COLORADO FOREST
RESTORATION INSTITUTE
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Monument Fire Center Prescribed Fire:
Immediate Post-Burn Monitoring Summary

Project Overview

In June 2024, the Pikes Peak Ranger District conducted roughly 650 acres of broadcast burning in the North and Nursery Units of the Monument Fire Center (MFC) Project (Figure 1). The project area has a large Gambel oak component and was masticated and thinned in 2023. The project's goals were to prepare the area to receive prescribed fire and manage oak density and wildfire risk to nearby communities and infrastructure.

The MFC is part of the Upper Monument Creek Landscape, where the Colorado Forest Restoration Institute (CFRI) partners with the Pike San Isabel National Forests and Colorado Springs Utilities to collect long-term monitoring data to inform collaborative adaptive management. The heavy Gambel oak component at MFC provides a unique opportunity to study oak response to multiple forest management activities, including the introduction of prescribed fire. Initial monitoring after mechanical treatment (Barrett and Parrish 2024) showed a decrease in overstory oak stem density and shrub cover; however, a large increase in oak seedling density (average stems per acre) was observed after treatment. Mastication and thinning also reduced coarse fuel loading despite a nearly

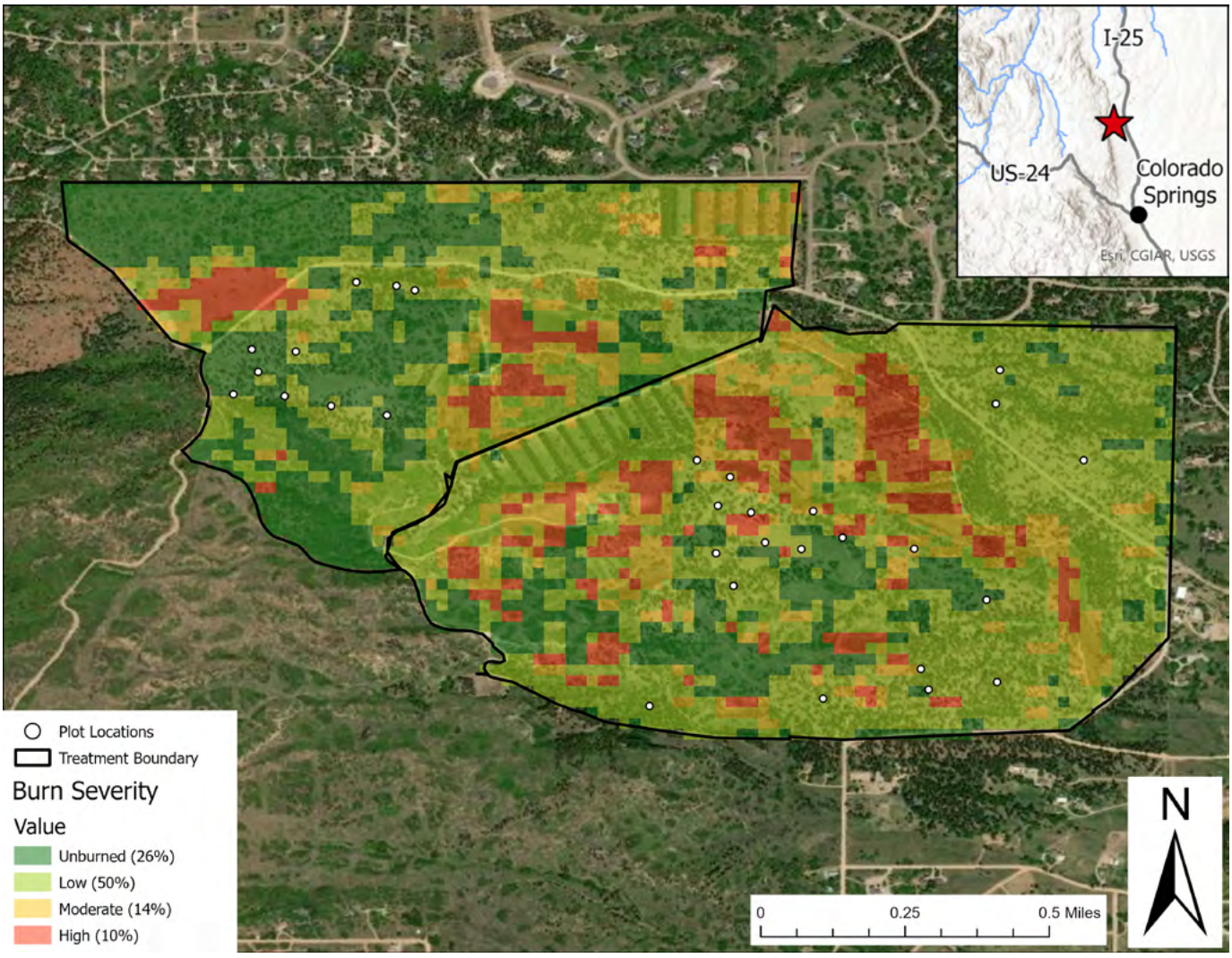

Figure 1. Burn Severity Map for MFC showing unit boundaries and monitoring plots. The percentage of the project area that burned under each severity is shown in parentheses in the legend. The burn severity map was calculated using aerial imagery to determine the difference in Normalized Burn Ratio (dNBR; Key and Benson 2006).

six-fold increase in fine woody fuel loading. Consequently, the use of prescribed fire was recommended to address the oak sprouting response and increased fine woody fuels resulting from treatment. This report represents immediate post-prescribed fire results, focusing on fuels and short-term prescribed fire outcomes. Longer-term outcomes such as oak response will be forthcoming, with monitoring at longer time steps post-prescribed fire.

