



**12.16 Upper Mora – Walker Flats CFRP  
2024 – 2 Years Post-Wildfire  
Field Inventory Summary  
New Mexico Forest and Watershed Restoration Institute**



*Photos by NMFWR Field Crew*

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# Table of Contents

Table of Contents .....	2
Figure List .....	3
Table List .....	4
Introduction and Project Description .....	5
Monitoring Methods.....	7
Disclaimer.....	7
Summary .....	8
Monitoring Detail - Tree Component .....	17
Overstory trees .....	17
Growing Stock .....	20
Snags .....	21
Tree Stand Size Distribution.....	22
Damages.....	24
Char & Scorch.....	28
Regeneration: Trees & Shrubs .....	28
Stand Tables .....	31
Understory & Forest Floor Component .....	37
Ground & Aerial Cover .....	37
Tree Canopy .....	39
Ladder Fuels .....	39
Surface Fuels .....	41
Litter and Duff.....	42
Fine Fuels .....	42
Thousand-Hour Fuels .....	44
Photo Comparisons:.....	46
Additional Resources .....	51
Works Cited.....	51
Supplementary Information .....	52
Species Lists .....	52
Plot Center Coordinates.....	53
Abbreviations & Acronyms .....	54

## Figure List

**Figure 1.** Regional overview map of the 12.16 Upper Mora Walker Flats CFRP project along with adjacent projects. .... 11

**Figure 2.** Stand boundaries generated for 12.16 Upper Mora CFRP, with all monitoring locations. .... 12

**Figure 3.** Composite Burn Index of the 12.16 Upper Mora Walker Flats CFRP project following the 2022 Hermit’s Peak Calf Canyon fire ..... 13

**Figure 4.** Map of color infrared of 12.16 Upper Mora Walker Flats CFRP project before and after the Hermit's Peak Calf Canyon fire..... 14

**Figure 5.** Map of NAIP Imagery of 12.16 Upper Mora Walker Flats CFRP project before and after the HPCC wildfire. .... 15

**Figure 6.** 12.16 Upper Mora Walker Flats CFRP project with monitoring plots and contour lines ..... 16

**Figure 7.** Species composition by status across all measurement periods for growing stock trees (>5” DBH). .... 18

**Figure 8.** Species composition by status across all measurement periods for snags (>5” DBH). .... 19

**Figure 9.** Mean height and live crown base height for growing stock trees (>5” DBH, live + sick status). Mean values represent averages of plot means for each monitoring status ..... 20

**Figure 10.** Mean basal area, mean trees per acre, and quadratic mean diameter for growing stock trees across both measurement periods (>5” DBH, live + sick status). Mean values represent averages of plot means for each monitoring status ..... 21

**Figure 11.** Mean basal area, mean trees per acre, and quadratic mean diameter for snags across both measurement periods (>5” DBH). Mean values represent averages of plot means for each monitoring status..... 22

**Figure 12.** Histogram showing distribution of growing stock trees by DBH class. The inset table shows mean DBH by monitoring period in inches. .... 23

**Figure 13.** Histogram showing distribution of snags by DBH class. The inset table shows mean DBH by monitoring period in inches. .... 23

**Figure 14.** Percentage of growing stock trees (>5” DBH) with observed damages in each monitoring year. .... 24

**Figure 15.** Percentage of snags (>5” DBH) with observed damages in each monitoring year. .... 26

**Figure 16.** Mean char height for trees measured 2 years post-wildfire. Mean values represent averages of plot means for each monitoring status ..... 28

**Figure 17.** Regeneration densities of trees and shrubs in the seedling and saplings classes across all measurement periods..... 29

**Figure 18.** Regeneration densities of dead trees and shrubs in the seedling and sapling classes across all measurement periods. No dead shrubs of sapling stature were observed either year. .... 30

**Figure 19.** Mean percent ground cover by monitoring status..... 37

**Figure 20.** Mean percent aerial cover by monitoring status. .... 38

**Figure 21.** Mean percent closed tree canopy by monitoring status..... 39

**Figure 22.** Ladder fuels in mean tons per acre by monitoring status. .... 40

<b>Figure 23.</b> Mean litter and duff loads by monitoring status. The inset table shows mean litter and duff depths in inches. ....	42
<b>Figure 24.</b> Mean fine fuel loads by monitoring status.....	43
<b>Figure 25.</b> Mean thousand-hour fuel loads by monitoring status.....	44
<b>Figure 26.</b> Proportion of total thousand-hour fuels by decay class and monitoring status.....	45
<b>Figure S27.</b> The following figures show tree (>5" DBH) metrics at the species level by status and measurement period .....	55
<b>Figure S28.</b> The following figures show seedling and sapling densities by status and measurement period .....	57

## Table List

<b>Table 1.</b> Percentage of acreage affected by the HPCC fire.....	8
<b>Table 2.</b> Summary table: 12.16 Upper Mora Walker Flats. Species dominance is based on numeric density. See Table 3, Table S11 for explanation of species codes. ....	10
<b>Table 3.</b> Species of trees observed in the overstory (live and dead).....	17
<b>Table 4.</b> List of damages observed on growing stock trees across all measurement periods by code and description. Count represents the number of observations of each damage type, individual trees may have more than one damage recorded. ....	25
<b>Table 5.</b> Counts of damages recorded to dead trees across monitoring periods. ....	27
<b>Table 6.</b> Stand table of forestland species metrics for the 2017-2018 PreTreatment monitoring period.	31
<b>Table 7.</b> Stand table of forestland species metrics for the 2024 PostFire2yr measurement period.....	34
<b>Table 8.</b> Mean percent ground cover by monitoring status. ....	38
<b>Table 9.</b> Ladder fuel average percent cover, height, and biomass for each category and monitoring status .....	40
<b>Table 10.</b> Fuel loads by type and monitoring status.....	41
<b>Table S11.</b> List of observed tree and shrub species by species symbol, scientific name, and common name .....	52
<b>Table S12.</b> List of plots coordinates by plot name, latitude, and longitude .....	53
<b>Table S13.</b> List of abbreviated terms by abbreviation and definition .....	54

## Introduction and Project Description

The Southwest Ecological Restoration Institutes (SWERI) includes three university-based restoration institutes: the New Mexico Forest and Watershed Restoration Institute (NMFWRI), the Colorado Forest Restoration Institute (CFRI), and the Ecological Restoration Institute (ERI) in Arizona. These institutes work together to develop a program of applied research and service to help create healthy forests, prevent wildfires, sustain the resiliency of water supplies to wildfires, and create jobs. NMFWRI is located at Highlands University (HU) in Las Vegas, NM. According to the Southwest Forest Health and Wildfire Prevention Act (P.L. 108-317), the authorizing legislation for the SWERI, the purpose of the institutes is to “promote the use of adaptive ecosystem management to reduce the risk of wildfires and restore the health of forest and woodland ecosystems in the Interior West.” NMFWRI has partnered with the United States Forest Service (USFS) and other agencies to monitor more than 2,500 plots on Collaborative Forest Restoration Program (CFRP) and other restoration projects across the state since 2007. The NMFWRI’s Ecological Monitoring Program maintains a professionally managed field crew to collect data on short and long-term ecosystem responses to restoration treatments. This data provides a critical scientific basis for adaptive management decisions and improved treatment effectiveness. The field crew also provides hands-on internship and training opportunities for students and recent graduates to help build New Mexico's forestry workforce.

During October 2017 through November 2018, the NMFWRI monitoring crews measured 154 plots across approximately 2,280 acres in the Walker Flats region of the Rio Mora watershed in the Pecos-Las Vegas Ranger District of the Santa Fe National Forest. These plots were established to record forest stand data for the CFRP NEPA planning project 12.16 entitled “*Upper Mora Watershed CFRP – Walker Flats Unit*,” hereafter referred to as “*Upper Mora CFRP*.” This project is accessible on foot on forest land via Encinal Road and NM Highway 518 northwest of Las Vegas, in Mora County, New Mexico. The site is mixed-conifer, including Douglas-fir, white fir, ponderosa pine, limber pine, and quaking aspen; and ranges in elevation between 8,500 – 9,800 feet with moderate to steep slopes and ridges. Mean plot slope was 25%; mean aspect of plots was south (156°).

The Adelante Resource Conservation and Development Council (Adelante RC&D) sought CFRP funding for restoration treatments due to “overstocked conditions [which] have resulted in growth suppression of trees, heavy shading and competition for moisture resulting in the elimination of most of the herbaceous vegetation on the forest floor.” The Council also cited the high risk of catastrophic, stand-replacing fire that would threaten several small villages and communities in the area and everyone dependent on the forest’s natural resources. A July 2019 Landscape Assessment by GL Environmental, INC. incorporating NMFWRI’s stand data for the Adelante RC&D recommended “thinning...of smaller diameter trees” and “prescribed fires” to

reduce fuel loading and the risk of catastrophic fires, as well as to provide an economic benefit to the area through forest product sales.

No restoration or thinning treatments took place prior to this project burning in the 2022 Hermit's Peak Calf Canyon wildfire. Adjacent CFRP projects in the Walker Flats area (e.g. 03.01 Walker Flats/La Jicarita and 31.10 Walker Flats Final Phase -Trujillo) had received restoration treatments<sup>1</sup>; the effects of this acreage on fire behavior in the Upper Mora project area is not clear at the time of this report. Human effects are prevalent in the area. There is a history of sheep and cattle grazing, hunting, OHV recreation, fuelwood harvest, and crew noted signs of Christmas tree harvest in small firs lopped off well above the base of the tree.

In spring 2022, this project area burned in the Hermit's Peak Calf Canyon (HPCC) wildfire at low to moderate composite burn severity. The Hermit's Peak fire began as an escaped prescribed burn and later merged with the Calf Canyon fire which started as a winter pile burn. The Hermit's Peak Calf Canyon fire grew to become the largest and most destructive wildfire in New Mexico history at 341,471 acres. Of this footprint, 14.5% was classified as high soil burn severity, 33.3% was classified as moderate soil burn severity, 39.3% was classified as low soil burn severity, and 12.8% was classified as unburned. More information about the HPCC wildfire is available here: <https://storymaps.arcgis.com/stories/d48e2171175f4aa4b5613c2d11875653>

Other post-fire reports, and a map of all NMFWRM monitoring within the burn scar, is available here: <https://nmfwri.org/monitoring/post-fire-monitoring-reports/>

Due to the time, personnel, and effort required to monitor 154 plots, NMFWRM made the decision to sample a subset of plots for the 2024 monitoring season. Management and research personnel selected an appropriate subset of 30 plots based on environmental metadata and accessibility to ensure a representative sample. During May through December 2024, the NMFWRM inventory and monitoring crews measured those 30 plots. The data presented here, including for the 2017-2018 pretreatment monitoring period, includes only these 30 plots to ensure comparability.

Post-fire, the Pecos-Las Vegas ranger district contracted crews to plant tree seedlings across this project area, starting during the 2024 field season. The primary species planted were proposed to be Ponderosa pine, Douglas-fir, limber pine, and Engelmann spruce. Densities may range from 40 to 680 trees per acre, and in isolated groups, randomly arranged groups, or in grid patterns. Not all plots monitored were planted, and if planted seedlings were recorded in-plot, these were included in regeneration data.

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<sup>1</sup> These project areas are also monitored by NMFWRM.

## Monitoring Methods

The NMFWRI monitoring crew followed the protocols published in their Field Monitoring Manual, linked here: <https://nmfwri.org/resources/upland-forests-monitoring-field-manual/>

These protocols are based on the Department of Interior's FEAT/FIREMON Integrated (FFI) sampling protocols. They used 1/10<sup>th</sup> acre fixed plots to assess tree size (diameter and height) and density (trees/acre). A nested sub-plot of 1/100<sup>th</sup> acre was used to estimate understory and ground cover in all years. Photo points were taken at each plot. Surface fuels were measured using Brown's transects. The location of the plots was based on a stratified random sampling design.

Plots were originally generated using stand delineation boundaries. As mentioned above, only a subset of the plots was selected for long-term monitoring. To do this, pre-treatment plots were binned into groups based on their average DBH. From there, we dropped the steepest 20% of sites for accessibility reasons, and randomly selected 5 sites from within each group. From there, we calculated the closest 3 plots within the same DBH group to provide a priority plot and 2 alternates for a total of 30 plots in the long-term subset. Only the data for these 30 plots are presented in the pretreatment data.

All raw data and photo points will be provided to the managers of the project area; the goal of this report is to summarize this information in a concise manner.

## Disclaimer

NMFWRI provides this report and the data collected with the disclaimer that the information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived. It is the responsibility of the data user to use the data **appropriately and within the limitations of monitoring data in general, and these data in particular.** NMFWRI gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data. This data and related graphics are not legal documents and are not intended to be used as such. This includes but is not limited to using these data as the primary basis for the development of thinning prescriptions or timber sales. NMFWRI shall not be held liable for improper or incorrect use of the data described and/or contained in this report.

Analysis was also done according to our standard protocols. Note that the values reported in the tables are expressed on a per acre basis, but represent only area actually sampled. We do not scale up these values to calculate volume of wood over the project area, and warn readers of this report that they are not intended for that purpose. The accompanying tables show summaries of our data, and some differences are discussed below; however, differences that seem apparent here may not stand up to rigorous statistical tests. For some estimates, the

standard deviation exceeds the mean (i.e., the coefficient of variation is greater than 100 percent), and sampling errors for some estimates exceed 100 percent. Therefore, data should be used and results interpreted with appropriate caution.

## Summary

### Data Summary

The field crew observed a relatively high diversity of tree species in the Upper Mora CFRP project area, with dominant species including ponderosa pine, white fir, and Douglas-fir (**Figure 7**). Tree health concerns for sick trees observed were primarily fire char on boles

(**Table 4**). This area lies within the footprint of the Hermit’s Peak Calf Canyon fire; the composite burn index for the project area was primarily classified at high severity (52.7%, **Figure 3, Table 1**).

Growing stock basal area and tree density both decreased following wildfire (**Figure 10**).

Snag basal area increased as well as snag density (**Figure 11**). The basal area of growing stock trees was greater than snag density pretreatment, at 97 ft<sup>2</sup>/acre and 22 ft<sup>2</sup>/acre, respectively. These metrics are swapped 2 years post-wildfire; growing stock at 15 ft<sup>2</sup>/acre and snags at 93 ft<sup>2</sup>/acre.

While live tree seedling densities increased post-wildfire, Gambel oak comprised almost all post-wildfire seedling regeneration, and densities of conifer seedlings decreased following wildfire (**Figure 17, Figure S28**). Following wildfire, live tree sapling densities also increased, comprised mostly of quaking aspen (**Figure 18, Figure S28**). Live shrubs of seedling stature densities also increased, while shrubs of sapling stature decreased post-wildfire (**Figure 17**). Creeping barberry dominated the seedling class of shrubs, whereas roundleaf snowberry dominated the sapling class; both pre- and post-wildfire (**Figure S28**).

Total surface fuel loads declined following wildfire, with surface fuel loads immediately post-wildfire measuring at 33% of pre-treatment levels (**Table 10**). 1000-hr fuels shifted towards proportionately more rotten fuels following wildfire (**Figure 26**). This may be due to the consumption of drier sound fuels, and rotten fuels persisting because they tend have a higher moisture content. Ladder fuel loads also decreased post-wildfire, with live woody fuels dominating pre- and post-wildfire (**Table 9**).

*Table 1. Percentage of acreage affected by the HPCC fire.*

12.16 Upper Mora CFRP - Composite Burn Index	
Unchanged	2.9%
Low Severity	17.0%
Moderate Severity	27.5%
High Severity	52.7%

Access to all plots remained possible via driving and hiking for the 2024 measurement period; however, road conditions were highly dependent on weather.

### **Management Implications:**

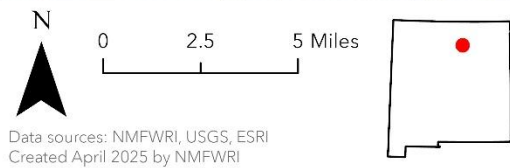
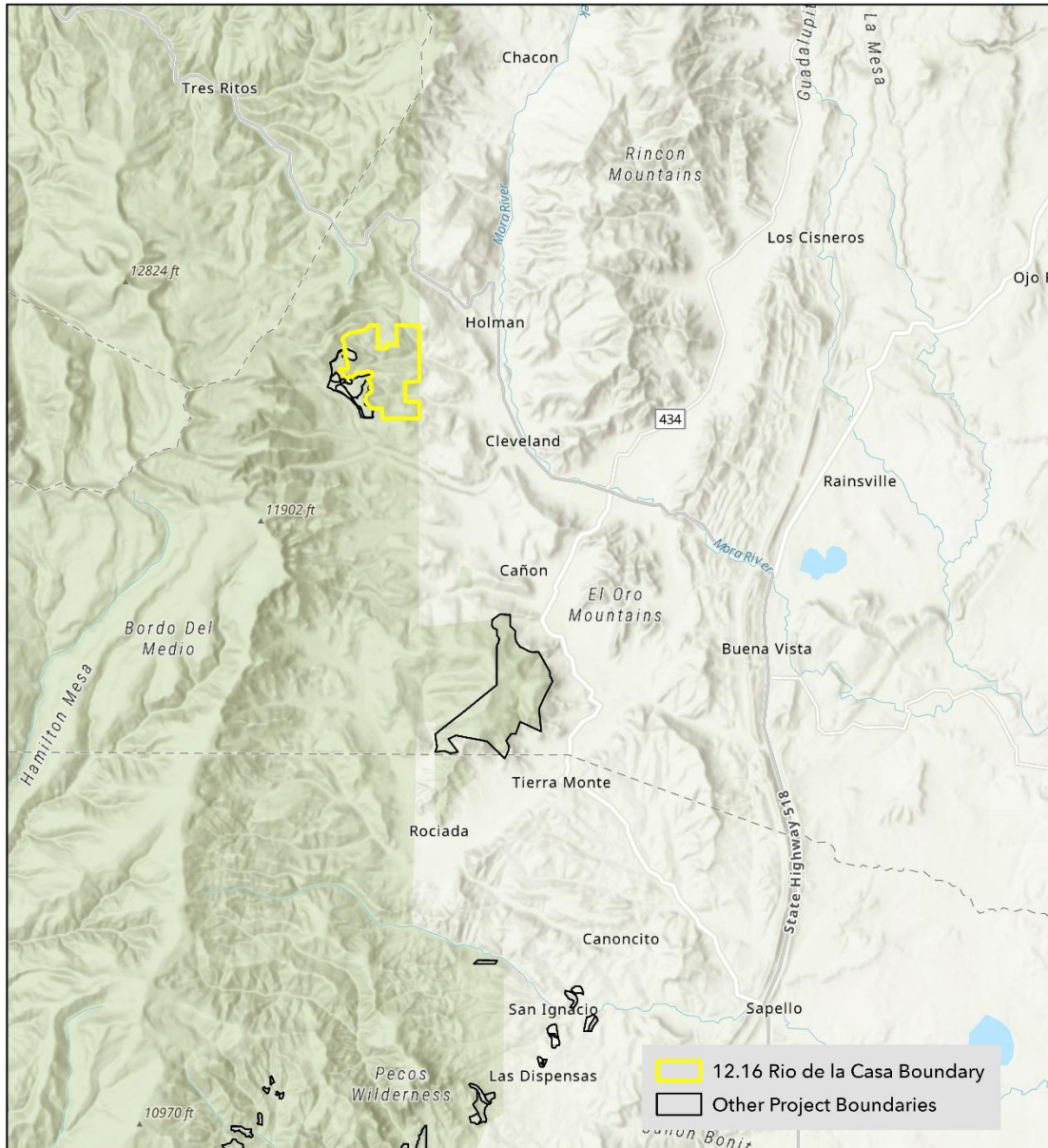
Despite high burn severities, high tree seedling densities indicate that the initial post-fire vegetation recovery outlook for this unit is good; and the data does not suggest any immediate regeneration or post-wildfire state transition concerns. Quaking aspen and Gambel oak dominated regeneration totals, with little conifer regeneration recorded. However, this can be explained by aspen's habit to readily sprout from underground rhizomes, while conifers require specific conditions for their seeds to germinate. Field crews noted that they observed far more conifer seedling regeneration later in the year, at the tail end of the monsoon season. Crews also observed variable survival in areas where ponderosa pine seedlings had been planted. Continued monitoring is recommended to determine germination and survival rates of natural and planted conifer seedlings. An increase of bare soil ground cover from 3.7% pretreatment to 19% immediately post-wildfire does indicate an increased risk of soil erosion post-wildfire. However, it appears that herbaceous and woody regeneration may help compensate for this. The field crew noted mullein (*Verbascum thapsus*, VETH) on multiple plots 2 years post-wildfire, as well as abundant cheatgrass (*Bromus tectorum*, BRTE) and nodding thistle (*Carduus nutans*, CANU4). While these are non-native species of potential concern for outcompeting native plants, they may also play a role in soil stabilization during the initial post-wildfire recovery period.

