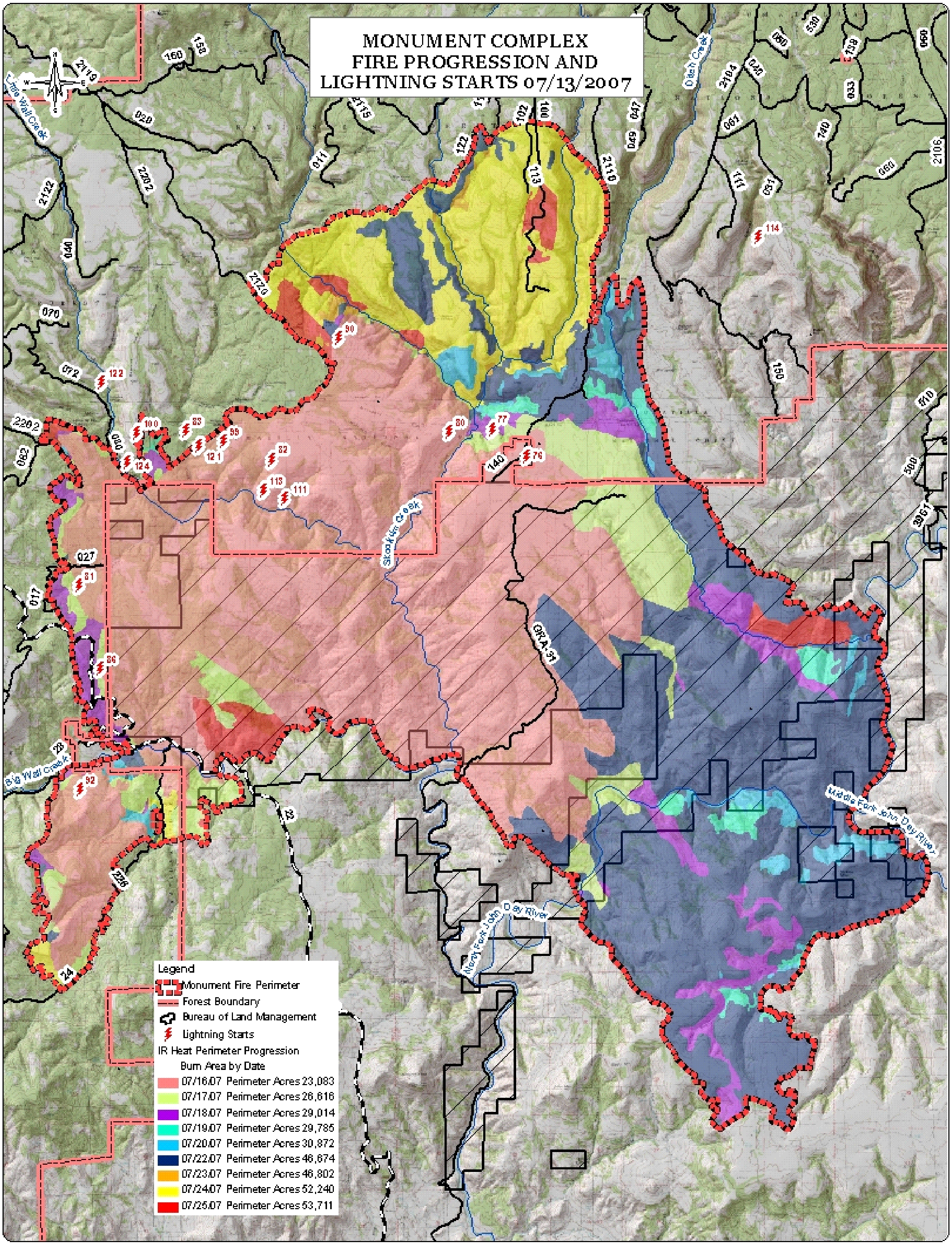
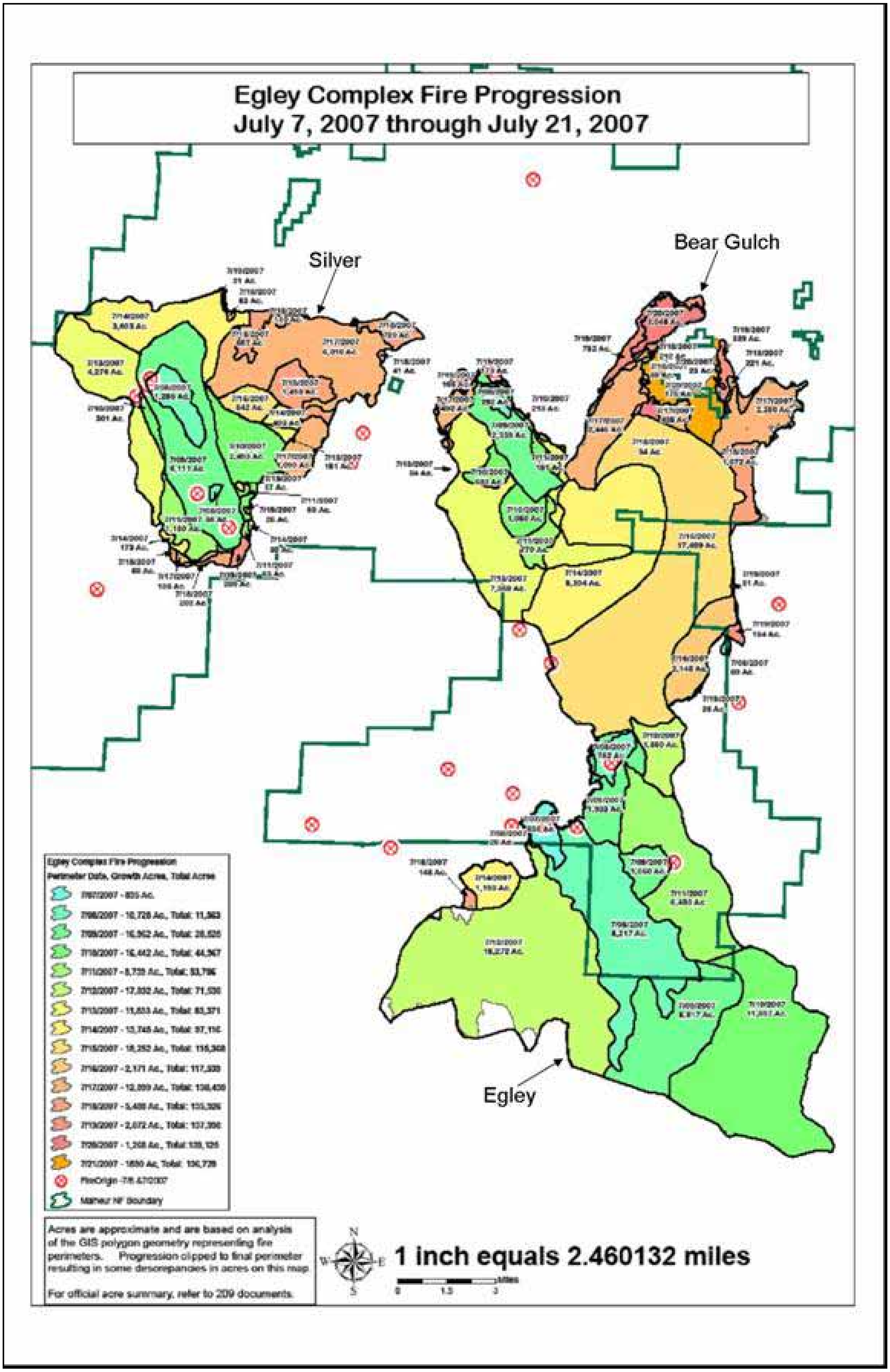

