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Silver Trident Monitoring Summary

Goals and Objectives

This report summarizes initial ecological monitoring results following forest management at the Silver Trident project within the Upper Monument Creek landscape (Table 1). Treatments within the Upper Monument Creek Landscape aim to: (1) promote a species composition favoring lower montane species over other conifers, (2) establish a more characteristic fire regime, and (3) establish a complex mosaic of forest density, size, and age. Additional project specific desired conditions and objectives for monitored units (6 and 7) in Silver Trident include: (1) increasing openings in the canopy, (2) reducing stand densities to a target basal area of 20 – 40 ft2/acre, while enhancing tree groups and scattered individual trees, and (3) setting the project area up for receiving prescribed fire in the future.

Table 1. Project Information Table

Implementation Agency	USFS, Pikes Peak RD
Ownership	USFS
Dates Monitored	Pre-treatment 2020, Post-treatment 2022
Year Completed	2022
Acres Treated	660
Acres monitored	131 (Units 6 and 7)
Forest Type	Dry Mixed Conifer (Units 6 and 7)
Implementation method	Mechanical and Hand Thinning
Slash treatment	Pile burning followed by broadcast burn

Project Overview

The project aimed to align with desired conditions outlined by the Front Range Collaborative Forest Landscape Restoration Program (FR-CFLRP) including: reducing forest density and canopy cover within targets, while enhancing moderately sized groups of trees and removing extensive, continuous canopy cover. The relative abundance of lower montane tree species such as ponderosa pine also increased project-wide. Tree regeneration remained highly variable, though increases in the relative abundance of aspen were seen both in the overstory and understory. Modeled flame lengths drastically decreased following treatment, and the fire type was lowered to primarily surface fire. These outcomes are likely a result of the decreased tree density and tree crown continuity, even though surface fuel loadings increased slightly and crown base height remained relatively unchanged. The future application of prescribed fire at the site will reduce surface fuel loadings and increase crown base height, further enhancing the stands' resistance to future disturbance.

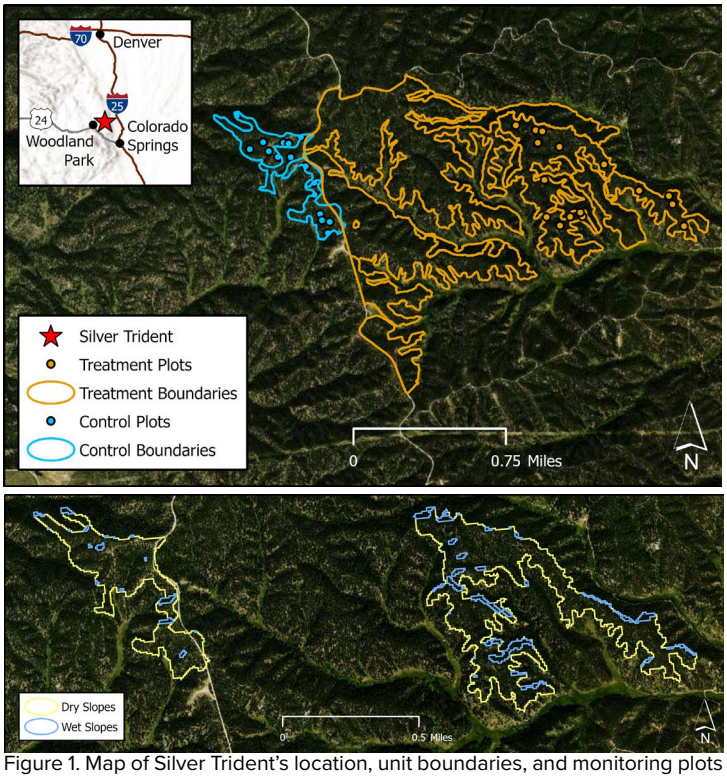

Figure 1. Map of Silver Trident's location, unit boundaries, and monitoring plots (top); map of wet vs dry[1] aspects used for plot stratification (bottom).