The reported substantial decrease in surface fuel loads, ladder fuel loads, growing stock basal area and density, and snag density following treatments and wildfire all indicate a somewhat decreased risk of near-future high-severity wildfire, based on fuel load and stand structure. The noted increase in snag basal area following wildfire may pose a concern for increasing surface fuel loads in the future as snags fall and become surface fuels. Additional monitoring is needed to determine ongoing adaptive management strategies as the post-wildfire ecosystem develops.

**Table 2.** Summary table: 12.16 Upper Mora Walker Flats. Species dominance is based on numeric density. See Table 3, Table S11 for explanation of species codes.

<b>12.16 Upper Mora CFRP: Summary Table</b>		
<b>Metric</b>	<b>2017/2018 PreTreatment</b>	<b>2024 PostFire2yr</b>
Dominant Growing Stock Species	PIPO	PIPO
Dominant Snag Species	ABCO	2TREE
Dominant Live Seedling	QUGA	QUGA
Dominant Live Sapling	QUGA	POTR5
Dominant Live Shrub (Seedling Class)	MARE11	MARE11
Dominant Live Shrub (Sapling Class)	SYRO	SYRO
Trees per Acre (growing stock)	140	18
Snags per Acre	43	150
Basal Area (growing stock, sqft/acre)	97	15
QMD (growing stock, inches)	11.3	13
Average Live Crown Base Height (ft)	14	20
Average Tree Height (ft)	39	45
Live Tree Seedlings Per Acre	3900	12000
Live Tree Saplings Per Acre	680	1500
Live Shrub Seedlings Per Acre	5000	19000
Live Shrub Saplings Per Acre	2000	100
Tree Canopy Cover (%)	69	52
Grass & Forb Cover (%)	31	39
Total Tons Surface Fuels per Acre	38	12

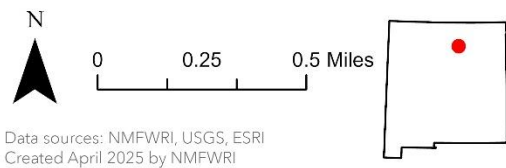
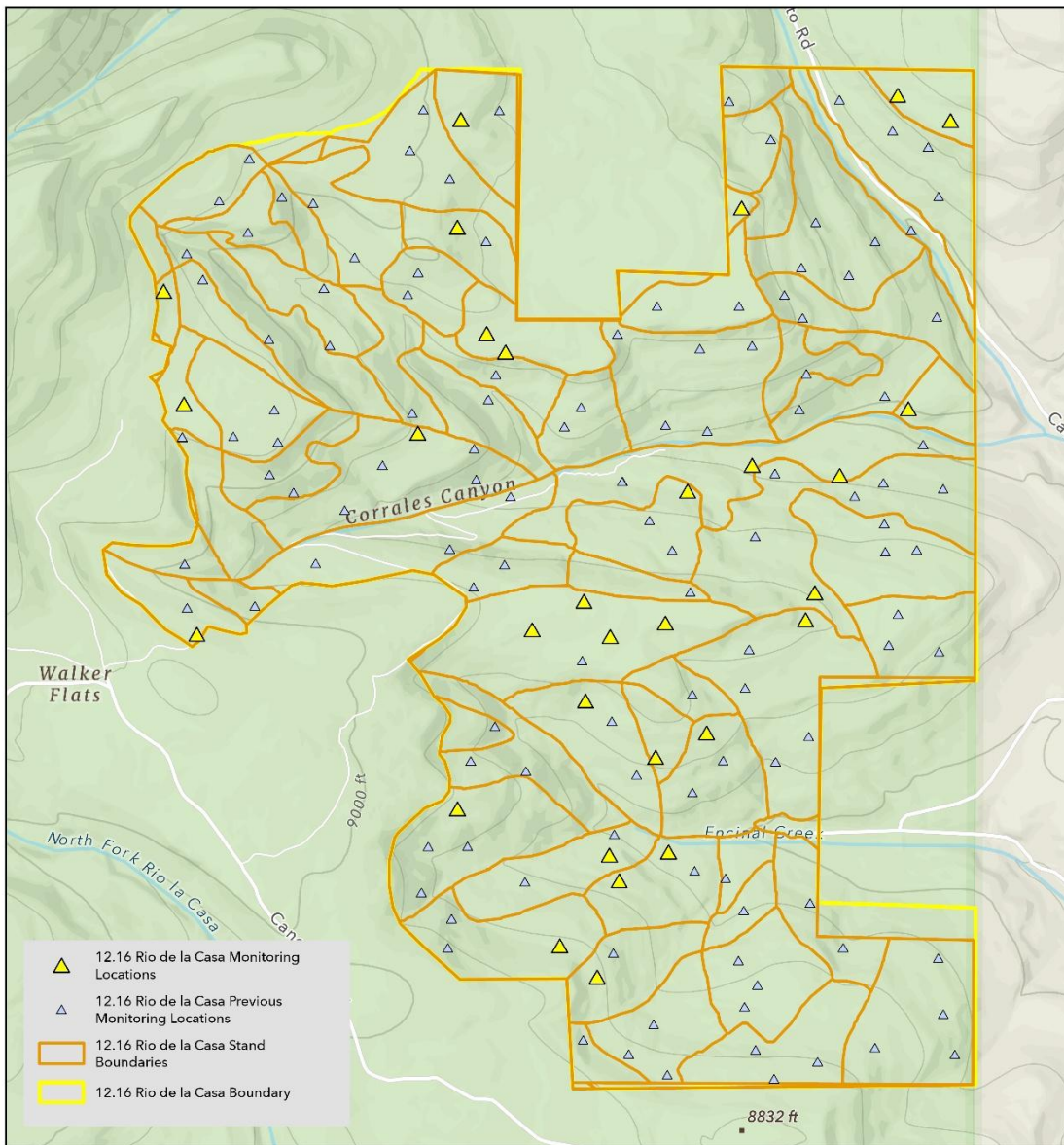
# 12.16 Rio de la Casa Upper Mora CFRP Overview Map



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Figure 1. Regional overview map of the 12.16 Upper Mora Walker Flats CFRP project along with adjacent projects.

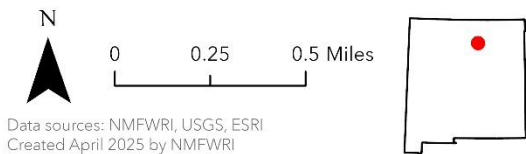
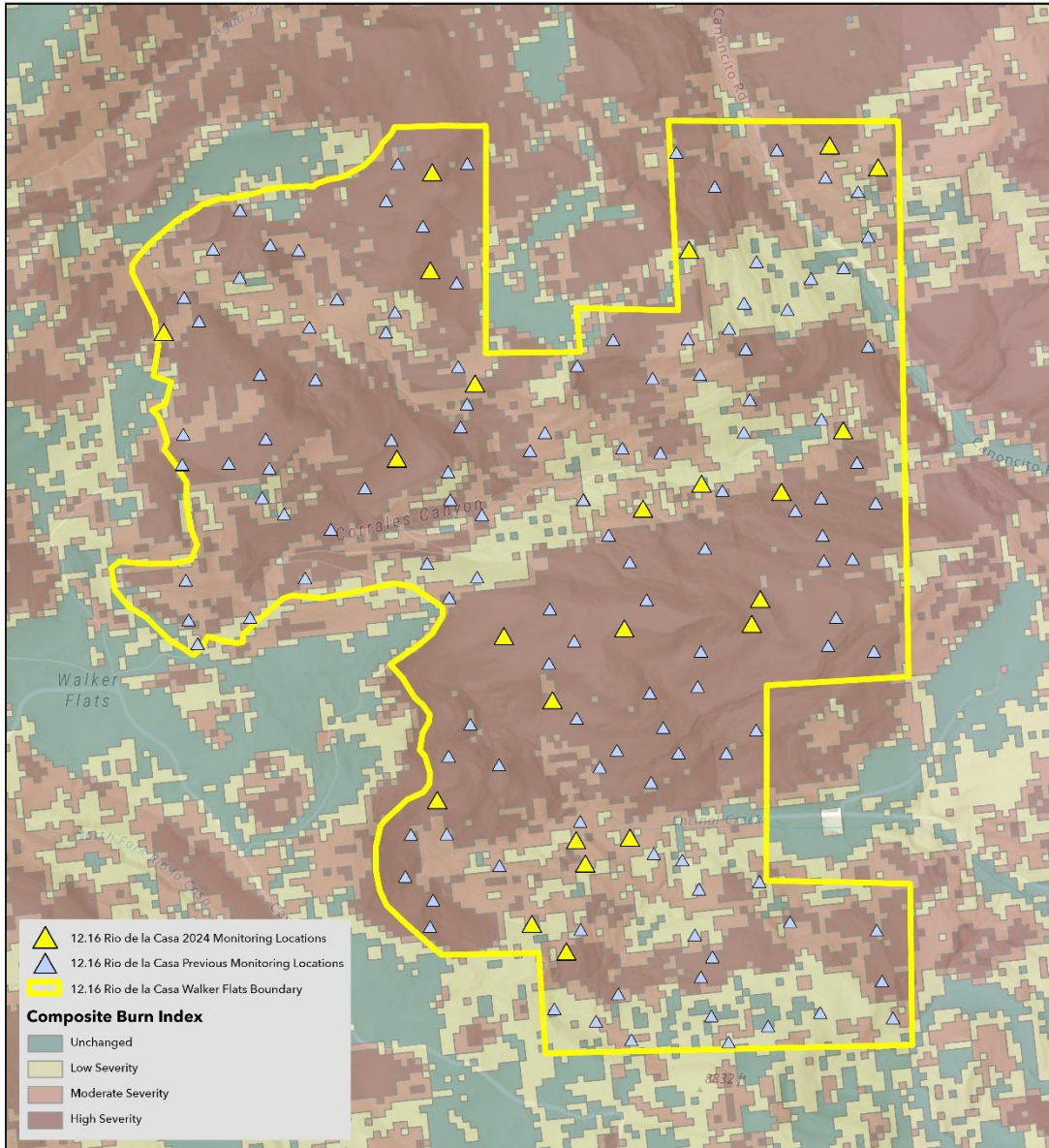
# 12.16 Rio de la Casa Upper Mora CFRP Stand Boundaries



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**Figure 2.** Stand boundaries generated for 12.16 Upper Mora CFRP, with all monitoring locations.

# 12.16 Rio de la Casa Upper Mora CFRP Composite Burn Index

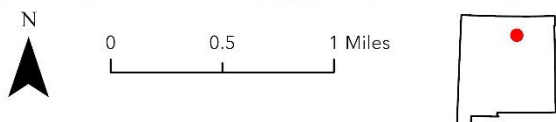
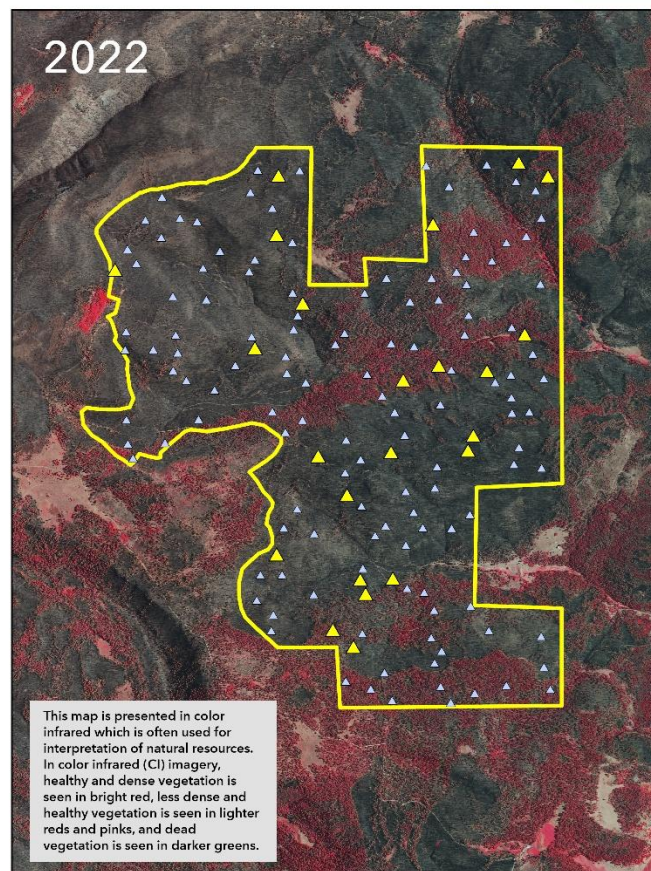
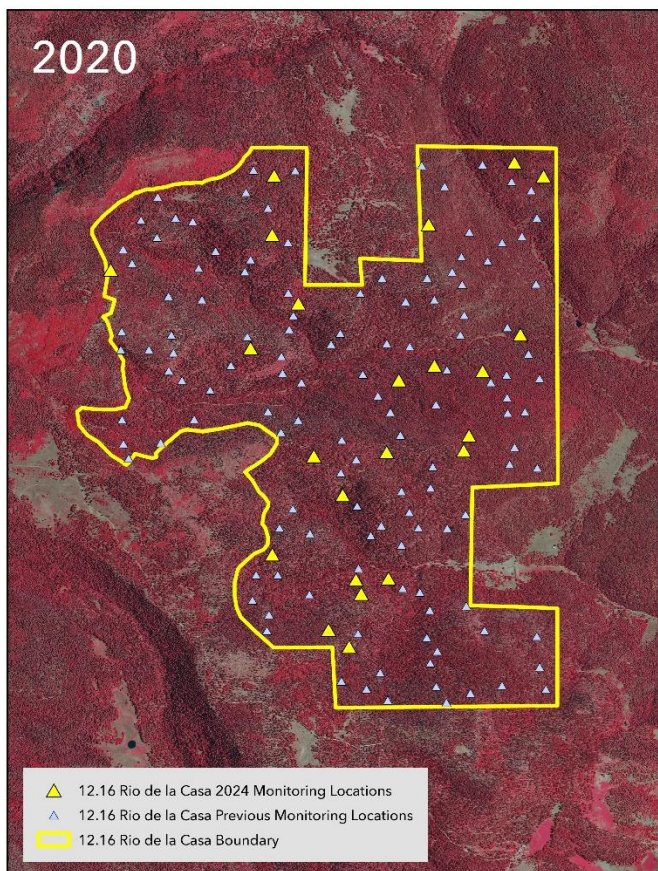


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**Figure 3.** Composite Burn Index of the 12.16 Upper Mora Walker Flats CFRP project following the 2022 Hermit's Peak Calf Canyon fire

# 12.16 Rio de la Casa Upper Mora CFRP

## Pre-fire 2020 Color Infrared vs Post-fire 2022 Color Infrared



Data sources: NMFWRI, USDA, ESRI  
Created April 2025 by NMFWRI

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Figure 4. Map of color infrared of 12.16 Upper Mora Walker Flats CFRP project before and after the Hermit's Peak Calf Canyon fire

# 12.16 Rio de la Casa Upper Mora CFRP

## Pre-fire 2020 NAIP Imagery vs Post-fire 2022 NAIP Imagery

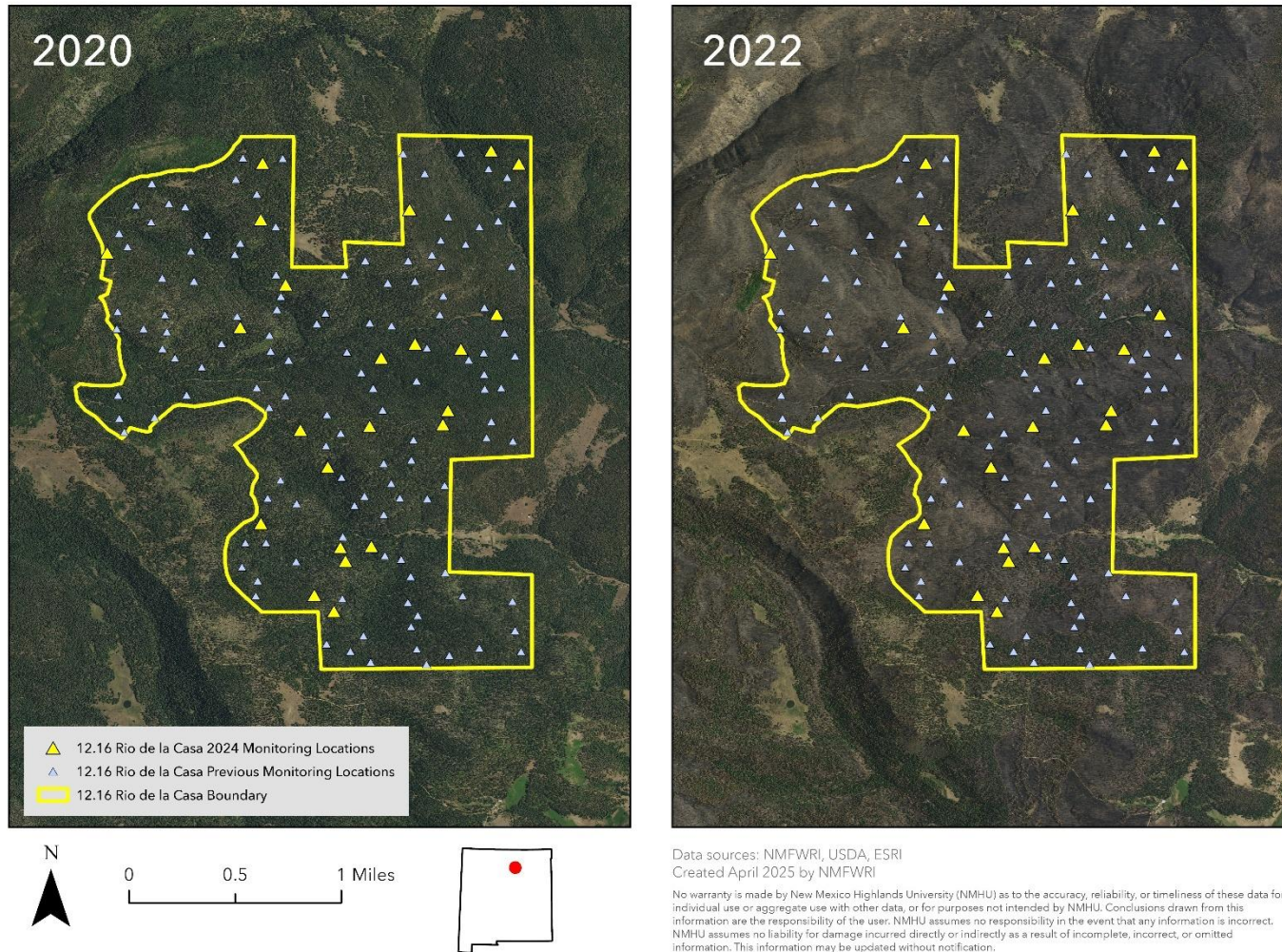
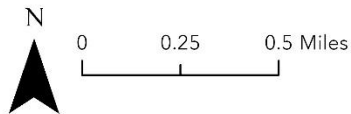
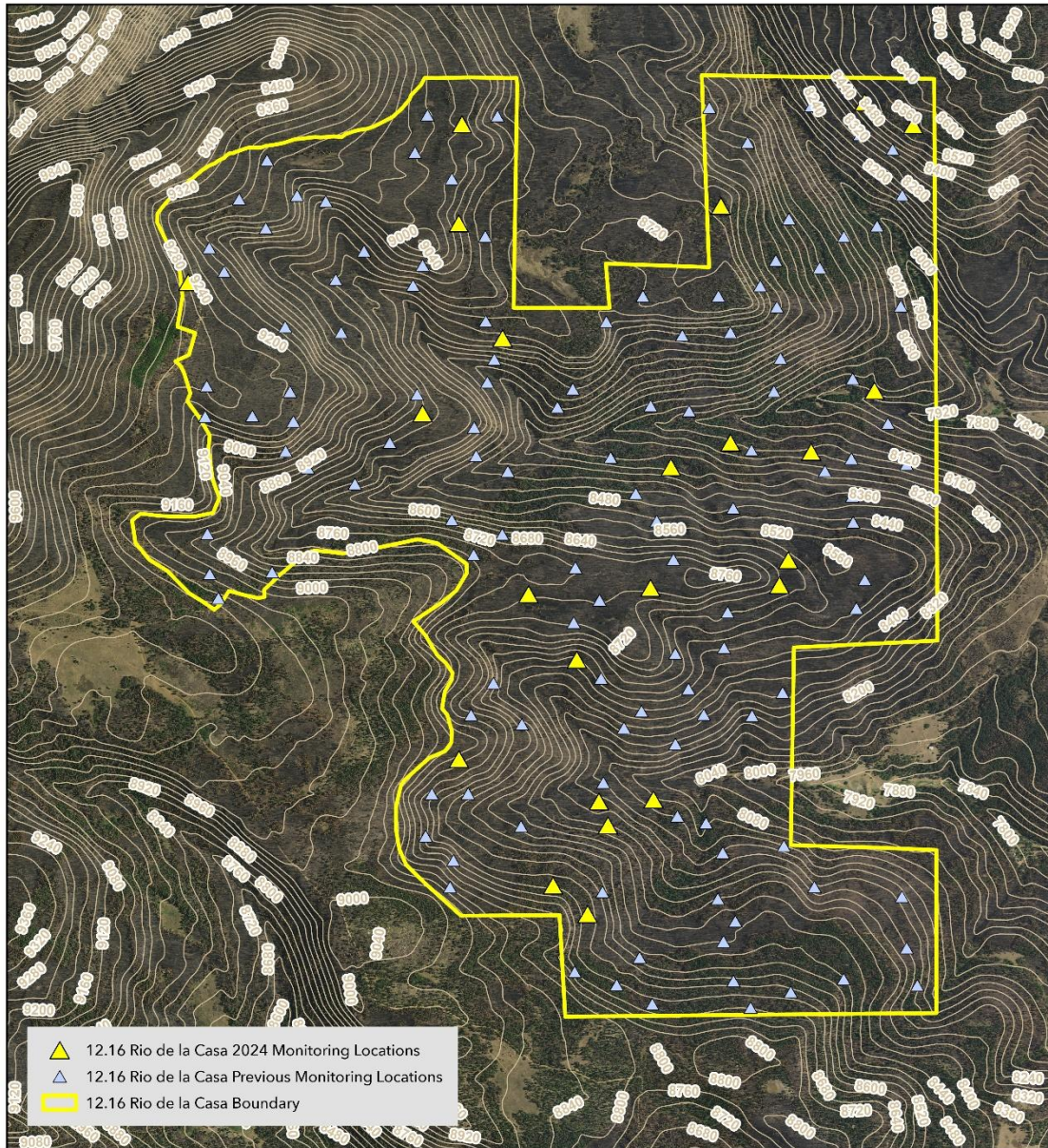
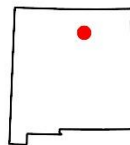


Figure 5. Map of NAIP Imagery of 12.16 Upper Mora Walker Flats CFRP project before and after the HPCC wildfire.

