



Monument Fire Center Monitoring Summary

Goals and Objectives

This report summarizes initial post-mechanical treatment (pre-broadcast burn) results at the Monument Fire Center (MFC), which is within the Upper Monument Creek Landscape. Treatments within the Upper Monument Creek Landscape aim to meet the desired conditions outlined by the Front Range Collaborative Forest Landscape Restoration Program (FR-CFLRP), including: (1) promoting a species composition favoring lower montane species, (2) establishing a more characteristic fire regime, and (3) establishing a complex mosaic of forest density, size, and age. Additionally, long-term goals and objectives include using a combination of mechanical treatments and broadcast burning to manage Gambel oak cover and stem density to reduce wildfire threat to nearby communities and U.S. Forest Service infrastructure. Due to the heavy oak component at MFC, and the planned silvicultural maintenance of the site, MFC provides a unique opportunity to monitor Gambel oak responses to forest management, including multiple entries of mastication, thinning, and broadcast burning.

Project Overview

This project aimed to not only meet desired conditions outlined by the FR-CFLRP, but also to meet objectives regarding management of Gambel oak for wildfire risk reduction objectives. It is important to note that this report only evaluates the response to the initial mastication and hand thinning treatment. Subsequent broadcast burns and additional mechanical treatments are planned to meet long term silvicultural goals and objectives. Because of the relatively unique pine-oak system within this project, this monitoring summary will focus primarily on results regarding oak response and wildfire risk. As such, Gambel oak was treated as both a shrub for shrub cover and height estimates, and a tree for overstory structure and regeneration estimates. Overall, management met FR-CFLRP objectives by reducing tree densities and canopy cover, increasing the relative abundance of ponderosa pine, and increasing quadratic mean diameter and crown base height. However, mastication resulted in a significant sprouting response of Gambel oak and regeneration has increased dramatically, despite initial reductions in oak cover. Overall, the initial entry at MFC increased fire suppression

opportunities, which can facilitate maintenance of the site, including the future use of prescribed fire for additional Gambel oak management and treatment longevity.

Table 1. Project Information Table

Implementation Agency	USFS, Pikes Peak RD
Ownership	USFS
Dates Monitored	Pre-treatment 2021, Post-treatment 2023
Year Completed	2023 (initial entry)
Acres Treated	1276
Acres Monitored	753 (Pine-oak units)
Forest Type	Pine-oak
Implementation Method	Mastication and Hand Thinning
Slash Treatment	Broadcast Burn

