CITY OF ASHLAND

An Analysis of Fuels Reduction Treatment Effectiveness During and After the 2009 Siskiyou Fire

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The Siskiyou Fire

On Monday, September 21st, 2009 a wildfire ignited on the hillside near 3500 Siskiyou Boulevard, just above Interstate 5. Strong winds from the east that day (National Weather Service Red Flag conditions) quickly fanned the fire despite the timely arrival of fire suppression resources including engines, helicopters, and retardant planes. Coincidentally, crews from Oregon Department of Forestry (ODF), the U.S. Forest Service (USFS), Ashland Fire & Rescue and Fire District 5 were reviewing actions taken on the Hot Springs Fire (September 14th) when the Siskiyou Fire call came in. Also, the ODF contracted retardant plane in Medford was already warming up on the runway to return to Redmond and they responded directly to the fire. Within 2 hours of the ignition, 5 retardant planes and three helicopters were providing aerial support for many engine crews who protected structures and attacked the fire. The fire advanced throughout the morning and afternoon, causing evacuations of approximately 150 homes and ultimately consumed one structure and several outbuildings. Fireline was constructed by bulldozer and hand crews primarily along the east and west flanks of the fire. Crews used the Talent Irrigation Ditch as an anchor for fireline along the north and northeast sides of the fire and a dirt driveway (sometimes called Diehl Road) along most of the southern flank, although the fire did “slop” over the driveway and irrigation ditch in several spots. In nearly all locations where the fire was controlled, vegetation had been managed through either an ODF sponsored National Fire Plan grant program, or a similar program coordinated by the City of Ashland through Ashland Fire & Rescue. These treatments included either mulching done by a small machine on tracks, or cut, piled and burned by hand by ODF employees, Community Justice crews, or Lomakatsi Restoration Project workers between 2006 and 2008. Exactly 80 acres within the 188 acres fire perimeter were thinned under these programs and to varying degrees altered the fire’s behavior and intensity and provided opportunities for suppression via air or ground. Suppression was not effective in a small percent of fuels reduction areas, but fire behavior and ecosystem effects were altered over the vast majority of fuels reduction zones.

Through a combination of factors, the fire was controlled before it crossed Tolman Creek Road, where it would have threatened many more homes and advanced toward the Ashland Watershed, source of the City’s municipal water supply.

Field Visits and Fire Mapping

On October 16th, 2009 a small group including Marty Main (City of Ashland forestry consultant), Darren Borgias (Regional Ecologist, The Nature Conservancy), Chris Chambers (Forest Resource Specialist, Ashland Fire & Rescue), Steve Bridges (retired ODF forest officer) and Don Boucher (US Forest Service, Environmental Planner) toured a portion of the fire area to look at the fire severity and reconstruct fire behavior in relation to the fuels reduction work completed between 2006 and 2009. Both Steve and Chris coordinated fuels reduction within the fire area prior to the fire.

Starting at the Coyle residence at 2003 Tolman Creek Road, the group covered primarily the eastern 2/3 of the fire area out to the TID ditch, returning to the primary driveway (Diehl Road) between 2003 and 1999 Tolman Creek Road. Later, Chris Chambers alone covered the western portion of the fire except for the lower finger extending down toward Siskiyou Blvd, which was covered on November 6th. A fire severity map was created and field checked for accuracy.

Mapping Methods

Detailed maps of the area, including the GIS perimeters of fuels reduction project areas (mapped in 2006-2008), were created for the field visits. Burn severity was mapped according to a table taken from an article by Jon E. Keeley (International Journal of Wildland Fire, 2009) and shown below in Table 1.

Table 1. The matrix originally proposed by Ryan and Noste (1985) that related changes in aboveground vegetation and soil organic matter to fire severity has generally been simplified to a table such as that below; modified from Ryan (2002) and Turner *et al.* (1994)