# 12.16 Rio de la Casa Upper Mora CFRP Monitoring Points with 20' Contours



Data sources: NMFWR, USGS, ESRI  
Created April 2025 by NMFWR



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Figure 6. 12.16 Upper Mora Walker Flats CFRP project with monitoring plots and contour lines

# Monitoring Detail - Tree Component

## Overstory trees

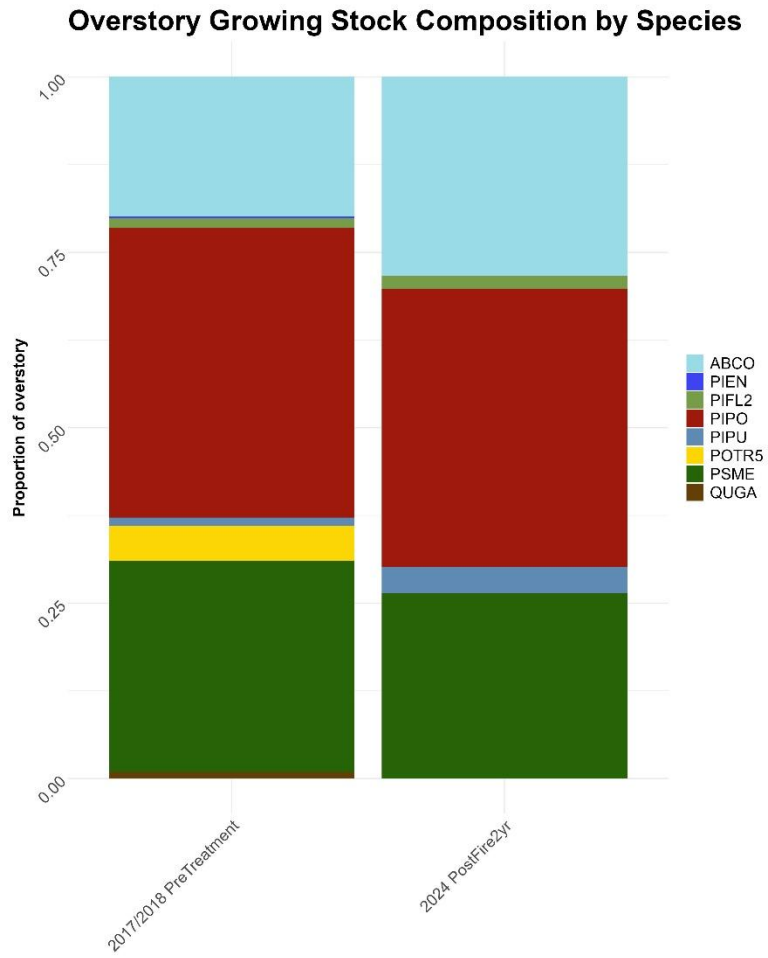
In the 2017-2018 pretreatment measurement period, the contracting partner dictated that NMFWR I use a 5-inch DBH cutoff for overstory trees. When NMFWR I returned in 2024 using another funding source, crews used a 1-inch DBH cutoff to enable data compatibility with other projects in the area. The data presented here includes only trees within the 5-inch cutoff; thus, smaller trees are excluded. The data for those small trees is available upon request.

The overstory (trees >5" DBH) showed high diversity with eight species represented across measurement periods (**Table 1, Figure 7**). Ponderosa pine was the dominant growing stock tree in both measurement periods, followed by white fir and Douglas-fir. The snag overstory was dominated by white fir and Ponderosa pine in the 2017-2018 pretreatment monitoring period (**Figure 8**). Post-wildfire, the most numerous snags recorded were Ponderosa pine and unknown species (2TREE). 2TREE is utilized when a tree is burned past recognition – in this case, this results indicate difficulty telling apart Douglas-fir and white fir. The accuracy of snag species identification immediately post-wildfire in 2024 was problematic due to the severity of the burn in some areas.

*Table 3. Species of trees observed in the overstory (live and dead).*

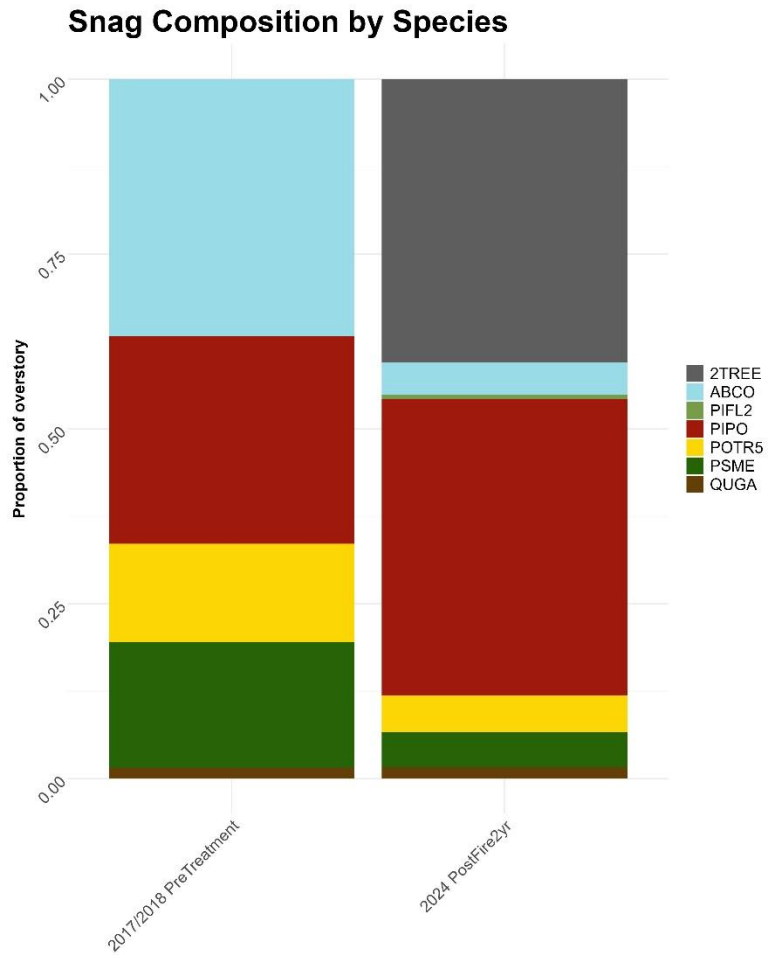
Species Symbol	Scientific Name	Common Name
ABCO	<i>Abies concolor</i>	white fir
PIEN	<i>Picea engelmannii</i>	Engelmann spruce
PIFL2	<i>Pinus flexilis</i>	limber pine
PIPO	<i>Pinus ponderosa</i>	ponderosa pine
PIPU	<i>Picea pungens</i>	Blue spruce
POTR5	<i>Populus tremuloides</i>	quaking aspen
PSME	<i>Psuedotsuga menziesii</i>	Douglas-fir
QUGA	<i>Quercus gambelii</i>	Gambel oak
2TREE		unknown tree*

\*Dead/burned and lacking identifying characteristics



**12.16 Upper Mora Walker Flats CFRP**

*Figure 7. Species composition by status across all measurement periods for growing stock trees (>5" DBH).*

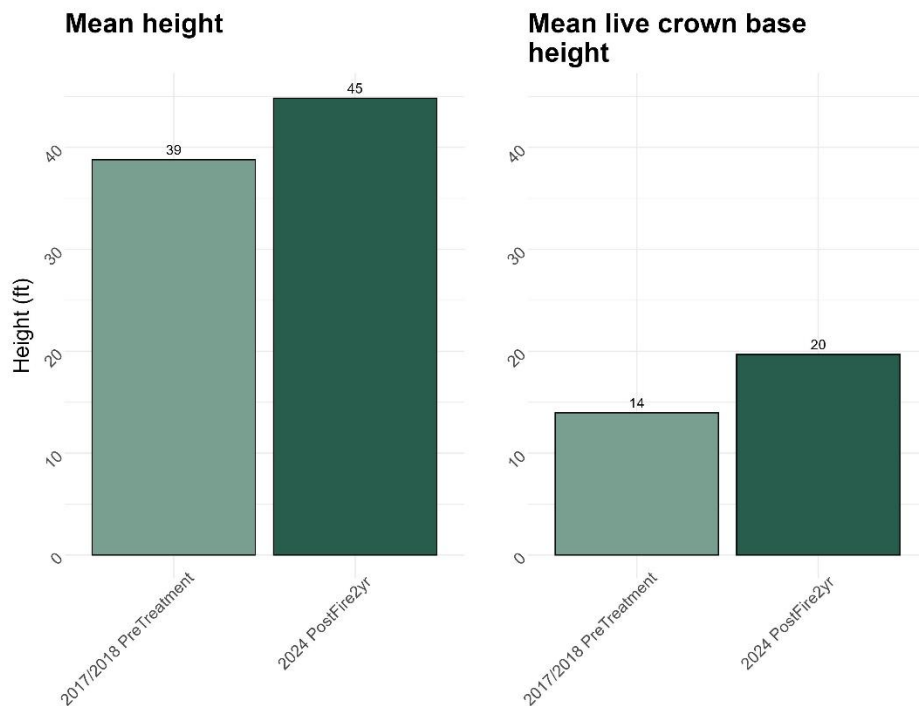


**12.16 Upper Mora Walker Flats CFRP**

**Figure 8.** Species composition by status across all measurement periods for snags (>5" DBH).

## Growing Stock

Mean height of all living trees increased from 39 feet pretreatment to 45 feet 2 years post-wildfire (**Figure 9**). This indicates that taller trees were more likely to have survived the fire, while smaller trees were killed. Mean height to live crown also increased, from 14 feet pretreatment to 20 feet 2 years post-wildfire. This indicates the wildfire raised the height to live crown by killing lower branches.



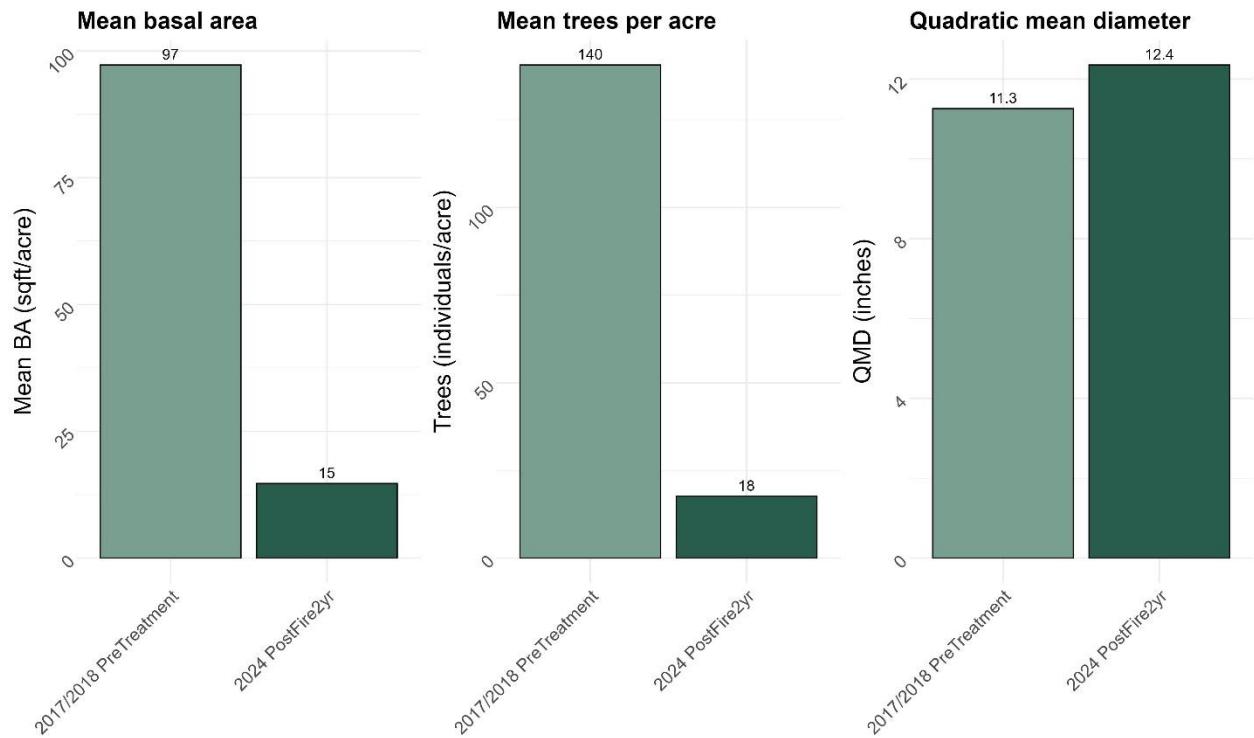
12.16 Upper Mora Walker Flats CFRP

**Figure 9.** Mean height and live crown base height for growing stock trees (>5" DBH, live + sick status). Mean values represent averages of plot means for each monitoring status

Growing stock mean basal area decreased from 97 ft<sup>2</sup>/acre pretreatment to 15 ft<sup>2</sup>/acre 2 years post-wildfire (**Figure 10**). Likewise, mean tree density decreased from 140 trees per acre pretreatment, to 18 trees per acre 2 years post-wildfire. Quadratic mean diameter increased from 11.3 inches pretreatment to 12.4 inches 2 years post-wildfire. These trends are reflective of the reduction in growing stock trees following fire, but do not indicate any major change in the mean diameter of trees remaining.

Percent Growing Stock Survival  
Post-HPCC wildfire  
**19.6%**

### Growing Stock



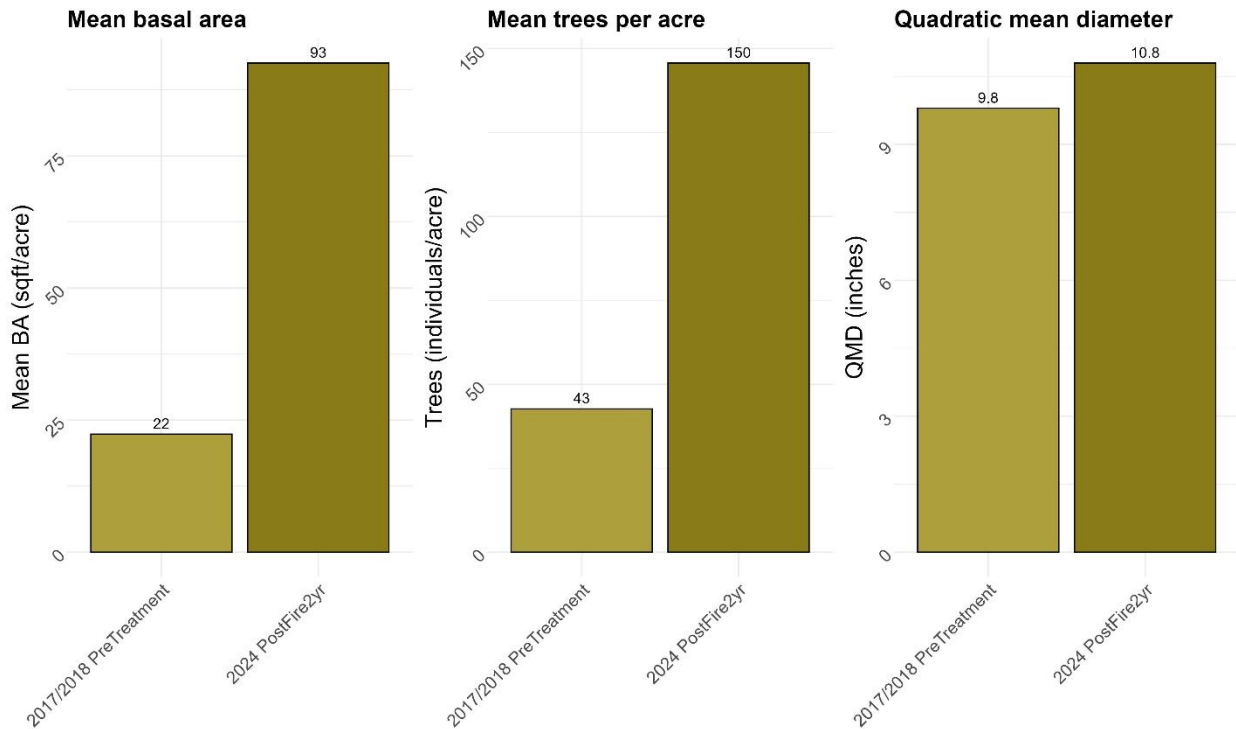
12.16 Upper Mora Walker Flats CFRP

**Figure 10.** Mean basal area, mean trees per acre, and quadratic mean diameter for growing stock trees across both measurement periods (>5" DBH, live + sick status). Mean values represent averages of plot means for each monitoring status

### Snags

Snag mean basal area increased from 22 ft<sup>2</sup>/acre pretreatment to 93 ft<sup>2</sup>/acre 2 years post-wildfire – note that this is nearly the inverse of the trend in growing stock basal area (**Figure 10**, **Figure 11**). Mean snag density increased from 43 trees per acre pretreatment to 150 trees per acre 2 years post-wildfire. These jumps show the large amounts of tree fatalities immediately post-fire. Quadratic mean snag diameter increased slightly from 9.8 inches pretreatment to 10.8 inches 2 years post-wildfire.