Figure 2. Photo series of CFRI monitoring plot showing pre-treatment (A), post-mastication and thinning (B), and post-prescribed fire (C). Note small oak sprouts and evidence of burned needles on ponderosa pine in (C).

Goals and Objectives

In addition to the broader goals and objectives outlined by the Front Range Collaborative Forest Landscape Restoration Program (FR-CFLRP), specific goals for the MFC prescribed fire included: (1) reducing oak brush continuity by at least 30%, (2) reducing mastication fuel loading by at least 50%, (3) introducing fire to at least 70% of the identified acres, (4) reducing conifer regeneration and raising crown base height, and (5) limiting overstory conifer mortality to a maximum of 35%. Goals and objectives related to oak brush continuity, conifer regeneration, and crown base height require longer-term monitoring and will be addressed in subsequent reports.

Methods

30 plots were established for pre- and post-treatment monitoring at MFC. Fire effects on the forest floor were classified at 12 subplots within each 1/10th acre monitoring plot (360 total) to assess burn severity. Percent of the plot that experienced fire was measured at a total of 100 points along 4 transects. Immediate post-burn protocols can be found on the CFRI website (CFRI 2020; 4 transects were used in the cardinal directions rather than 8 as shown in this protocol). Subsequent monitoring efforts will be completed 1- and 5-years post-burn to collect treatment effectiveness results, including longer-term monitoring of oak response, and trends in forest structure and composition.

Highlights and Conclusions

Burn severity mapping shows that 74% of the project area burned (Figure 1), and 100% of the field monitoring plots experienced some effect of prescribed fire (note: one plot was dropped due to sampling error). Of these plots, an average of 50% of the plot area had signs of fire, with a range of 8% to 93% (Figure 3), indicating high variability in burn coverage across the project at finer scales. Additionally, 64% of the substrate burned, and 61% of the vegetation burned, predominately at low severity (Figure 4). Overall, the prescribed burn met objectives of introducing fire to over 70% of the area, though patterns at the finer scale are more nuanced with greater variability in burn coverage.