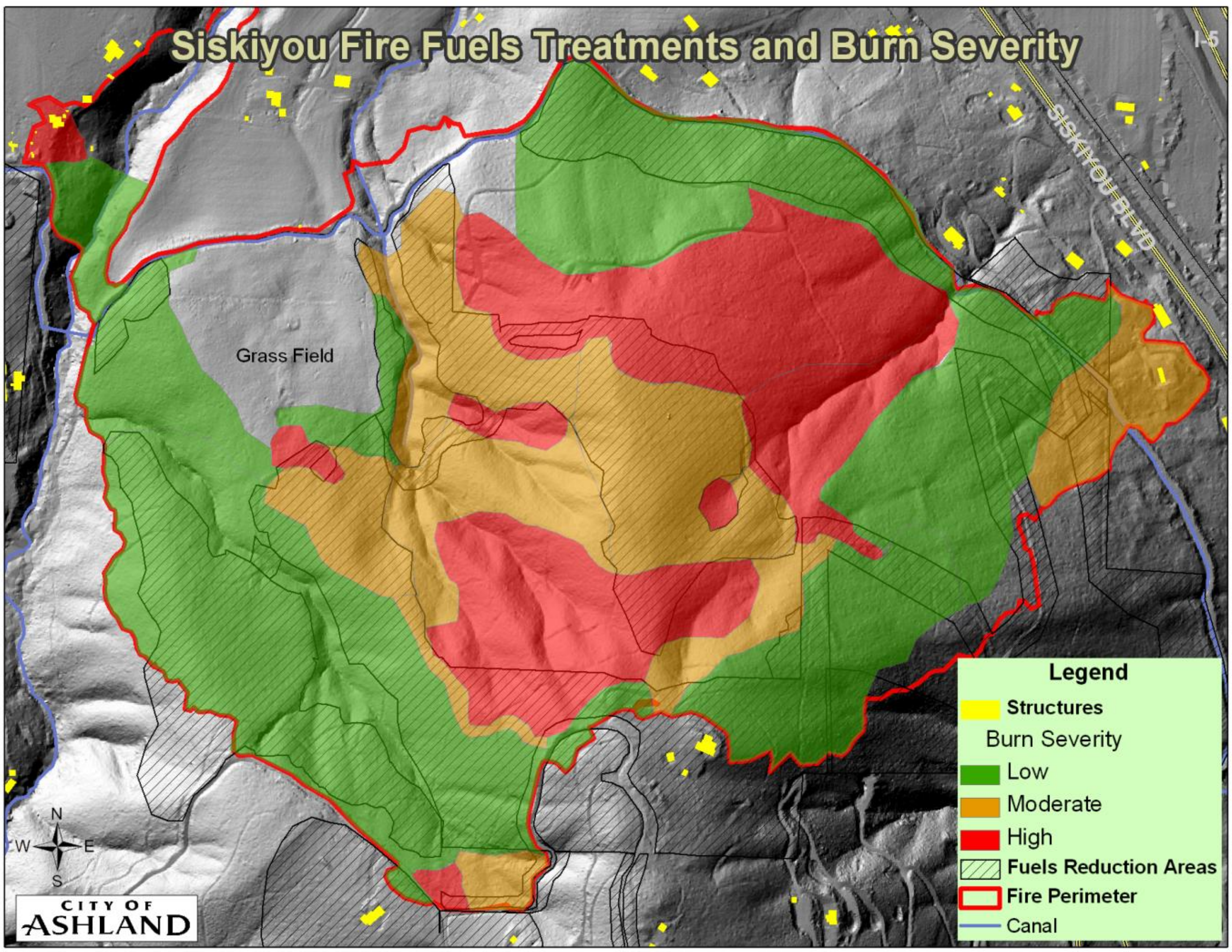
Fire severity	Description
Unburned	Plant parts green and unaltered, no direct effect from heat
Scorched	Unburned but plants exhibit leaf loss from radiated heat
Light	Canopy trees with green needles although stems scorched
	Surface litter, mosses, and herbs charred or consumed
	Soil organic layer largely intact and charring limited to a few mm depth
Moderate or severe surface burn	Trees with some canopy cover killed, but needles not consumed
	All understorey plants charred or consumed
	Fine dead twigs on soil surface consumed and logs charred
	Pre-fire soil organic layer largely consumed
Deep burning or crown fire	Canopy trees killed and needles consumed
	Surface litter of all sizes and soil organic layer largely consumed
	White ash deposition and charred organic matter to several cm depth

Burn severity was assigned a value ranging from 1-5 with 1 being Unburned and 5 being Crown Fire using the descriptions in Table 1. The majority of the fire area was field mapped using this approach to get a roughly accurate assessment of how fire severity and suppression effectiveness was affected by the fuels reduction work. Field maps were digitized into a GIS database in order to see the relationship between fire severity, fire boundaries, topography, and locations of the fuels reduction projects (see Map 1). Although there are hard and fast divisions on the map between severity classes, that may or may not be the case on the ground. There is some gradation between burn severities and even small patches of one severity within a larger area of another severity. There were no percentages or acres derived from this mapping and the overall interpretation is not tied to a literal interpretation of these boundaries.

