Tecolote Northridge Post-fire Immediate
Field Inventory Summary | 2023
New Mexico Forest and Watershed Restoration Institute

Photo by NMFWRI Field Crew

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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 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 June 2011 and July 2023, NMFWRI inventory and monitoring crews measured 10 plots across approximately 98 acres in the Encinoso Canyon region of the Tecolote Creek watershed in the Pecos-Las Vegas Ranger District of the Santa Fe National Forest. These plots were established within three Northridge units of the "Road 18 Habitat Improvement/Timber Sale" project. This project is accessible by Forest Road 18 off NM Highway 283 northwest west of Mineral Hill, in San Miguel County, New Mexico. The site is predominantly ponderosa pine, but includes Douglas fir, limber pine, and Gambel oak, and ranges in elevation between 7400 - 8400 feet with moderate to steep slopes.

As of 2011, the project was adjacent to designated Mexican Spotted Owl Critical Habitat, Restricted Habitat, and Goshawk post-fledgling area (PFA). The project area was thinned following 2011 pre-treatment data collection, but NMFWRI does not have further details on the treatment.

In spring 2022, all units were burned in the Hermit's Peak Calf Canyon (HPCC) wildfire at low to high composite burn severity. The Hermit's Peak fire began as an escaped prescribed burn in the Las Dispensas area 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, 24% was classified as high soil burn severity, 30% was classified as moderate soil burn severity, 37% was classified as low soil burn severity, and 9% was classified as unburned. More information about the HPCC wildfire is available here: https://storymaps.arcgis.com/stories/d48e2171175f4aa4b5613c2d11875653

Monitoring Methods

The NMFWRI monitoring crew followed the protocols published in the 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 1/10th acre fixed plots to assess tree size (diameter and height) and density (trees/acre). A nested sub-plot of 1/100th 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.

All raw data and photo points will be provided to the managers of the project area on their request; 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. These 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 wide variety of plot types across the project, ranging from intact forest with low post-fire tree mortality to highly burned areas with no surviving trees. Tree health concerns post-fire include bark beetles, mistletoe, foliage disease, fire scorch and/or char, fire scars, and bird damage (Error! Reference source not found.). Ponderosa pine remains the dominant growing stock species, with an absence of live limber pine and Gambel oak in the tree class immediately post-fire (**Figure 3**).

Growing stock basal area and tree density both decreased from pre-treatment to immediately post-fire measurements while mean diameter increased (**Figure 5**). Similarly, mean height and mean live crown base height both increased from the pre-treatment to post-fire measurements (**Figure 4**). Snag density, basal area, and diameter all increased from the pre-treatment to immediate post-fire measurements (**Figure 8**). A decline in canopy cover was noted between pre-treatment and immediate post-fire measurements (Error! Reference source not found.).

From pre-treatment to immediate post-fire measurements, total ladder fuel cover decreased in all fuel categories and total average biomass decreased as well (Error! Reference source not found.). Surface fuel loads also decreased in all categories immediately post-fire (Error! Reference source not found.), with all remaining thousand hour fuels classified as sound in decay class 2 (**Figure 20**).

Tree regeneration density almost tripled in the live seedling class immediately post-fire but no live saplings were recorded immediately post-fire. Shrub densities in the seedling class were low pre-treatment and increased by nearly 100-fold in the immediately post-fire measurement (**Figure 8**). Both dead tree seedlings and dead tree saplings increased from pre-treatment to immediately post fire (**Figure 9**).

Access to all plots remained good via driving and hiking for the 2023 measurement period.

Management Implications:

While some plots experienced complete or near-complete tree mortality post-fire (primarily in Unit 1 – plots 1A, 1B, and 1C), others retained a living ponderosa pine overstory as a result of the "patchwork" style burn through this project area. Oaks accounted for almost all regeneration measured immediately post-fire and some high-mortality plots may be susceptible to conversion to oak scrubland without management intervention. However, a mixture of burn severities across this project created opportunities for seed-trees in intact stands to assist in the regeneration of adjacent high-severity patches. While bare soil was estimated to account for 23% of ground cover post-fire, a large increase of post-fire shrub species such as Fendler's ceanothus (*Ceanothus fendleri*) and leadplant (*Amorpha canescens*) may be contributing to soil stabilization of this area. The crew also noted abundant mullein (*Verbascum thapsus)* growing on plots. While a non-native species of potential concern for outcompeting native plants, mullein may also be playing a role in soil stabilization during the initial post-fire recovery period.