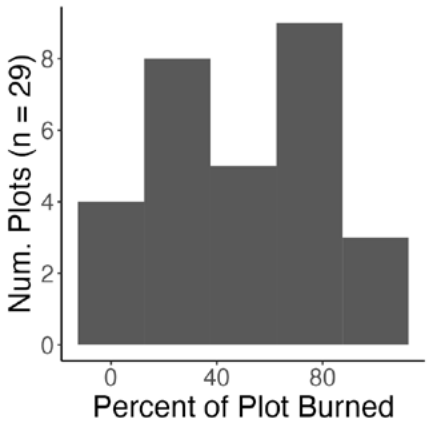

Figure 3. Burned area distribution of the 29 plots that experienced fire.

Litter and duff loadings remained relatively unchanged following the burn, however loadings for both litter and duff remained statistically lower than pre-treatment conditions (Figure 5A). Prescribed fire reduced 1-hr fuels by 88%, 10-hr fuels by 80%, and 100-hr fuels by 67%. All of these reductions in fine woody fuels represent a statistically significant reduction in fuels, with post-burn fuel loadings approximating pre-treatment conditions, thus meeting objectives of reducing fine fuel loading by at least 50% (Figure 5B).

Average crown volume scorch, maximum scorch height, and stem char height for trees and saplings was highly variable between plots, with crown volume scorch ranging from 0-100%, maximum scorch height from 0-30 feet, and stem char height from 0-20 feet (Table 1). Despite the variability in tree effects, 21% of the sampled trees and saplings saw greater than 90% crown volume scorch, a threshold where we expect to start seeing tree mortality, thus meeting the objective of limiting conifer mortality to 35%. Although we did not measure crown base height directly, we anticipate crown base height to increase given average crown volume scorch of 23% and maximum scorch height of 12 feet.

Table 1. Average percent of crown volume scorched, average maximum scorch height, and stem char height. Standard deviation is in parentheses.

	Crown Volume Scorch (%)	Max Scorch Height (ft)	Stem Char Height (ft)
Trees*	23 (31)	12 (10)	3 (4)

* Metrics are for trees and saplings combined

Overall, prescribed fire at the Monument Fire Center met all objectives that were measured immediately post-burn. Prescribed fire reduced fine fuel loadings by more than 50%, returning fuel loads to pre-treatment conditions while introducing fire to over 70% of the project area. Additionally, conifer mortality is estimated at 21%, and crown base heights were likely increased as a result of the burn. We expect Gambel oak to resprout as a result of the burn (see sprouting in Figure 2C). Subsequent monitoring of oak cover and conifer regeneration is planned to evaluate treatment longevity.

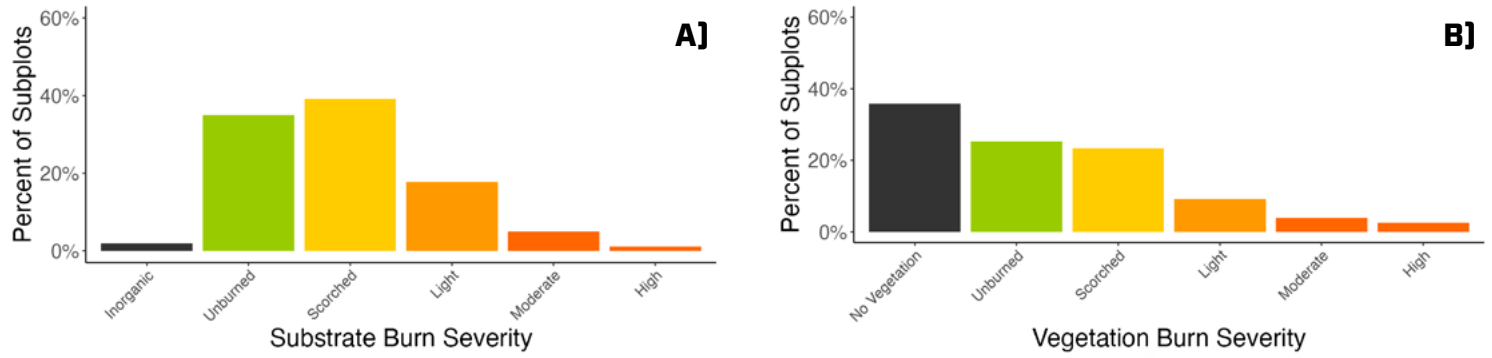

Figure 4. Substrate burn severity (A) and vegetation burn severity (B).