MONUMENT COMPLEX
FIRE PROGRESSION AND
LIGHTNING STARTS 07/13/2007
Legend
Monument Fire Perimeter
Forest Boundary
Bureau of Land Management
Lightning Starts
IR Heat Perimeter Progression
Burn Area by Date
07/16/07 Perimeter Acres 23,083
07/17/07 Perimeter Acres 26,616
07/18/07 Perimeter Acres 29,014
07/19/07 Perimeter Acres 29,785
07/20/07 Perimeter Acres 30,872
07/22/07 Perimeter Acres 46,674
07/23/07 Perimeter Acres 46,802
07/24/07 Perimeter Acres 52,240
07/25/07 Perimeter Acres 53,711
Little Wall Creek
Big Wall Creek
Skookum Creek
Middle Fork John Day River
North Fork John Day River
Ditch Creek


Egley Complex Fire Progression
July 7, 2007 through July 21, 2007
Silver
Bear Gulch
Egley
Acres are approximate and are based on analysis of the GIS polygon geometry representing fire perimeters. Progression clipped to final perimeter resulting in some descrepancies in acres on this map.
For official acre summary, refer to 209 documents.
1 inch equals 2.460132 miles

Appendix 2 – Fuel Treatment Prescriptions

Fuel and other vegetation treatments within the perimeter of the GW fire.