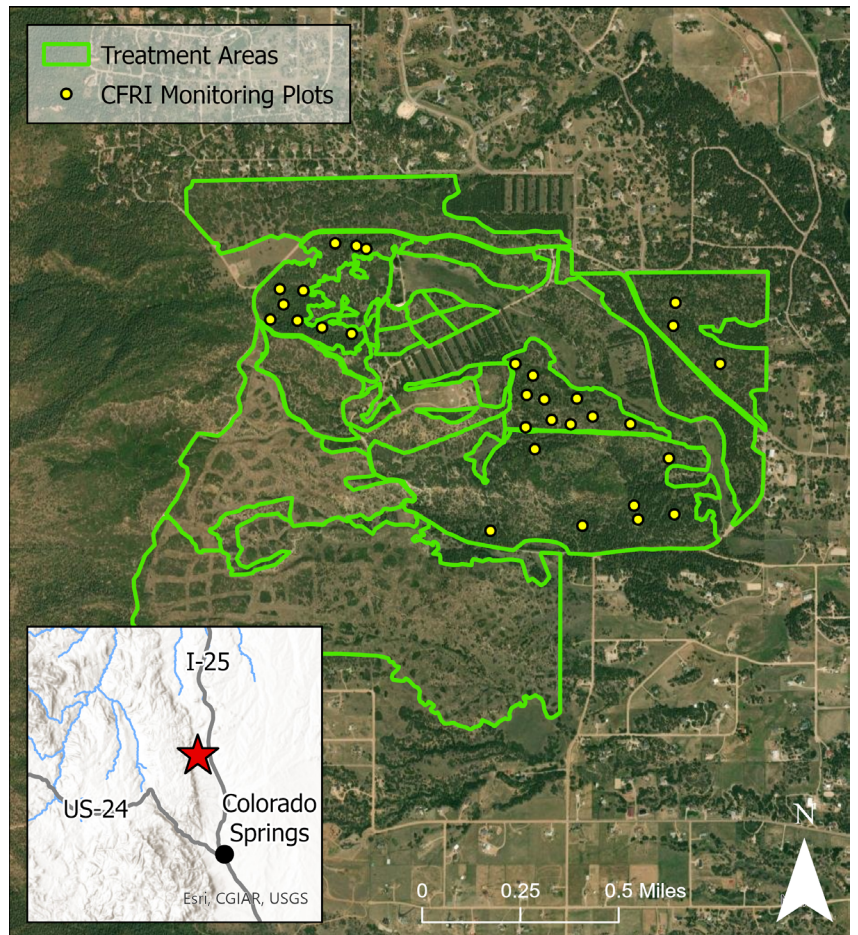


Figure 1. Map of Monument Fire Center's location, unit boundaries, and monitoring plots.

Pre and Post Treatment Photos



Stand Structure and Composition

Table 2. Stand characteristics (mean \pm standard deviation pre- and post-forest thinning. Asterisks (*) denote a statistically significant difference at an $\alpha=0.05$ level) from 29 plots within treatment units.

Phase	Trees per Acre	Basal Area (ft ² /ac)	Canopy Cover (%)	Seedlings per Acre	Ponderosa by BA (%)	Quadratic Mean Diameter (in)	Crown Base Height (ft)
Pre	2552 \pm 2235*	99 \pm 43*	32 \pm 24	7741 \pm 5821*	67%	3.5 \pm 1.9*	6.1 \pm 3.8*
Post	98 \pm 155*	51 \pm 41*	23 \pm 22	2110 \pm 22450*	98%	12.9 \pm 3.8*	11.9 \pm 5.0*