Data trends (increasing live crown base height, substantially reduced surface fuels and ladder fuels) suggest this project area has a decreased capacity to support additional high-severity fire. However, an increase in snag density as well as abundant regrowth by one season post-fire suggest surface and ladder fuels may rebound in coming years. Additional monitoring is needed to determine ongoing adaptive management strategies as the post-fire ecosystem develops.

__Table 1.__ Summary table: Tecolote Northridge. Species dominance is based on numeric density.

Tecolote Northridge		
Metric	**2011 PreTreatment**	**2023 PostFireImmediate**
Dominant Growing Stock Species	PIPO	PIPO
Dominant Snag Species	PIPO	PIPO
Dominant Live Seedling	QUGA	QUGA
Dominant Live Sapling	PIPO	PSME
Dominant Live Shrub (Seedling Class)		AMCA6
Average Aspect (degrees)	125	129
Trees per Acre (growing stock)	329	87.5
Basal Area (growing stock, sqft/acre)	133	68.3
QMD (growing stock, inches)	8.96	12.6
Average Tree Height (ft)	35.3	43.6
Average Live Crown Base Height (ft)	18.9	23.5
Height of Tallest Tree (ft)	78	81.8
Live Tree Seedlings Per Acre	698	1560
Live Tree Saplings Per Acre	15	0
Live Shrub Seedlings Per Acre		485
Tree Canopy Cover (%)	65	38
Grass & Forb Cover (%)		32
Total Tons Surface Fuels per Acre	21.6	11.4

Note: For a list of species by full name, please see Supplementary Information.