Pre and Post Treatment Photos

Stand Structure and Composition

Table 2. Stand characteristics (mean ± standard deviation). Asterisks (*) denote a statistically significant difference between pre/post phase at an α=0.05 level.

Site Conditions	Phase	Trees per Acre	Basal Area (ft2/ac)	Canopy Cover (%)	Seedlings per Acre	Ponderosa by BA (%)	Quadratic Mean Diameter (in)	Crown Base Height (ft)
DRY	Pre	303 ± 155*	95 ± 32*	47 ± 19*	809 ± 1089	39	8.1 ± 1.7*	10.6 ± 2.9
	Post	29 ± 18*	27 ± 17*	12 ± 12*	1021 ± 1022	67	13.5 ± 2.8*	12.6 ± 4.8
WET	Pre	545± 124*	97± 29*	55 ± 25	4992 ± 5518	34	5.7 ± 0.7	11.5 ± 4.4
	Post	193 ± 74*	37 ± 16*	24 ± 15	5383 ± 5082	51	5.9 ± 0.6	11.8 ± 5.0
COMBINED	Pre	367 ± 181*	96 ± 30*	49 ± 20*	1924 ± 3322	37	7.5 ± 1.9*	10.8 ± 3.2
	Post	73 ± 84*	30 ± 17*	16 ± 14*	2184 ± 3204	58	11.5 ± 4.2*	12.4 ± 4.7