Some of the photos in the fire area were taken at photo points established by Chris Chambers prior to the commencement of fuels reduction work and after completion of work in March of 2007. See "Photo Point Gallery" at the end of this report.

Lastly, a U.S. Forest Service "Fuels Treatment Evaluation Checklist" was used to assess the success of fuels reduction work in relation to suppression, safety, and incident management. The checklist is included as Attachment A.

Map 1. Siskiyou Fire Severity with Fuel Treatments



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Conclusions

Fire Severity Mapping

Throughout the fire area, fuels reduction work altered the fire behavior and post-fire ecological effects, and significantly aided in the protection of structures and successfully containing the fire east of Tolman Creek Road.

Due to the differing vegetation communities in the area, it was challenging to map fire severity represented by vegetation effects. For example, crown scorch without needle/leaf consumption was common but represents a vastly different heat output (severity) in white oak woodland than in a mature mixed conifer stand, not to mention differing ecosystem effects. White oak canopy tops are 15 to 25 feet from the ground while the conifer canopies ranged from 20 to 100 feet and greater from the ground, so it takes a lot more heat in mixed conifer to cause the same scorching and drying through the canopy as in an oak woodland setting. It may also be possible that different species are less or more susceptible to heat damage. As a result, the oak woodland with browned leaves received a lower severity rating (3) than the mixed conifer stand (4) with the same effects. Bole scorch heights were a more reliable aid in determining severity. In the end, this mapping deviated from a strict interpretation of the descriptors and assigned values in Table 1 in order to more accurately reflect the actual fire severity regardless of vegetation type.

Fuels Treatment Effects on Fire Behavior

There were several areas of crown fire (See Map 2) that spread directly into fuels treatment zones. In all cases except one, the fuels treatment areas caused the crown fire to become an intense ground fire, and particularly on the western and southern flanks, the crown fire became a low severity underburn. One particularly narrow fuels reduction zone (85-350 feet wide) did burn as an intense crown fire, likely due to the narrow width and proximity to a core area of untreated fuels on steep slopes where significant crown fire originated and advanced into this narrow lateral ridge treatment zone (Photo 1). Just down the same ridge where this fuels treatment zone expanded in width, the crown fire did penetrate, but dropped to the ground across the width of the treatment zone, resulting in a severe ground fire with bole scorching up to 40 to 50 feet, but not crown consumption. Most of the areas mapped as category 4 or severe surface burns, showed no green foliage left on trees, but with brown foliage still largely intact. Bole scorch was often 30 or more feet from the base of the tree (Photo 2). Areas mapped as category 3, or light severity, had large portions of the crowns still intact with green foliage. These areas tended to be where the fire was backing or flanking, the slope was less steep, wind wasn't direct or continuous, suppression was effective, and/or where fuels reduction work had been completed. It would be difficult to know which of these factors most significantly influenced fire behavior and likely they were working in concert. *However, where fuels reduction areas were directly adjacent to high intensity flames in otherwise similar topography, timing, and vegetation, the change in severity was pronounced.*

Photo 1. Crown fire burned through narrow fuels treatment zone in foreground, but not downslope where treatment was wider and continuous