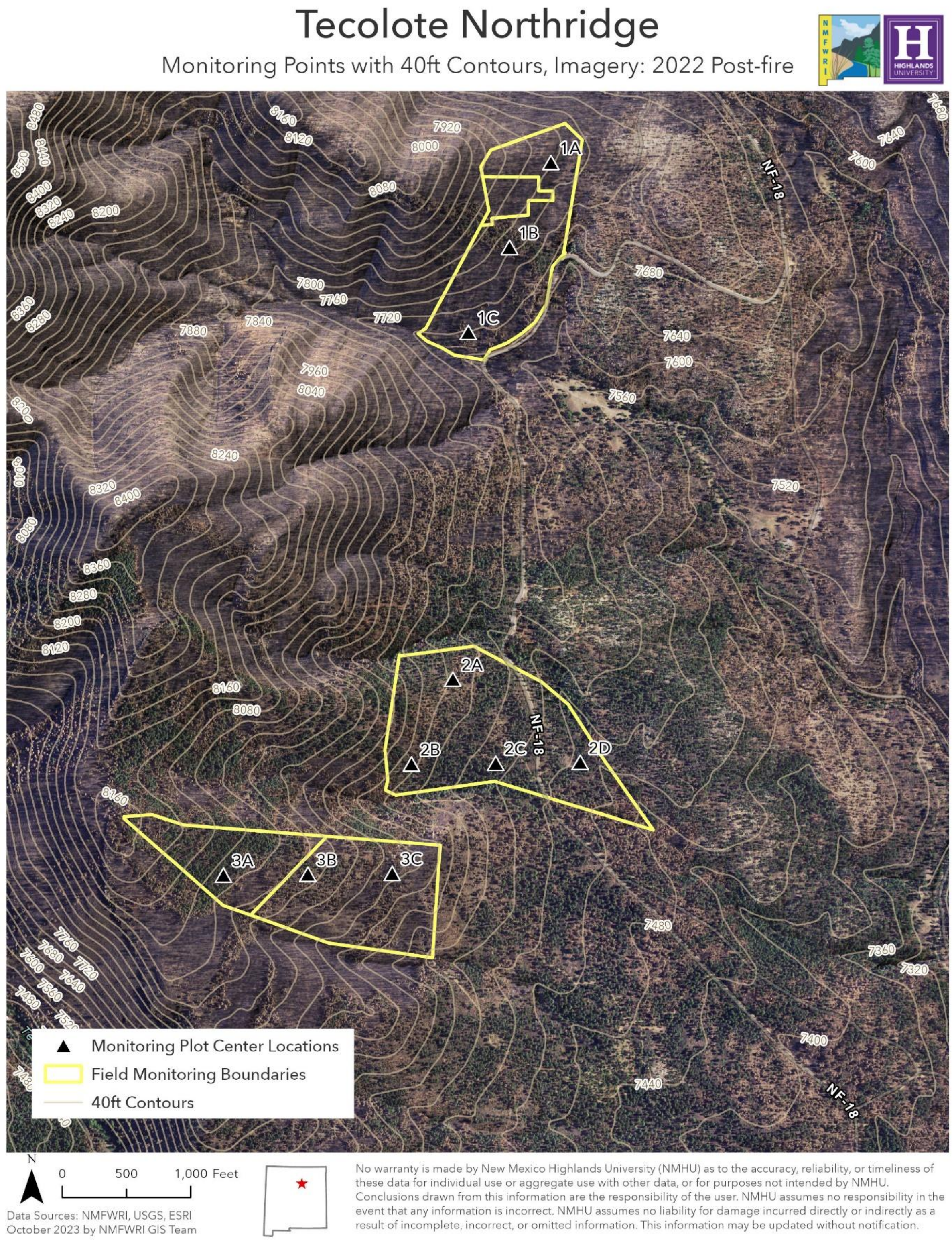


***Figure 1**. Map of Tecolote Northridge project areas and plots with post-fire satellite imagery*

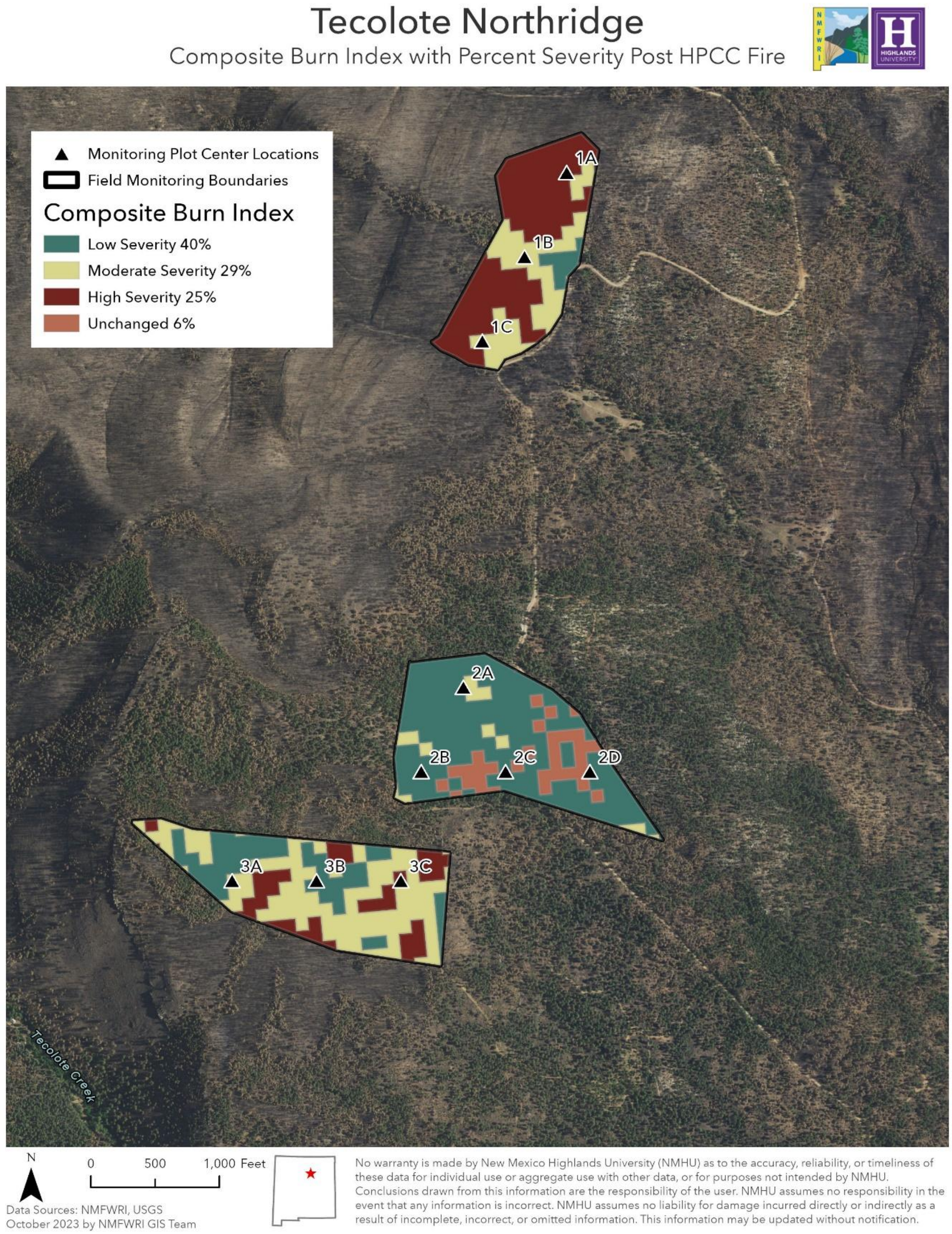


Figure 2. *Map of Tecolote Northridge project areas and plots overlaid on composite burn index from the Hermit's Peak Calf Canyon fire. Percent coverage of each burn severity category within the project area is listed in the legend.*