Project Name	Unit	Acres	Planted	PCT	FuelsTrt	Comments
Bear Flat (BF)	6	24	1979	1991	--	
Bear Flat (BF)	7	21	1979	1994	--	
Bear Flat (BF)	9	13	1979	1994	--	
Bear Flat (BF)	10	7	1979	1994	--	
Bear Flat (BF)	12	24	1979	1991	--	Harvest -- Final Removal in 1979
Bear Flat (BF)	15	18	1979	1991	--	
Bear Flat (BF)	16	17	1979	1991	--	
Bear Flat (BF)	19	37	1979	2000	--	
Bear Flat (BF)	20	33	1979	2000	--	
Bear Flat (BF)	22	41	1979	1992	--	
Bear Flat (BF)	23	36	1979	1997	--	
Blue Grass (BG)	1	18	1983	?	--	
Blue Grass (BG)	2	14	1983	--	--	
Blue Grass (BG)	3	27	1983	1997	--	
Blue Grass (BG)	4	20	1983	1997	--	
Demo (D)	1		--	2000	HP&B	
Demo (D)	2		--	2000	HP&B	HP&B = Hand pile and burn
Demo (D)	3		--	2000	HP&B	
Dry Creek (DC)	1	25	1983	2001	--	
Dry Creek (DC)	2	8	1983	1999	--	
Dry Creek (DC)	3	23	1983	1999	--	
Dry Creek (DC)	4	19	1983	1999	--	
Dry Creek (DC)	5	11	1983	1999	--	
Dry Creek (DC)	6	32	1987	2000	--	
Dry Creek (DC)	7	16	1983	2001	--	
Dry Creek (DC)	8			Mid 80s	P&B	Commercially thinned mid-1980s.
Dry Creek (DC)	9	21	21	--	--	
Dry Creek (DC)	10	12	12	--	--	
Drylight (DL)	10	18	1989	--	--	
Drylight (DL)	11	9	1989	--	--	
Drylight (DL)	13	19	1989	--	--	
Drylight (DL)	14	12	1991	Mid 90s	--	
Drylight (DL)	15	19	1989	Mid 90s	--	
Drylight (DL)	16	37	1989	Mid 90s	--	
Pine Flat (PF)	32	24	1989	1999	--	
Pine Flat (PF)	40	20	1983	Late 90s	--	
Pine Flat (PF)	41				P&B	Commercially thinned in mid-1990s. P&B = Pile and burn
Pine Flat (PF)	43	34	1989	1994	SB	SB= Slash buster used to thin and treat fuels.
Wagon Road (WR)	11	19	1989	--	--	
Wagon Road (WR)	15	24	1987	--	--	
Wagon Road (WR)	17	14		--	--	Natural Regen
Wagon Road (WR)	18	33	1987	--	--	

Project Name	Unit	Acres	Planted	PCT	FuelsTrt	Comments
Wagon Road (WR)	20	23	1987	--	--	
Wagon Road (WR)	21	21	1987	--	--	
Wagon Road (WR)	22	7	1987	--	--	
Wagon Road (WR)	23	20	1987	--	--	
Wagon Road (WR)	24	18	1985	--	--	
Wagon Road (WR)	25	20	1985	Mid 90s	--	
Wagon Road (WR)	26	14	1987	--	--	
Wagon Road (WR)	27	14	1987	--	--	
Wagon Road (WR)	28	23	1986	--	--	

Appendix 3 – Fire Severity Tables

	Unchanged / Very Low	Low	Moderate	High	Total
Untreated	2,172 (37.2%)	2,065 (35.4%)	1,538 (26.3%)	63 (1.1%)	5,839 (29.3%)
1988 & 1998 Underburns	744 (53.5%)	542 (39.0%)	104 (7.5%)	0 (0.0%)	1390 (7.0%)
1990 Underburn	38 (27.7%)	48 (35.0%)	49 (35.8%)	2 (1.5%)	137 (0.7%)
1991 & 1998 Underburns	847 (54.6%)	548 (35.3%)	154 (9.9%)	2 (0.1%)	1551 (7.8%)
1994 Underburn	831 (54.2%)	528 (34.4%)	167 (10.9%)	7 (0.5%)	1533 (7.7%)
1996 Underburn	2314 (49.7%)	1411 (30.3%)	922 (19.8%)	12 (0.3%)	4659 (23.4%)
1997 Underburn	538 (40.7%)	464 (35.1%)	314 (23.7%)	7 (0.5%)	1323 (6.6%)
1998 Underburn	1138 (39.4%)	1075 (37.2%)	659 (22.8%)	17 (0.6%)	2889 (14.5%)
1999 & 2001 Underburns	14 (20.9%)	27 (40.3%)	25 (37.3%)	1 (1.5%)	67 (0.3%)
2001 Underburn	7 (70.0%)	2 (20.0%)	1 (10.0%)	0 (0.0%)	10 (0.1%)
Total Underburns	6,471 (47.7%)	4,645 (34.3%)	2,395 (17.7%)	48 (0.4%)	13,559 (68.0%)
Other Treatments	130 (23.7%)	247 (45.2%)	168 (30.7%)	3 (0.5%)	547 (2.7%)
Total	8,773 (44.0%)	6,957 (34.9%)	4,101 (20.6%)	114 (0.6%)	19,945 (100%)