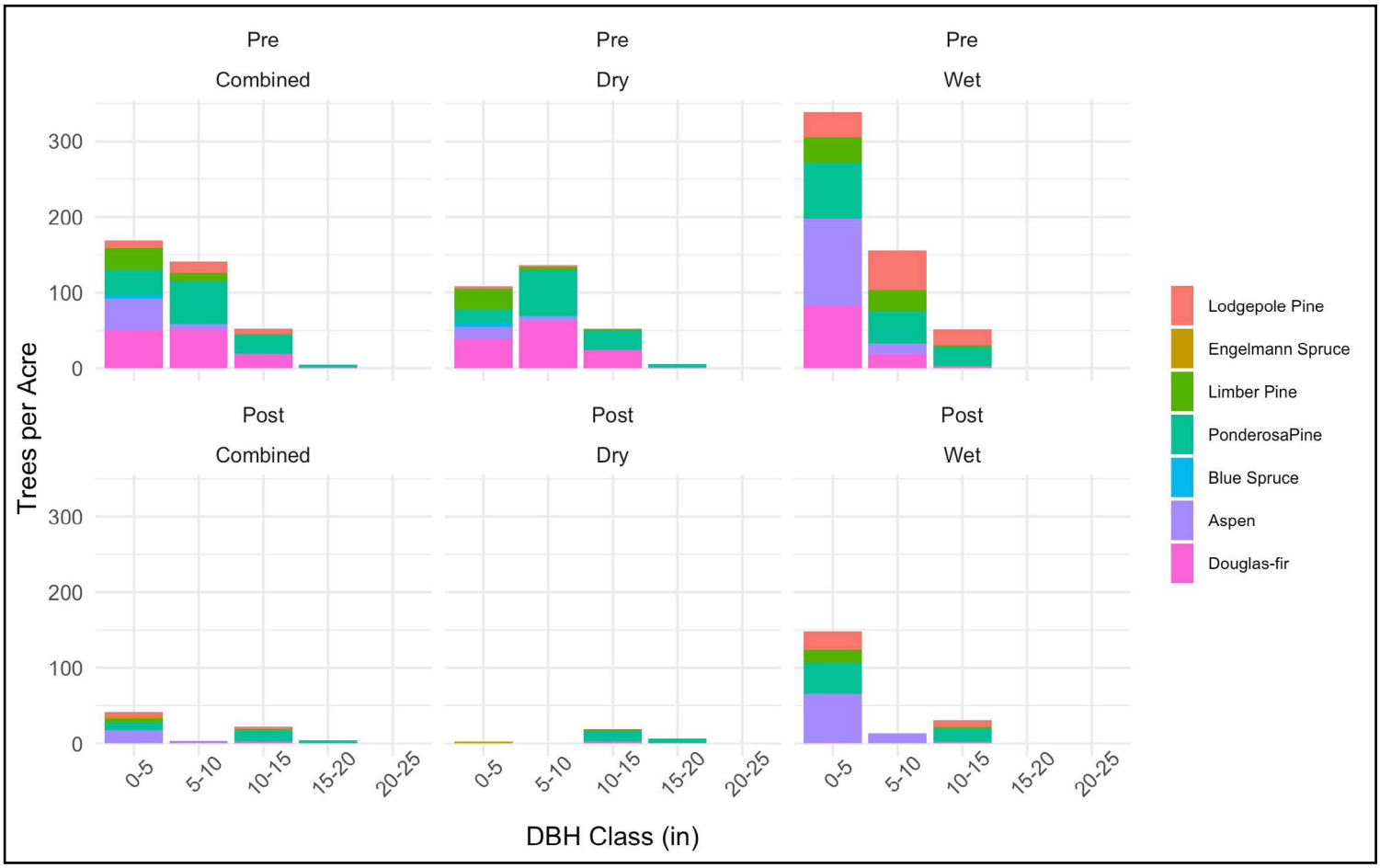

Figure 2. Diameter Distribution

Methods: Data was collected on the ground from 15 plots to assess changes in stand structure and composition, tree regeneration, and tree group arrangement. Plots were further stratified to dry aspects (n=11) and wet aspects (n=4).

Highlights: Restoration treatments moved most forest structure and composition metrics towards desired conditions and within project specific goals, with greater changes occurring across dry and less productive aspects compared to wetter areas. Differences in dry vs. wet aspects suggest that heterogeneous forest structures were maintained across the larger landscape, aligning with desired conditions. While the proportion of ponderosa pine to other conifers increased across all aspects among overstory trees, there were no statistically significant differences in overall tree regeneration density, with Douglas-fir remaining a significant component of the seedling community. Further reductions in Douglas-fir tree seedlings and increased crown base height may be accomplished with future prescribed fire to better meet desired conditions.