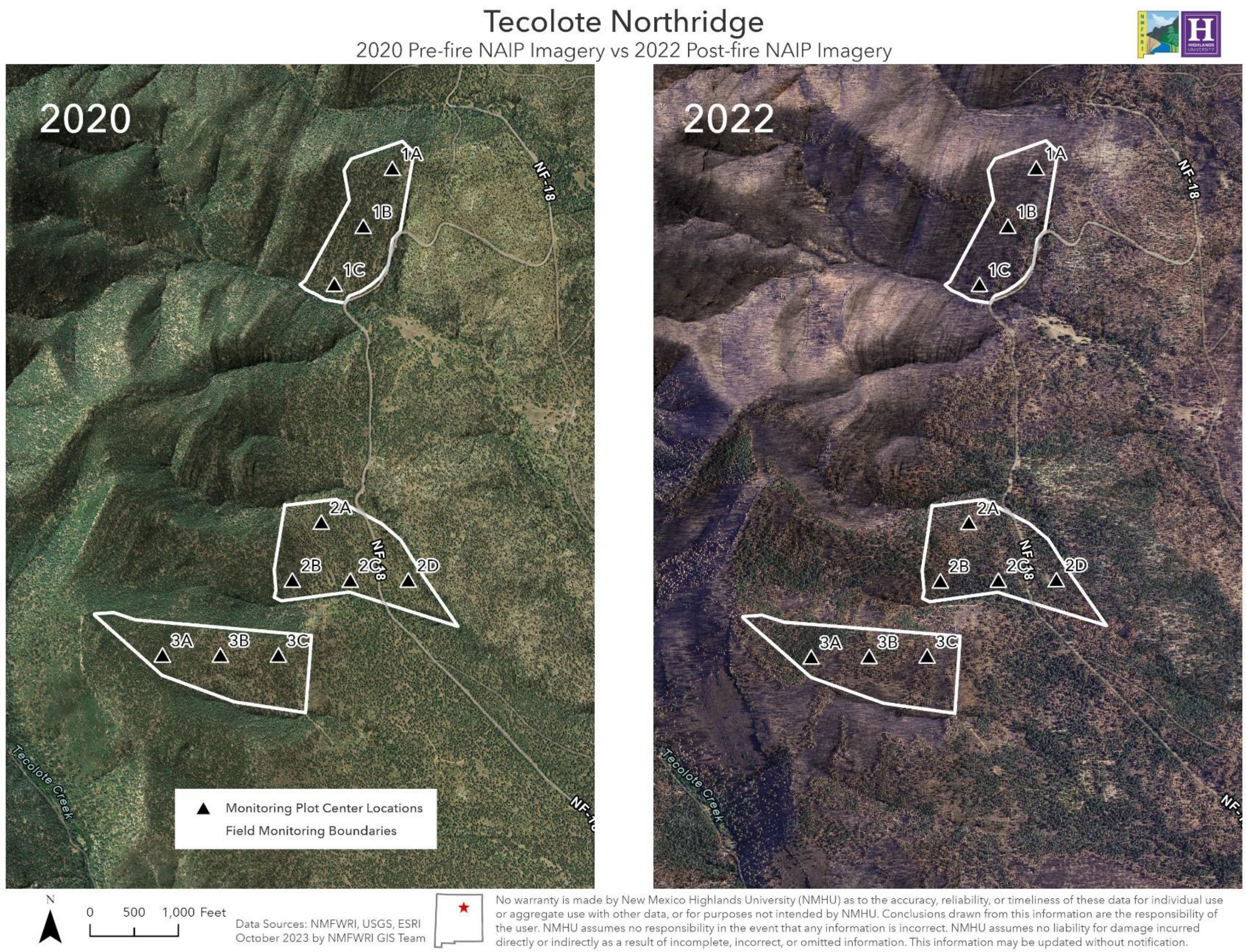


Figure 3. *Map of Tecolote Northridge project area and plots with 2020 pre-fire satellite imagery and 2022 post-fire satellite imagery following the Hermits Peak Calf Canyon fire*