Table 1 – Acres and proportions (percentages) of unchanged/very low, low, moderate, or high severities observed from the 2007 Monument Fire within prior underburn treatments on the Heppner District, Umatilla National Forest. Note that the 1998 underburn encompassed 1988 and 1991 underburns; and that the 2001 underburn encompassed a 1999 underburn.

	N	Unchanged / Very Low	Low	Moderate	High	Total
Untreated Lands	1	653 (14.9%)	2,109 (48.0%)	1,191 (27.1%)	440 (10.1%)	4,393 (74.6%)
Past Wildfires	4	79 (18.4%)	177 (41.2%)	155 (36.3%)	18 (4.1%)	429 (7.3%)
Fuels Treatment Units (hand pile and burn)	3	38 (19.6%)	88 (45.2%)	66 (33.8%)	3 (1.4%)	196 (3.3%)
Commercial Harvests Units	5	76 (17.0%)	176 (39.6%)	177 (39.7%)	17 (3.8%)	446 (7.6%)
Non-Commercial Thinning Units	11	153 (18.6%)	415 (50.5%)	251 (30.5%)	4 (0.5%)	823 (14.0%)
Total USFS Lands		906 (15.4%)	1909 (32.4%)	2596 (44.1%)	476 (8.1%)	5887 (100%)

Table 2 – Acres and proportions (percentages) of unchanged/very low, low, moderate, or high Burned Area Reflectance Classification (BARC) severity classes observed in prior fuel or vegetation treatment units within the 2007 GW Fire perimeter.

	N	Unchanged / Very Low	Low	Moderate	High	Total
Untreated Lands	1	13,496 (23.6%)	15,460 (27.1%)	22,920 (40.2%)	5,194 (9.1%)	57,069 (58.3%)
Past Wildfires	2	2,455 (16.3%)	5,399 (35.9%)	6,605 (44.0%)	559 (3.7%)	15,018 (15.3%)
Underburn Treatment Units	8	1,195 (31.1%)	1,625 (42.2%)	920 (23.9%)	107 (2.8%)	3,847 (3.9%)
Commercial Harvests Units	19	3,337 (18.7%)	6,823 (38.2%)	7,119 (39.9%)	567 (3.2%)	17,846 (18.2%)
Non-Commercial Thinning Units	20	2,787 (16.5%)	6,547 (38.9%)	7,201 (42.7%)	309 (1.8%)	16,844 (17.2%)
Total USFS Lands		20,948 (21.4%)	30,548 (31.2%)	39,862 (40.7%)	6,539 (6.7%)	97,897 (100%)

Table 3 – Acres and proportions (percentages) of unchanged/very low, low, moderate, or high Burned Area Reflectance Classification (BARC) severity classes observed on past wildfires or past forest management units within the 2007 Egley Complex perimeter.

Appendix 4 – References

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Appendix 5 – Acknowledgements

The authors of this report would like to thank the following people who contributed information, interviews, or other support to the report's three Assessment Teams.

Deschutes National Forest
Mark Rapp, Maurice Evans, Tom Goheen, Jason Loomis, Gary Miller

Malheur National Forest
Ken Higle, George Wynn, Jeremy Sisneros

Burns District Bureau of Land Management
Dan Ridenour, Steve Morefield, Sean Rothwell, Jeff Rose

Rocky Mountain Research Station
Sarah Lewis, Christine Craig

Umatilla National Forest
Dave Powell, Bill Aney, Dale Boyd, Scott Wryn, Brian Spivey, Alan Ager

Others
Bruce Chaney, Tom Iraci, Tim Sexton, Valdo Calvert, John Heckman, Kate D'Ambrosio, Paul Keller