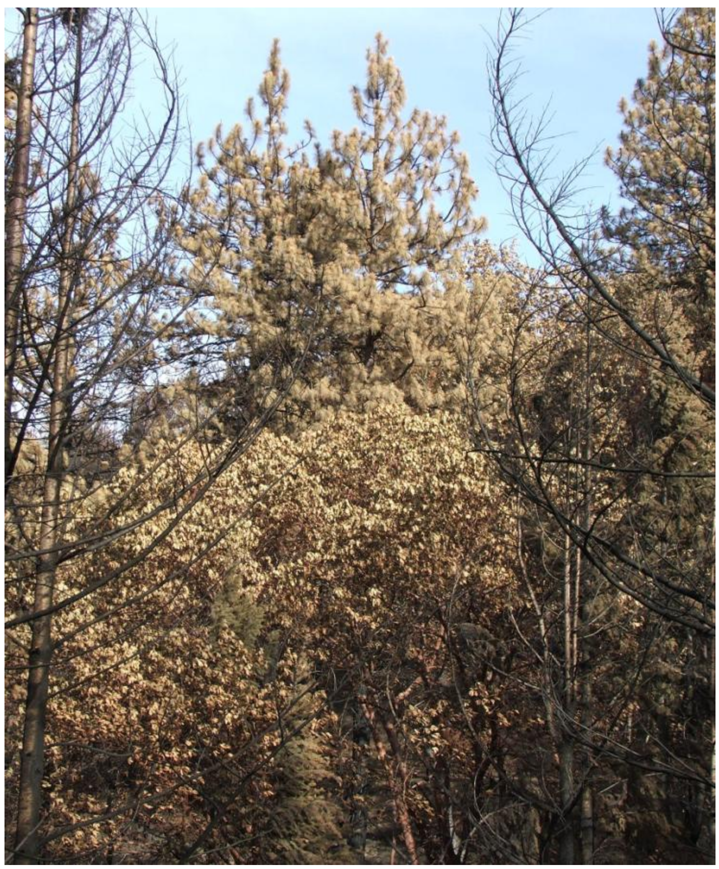

Photo 2. Looking into Class 4 severity area where canopy is dried and likely dead, but not consumed.

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Ecological Effects

Fuels treatments are often thought of as a means to stop a fire, yet the intended or unintended effects on the pre and post fire ecosystem can be beneficial. Work done on one property (38.5 acre project area) under the City of Ashland grant intentionally involved ecological restoration objectives for forest health as well as wildfire suppression. Although post fire ecosystem benefits were not outlined as a goal during fuels reduction planning, the resulting landscape shows specific examples of positive ecological outcomes in treated and burned areas as well as negative ecological outcomes in non-treated areas.

In mixed conifer stands that were thinned and then burned at moderate intensity (needles intact but brown--class 4), there is a chance that enough conifer trees may survive to contribute seeds to adjacent severely burned areas. Perhaps most notable in these areas is the post fire needle fall that is creating "effective ground cover", which quells erosion and contributes to the organic component of soil that was largely burned off (see photos below, taken at the same time). Conversely, in Class 5 severity areas, there is little to no contribution of leaves or needles, leaving soils subject to rainfall impact and setting back long term soil recovery.

Fallen needles in class 4 severity

Adjacent bare soil in class 5 severity

An unfortunate result in Class 4 settings is the expected mortality of the vast majority, if not all, of the maturing conifers. Despite the lack of ladder fuels and crown fire, nearly all the crown foliage was desiccated, making survival of individual trees unlikely—except for basal sprouting of hardwoods. Had the fire not occurred during late season (low live fuel moisture) and red flag conditions (humidity 5-10 percent), the effects may not have been as severe in class 4 severity stands where thinning was completed. See conclusion for more on fuels treatment design.

Where the fire was less severe (class 3 severity), trees survived in significant numbers and the soil duff and litter were largely intact (photo below).
Assuming that this low elevation site (ranges from 2260 feet to 2950 feet) would have historically been adapted to frequent and low intensity fire, the high severity areas could be seen as a departure from the historical fire regime. The loss of mid-seral ponderosa pine dominated stands in particular, suggests that the progression toward an open forest type more characteristic of historic conditions was interrupted by an infrequent, high intensity fire which will set back the clock to early seral vegetation dominated by

brush and hardwoods for many years to come. Without management intervention, brush and hardwood dominated stands will develop to an elevated level of high intensity fire potential for decades to come, creating the conditions for a high intensity re-burn. This type of vegetation development is readily apparent in the area burned by the 1959 Ashland Watershed fire and the 1973 Hillview fire. In high intensity portions in the older burned areas, the re-establishment of an open, mixed conifer forest and low intensity fire regime has been difficult or impossible and certainly cost and labor intensive. The older burned areas continue to be some of the most hazardous areas in the Ashland interface zone, and the 1959 fire area in particular. The replacement of open forest conditions by early seral species and structure is very undesirable for protecting homes and adjacent values, soil conservation, land value, and perhaps carbon storage.

Implications for Fuels Reduction Planning

Fuels and forest managers often plan fuels reduction projects to be effective during all but the worst fire weather conditions. While this is wise, it does leave the door open for severe effects (to homes, infrastructure, and ecosystem) when a fire burns during severe weather conditions. Yet, most fires-and especially wind driven fires, are not uniformly severe even under severe conditions. The Siskiyou Fire experience confirms that a fire can be controlled under severe conditions, pointing to the importance of strategic treatments in a variety of landscape and vegetation conditions in a project area or area of concern. Differences in topography, vegetation communities, and suppression access will produce different fire severity outcomes. A variety of settings create opportunities where all fire behavior elements (fuels, topography, weather) are not in alignment. Although reserve (untreated) areas were left on steep slopes and densely crowded stands where fire was likely to be severe, the geographic locations of reserves minimized exposure to homes and were surrounded by treatment areas that ultimately aided in the fire’s control. Smaller (1/4 acre or less) untreated areas were left for habitat diversity and economic reasons, and in all cases, these patches burned at high intensity. The patches included white-leaf manzanita clumps, and dense reproduction of incense cedar. Again, placement of leave patches should be taken seriously with the assumption that they can burn at high intensity and affect anything adjacent.