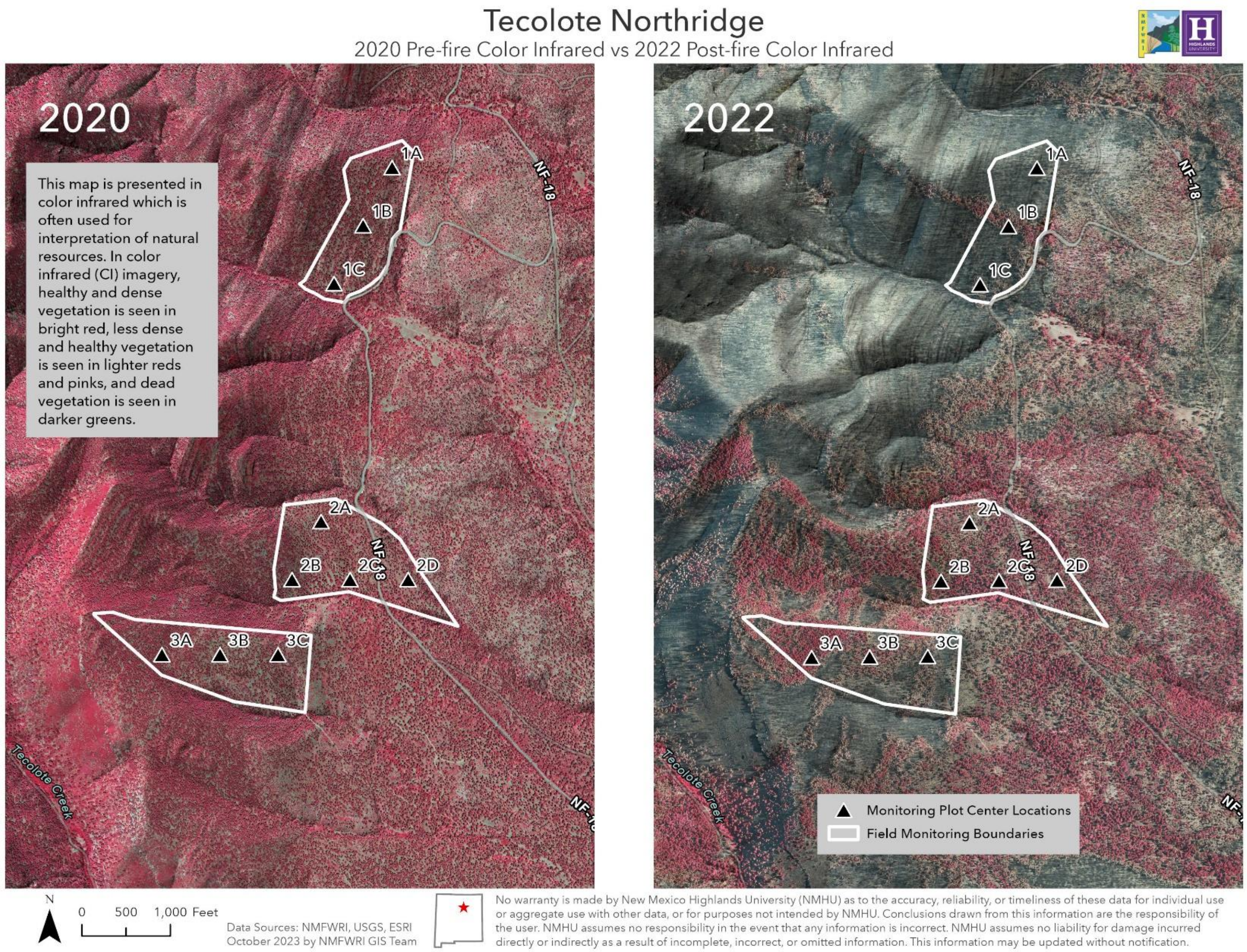


Figure 4. *Map of Tecolote Northridge project area and plots with 2020 pre-fire color infrared imagery and 2022 post-fire color infrared imagery following the Hermits Peak Calf Canyon fire*

Monitoring Detail - Tree Component

Overstory Trees

The overstory was dominated by ponderosa pine across all monitoring statuses for live trees and snags both pre-treatment and immediately post-fire. Other overstory components include Douglas fir, Gambel oak, and limber pine. While live limber pine was recorded in the overstory pre-treatment, immediately post-fire all limber pine recorded were snags. Trees labeled “2TEN” were too decayed or too burned to identify reliably to species.