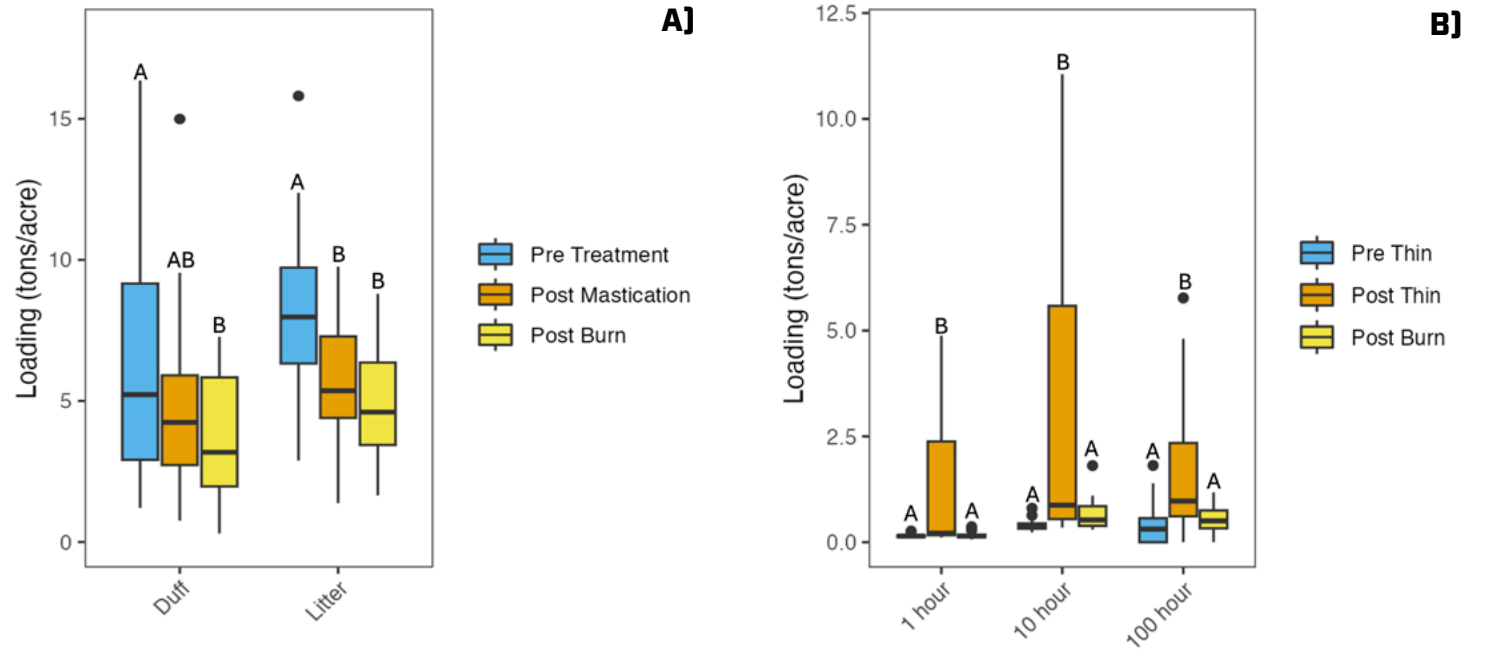

Figure 5. Litter and duff (A) and fine woody fuel loading (B). Letters above the boxplots indicate statistically significant differences in fuel loadings at the $\alpha = 0.05$ level.

References

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