## Snags

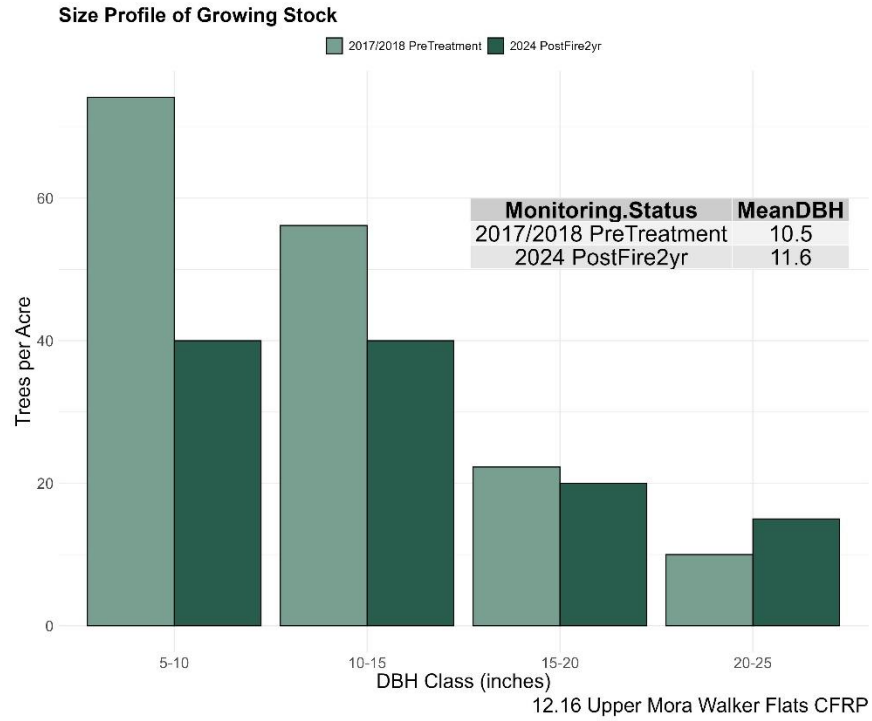


12.16 Upper Mora Walker Flats CFRP

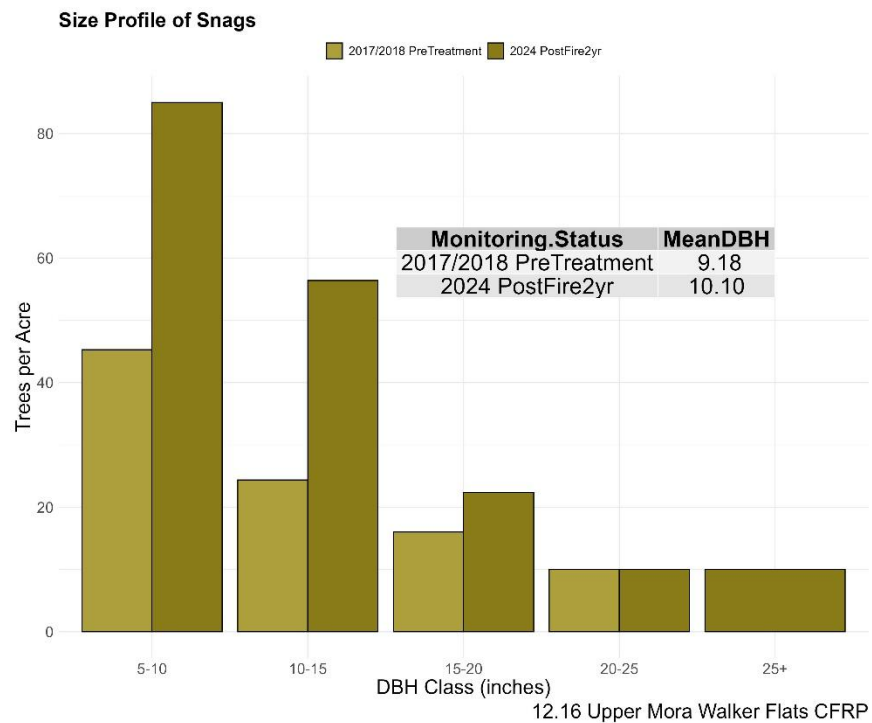
**Figure 11.** Mean basal area, mean trees per acre, and quadratic mean diameter for snags across both measurement periods (>5" DBH). Mean values represent averages of plot means for each monitoring status

## Tree Stand Size Distribution

The figures below show histograms of the size distribution of growing stock trees and snags by DBH class; the inset tables display mean DBH in inches (**Figure 12, Figure 13**). Mean DBH of growing stock trees and snags increased slightly from 2017-2018 to 2024. This shows that the severity of the fire in some areas resulted in the deaths of larger trees, which may have survived a more moderate fire. This, along with the decrease in live smaller-DBH trees per acre, may also suggest that in areas where fire severity was more moderate, larger trees were more likely to survive.



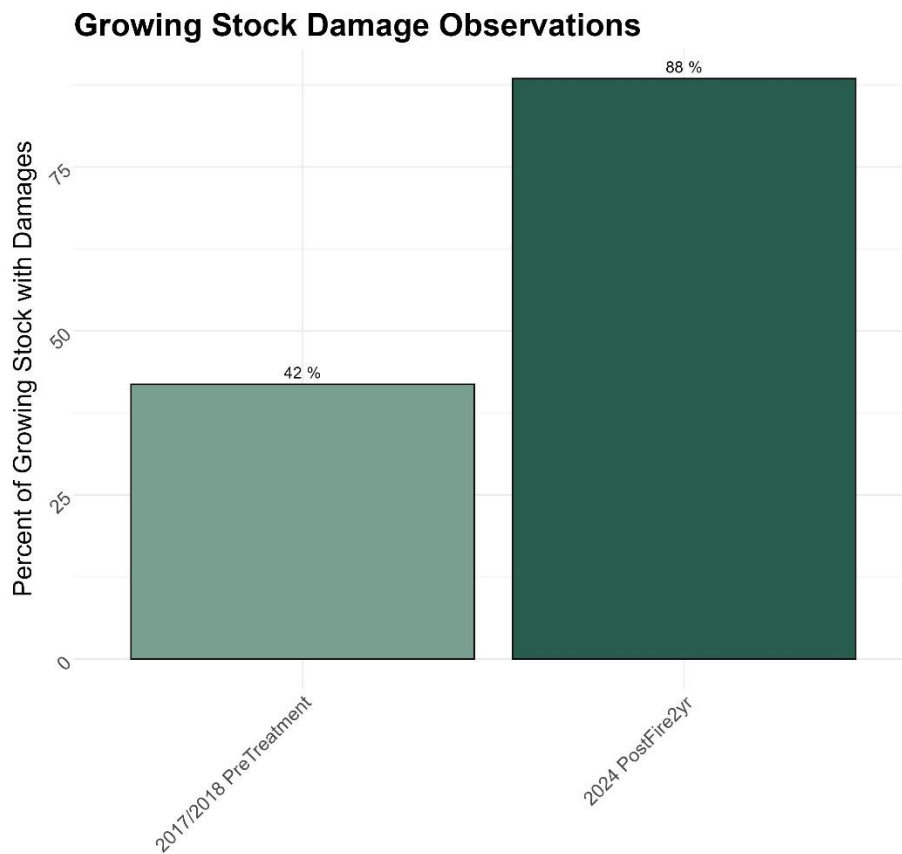
**Figure 12.** Histogram showing distribution of growing stock trees by DBH class. The inset table shows mean DBH by monitoring period in inches.



**Figure 13.** Histogram showing distribution of snags by DBH class. The inset table shows mean DBH by monitoring period in inches.

## Damages

In the 2017-2018 pretreatment monitoring period, 42% of growing stock trees were observed with damages. In 2024, 2 years post-wildfire, 88% of growing stock trees had damages. In 2017-2018, mistletoe was the most common damage recorded for growing stock trees, with 114 observations; only 4 observations of mistletoe were recorded for growing stock trees in 2024 (**Figure 14, Table 4**). This is consistent with published research results describing a reduction in mistletoe infection following fire (Conklin & Armstrong, 2005). The second most numerous damage recorded in 2017-2018 pretreatment was broom rust, with 35 observations. In 2024 2 years post-wildfire, the second most common was witches' broom, with 14 observations. Witches' broom is a dense, abnormal growth of twigs and shoots that can be caused by many types of infection, including mistletoe and broom rusts. 2 years post-fire, the most common damage recorded to growing stock trees was fire damage, or char, on the bole.



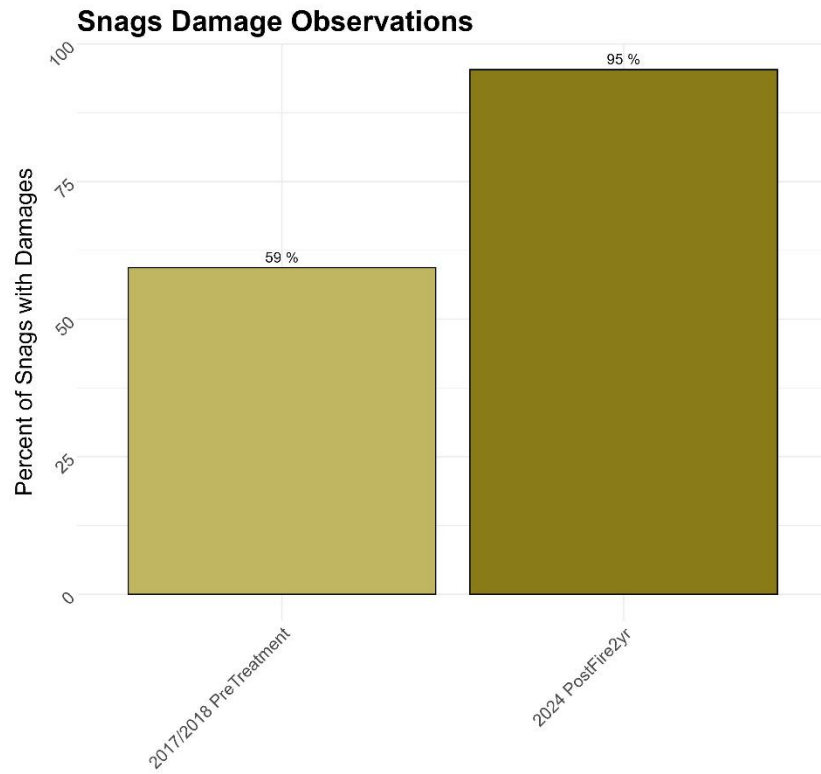
12.16 Upper Mora Walker Flats CFRP

**Figure 14.** Percentage of growing stock trees (>5" DBH) with observed damages in each monitoring year.

**Table 4.** List of damages observed on growing stock trees across all measurement periods by code and description. Count represents the number of observations of each damage type, individual trees may have more than one damage recorded.

<b>12.16 Upper Mora Walker Flats: Growing Stock Trees by Damage Code</b>			
<b>Monitoring.Status</b>	<b>Damage</b>	<b>Count</b>	<b>Description</b>
2017/2018 PreTreatment	23001	114	Mistletoe
	27000	35	Broom rust
	99004	8	Uncharacteristic forked top, above or below DBH
	90000	5	Unknown cause
	99006	5	Uncharacteristic crooked or twisted bole
	25000	4	Witches' broom
	25001	3	Blight
	50008	3	Lightning scar
	99037	3	Leaning bole
	ABGR	2	Abnormal Growth
	10000	2	General insects
	99000	2	Physical effects of damage
	23000	1	Epiphytic/parasitic plants
	99002	1	Dead top
	2024 PostFire2yr	30000	41
25000		14	Witches' broom
99004		11	Uncharacteristic forked top, above or below DBH
23001		4	Mistletoe
99006		4	Uncharacteristic crooked or twisted bole
10000		4	General insects
27000		3	Broom rust
99016		3	Unusually sparse foliage
99037		2	Leaning bole
99026		2	Wounds or cracks
25001		1	Blight
90000		1	Unknown cause
99000		1	Physical effects of damage
99001		1	Broken top
41010		1	Bird damage

In the pretreatment monitoring period, 59% of snags had damages; post-wildfire, 95% of snags were damaged. The most common damage recorded for snags in the 2017-2018 pretreatment monitoring period was a broken top (Table 5). In 2024, 2 years post wildfire, the most common damages were fire scars, followed by an uncharacteristic forked top and broken tops.



12.16 Upper Mora Walker Flats CFRP

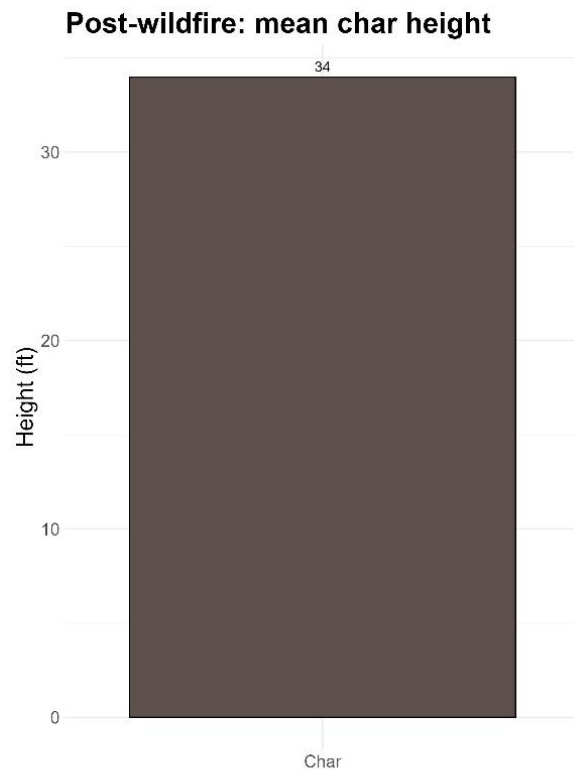
**Figure 15.** Percentage of snags (>5" DBH) with observed damages in each monitoring year.

**Table 5.** Counts of damages recorded to dead trees across monitoring periods.

<b>12.16 Upper Mora Walker Flats: Snags by Damage Code</b>			
<b>Monitoring.Status</b>	<b>Damage</b>	<b>Count</b>	<b>Description</b>
2017/2018 PreTreatment	99001	59	Broken top
	11000	4	Bark beetles
	99037	4	Leaning bole
	99006	3	Uncharacteristic crooked or twisted bole
	23001	2	Mistletoe
	27000	2	Broom rust
	10000	1	General insects
	25000	1	Witches' broom
	23000	1	Epiphytic/parasitic plants
	50008	1	Lightning scar
2024 PostFire2yr	30000	406	Fire scar, char and/or scorch
	99004	47	Uncharacteristic forked top, above or below DBH
	99001	34	Broken top
	99006	22	Uncharacteristic crooked or twisted bole
	25000	9	Witches' broom
	41010	2	Bird damage
	99036	2	Fire scar (catface)
	99037	1	Leaning bole
99026	1	Wounds or cracks	

## Char & Scorch

Two years post-wildfire, all living trees had evidence of fire on their boles. Char height (highest point of blackened bark) averaged 34 ft (**Figure 16**). Recall that mean height in 2024 was 45 ft and mean live crown base height was 20 ft (**Figure 9**).



12.16 Upper Mora Walker Flats CFRP

**Figure 16.** Mean char height for trees measured 2 years post-wildfire. Mean values represent averages of plot means for each monitoring status

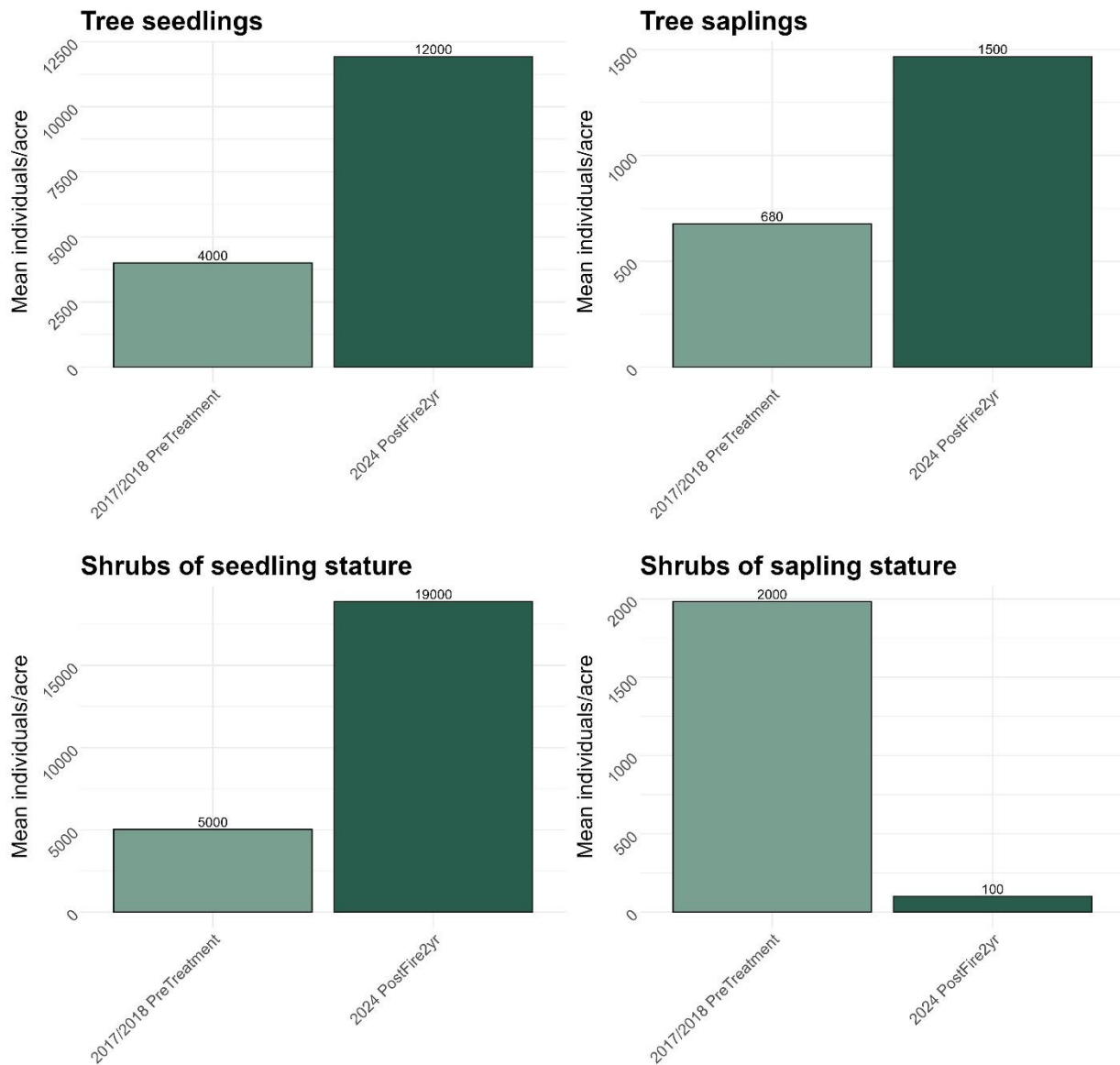
## Regeneration: Trees & Shrubs

Mean live tree seedling and sapling density, as well as shrub seedling density, all increased substantially from the 2017-2018 pretreatment monitoring period to the 2024 2 year post-wildfire monitoring period (**Figure 17**). The density of shrubs of sapling stature, however, decreased by a comparable amount. The overstocked pretreatment conditions of the Upper Mora CFRP resulted in a sparse understory. The HPCC wildfire opened the canopy and likely released nutrients into the soil, allowing for a woody understory to explode with less competition from overstory trees. The most numerous tree seedlings and saplings across both measurement periods was Gambel oak, quaking aspen, and chokecherry (**Figure S28**), which have been shown to resprout vigorously after wildfire. The dominant shrub seedlings 2 years post-wildfire were overwhelmingly creeping barberry. Shrubs of sapling stature were

dominated by roundleaf snowberry across both measurement periods. See Supplementary Figures for a full breakdown of regeneration densities by species (**Figure S28**).

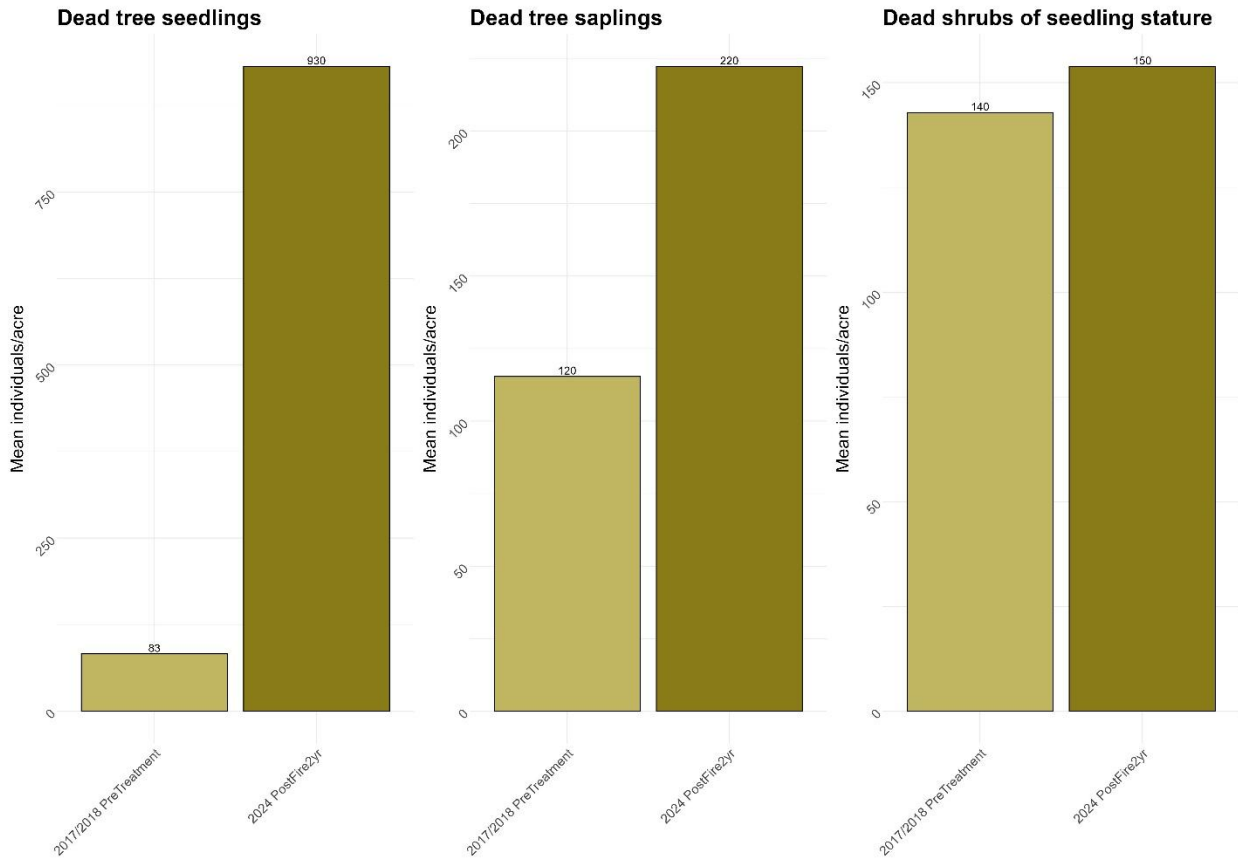
Dead tree seedlings and saplings and dead shrub seedlings decreased from the 2017-2018 pretreatment measurement period to the 2024 2 year post-wildfire measurement period (**Figure 18**). No dead shrubs of sapling stature were detected across either measurement period. The increase in live regeneration is therefore reflective of a replacement of trees and shrubs killed by the HPCC wildfire.