***Table 2**. Information for species found in the project area.*

Species Symbol	Scientific Name	Common Name
PIFL2	*Pinus flexilis*	limber pine
PIPO	*Pinus ponderosa*	ponderosa pine
PSME	*Psuedotsuga menziesii*	Douglas-fir
QUGA	*Quercus gambelii*	Gambel oak
2TEN		unknown conifer*

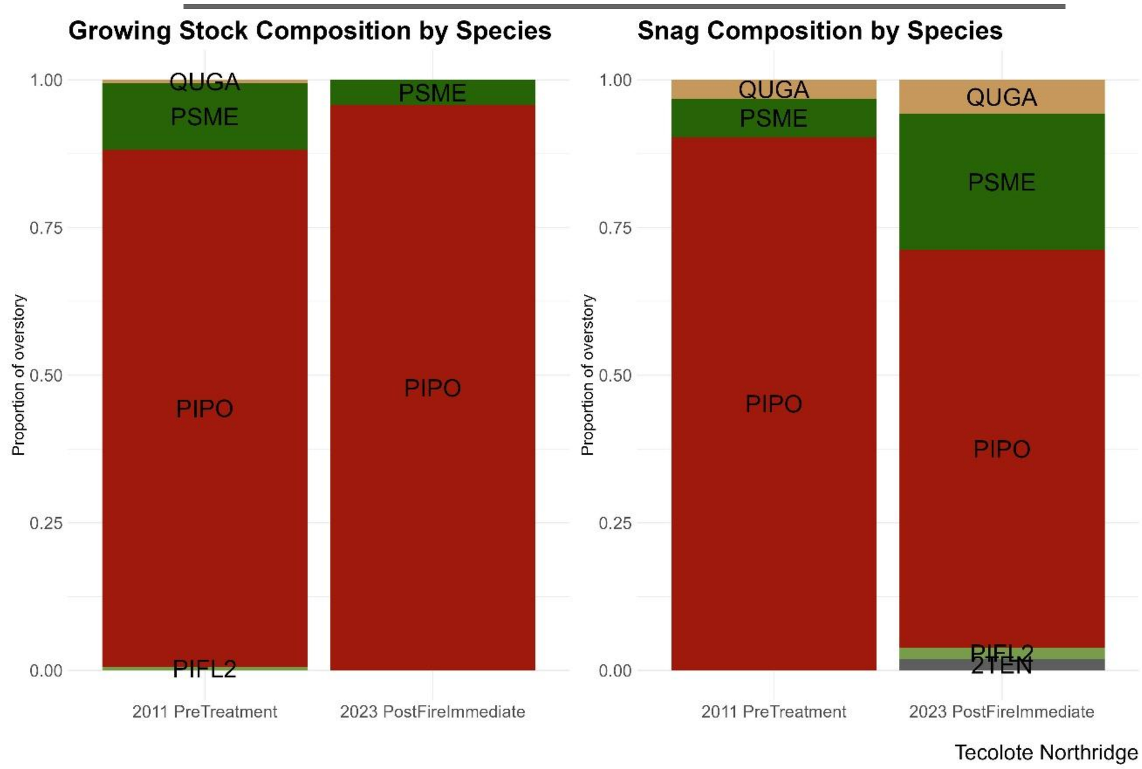


***Figure 5.** Species composition by status across both measurement periods for all trees (>1” DBH).*

Growing Stock

Growing stock mean height increased from 36 ft pre-treatment to 48 ft immediately post-fire as smaller trees were consumed and killed by fire, and possibly in the treatment as well. Likewise, mean live crown base height increased from 19 ft pre-treatment to 28 feet immediately post-fire, likely due to both a loss of smaller trees and scorch of lower branches on many trees.