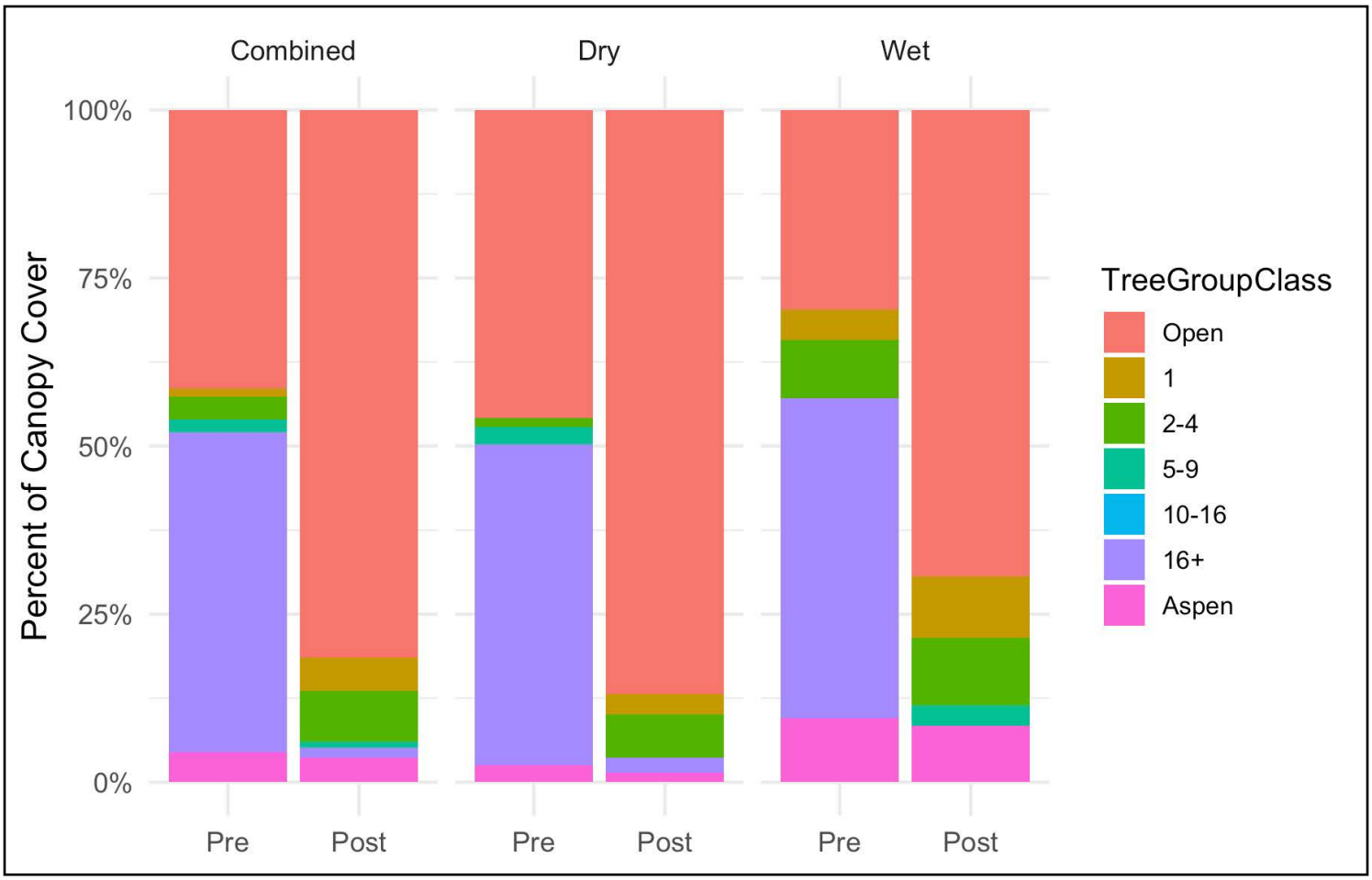

Figure 3. Tree Group Arrangement

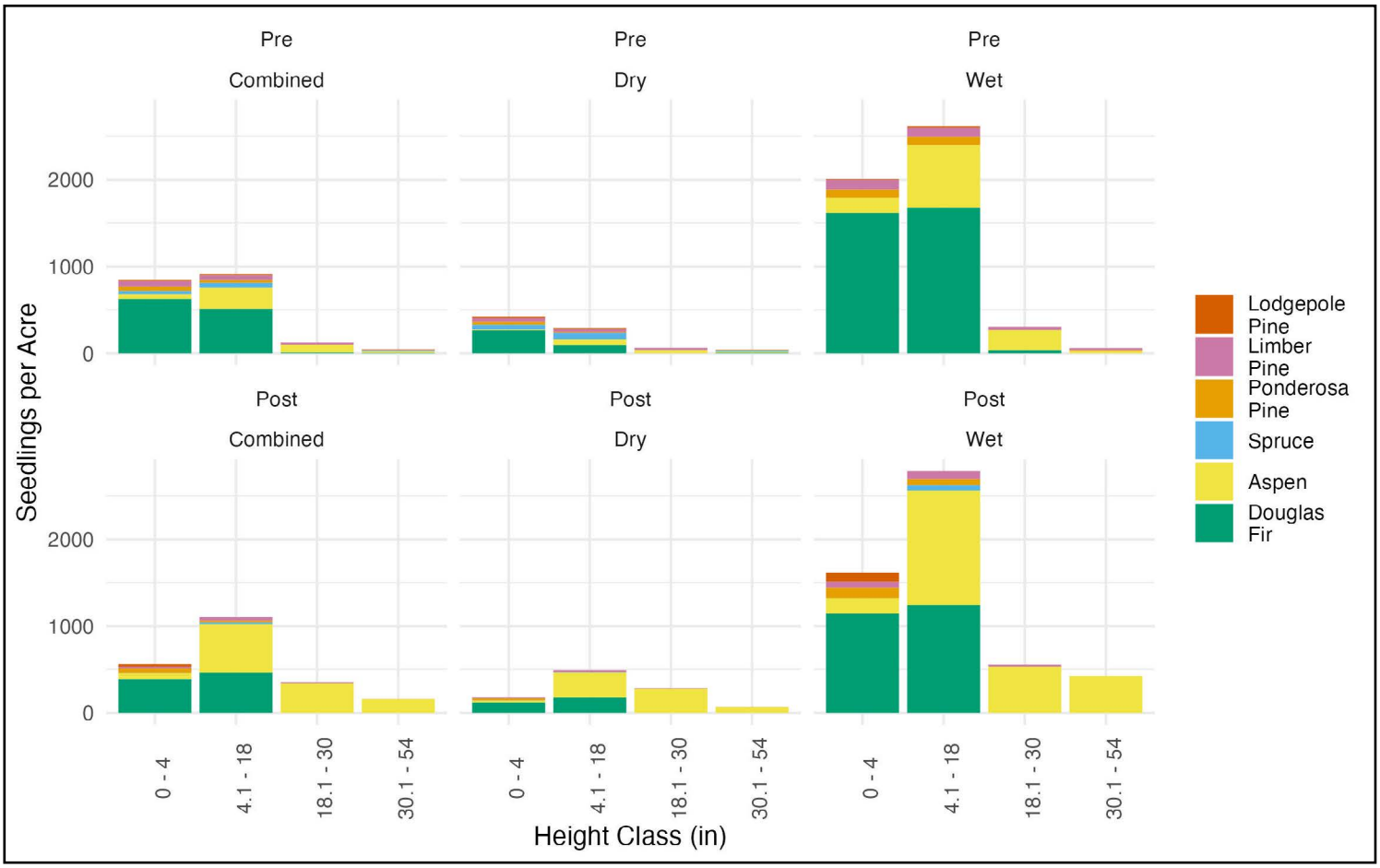

Figure 4. Seedling Density

Fuels and Fire Behavior

Table 3. Surface fuel conditions pre- and 1 year post treatment (combined wet and dry aspects).

Phase	Fine Woody Fuel Loading (tons/acre)	Coarse Woody Fuel Loading (tons/acre)	Litter Depth (in)	Duff Depth (in)	Shrub Cover (%)
Pre	1.71 ± 0.79*	1.88 ± 1.61*	0.98 ± 0.44	0.56 ± 0.19	6.69 ± 3.80
Post	2.79 ± 1.20*	10.2 ± 8.81*	0.99 ± 0.45	0.68 ± 0.39	5.22 ± 5.42

Table 4. Modeled fire behavior (combined wet and dry aspects)

Phase	Pre		Post	
Fire Weather Conditions	Moderate	Severe	Moderate	Severe
Total Flame Length (feet)	1.0	23.9	1.4	3.7
Surviving Tree Basal Area (%)	58.4	31.6	73.4	64.6