### Regeneration: shrubs and trees per acre



**Figure 17.** Regeneration densities of trees and shrubs in the seedling and saplings classes across all measurement periods.

Regeneration: dead shrubs and trees per acre



12.16 Upper Mora Walker Flats CFRP

**Figure 18.** Regeneration densities of dead trees and shrubs in the seedling and sapling classes across all measurement periods. No dead shrubs of sapling stature were observed either year.

## Stand Tables

Stand tables provide another way to visualize trees in an area. They represent the number of trees per acre in certain diameter classes and provide other summary values in a concise format.

### 2017-2018 Pretreatment

**Table 6.** Stand table of forestland species metrics for the 2017-2018 PreTreatment monitoring period.

Woodland Species		Saplings			Pole			Mature Trees										Total by Species	%Species for all G-Stock		
Diameter Class		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30			32+	
QUGA	COUNT	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	
Gambel oak	TPA	0	0	0	1.0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0.94%
	BA/AC	0	0	0	0.17	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0.29%
	AVE HT. (HL)	0	0	0	19	16	0	0	0	0	0	0	0	0	0	0	0	0	0		
Woodland Species	COUNT	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	
Sub-total	TPA	0	0	0	1.0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0.94%
	BA/AC	0	0	0	0.17	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0.29%
	AVE HT. (HL)	0	0	0	19	16	0	0	0	0	0	0	0	0	0	0	0	0	0		
Summary by Size Class for Woodland Species	TPA	0			1.3			0										1.3			
	TPA %	0%			100%			0%										100%			
	BA/AC	0			0.28			0										0.28			
	BA/AC %	0%			100%			0%										100%			
	QUADRA TIC MEAN DIA.	0			6.2			0										6.2			
	AVE HT. (HL)	0			18			0										18			

Forestland Species		Saplings			Pole			Mature Trees										Total by Species & Coverttype	%Species for all G-Stock	
		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30			32
<b>ABCO</b>	COUNT	0	0	0	22	18	11	12	9	4	5	1	2	0	0	0	0	0	84	
<b>White fir</b>	TPA	0	0	0	7.3	6.0	3.7	4.0	3.0	1.3	1.7	0.33	0.67	0	0	0	0	0	28	19.8%
	BA/AC	0	0	0	1.3	1.9	1.9	3.2	3.2	1.8	3.0	0.68	1.8	0	0	0	0	0	18.8	19.3%
	AVE HT. (HL)	0	0	0	26.7	31.1	40.5	42.3	47.4	53.1	50.7	64.0	57.5	0	0	0	0	0		
<b>PIPO</b>	COUNT	0	0	0	18	29	38	29	28	15	9	3	4	1	0	0	0	0	174	
<b>Ponderosa pine</b>	TPA	0	0	0	6.0	9.7	12.7	9.7	9.3	5.0	3.0	1.0	1.3	0.33	0	0	0	0	58	41.0%
	BA/AC	0	0	0	1.1	3.4	6.8	7.7	9.9	6.9	5.3	2.2	3.5	1.1	0	0	0	0	47.8	49.1%
	AVE HT. (HL)	0	0	0	28.2	35.2	41.8	43.5	48.2	51.0	53.2	56.5	59.4	64.0	0	0	0	0		
<b>PSME</b>	COUNT	0	0	2	31	29	26	18	7	9	4	1	0	2	0	0	0	0	129	
<b>Douglas-fir</b>	TPA	0	0	0.67	10.3	9.7	8.7	6.0	2.3	3.0	1.3	0.33	0	0.67	0	0	0	0	43	30.4%
	BA/AC	0	0	0.06	1.8	3.4	4.6	4.6	2.6	4.0	2.3	0.73	0	2.1	0	0	0	0	26.2	26.9%
	AVE HT. (HL)	0	0	19.2	25.2	35.2	38.6	45.5	48.3	54.8	62.5	57.0	0	68.7	0	0	0	0		
<b>PIFL2</b>	COUNT	0	0	0	1	1	2	2	0	0	0	0	0	0	0	0	0	0	6.0	
<b>Limber pine</b>	TPA	0	0	0	0.33	0.33	0.67	0.67	0	0	0	0	0	0	0	0	0	0	2.0	1.4%
	BA/AC	0	0	0	0.08	0.10	0.35	0.49	0	0	0	0	0	0	0	0	0	0	1.0	1.1%
	AVE HT. (HL)	0	0	0	22.0	40.0	38.0	45.0	0	0	0	0	0	0	0	0	0	0		
<b>PIPU</b>	COUNT	0	0	0	2	0	1	1	1	0	0	0	0	0	0	0	0	0	5.0	
<b>Colorado blue spruce</b>	TPA	0	0	0	0.67	0	0.33	0.33	0.33	0	0	0	0	0	0	0	0	0	1.7	1.2%
	BA/AC	0	0	0	0.14	0	0.15	0.28	0.37	0	0	0	0	0	0	0	0	0	0.94	0.97%
	AVE HT. (HL)	0	0	0	28.9	0	30.0	65.0	46.0	0	0	0	0	0	0	0	0	0		
<b>PIEN</b>	COUNT	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1.0	
<b>Engleman spruce</b>	TPA	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0.33	0.24%
	BA/AC	0	0	0	0	0	0	0.30	0	0	0	0	0	0	0	0	0	0	0.30	0.31%
	AVE HT. (HL)	0	0	0	0	0	0	68.0	0	0	0	0	0	0	0	0	0	0		
<b>POTR5</b>	COUNT	0	0	0	11	8	2	0	0	0	0	0	0	0	0	0	0	0	21.0	
<b>Aspen</b>	TPA	0	0	0	3.7	2.7	0.67	0	0	0	0	0	0	0	0	0	0	0	7.0	5.0%
	BA/AC	0	0	0	0.67	0.93	0.34	0	0	0	0	0	0	0	0	0	0	0	1.9	2.0%
	AVE HT. (HL)	0	0	0	32.6	41.6	34.1	0	0	0	0	0	0	0	0	0	0	0		
<b>Forestland Species Sub-total</b>	COUNT	0	0	2	85	85	80	63	45	28	18	5	6	3	0	0	0	0	420	
	TPA	0	0	0.67	28.3	28.3	26.7	21.0	15.0	9.3	6.0	1.7	2.0	1.0	0	0	0	0	140	99.1%
	BA/AC	0	0	0.06	5.2	9.7	14.2	16.5	16.0	12.7	10.5	3.6	5.3	3.2	0	0	0	0	97.0	99.7%
	AVE HT. (HL)	0	0	19	27	35	40	45	48	52	55	58	59	67	0	0	0	0		
<b>Summary by Size Class for Forestland Species</b>	TPA	0.67			83.3			56.0										140		
	TPA %	0.48%			59.5%			40.0%										100%		
	BA/AC	0.06			29.1			67.8										97.0		
	BA/AC %	0.06%			30.0%			69.9%										100%		
	QUADRATIC MEAN DIA.	4.0			8.0			14.9										11.3		
AVE HT. (HL)	19			36			51										47			

<b>Stand Total</b>		Saplings			Pole			Tree or Sawlog											Total by Class, Growing Stock & Dead	% by Class, Growing Stock vs Dead
<u>Diameter Class</u>		<u>0</u>	<u>2</u>	<u>4</u>	<u>6</u>	<u>8</u>	<u>10</u>	<u>12</u>	<u>14</u>	<u>16</u>	<u>18</u>	<u>20</u>	<u>22</u>	<u>24</u>	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>		
<b>Growing Stock (All living trees in woodland &amp; forestland)</b>	<b>COUNT</b>	0	0	2	88	86	80	63	45	28	18	5	6	3	0	0	0	0	<b>424</b>	
	<b>TPA</b>	0	0	0.67	29.3	28.7	26.7	21.0	15.0	9.3	6.0	1.7	2.0	1.0	0	0	0	0	<b>141</b>	<b>76.7%</b>
	<b>BA/AC</b>	0	0	0.06	5.3	9.8	14.2	16.5	16.0	12.7	10.5	3.6	5.3	3.2	0	0	0	0	<b>97.3</b>	<b>81.3%</b>
	<b>AVE HT, HL</b>	0	0	19	27	35	40	45	48	52	55	58	59	67	0	0	0	0		
<b>Summary by Size Class (All living trees in woodland &amp; forestland)</b>	<b>TPA</b>	0.67			84.7			56.0											<b>141</b>	
	<b>TPA %</b>	0.47%			59.9%			39.6%											<b>100%</b>	
	<b>BA/AC</b>	0.06			29.4			67.8											<b>97.3</b>	
	<b>BA/AC %</b>	0.06%			30.2%			69.7%											<b>100%</b>	
	<b>QMD MEAN DIA.</b>	4.0			8.0			14.9											<b>11.2</b>	
	<b>AVE HT, HL</b>	19			36			51											<b>47</b>	
<b>Dead (All dead trees in woodland &amp; forestland)</b>	<b>COUNT</b>	0	1	0	41	32	17	22	7	5	3	0	1	0	0	0	0	0	<b>129</b>	
	<b>TPA</b>	0	0.33	0	13.7	10.7	5.7	7.3	2.3	1.7	1.0	0	0.33	0	0	0	0	0	<b>43.0</b>	<b>23.3%</b>
	<b>BA/AC</b>	0	0.01	0	2.5	3.7	3.2	5.6	2.4	2.4	1.6	0	0.93	0	0	0	0	0	<b>22.3</b>	<b>18.7%</b>
	<b>AVE HT, HL</b>	0	28	0	24	25	29	31	27	24	49	0	27	0	0	0	0	0	<b>29</b>	
<b>Total for all sample trees including Growing Stock and Dead</b>	<b>COUNT</b>	0	1	2	129	118	97	85	52	33	21	5	7	3	0	0	0	0	<b>553</b>	
	<b>TPA</b>	0	0.33	0.67	43.0	39.3	32.3	28.3	17.3	11.0	7.0	1.7	2.3	1.0	0	0	0	0	<b>184</b>	<b>100%</b>
	<b>BA/AC</b>	0	0.01	0.06	7.8	13.5	17.4	22.1	18.4	15.0	12.2	3.6	6.2	3.2	0	0	0	0	<b>120</b>	<b>100%</b>

NOTE1: Average Diameter calculated using the Quadratic Mean Diameter (QDM), equivalent equation:  $(\text{SQRT}((\text{BA/AC})/\text{TPA}) / 0.005454)$ ; NOTE2: Average Height (HL), calculated using Lorey's height equation for a weighted mean,  $\text{HL} = \text{SUM}(bi * hi) / \text{SUM}(bi)$ , where bi is basal area of individual tree & hi is height of an individual tree.

## 2024 Post-wildfire 2 years

Table 7. Stand table of forestland species metrics for the 2024 PostFire2yr measurement period

Woodland Species		Saplings			Pole			Mature Trees											Total by Species	%Species for all G-Stock
Diameter Class		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+		
QUGA	COUNT	0	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.0	
Gambel oak	TPA	0	1.7	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	13.3%
	BA/AC	0	0.04	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.19	1.3%
	AVE HT. (HL)	0	12	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Woodland Species	COUNT	0	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.0	
Sub-total	TPA	0	1.7	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	13.3%
	BA/AC	0	0.04	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.19	1.3%
	AVE HT. (HL)	0	12	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Summary by Size Class for Woodland Species	TPA	3.7			0			0											3.7	
	TPA %	100%			0%			0%											100%	
	BA/AC	0.19			0			0											0.19	
	BA/AC %	100%			0%			0%											100%	
	QUADRA TIC MEAN DIA. AVE HT. (HL)	3.1			0			0											3.1	
		14			0			0											14	

Forestland Species		Saplings			Pole			Mature Trees										Total by Species & Covertypes	%Species for all G-Stock	
Diameter Class		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32		
<b>ABCO</b> White fir	COUNT	0	11	2	1	3	2	4	3	0	0	1	1	0	0	0	0	0	28.0	
	TPA	0	3.7	0.67	0.33	1.0	0.67	1.3	1.0	0	0	0.33	0.33	0	0	0	0	0	9.3	33.7%
	BA/AC	0	0.07	0.06	0.06	0.30	0.35	1.0	1.1	0	0	0.77	0.87	0	0	0	0	0	4.6	30.7%
	AVE HT. (HL)	0	9.7	14.8	25.2	38.4	42.0	42.1	46.0	0	0	49.8	55.7	0	0	0	0	0		
<b>PIPO</b> Ponderosa pine	COUNT	0	0	1	3	3	3	4	1	5	1	0	1	0	0	0	0	0	22.0	
	TPA	0	0	0.33	1.0	1.0	1.0	1.3	0.33	1.7	0.33	0	0.33	0	0	0	0	0	7.3	26.5%
	BA/AC	0	0	0.04	0.16	0.40	0.57	1.1	0.34	2.2	0.54	0	0.89	0	0	0	0	0	6.2	41.0%
	AVE HT. (HL)	0	0	27.4	19.8	38.0	33.2	46.9	57.3	53.3	52.8	0	72.9	0	0	0	0	0		
<b>PSME</b> Douglas-fir	COUNT	0	3	1	3	2	2	1	2	4	0	0	0	0	0	0	0	0	18.0	
	TPA	0	1.0	0.33	1.0	0.67	0.67	0.33	0.67	1.3	0	0	0	0	0	0	0	0	6.0	21.7%
	BA/AC	0	0.01	0.03	0.17	0.25	0.35	0.22	0.70	1.9	0	0	0	0	0	0	0	0	3.6	23.8%
	AVE HT. (HL)	0	12.1	20.5	29.2	46.2	50.9	56.5	58.5	63.8	0	0	0	0	0	0	0	0		
<b>PIFL2</b> Limber pine	COUNT	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1.0	
	TPA	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0.33	1.2%
	BA/AC	0	0	0	0	0	0.21	0	0	0	0	0	0	0	0	0	0	0	0.21	1.4%
	AVE HT. (HL)	0	0	0	0	0	31.1	0	0	0	0	0	0	0	0	0	0	0		
<b>PIPU</b> Colorado blue spruce	COUNT	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2.0	
	TPA	0	0	0	0	0.33	0.33	0	0	0	0	0	0	0	0	0	0	0	0.67	2.4%
	BA/AC	0	0	0	0	0.10	0.17	0	0	0	0	0	0	0	0	0	0	0	0.28	1.8%
	AVE HT. (HL)	0	0	0	0	41.9	49.1	0	0	0	0	0	0	0	0	0	0	0		
<b>POTR5</b> Aspen	COUNT	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0	
	TPA	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	1.2%
	BA/AC	0	0.0018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0018	0.012%
	AVE HT. (HL)	0	10.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<b>Forestland Species Sub-total</b>	COUNT	0	15	4	7	9	9	9	6	9	1	1	2	0	0	0	0	0	72.0	
	TPA	0	5.0	1.3	2.3	3.0	3.0	3.0	2.0	3.0	0.33	0.33	0.67	0	0	0	0	0	24.0	86.7%
	BA/AC	0	0.09	0.13	0.38	1.1	1.7	2.3	2.2	4.0	0.54	0.77	1.8	0	0	0	0	0	14.9	98.7%
	AVE HT. (HL)	0	10	20	25	40	40	46	52	58	53	50	64	0	0	0	0	0		
<b>Summary by Size Class for Forestland Species</b>	TPA	6.3			8.3			9.3										24.0		
	TPA %	26.4%			34.7%			38.9%										100%		
	BA/AC	0.21			3.1			11.6										14.9		
	BA/AC %	1.4%			20.7%			77.9%										100%		
	QUADRATIC MEAN DIA.	2.5			8.2			15.1										10.7		
AVE HT. (HL)	16			38			55										51			

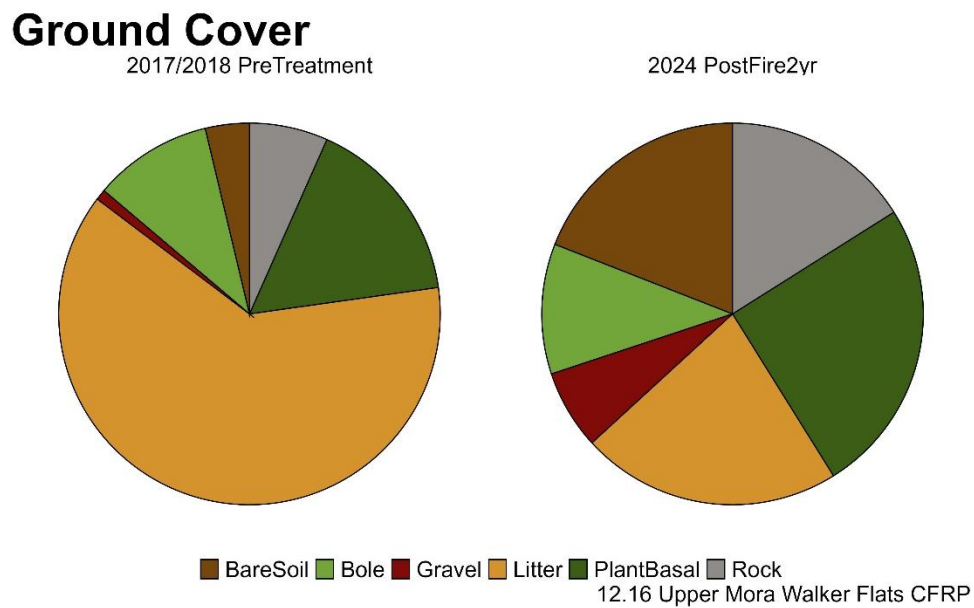
<b>Stand Total</b>		Saplings			Pole			Tree or Sawlog											Total by Class, Growing Stock & Dead	% by Class, Growing Stock vs Dead
<b>Diameter Class</b>		<b>0</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>	<b>14</b>	<b>16</b>	<b>18</b>	<b>20</b>	<b>22</b>	<b>24</b>	<b>26</b>	<b>28</b>	<b>30</b>	<b>32</b>		
<b>Growing Stock (All living trees in woodland &amp; forestland)</b>	<b>COUNT</b>	0	20	10	7	9	9	9	6	9	1	1	2	0	0	0	0	0	<b>83.0</b>	
	<b>TPA</b>	0	6.7	3.3	2.3	3.0	3.0	3.0	2.0	3.0	0.33	0.33	0.67	0	0	0	0	0	<b>27.7</b>	<b>5.6%</b>
	<b>BA/AC</b>	0	0.13	0.28	0.38	1.1	1.7	2.3	2.2	4.0	0.54	0.77	1.8	0	0	0	0	0	<b>15.1</b>	<b>12.8%</b>
	<b>AVE HT, HL</b>	0	11	17	25	40	40	46	52	58	53	50	64	0	0	0	0	0		
<b>Summary by Size Class (All living trees in woodland &amp; forestland)</b>	<b>TPA</b>	10.0			8.3			9.3											<b>27.7</b>	
	<b>TPA %</b>	36.1%			30.1%			33.7%											<b>100%</b>	
	<b>BA/AC</b>	0.40			3.1			11.6											<b>15.1</b>	
	<b>BA/AC %</b>	2.7%			20.4%			76.9%											<b>100%</b>	
	<b>QMD MEAN DIA.</b>	2.7			8.2			15.1											<b>10.0</b>	
	<b>AVE HT, HL</b>	15			38			55											<b>50</b>	
<b>Dead (All dead trees in woodland &amp; forestland)</b>	<b>COUNT</b>	9	737	219	102	98	83	65	34	27	16	6	1	4	1	0	0	0	<b>1402</b>	
	<b>TPA</b>	3.0	246	73.0	34.0	32.7	27.7	21.7	11.3	9.0	5.3	2.0	0.33	1.3	0.33	0	0	0	<b>467</b>	<b>94.4%</b>
	<b>BA/AC</b>	0.011	4.8	5.9	6.4	11.1	14.9	16.7	11.6	12.2	9.2	4.3	0.82	4.1	1.2	0	0	0	<b>103</b>	<b>87.2%</b>
	<b>AVE HT, HL</b>	7	12	20	30	38	44	51	55	55	60	66	73	49	75	0	0	0	<b>46</b>	
<b>Total for all sample trees including Growing Stock and Dead</b>	<b>COUNT</b>	9	757	229	109	107	92	74	40	36	17	7	3	4	1	0	0	0	<b>1485</b>	
	<b>TPA</b>	3.0	252	76.3	36.3	35.7	30.7	24.7	13.3	12.0	5.7	2.3	1.0	1.3	0.33	0	0	0	<b>495</b>	<b>100%</b>
	<b>BA/AC</b>	0.01	4.9	6.2	6.8	12.1	16.5	19.1	13.8	16.3	9.7	5.1	2.6	4.1	1.2	0	0	0	<b>118</b>	<b>100%</b>
NOTE1: Average Diameter calculated using the Quadratic Mean Diameter (QDM), equivalent equation: $(\text{SQRT}((\text{BA/AC})/\text{TPA}) / 0.005454)$ ; NOTE2: Average Height (HL), calculated using Lorey's height equation for a weighted mean, $\text{HL} = \text{SUM}(b_i * h_i) / \text{SUM}(b_i)$ , where $b_i$ is basal area of individual tree & $h_i$ is height of an individual tree.																				