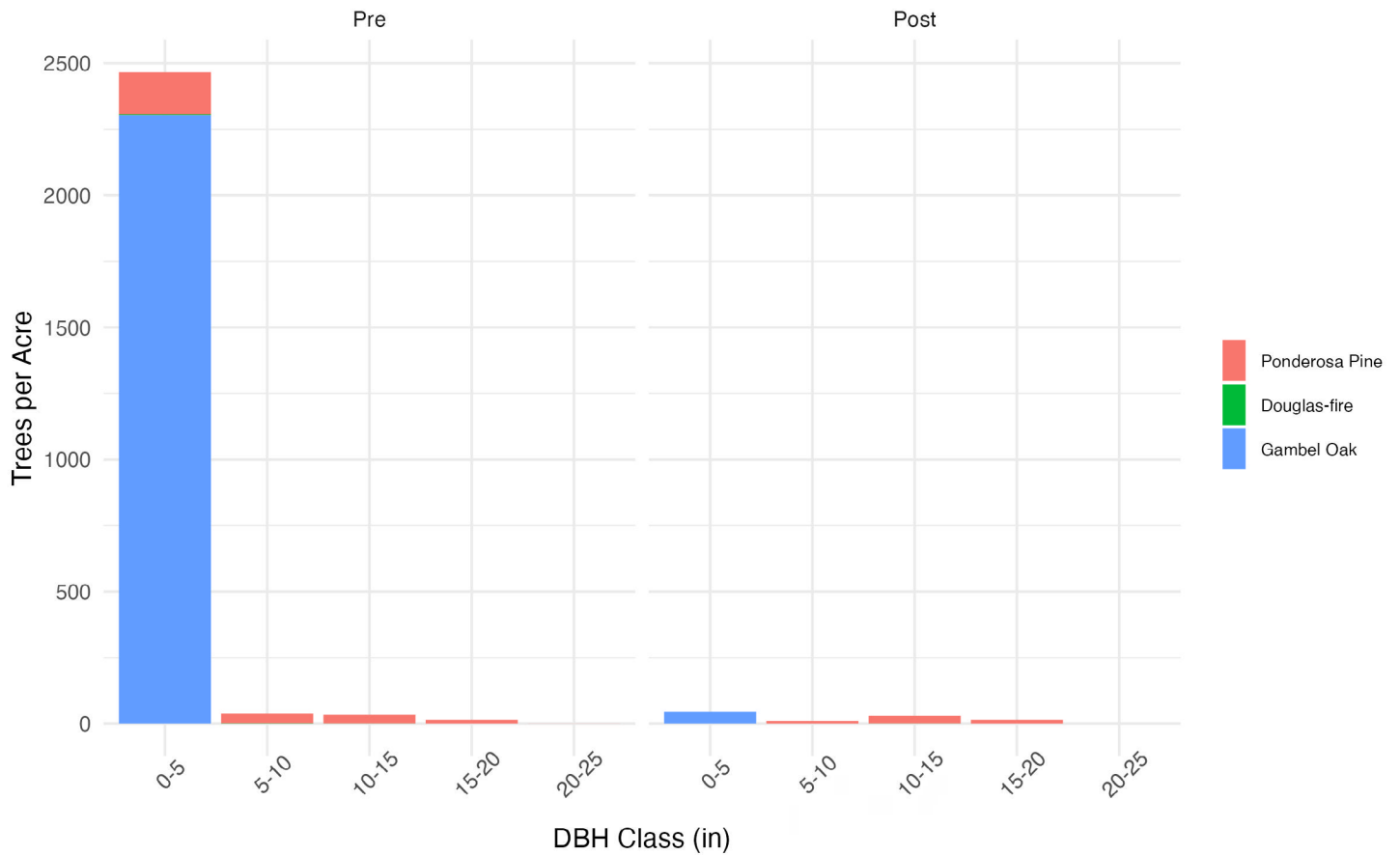


Figure 2. Diameter Distribution

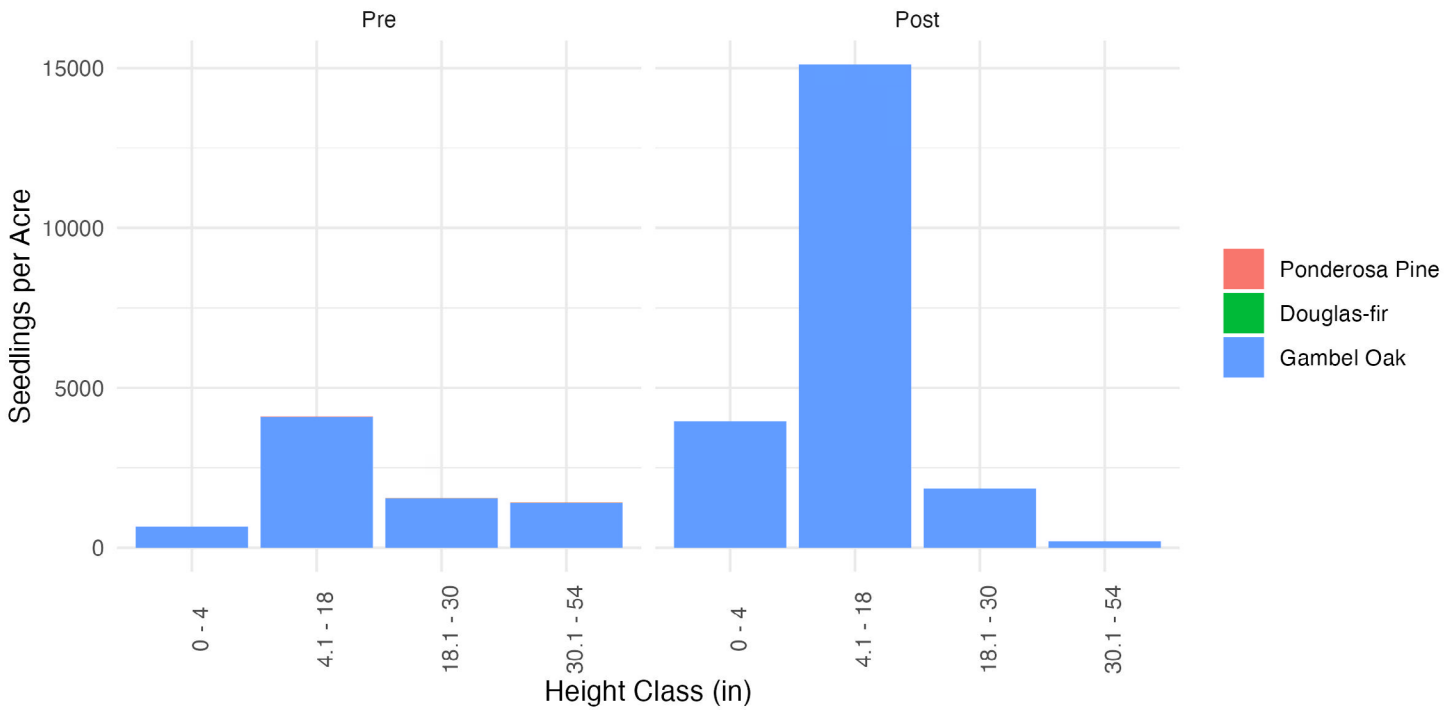


Figure 3. Seedling Composition

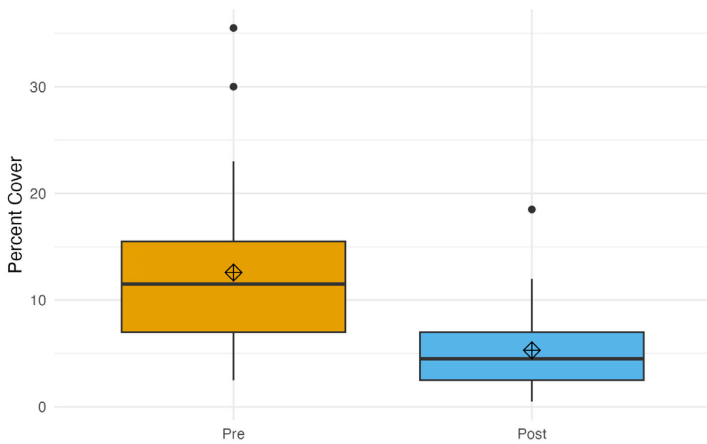


Figure 4. Oak Ground Cover

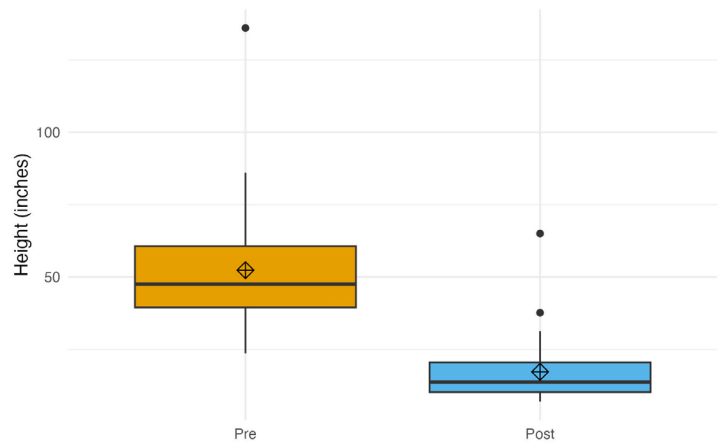


Figure 5. Shrub Height

Highlights: Mastication moved forest structure and composition towards the desired outcomes outlined by the FR-CFLRP. Management resulted in reductions in forest density and increases in both quadratic mean diameter and crown base height. Furthermore, tree density in the smallest DBH class (0-5 inches) was dramatically reduced via the removal of Gambel oak, and ponderosa pine relative abundance in the overstory increased substantially. Mastication also resulted in initial reductions in oak ground cover and shrub height, reducing ladder fuels throughout the stand. However, the oak response to mastication is noteworthy, with large increases in seedlings per acre in the 0-4- and 4.1-18-inch size class despite overall reductions in cover. We would expect increases in oak regeneration due to sprouting to ultimately lead to increases in oak ground cover without continued maintenance of the site. Forest management has resulted in a favorable structure for the application of prescribed fire in the near future, which should target oak sprouting.

Fuels and Fire Behavior