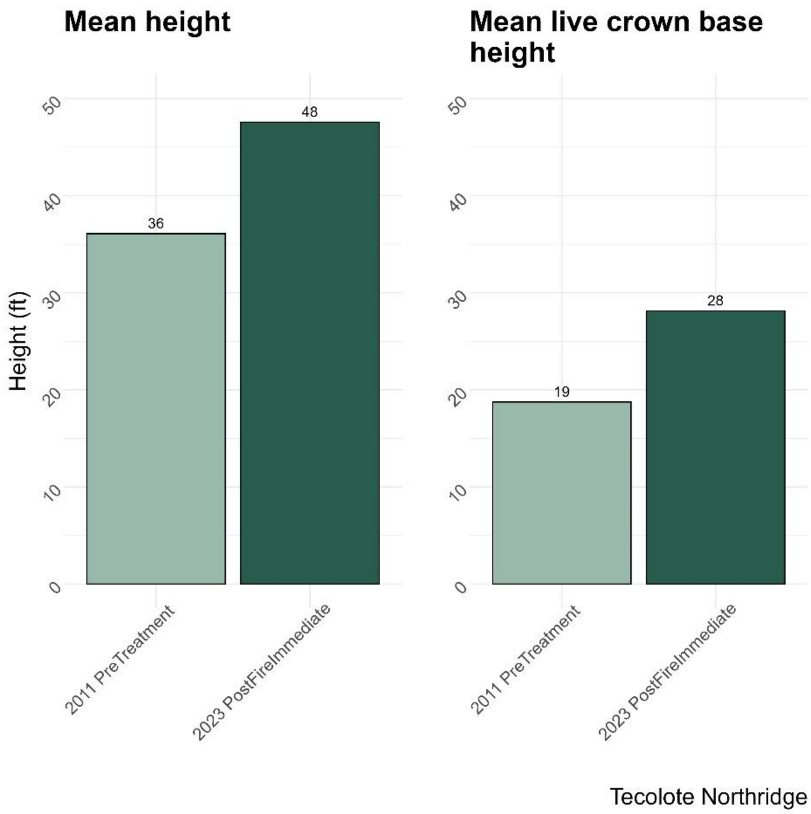


Figure 6. *Mean height and live crown base height for growing stock trees (>1" DBH, live + sick status). Mean values represent averages of plot means for each monitoring status.*

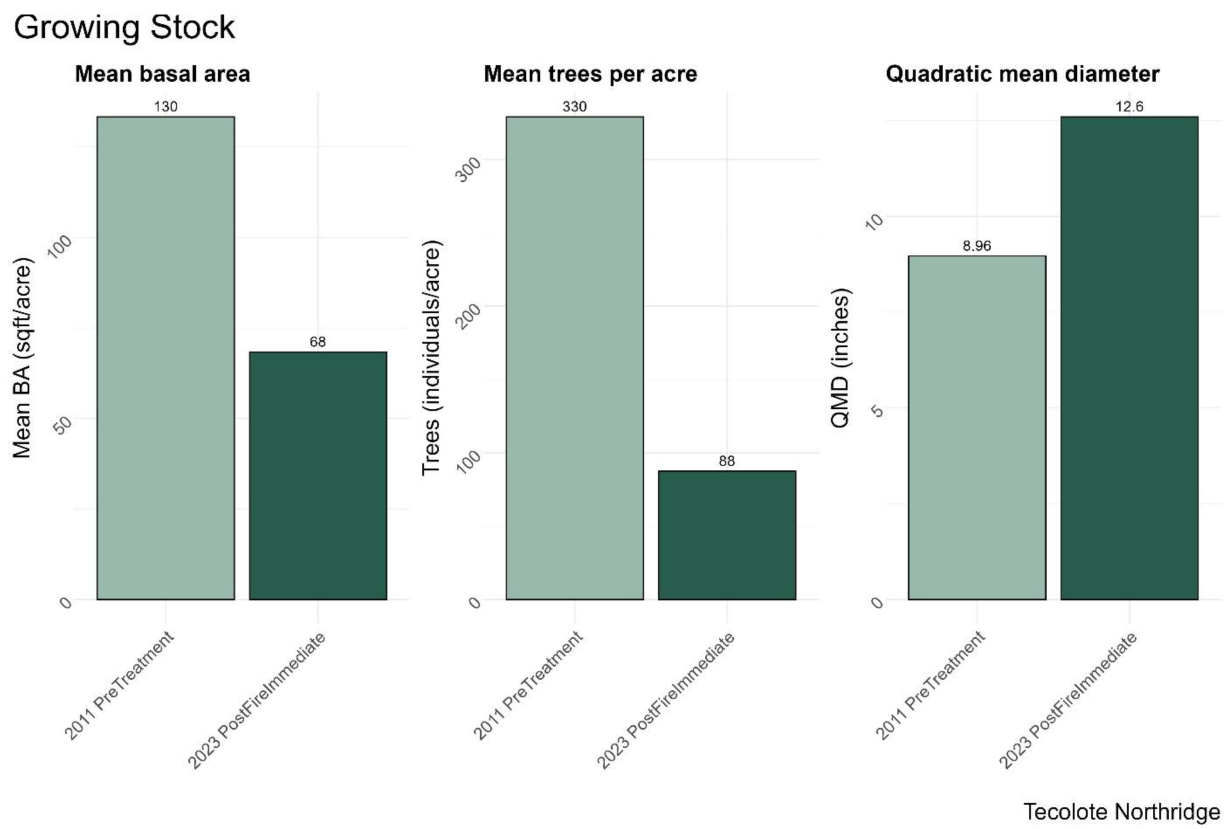


Figure 7*. Mean basal area, mean trees per acre, and quadratic mean diameter for growing stock trees across both measurement periods (>1" DBH, live + sick status). Mean values represent averages of plot means for each monitoring status.*