# Understory & Forest Floor Component

## Ground & Aerial Cover

Measurements of ground cover for litter decreased from pretreatment to 2 years post-wildfire (**Figure 19, Table 8**). Concurrently, proportional cover of plant basal, bare soil, rock, and gravel increased between these monitoring periods. This shows how the wildfire consumed much dead plant material, exposing mineral soil and rock. However, this removal of biomass and the resulting increased availability of resources appears to have allowed an increase in the cover of herbaceous plants.

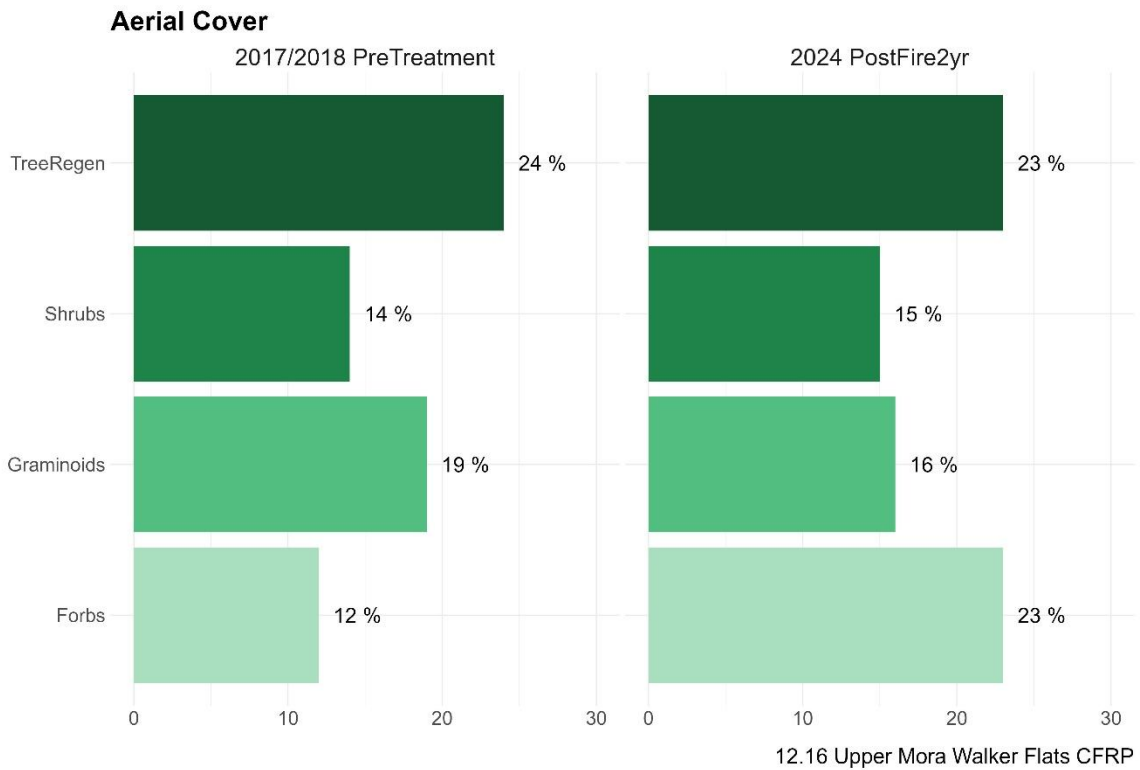
Mean aerial cover of tree regeneration, shrubs, and graminoids stayed relatively steady between 2017-2018 and 2024, whereas forb cover nearly doubled; from 12% pretreatment to 23% 2 years post-fire (**Figure 20**).



**Figure 19.** Mean percent ground cover by monitoring status.

**Table 8.** Mean percent ground cover by monitoring status.

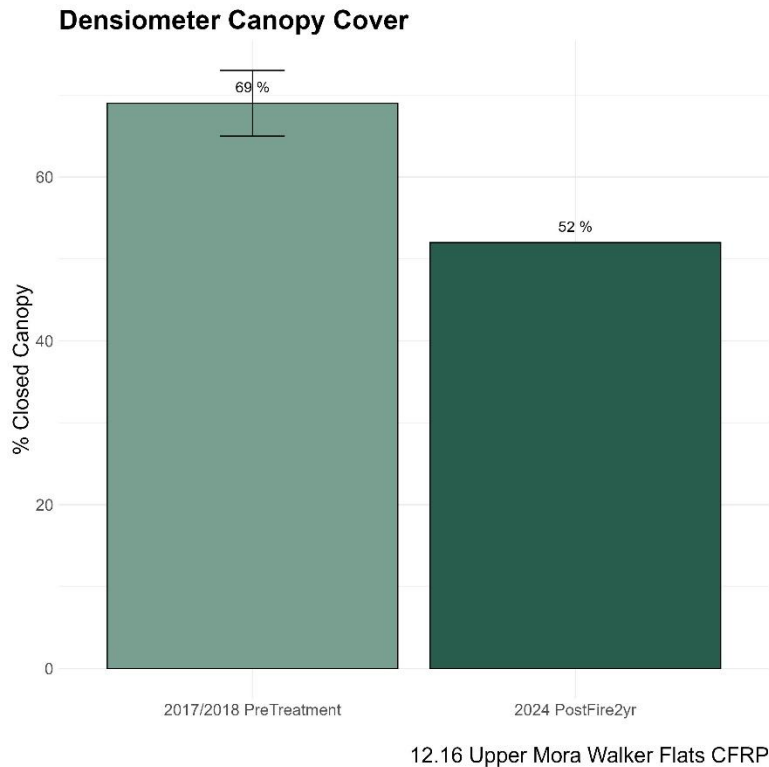
Ground Cover		
Monitoring Status	Cover Class	% Cover
2017/2018 PreTreatment	PlantBasal	16.0
	Bole	10.0
	Litter	62.0
	BareSoil	3.7
	Rock	6.6
	Gravel	0.9
2024 PostFire2yr	PlantBasal	25.0
	Bole	11.0
	Litter	22.0
	BareSoil	19.0
	Rock	16.0
	Gravel	6.7



**Figure 20.** Mean percent aerial cover by monitoring status.

## Tree Canopy

2017-2018 canopy measurements cannot be confirmed with less than a 4% error rate due to inconsistencies in field calculations. The mean percentage of closed canopy as measured by a densiometer decreased slightly from 69% pretreatment to 52% 2 years post-wildfire (**Figure 21**). This is consistent with measured tree mortality. Dead branches and tree canopies are included in canopy measurements – this explains why observed closed canopy did not decrease more substantially despite high mortality from the HPCC wildfire.



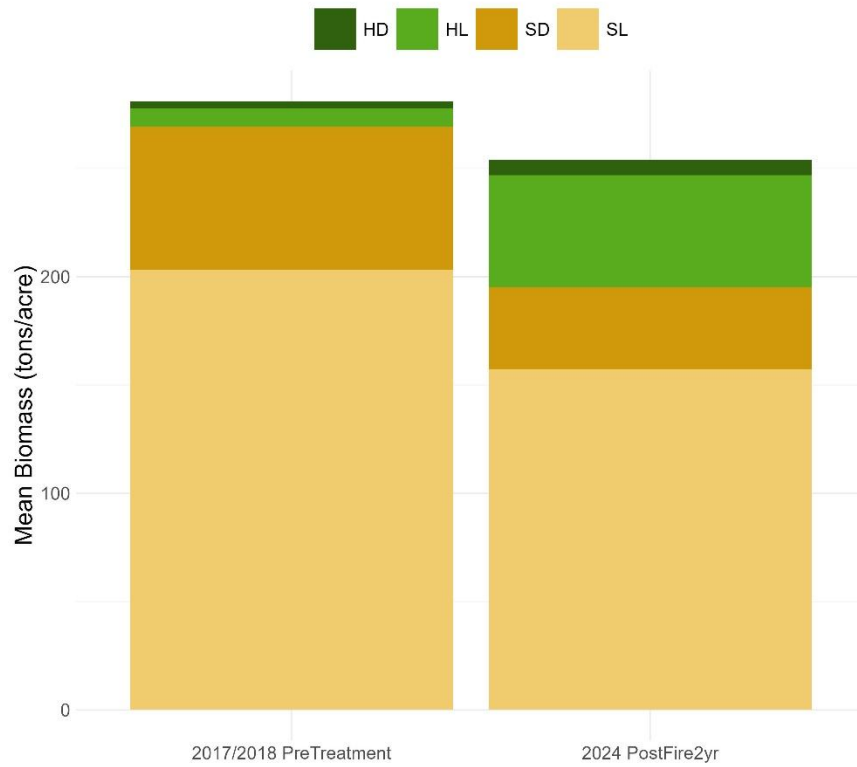
**Figure 21.** Mean percent closed tree canopy by monitoring status.

## Ladder Fuels

Average biomass of ladder fuels decreased from 280 tons per acre pretreatment to 250 tons per acre 2 years post-wildfire (**Figure 22, Table 9**). For both monitoring periods, the dominant component of ladder fuel biomass was live woody fuels at 200 tons per acre pretreatment, but this was reduced to 160 tons per acre immediately post-wildfire. The presence of dead woody fuels decreased, and live and dead herbaceous fuels increased 2 years post-wildfire. This suggests that while the HPCC wildfire consumed woody materials this also encouraged herbaceous plant growth in the understory.

Ladder Fuel Types	
HD	Herbaceous Dead
HL	Herbaceous Live
SD	Woody Dead
SL	Woody Live

### Ladder Fuels: tons per acre



12.16 Upper Mora Walker Flats CFRP

**Figure 22.** Ladder fuels in mean tons per acre by monitoring status.

**Table 9.** Ladder fuel average percent cover, height, and biomass for each category and monitoring status

Ladder Fuel Biomass					
Monitoring Status	Vegetation	Mean % Cover	Mean Height (ft)	Mean Biomass (tons/acre)	Total Biomass (tons/acre)
2017/2018 PreTreatment	HD	3.7	0.64	3.6	280
	HL	16	0.61	8.3	
	SD	5.2	1.7	66	
	SL	21	2.8	200	
2024 PostFire2yr	HD	3.6	1.3	7.1	250
	HL	30	1.5	52	
	SD	1.7	3.5	38	
	SL	20	2.2	160	

## Surface Fuels

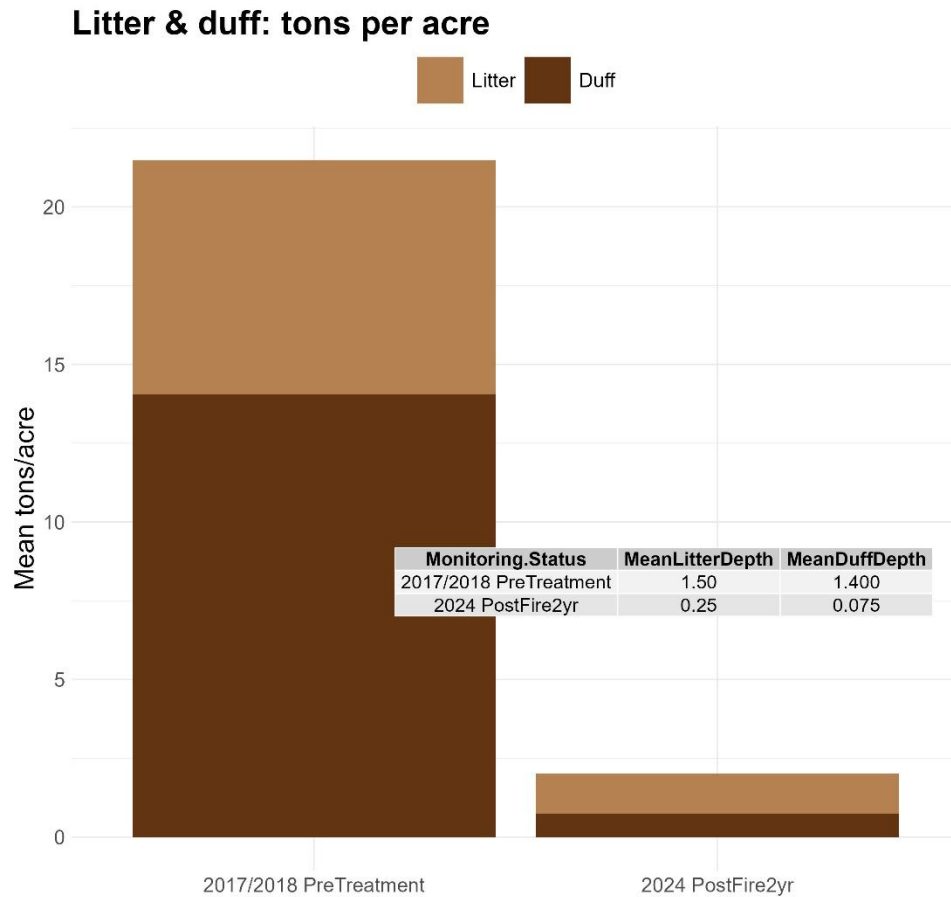
Total fine fuels, total wood fuels, and total surface fuels all decreased from the first monitoring period to the next (**Table 10**). Total surface fuels dropped substantially from 38 tons per acre pretreatment, to 12 tons per acre 2 years post-wildfire.

**Table 10.** Fuel loads by type and monitoring status

Total Surface Fuels Table										
Monitoring Status	1-hr (tons/acre)	10-hr (tons/acre)	100-hr (tons/acre)	1000-hr sound (tons/acre)	1000-hr rotten (tons/acre)	Litter (tons/acre)	Duff (tons/acre)	Total Fine Fuels (tons/acre)	Total Wood Fuels (tons/acre)	Total Surface Fuels (tons/acre)
2017/2018 PreTreatment	0.25	1.6	2	7.3	5	7.4	14	3.8	16	38
2024 PostFire2yr	0.094	0.46	0.28	7.5	2.1	1.3	0.75	0.83	10	12

## Litter and Duff

Litter and duff fuel loads decreased substantially from 7.4 tons per acre pretreatment, to 1.3 tons per acre 2 years post-wildfire (**Figure 23, Table 10**). Likewise, duff fuel loads dropped from 14 tons per acre to 0.75 tons per acre. Mean litter and duff depth in inches also decreased – this is all consistent with the knowledge that fire consumes surface fuels. The decrease in duff especially confirms the high severity of fire that this project experienced. Duff holds more moisture and therefore takes more energy to ignite and to fully burn than fine litter.



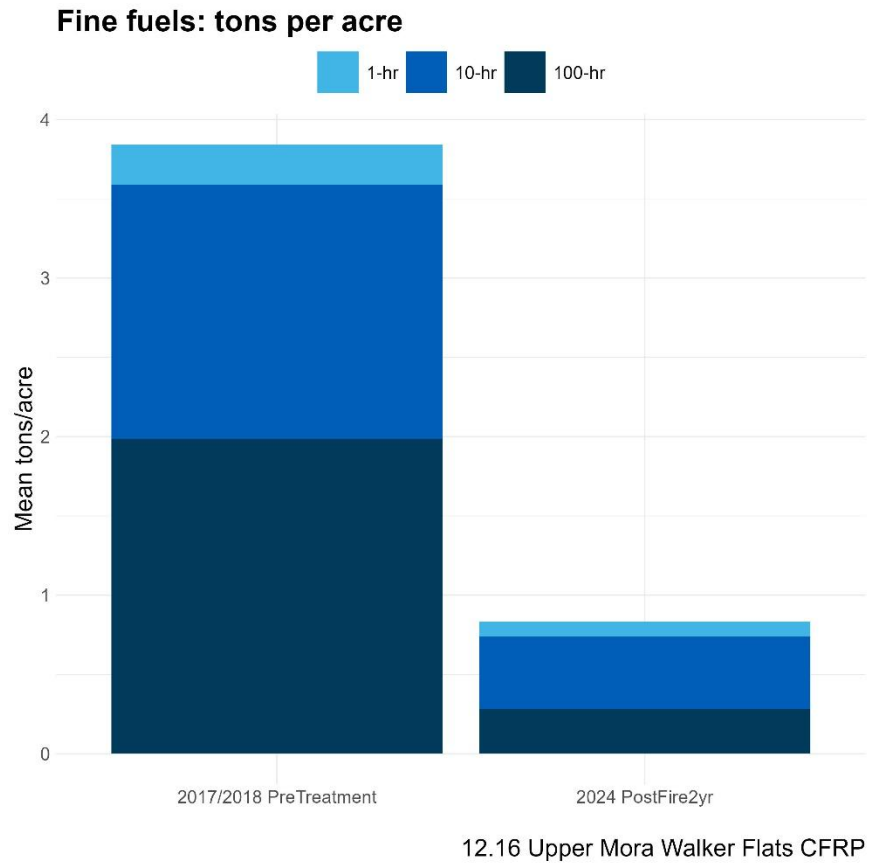
12.16 Upper Mora Walker Flats CFRP

**Figure 23.** Mean litter and duff loads by monitoring status. The inset table shows mean litter and duff depths in inches.

## Fine Fuels

Total fine fuels decreased from the 2017-2018 pretreatment measurement period to the 2024 2 year post-wildfire measurement period (**Figure 24, Table 10**). 1-hr fuels decreased from 0.25 tons per acre pretreatment to 0.094 tons per acre 2 years post-wildfire. 10-hr fuels decreased from 1.6 tons per acre to 0.46 tons per acre; 100-hr fuels decreased from 2 tons per acre to 0.28 tons per acre 2 years post-wildfire. Due to the length of time between the post-wildfire

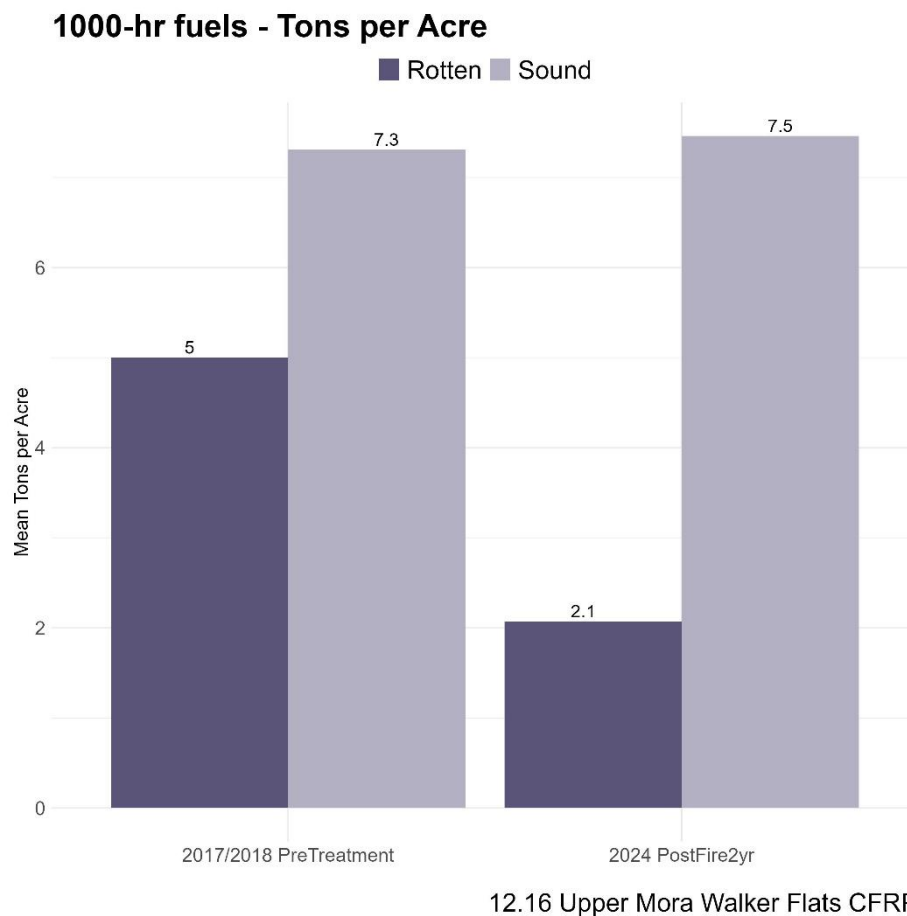
measurement period and the wildfire itself, many of these fine fuels may be from fire-killed trees that dropped branches and twigs more recently.