Table 3. Surface fuels changes pre- to post-mastication. Gambel oak comprised the majority of reported shrub cover.

Phase	Fine Woody Fuel Loading (tons/acre)	Coarse Woody Fuel Loading (tons/acre)	Litter Depth (in)	Duff Depth (in)	Shrub Cover (%)
Pre	0.95 ± 0.10*	1.35 ± 0.84*	1.23 ± 0.08*	0.87 ± 0.1	13.90 ± 1.60*
Post	6.16 ± 1.27*	0.77 ± 0.61*	0.85 ± 0.06*	0.65 ± 0.07	5.72 ± 0.90*

Table 4. Modeled fire behavior. Fire behavior was modeled from 29 treated plots using the Forest and Vegetation Simulator Fire and Fuels Extension (FFE-FVS). Seedlings in the 0–4-inch size class were removed from analysis.

Phase	Pre		Post	
	Moderate	Severe	Moderate	Severe
Fire Weather Conditions	Moderate	Severe	Moderate	Severe
Total Flame Length (feet)	3.6	39.4	1.7	13.7
Surviving Tree Basal Area (%)	37.2	0.5	75.7	32.2

Highlights: Fine woody fuel loading increased following treatment, while coarse woody fuel loading, litter/duff depths, and shrub cover all decreased. Predicted flame lengths decreased and surviving tree basal area increased under both moderate and severe modeled conditions. After treatment, the Torching Index substantially increased and Crowning Index slightly increased, indicating a reduced risk of crown fire. Overall, predicted fire behavior was moderated as a result of the treatment as active and passive fires modeled in pre-treatment plots transitioned to mostly surface fires following treatment.