Ashland Fire & Rescue has maintained a Tactical Opportunities Fire Suppression Map since 2004, which outlines all fuels reduction work in strategic or tactical landscape locations. This map was valuable during Siskiyou Fire operations and allowed for suppression planning, contingency planning on the west side of Tolman Creek Road, as well as a quickly accessible, pre-printed, large format map for basic operations such a structure locations, transportation routes, and water sources.

Photo Point Gallery

High Intensity Pre-Treatment, Post-Treatment, and Post-Fire

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Low Intensity-- Post Fuels Reduction and Post Fire

Mixed Moderate/High Intensity—Pre Treatment, Post-Treatment, and Post Fire

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Appendix Attachment A: U.S. Forest Service Fuels Treatment Evaluation Checklist

Fuels Treatment Evaluation Checklist

Fire Name: Siskiyou
Fire Number: ____________
Fire Date: 9/21/09

Treatment

1. Did the fire burn in, or immediately adjacent to a hazardous fuels treatment area? [x] Yes [ ] No
2. Age of the treatment: [ ] 0-1 Year [x] 1-5 Years [ ] 5 -10 years [ ] more than 10 years
3. The type of treatment that effected this fire (check all that apply):
   - [x] Pre-commercial thinning
   - [ ] Commercial thinning
   - [ ] Commercial harvest
   - [ ] Biomass removal
   - [ ] Mastication without follow-up treatment
   - [ ] Mastication with follow-up treatment
   - [ ] Fuelbreak
   - [ ] Defensible Fuel Profile Zone
   - [ ] Disking
   - [ ] Understory burning
   - [ ] Prescribed fire
   - [x] Hand piling

Suppression

4. The treatment (check all that apply):
   - [x] Provided an anchor point for suppression
   - [ ] Increased fireline production rates
   - [x] Reduced surface fire intensity
   - [ ] Slowed rates of spread
   - [x] Served a part of the final control line
   - [x] Allowed for firing operations
   - [x] Reduced spotting or firebrand production
   - [x] Improved ingress or egress into the fire area
5. The treatment improved the effectiveness of air operations: (check all that apply):
   - [x] Fixed wing
   - [x] Rotor wing
   - [x] Improved canopy penetration
   - [ ] Reduced required coverage levels
6. The treatment protected private property or government improvements:
   [x] Yes [ ] No
7. If yes to #6, how many structures:
   [ ] Less than 5 [x] 5 to 25 [ ] 26 to 100 [ ] more than 100

Safety

8. The treatment area allowed for direct attack on the fire:
   [x] Yes [ ] No
9. The treatment served as either an escape route or safety zone:
   [x] Yes [ ] No
10. The treatment provided protection to public improvements (check all that apply):
    - [ ] Roads
    - [ ] Schools
    - [x] Structures
    - [ ] Powerlines
    - [ ] Other utility infrastructure
    - [ ] Other

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Incident Management

11. The effects of the fuels treatment reduced the final fire size:
    - [x] Yes
    - [ ] No

12. Incident management level of this fire:
    - [ ] Type 4
    - [x] Type 3
    - [ ] Type 2
    - [ ] Type 1

13. Expected incident management level of the fire had the treatment not been in place:
    - [ ] Type 4
    - [ ] Type 3
    - [ ] Type 2
    - [ ] Type 1

14. The effects of the treatment on the fire reduced the duration of the incident: -
    - [x] Yes
    - [ ] No

15. The expenditure of ~~WFSU~~ State/FEMA funds decreased as a direct result of the treatment:
    - [x] Yes
    - [ ] No

COMPLETE THE *BURN SEVERITY MATRIX* FOR TREATED AND UNTREATED BURN AREAS OF THE FIRE.

Sample Size: The sample is not intended to be statistically significant.

For fires over 5 acres complete 10 transects of 45 meters for both treated and untreated burn areas. For fires less than 5 acres, complete 5 transects of 45 meters for both treated and untreated burn areas.

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