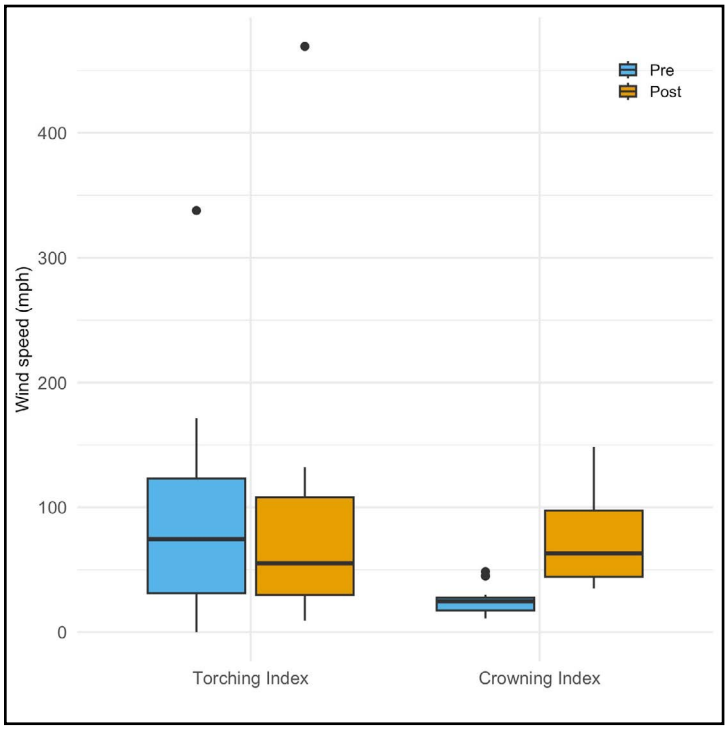

Figure 5 . Torching Index (wind speed needed to initiate crown fire activity) and Crowning Index (wind speed needed to carry active crown fire)

Methods: To model the potential fire behavior before and after treatment, field data was used with the Forest and Vegetation Simulator Fire and Fuels Extension (FFE-FVS). Results are presented for dry and wet aspects combined.

Highlights: Fine and coarse fuel loading increased after treatment while litter/duff depths and shrub cover remained relatively unchanged. Surviving tree basal area increased under both moderate and severe weather conditions. The modeled wind speed required to initiate crown fire remained unchanged following treatment; however, the modeled wind speed needed to sustain crown fire increased after treatment. Under severe weather conditions, modeled fire behavior in most plots transitioned from active and

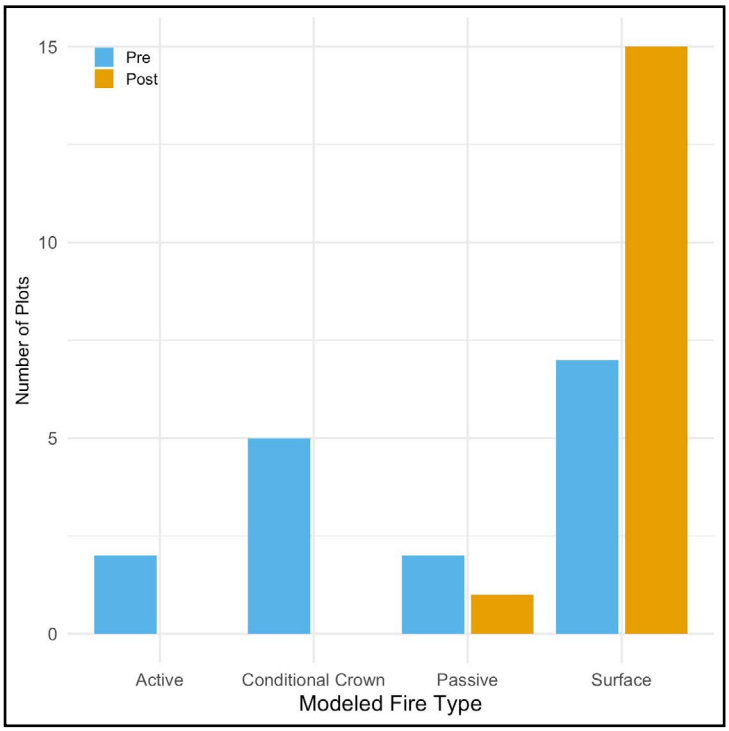

Figure 6. Number of pre- and post-treatment plots within each modeled fire type under severe fire weather conditions

conditional crown fire to predominately surface fire with occasional passive crown fire after restoration treatments.

Conclusions

Overall treatments were effective at altering forest composition, changing canopy structure, and reducing modeled fire behavior towards desired conditions. Managers should be careful of large increases in surface fuels, though as shown here, increases of approximately 1 ton/acre of fine fuels was not sufficient to increase modeled fire behavior. Tree regeneration was not impacted by treatment and should be monitored in the future. High abundance of seedling regeneration has implications for treatment longevity, and the reintroduction of prescribed fire could continue to promote desired stand conditions.

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