Conclusions

Overall, initial mechanical treatments altered forest composition, significantly decreasing tree densities and oak ground cover while increasing quadratic mean diameters and crown base height. Additionally, treatment resulted in decreased coarse fuel loading and litter depths. These changes likely contribute to moderated modeled fire behavior. However, managers should watch for increases in fine fuel loads and monitor the oak sprouting response, as seen in the dramatic increase in oak seedlings per acre. Implementing prescribed fire in the near future—while modeled fire behavior favors surface and passive fire—could help address oak sprouting, reduce surface fuel loading, and increase treatment longevity, further moving the site towards desired conditions. Overall, the initial mechanical treatments helped promote desired conditions, and the continued treatment of the site via planned broadcast burning and additional mechanical entries will further maintain desired conditions and provide additional opportunities to monitor Gambel oak response to various levels of silvicultural treatment.

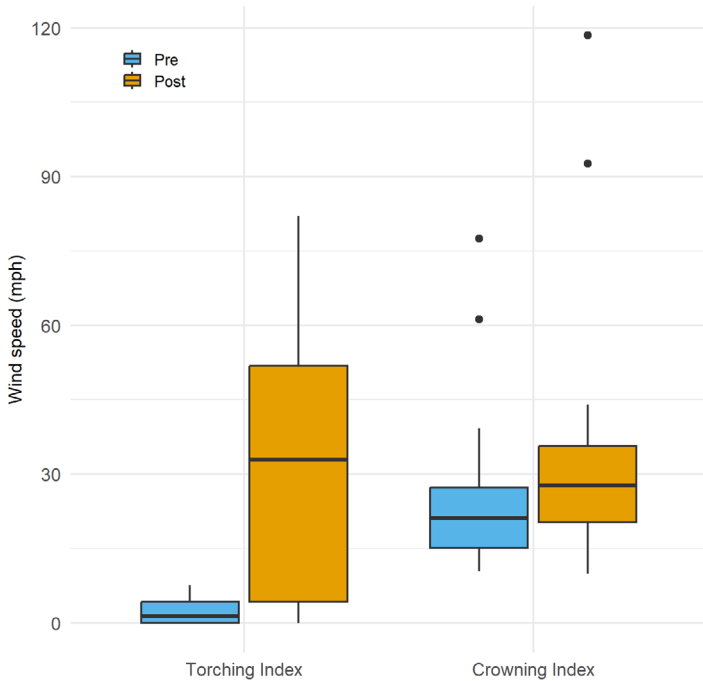


Figure 6. Boxplots showing the average wind speeds necessary to initiate crown fire activity (Torching Index) and carry active crown fire (Crowning Index) for pre- and post-treatment plots.

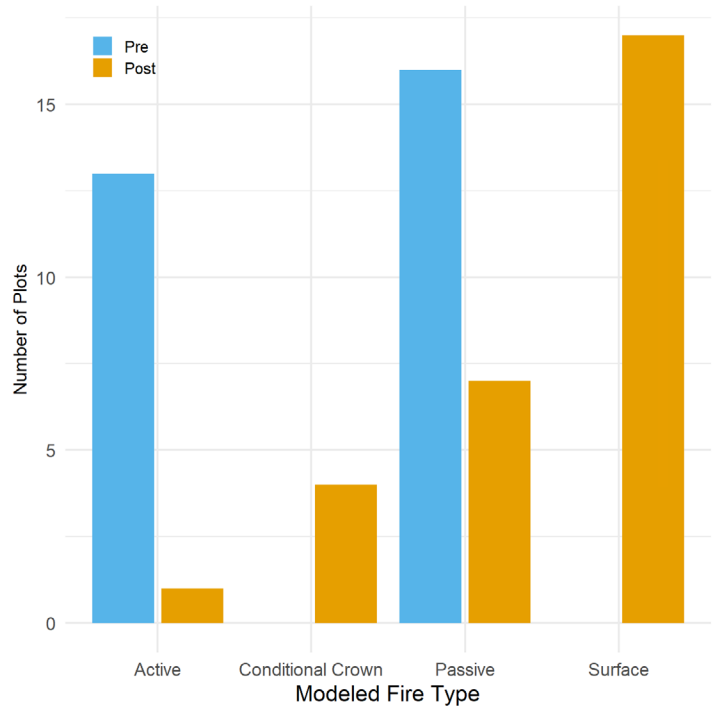


Figure 7. Number of pre- and post-treatment plots within each modeled fire type under severe weather conditions.