Ecological Restoration Institute

***Fact Sheet**: Do Fuel Treatments Reduce Fire Severity in Ponderosa Pine Forests? Tree Mortality Patterns One Year after the Wallow Fire*

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Do Fuel Treatments Reduce Fire Severity in Ponderosa Pine Forests?
Tree Mortality Patterns One Year after the Wallow Fire

Introduction

In recent decades, more frequent, larger and more severe wildfires have erupted in dry forest types (e.g., ponderosa pine) across the western United States (Westerling et al. 2006). Given predictions for a warmer and drier climate across the interior West, such fires are likely to continue.

In an effort to mitigate large, severe wildfires, fuel treatments are under way across the West. The priority sites for these fuel treatments are in the wildland urban interface (WUI), where relatively small treatment units are concentrated around towns and dispersed settlements (Ager et al. 2010). There is a growing body of anecdotal and empirical evidence that suggests WUI treatments are effective for reducing damage to communities (Martinson and Omi 2013, Safford et al. 2009), but it remains unclear whether these treatments can mitigate today's uncharacteristically large and severe wildfires. Computer modeling shows that by failing to invest in treatments beyond the WUI, high burn severities will persist at the greater landscape level (Waltz 2012).

Figure 1. Paired treated (left) and untreated (right) units.

In this study, ERI researchers used a post-wildfire field measurement approach to study and describe the effectiveness of WUI hazardous fuels treatments in reducing fire behavior and conserving forest resiliency during the Wallow Fire, a 538,000-acre uncharacteristically, high-severity wildfire that burned in Arizona in 2011. Our primary goals were to: 1) measure changes in burn severity as the wildfire transitioned from high-severity untreated to treated areas, 2) compare ponderosa pine tree mortality and basal area (BA) loss across paired treated and untreated areas, and 3) compare post-fire stand structure, tree regeneration, snag density, and coarse woody debris between treatments with respect to natural ranges of variability (NRV).

Research Findings

1. In two of three paired treatments, burn severity was reduced as the wildfire transitioned from untreated areas to treated areas (Figures 1 and 2). In all three cases, the wildfire killed significantly fewer trees in the treated areas than the paired untreated areas. In fact, treatment units showed no significant reduction in tree densities post-fire, although all treatment units had fire-killed trees. In both treated and untreated areas, the majority of trees killed were relatively small in size—less than 8 inches in diameter at breast height (DBH).
2. The post-fire live tree density and BA remained substantially higher in all untreated units than treated units. Two of the three treated units remained in NRV in terms of tree density (Figure 3) and basal area. The wildfire also moved one untreated area toward NRV conditions, whereas tree densities were as much as twice the upper density ranges found historically in the other two untreated areas. We observed little tree regeneration in either treated or untreated units. Post-fire coarse woody debris was generally higher in untreated units (0.7–5.6 ton ac-1) than treated units (0.4–1.8 ton ac-1). Standing snag density (≥12 in. DBH) was slightly higher in two of the three treated units than in the untreated units, although not significantly different.

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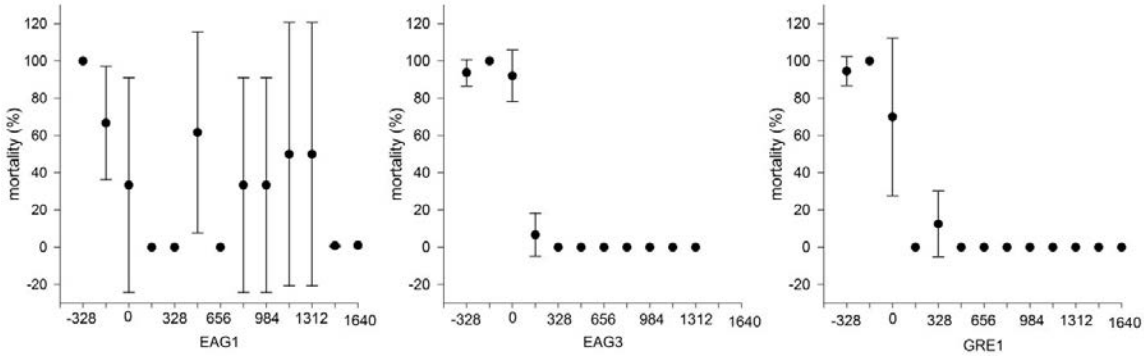

Figure 2. Percent total mortality in relation to distance (feet) to treatment edge. Bars represent ± 1 standard deviation (SD).

Management Implications

- This study showed changes in fire effects within treated areas as well as less overall tree mortality in treated units. In two cases, reduced tree mortality effects were seen within 300 feet into a treated stand.
- Higher variability in burn severity occurred among sites than between paired treated and untreated areas of similar topography and fire progression times.
- Untreated forests lost about100 trees per acre in the Wallow Fire, but are still twice as dense as pre-fire treatment areas. This suggests these stands may still be vulnerable to the extreme fire behavior seen in today's uncharacteristically large and severe "mega-fire" event.

Research Challenges and Needs

- Understanding variability in tree mortality among treated units was constrained by limited information on pre-fire treatment prescriptions and suppression tactics used within or adjacent to forest treatments during the Wallow Fire.
- Future questions include how differing suppression activities within treated areas contribute to mortality in treated areas, and the relationship of total treatment size and fire effects.
- Future studies in post-fire landscapes are needed to look at stand resilience to future wildfire and, subsequently, any need for prioritization of future treatments within burned landscapes.

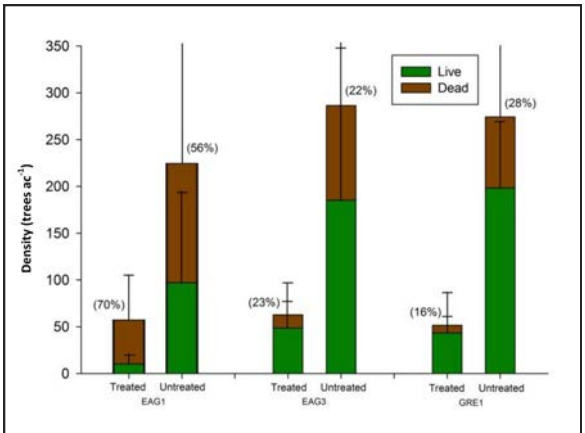

Figure 3. Live and killed tree densities by treated and untreated paired units (Bars represent ± 1 SD; mortality % in parentheses).

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