**Figure 24.** Mean fine fuel loads by monitoring status

## Thousand-Hour Fuels

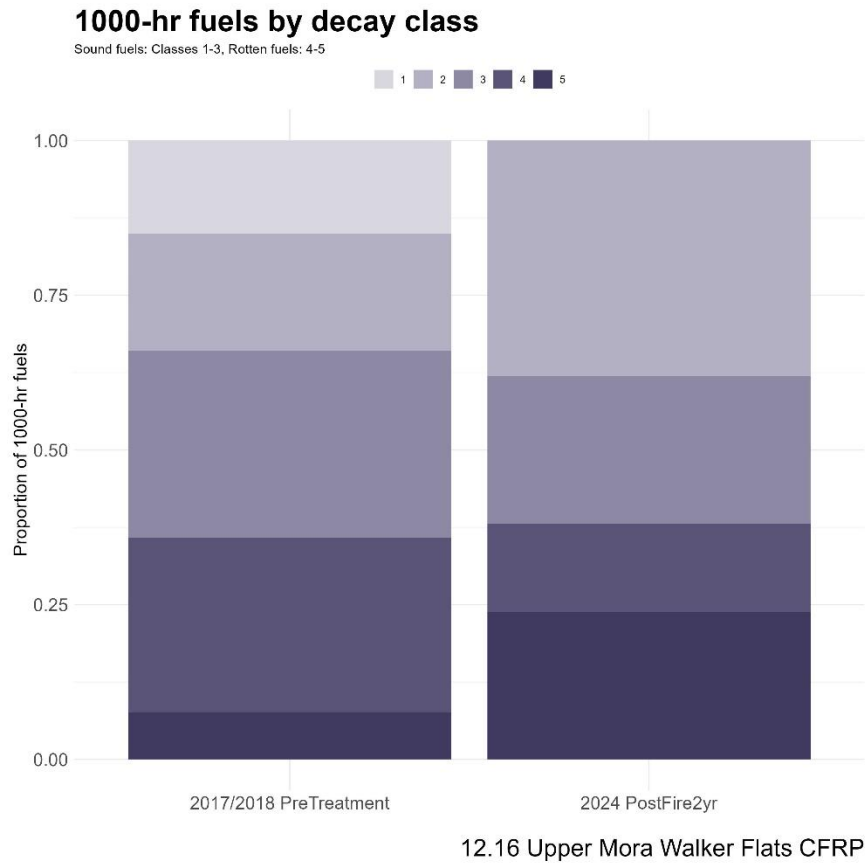
Rotten 1000-hour fuels decreased from 5 tons per acre pretreatment to 2.1 tons per acre 2 years post-wildfire (**Figure 25, Table 10**). Sound 1000-hour fuels loads increased slightly from 7.3 tons per acre pretreatment to 7.5 tons per acre 2 years post-wildfire. The decrease in rotten 1000-hour fuels indicates that the HPCC wildfire consumed a large amount of dead and down logs, while the steady value of sound fuels suggests that many fire-killed and fire-destabilized trees have fallen since the wildfire passed through the area.



**Figure 25.** Mean thousand-hour fuel loads by monitoring status

While 1000-hour fuels pretreatment were made up of all 5 decay classes, two years post-wildfire, 1000-hour fuels were placed into decay classes 2 through 5 (**Figure 26**). Decay class 1 represents freshly downed 1000-hour fuels with minimal decay. Progressing to decay class 5, this represents the most decayed a woody fuel can become before it is considered duff. The higher proportion of rotten 1000-hour fuels post-fire may be due to the persistence of rotten

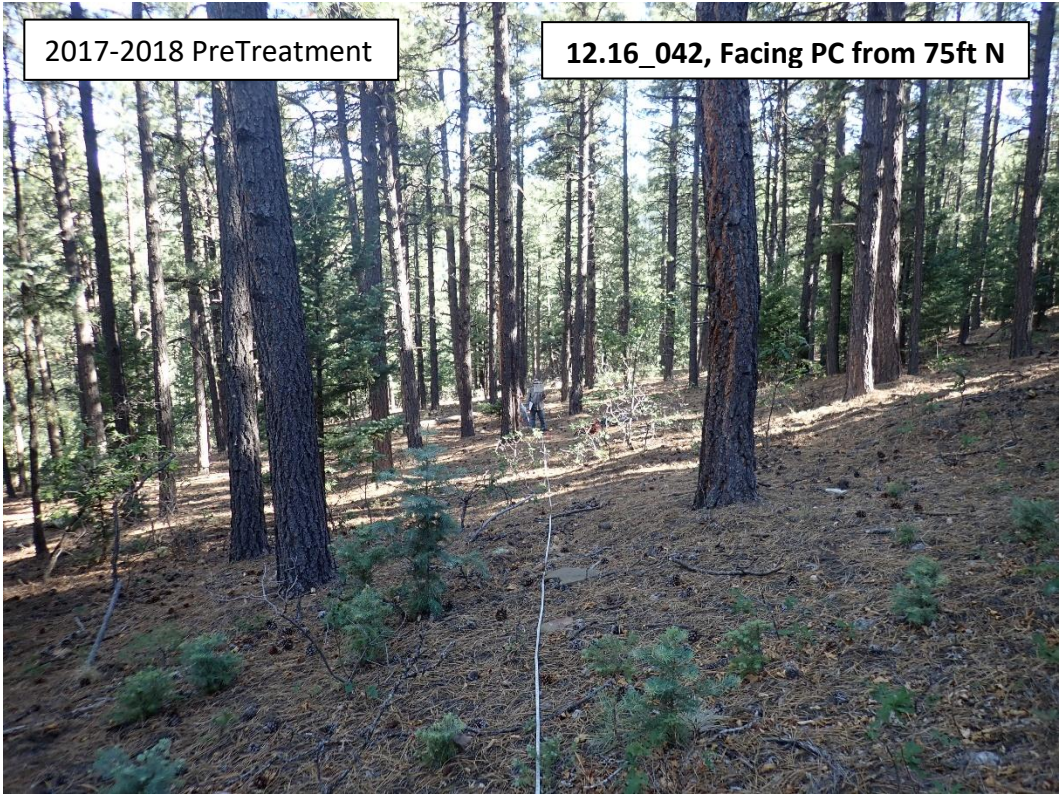
fuels through their higher moisture content, which makes them less likely to be consumed by wildfire. Sound fuels have a lower moisture content, and therefore ignite more easily.



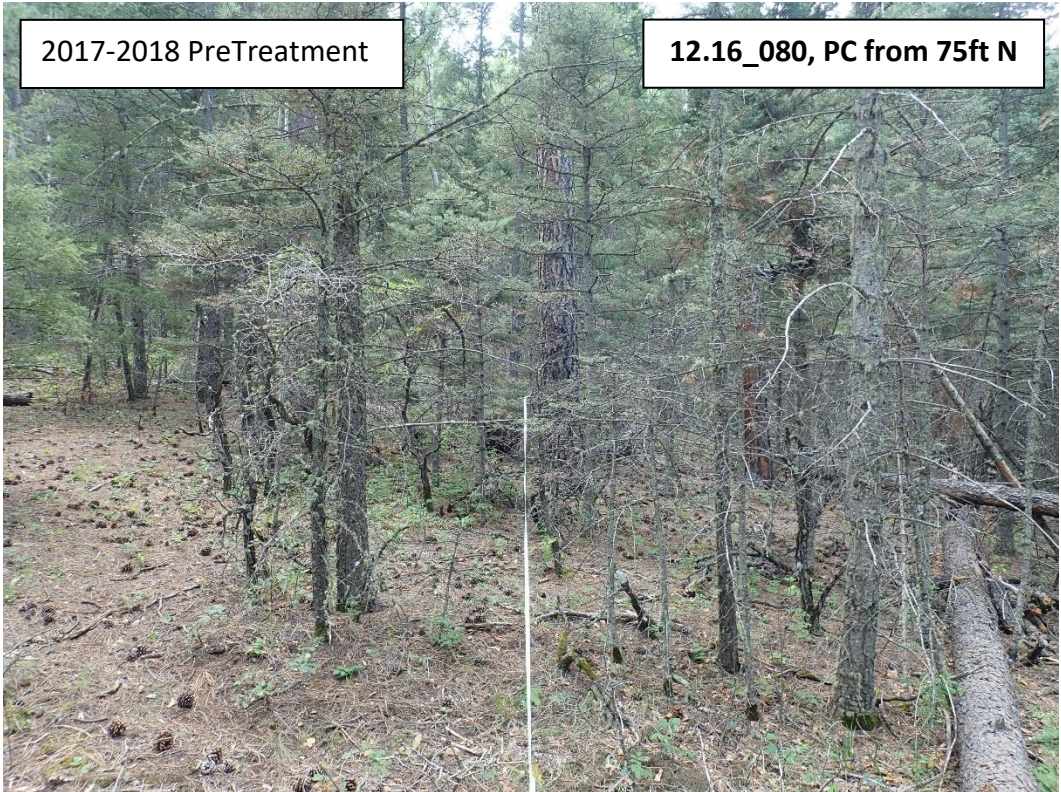
**Figure 26.** Proportion of total thousand-hour fuels by decay class and monitoring status

## Photo Comparisons:









2017-2018 PreTreatment

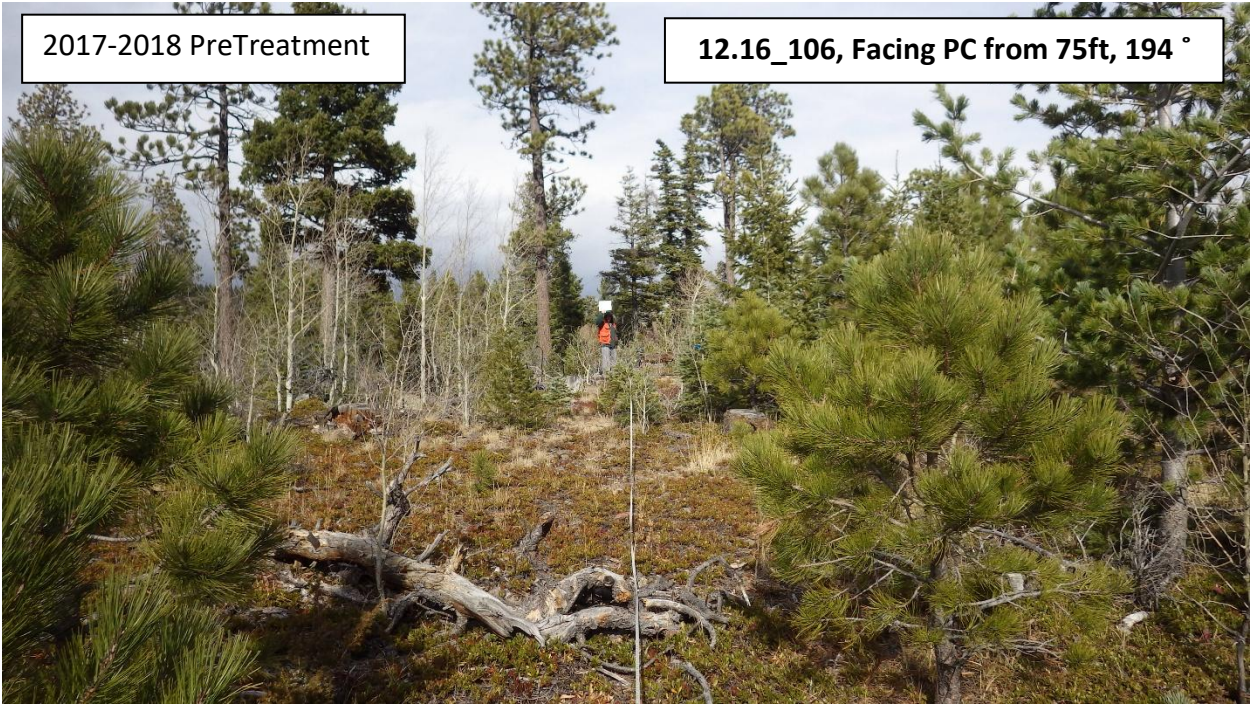
12.16\_080, PC from 75ft N



2024 PostFire2yr

2017-2018 PreTreatment

12.16\_106, Facing PC from 75ft, 194 °



2024 PostFire2yr



## Additional Resources

In 2023, NMFWRI published their first version of a field manual: “Guidelines and Protocols for Monitoring Upland Forests – Field Manual.” - <https://nmfwri.org/resources/upland-forests-monitoring-field-manual/>

For more information regarding monitoring criteria and methodology please contact NMFWRI or consult the 2008 document authored by Derr, et. al., *Monitoring the Long Term Ecological Impacts Of New Mexico’s Collaborative Forest Restoration Program, New Mexico Forest Restoration Series Working Paper 5*, available on NMFWRI’s website here: <http://nmfwri.org/collaborative-forest-restoration-program/cfrp-long-term-monitoring>.

For additional information on forest health, forest insects and disease, and non-native species management see resources from the New Mexico Forest and Watershed Health Office: <https://www.emnrd.nm.gov/sfd/forest-and-watershed-health-office/>

For additional information on post-wildfire community resources, events, and recovery action strategy see the Hermit’s Peak/Calf Canyon Post-Fire Resource Hub: <https://hermits-peak-calf-canyon-fire-resources-nmhu.hub.arcgis.com/>

## Works Cited

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- Derr, T., McGrath, D., Estrada, V., Krasilovsky, E., & Evans, Z. (n.d.). *MONITORING THE LONG TERM ECOLOGICAL IMPACTS OF NEW MEXICO’S COLLABORATIVE FOREST RESTORATION PROGRAM*.
- New Mexico Forest and Watershed Restoration Institute. (2024). *Guidelines and Protocols for Monitoring Upland Forests Field Manual, First Edition*.
- New Mexico Forest and Watershed Restoration Institute. (2022, August 24). *Hermit’s Peak and Calf Canyon Fire*. ArcGIS StoryMaps. <https://storymaps.arcgis.com/stories/d48e2171175f4aa4b5613c2d11875653>
- Southwest Forest Health and Wildfire Prevention Act of 2004, no. 108–317, 108th Congress (2004). <https://www.congress.gov/108/plaws/publ317/PLAW-108publ317.pdf>

# Supplementary Information

## Species Lists

**Table S11.** List of observed tree and shrub species by species symbol, scientific name, and common name

### Tree Species

Species Symbol	Scientific Name	Common Name
ABCO	<i>Abies concolor</i>	white fir
ACGL	<i>Acer glabrum</i>	Rocky Mountain maple
AMAL2	<i>Amelanchier alnifolia</i>	Saskatoon serviceberry
CEMO2	<i>Cercocarpus montanus</i>	Mountain mahogany
JUSC2	<i>Juniperus scopulorum</i>	Rocky Mountain juniper
PIEN	<i>Picea engelmannii</i>	Engelmann spruce
PIFL2	<i>Pinus flexilis</i>	Limber pine
PIPO	<i>Pinus ponderosa</i>	ponderosa pine
PIPU	<i>Picea pungens</i>	Blue spruce
POTR5	<i>Populus tremuloides</i>	Quaking aspen
PSME	<i>Psuedotsuga menziesii</i>	Douglas-fir
PRVI	<i>Prunus virginiana</i>	Chokecherry
QUGA	<i>Quercus gambelii</i>	Gambel oak
SABE2	<i>Salix bebbiana</i>	Bebb willow

### Shrub Species

Species Symbol	Scientific Name	Common Name
ARUV	<i>Arctostaphylos uva-ursi</i>	kinnickinnick
BEFE	<i>Berberis fendleria</i>	Colorado barberry
CEFE	<i>Ceanothus fendleri</i>	Fendler's ceanothus
JAAM	<i>Jamesia Americana</i>	Fivepetal cliffbush

<b>Species Symbol</b>	<b>Scientific Name</b>	<b>Common Name</b>
MARE11	<i>Mahonia repens</i>	creeping barberry
PAMY	<i>Paxistima myrsintes</i>	Oregon boxleaf
RHTR	<i>Rhus trilobata</i>	Shunkbush sumac
RICE	<i>Ribes cereum</i>	Wax currant
RIIN2	<i>Ribes inerme</i>	Whitestem gooseberry
ROWO	<i>Rosa woodsii</i>	Woods' rose
RUID	<i>Rubus idaeus</i>	American red raspberry
RUPA	<i>Rubus parviflorus</i>	thimbleberry
SHCA	<i>Shepherdia canadensis</i>	Russet buffaloberry
SODU2	<i>Sorbus dumosa</i>	Arizona mountain ash
SYRO	<i>Symphoricarpos rotundifolius</i>	Roundleaf snowberry

**Table S12.** List of plots coordinates by plot name, latitude, and longitude

## Plot Center Coordinates

<b>Plot Name*</b>	<b>Latitude</b>	<b>Longitude</b>
12.16_013	36.006127	-105.437101
12.16_019	36.007232	-105.438749
12.16_025	36.009566	-105.436149
12.16_028	36.010478	-105.436590
12.16_029	36.01059785	-105.43398937
12.16_033	36.012105	-105.443280
12.16_040	36.01398397	-105.43457261
12.16_042	36.01486433	-105.43231937
12.16_045	36.015983	-105.437670
12.16_053	36.01828294	-105.43659533
12.16_054	36.018308	-105.454802
12.16_055	36.018511	-105.440029
12.16_056	36.018776	-105.434168
12.16_057	36.018916	-105.427997
12.16_061	36.01955058	-105.43775236
12.16_062	36.019879	-105.427597

12.16_080	36.023489	-105.433216
12.16_085	36.024076	-105.426521
12.16_088	36.024423	-105.430381
12.16_096	36.025512	-105.445099
12.16_103	36.026465	-105.423514
12.16_106	36.02651992	-105.45539036
12.16_111	36.028425	-105.441257
12.16_117	36.02908123	-105.442094
12.16_125	36.030542	-105.456322
12.16_140	36.032874	-105.443402
12.16_143	36.033606	-105.430894
12.16_154	36.036761	-105.421713
12.16_155	36.036719	-105.443272
12.16_160	36.037655	-105.424044

\*Previous iterations and records of this project use the non-standardized plot names “RC\_01”, etc. This table only includes coordinates for the 30 plots which were monitored in 2024 and whose data is represented in this report.

**Table S13.** List of abbreviated terms by abbreviation and definition

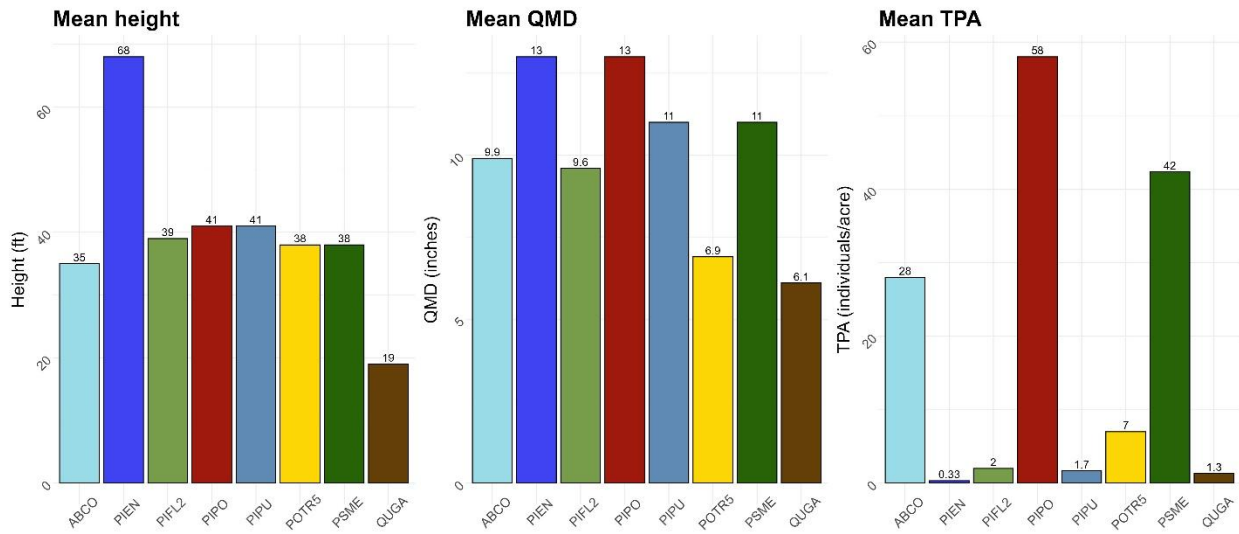
## Abbreviations & Acronyms

<b>Acronym/Abbreviation/Term</b>	<b>Definition as used by NMFWRI</b>
1-hr fuel	Woody surface debris < 0.25 inches in diameter
10-hr fuel	Woody surface debris 0.25 – 1 inch in diameter
100-hr fuel	Woody surface debris 1.0 – 3.0 inches in diameter
1000-hr fuel	Woody surface debris > 3.0 inches in diameter
CFRP	Collaborative Forest Restoration Program
DBH	Diameter at breast height (4.5 feet)
FFI	FEAT/FIREMON Integrated
FEAT	Fire Ecology Assessment Tool
FIREMON	Fire Effects Monitoring and Inventory System
HD	Herbaceous dead (dead non-woody species)
HL	Herbaceous live (live non-woody species)
NMFWRI	New Mexico Forest and Watershed Restoration Institute
USFS	United States Forest Service
Sapling	Height > 4.5 feet & DBH < 1 inch
Seedling	Height < 4.5 feet
SD	Standing dead (dead woody species)
SL	Standing live (live woody species)
“Sick”	Attribute given to trees/shrubs not expected to survive long term
SWERI	Southwest Ecological Restoration Institute
TPA	Trees per acre (trees/acre)
Tree	Height > 4.5 feet & DBH > 1 inch

## Supplementary Figures

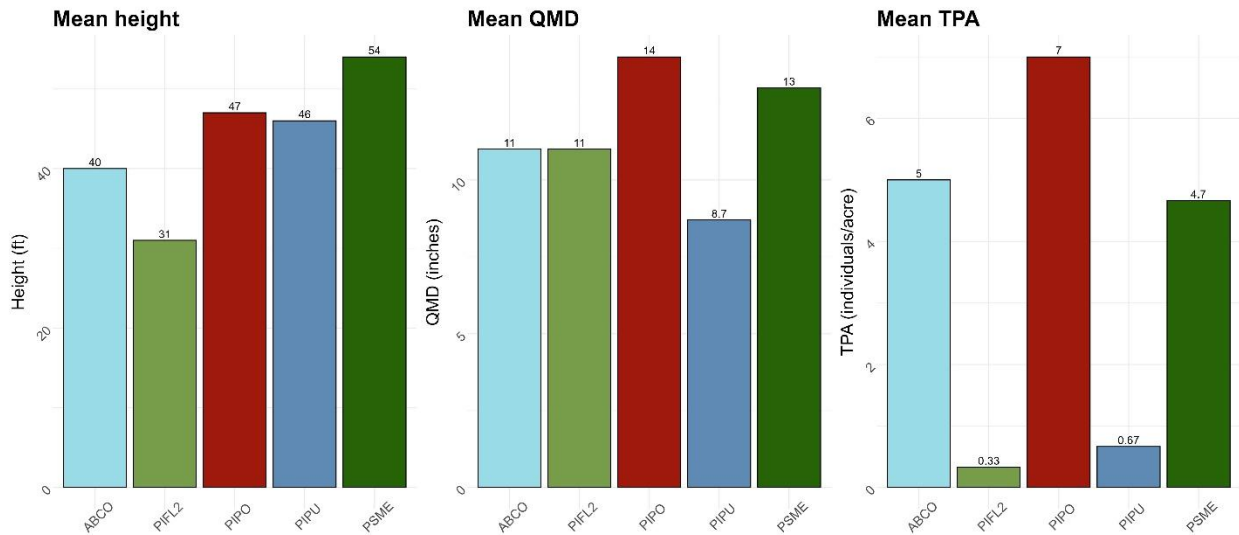
**Figure S27.** The following figures show tree (>5" DBH) metrics at the species level by status and measurement period

Pretreatment: growing stock metrics by species



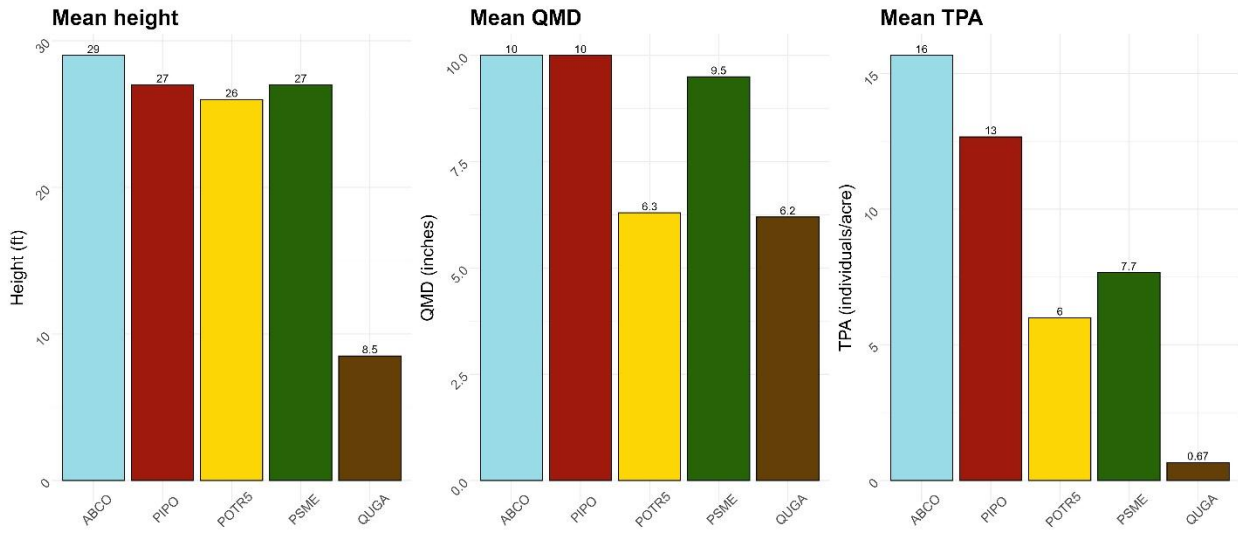
12.16 Upper Mora Walker Flats CFRP

Post-fire 2yrs: growing stock metrics by species



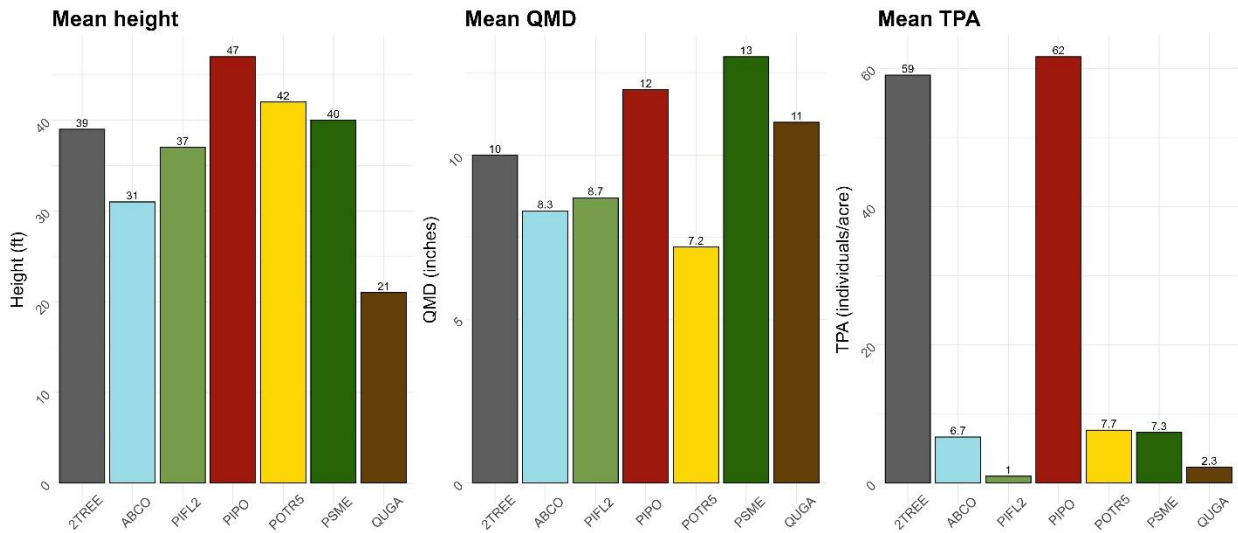
12.16 Upper Mora Walker Flats CFRP

PreTreatment: snag metrics by species



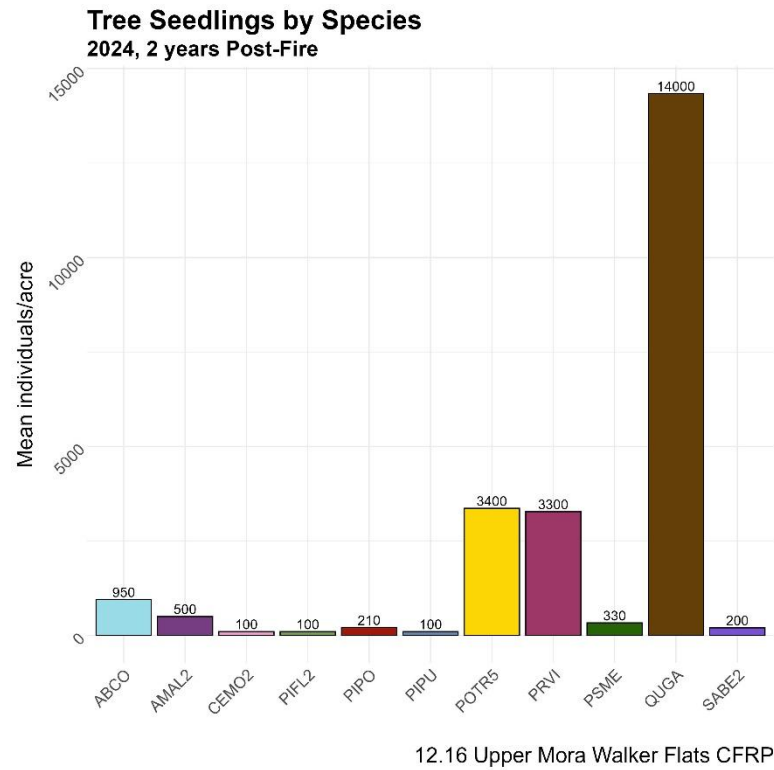
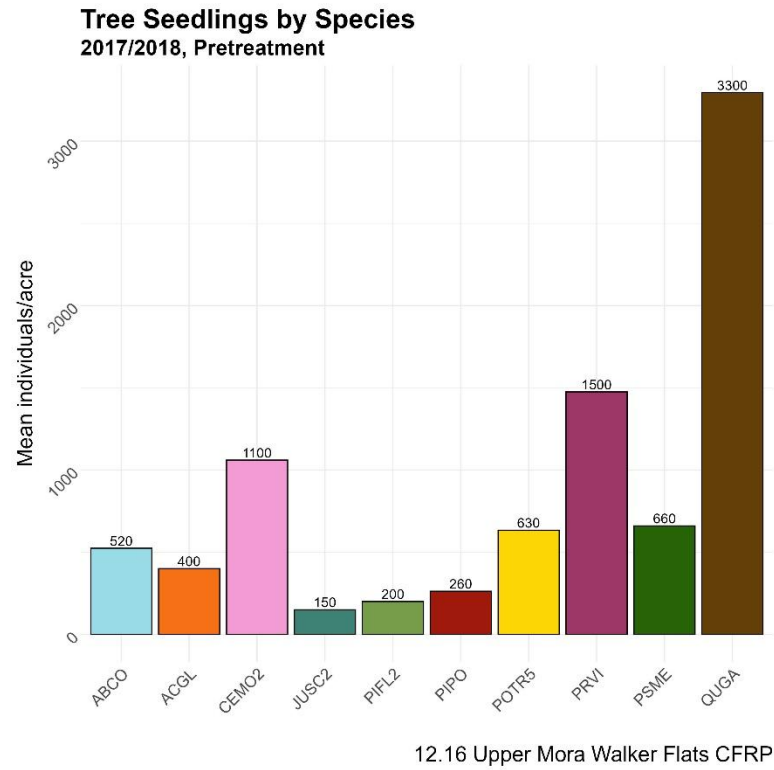
12.16 Upper Mora Walker Flats CFRP

Post-fire 2yrs: snag metrics by species

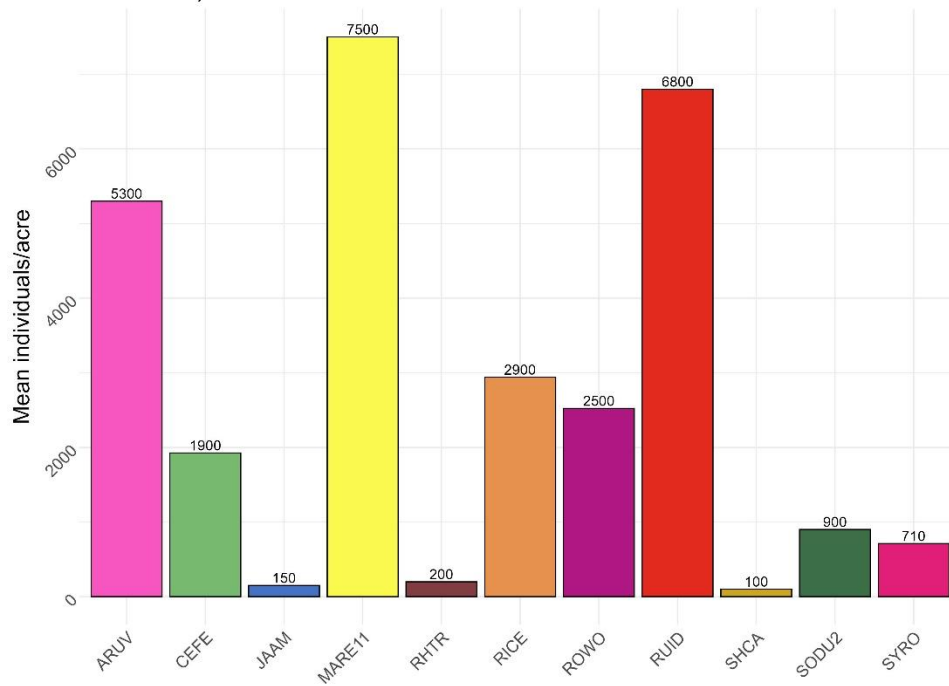


12.16 Upper Mora Walker Flats CFRP

Figure S28. The following figures show seedling and sapling densities by status and measurement period

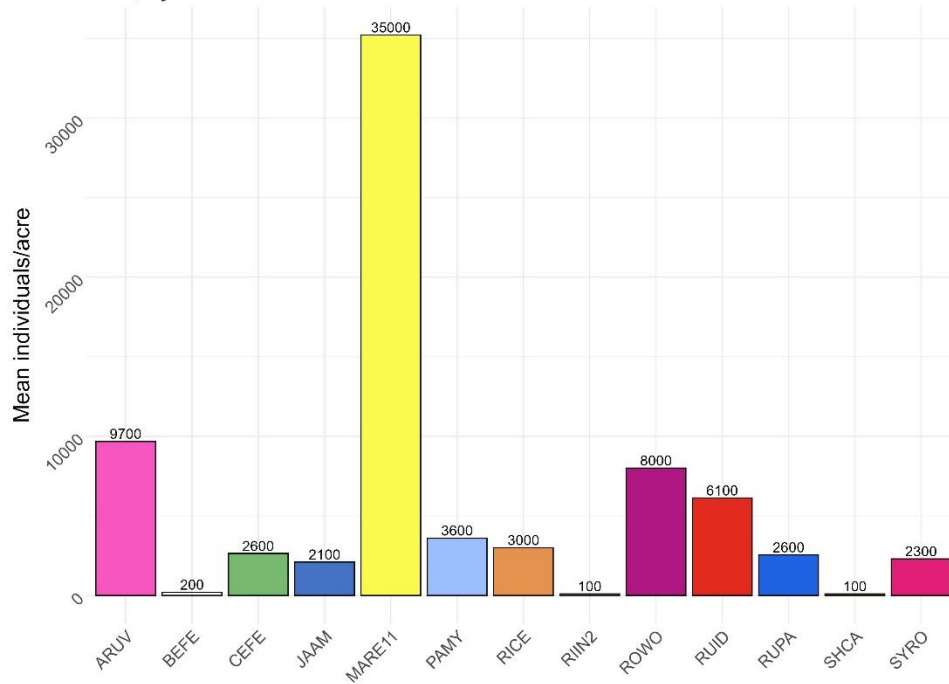


**Shrubs of Seedling Stature by Species**  
2017/20018, Pretreatment



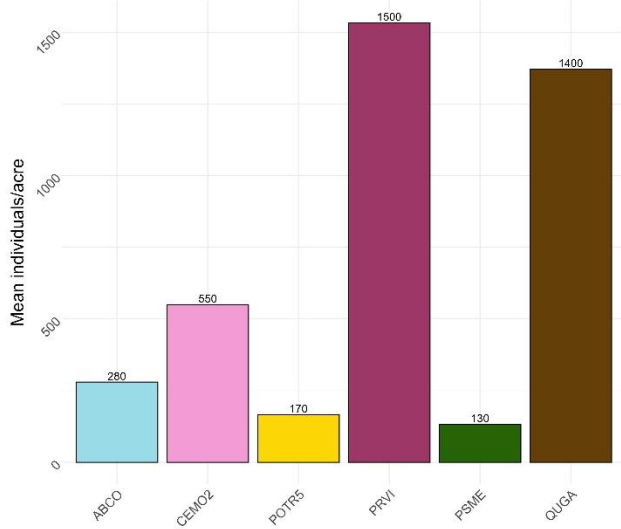
12.16 Upper Mora Walker Flats CFRP

**Shrubs of Seedling Stature by Species**  
2024, 2yrs Post-Fire



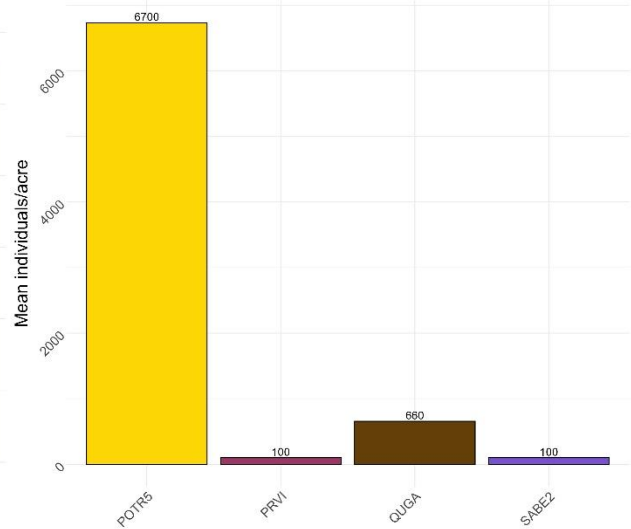
12.16 Upper Mora Walker Flats CFRP

**Tree Saplings by Species**  
2017/2018, Pretreatment



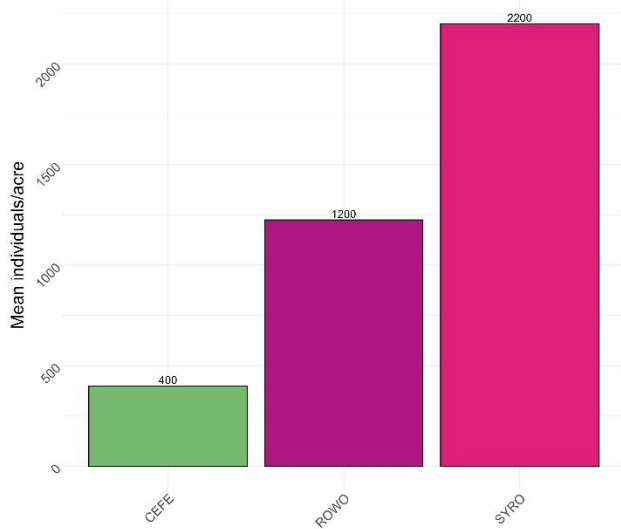
12.16 Upper Mora Walker Flats CFRP

**Tree Saplings by Species**  
2024, 2 years Post-Fire



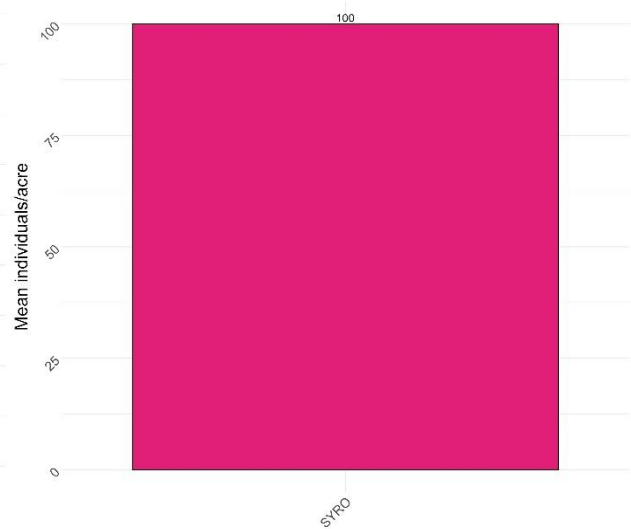
12.16 Upper Mora Walker Flats CFRP

**Shrubs of Sapling Stature by Species**  
2017/2018, Pretreatment



12.16 Upper Mora Walker Flats CFRP

**Shrubs of Sapling Stature by Species**  
2024, 2 yrs Post-Fire



12.16 Upper Mora Walker Flats CFRP