21.3% of Growing Stock trees persisted following thinning treatments and the HPCC wildfire as of 2023

This is a **78.7%** Mortality rate

Mean basal area and mean trees per acre decreased from 2011 Pretreatment to 2023 PostFireImmediate. This indicates a decrease in number of trees, due to both thinning treatments and fire mortality. Quadratic mean diameter across plots increased from 8.96in to 12.6in immediately post-wildfire, showing that larger trees were more likely to be preserved in thinning treatments and were more likely to survive the HPCC wildfire. A breakdown of these metrics by tree species is available in the Supplementary Figures (Figures 24-27).

A histogram of the size profile of the growing stock by diameter show a substantial decrease in the overall number of growing stock trees from the pre-treatment to immediately post-wildfire measurements. This decrease is paired with an increase in mean diameter, height, and live crown base height, illustrating the selective retention of larger trees.

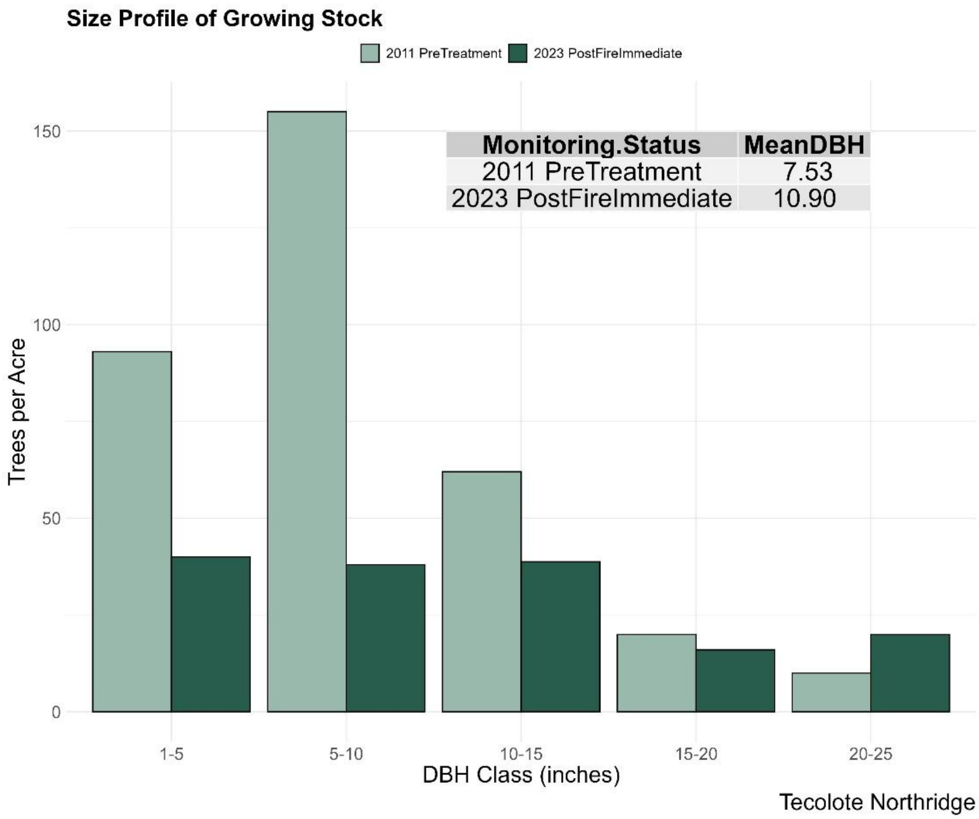


Figure 8. *Histogram of growing stock trees per acre by diameter class and monitoring status*

Snags

Snag mean basal area increased substantially from 8.6 sqft/acre pre-treatment to 37 sqft/acre immediately post-fire. Following a similar trend, mean snags per acre increased from 31 trees per acre pre-treatment to 65 trees per acre immediately post-fire. Additionally, snag quadratic mean diameter increased from 6.74” pre-treatment to 9.68” immediately post-fire. These patterns illustrate an increase in snags overall, as well as an increase in the size of snags following treatment and fire.

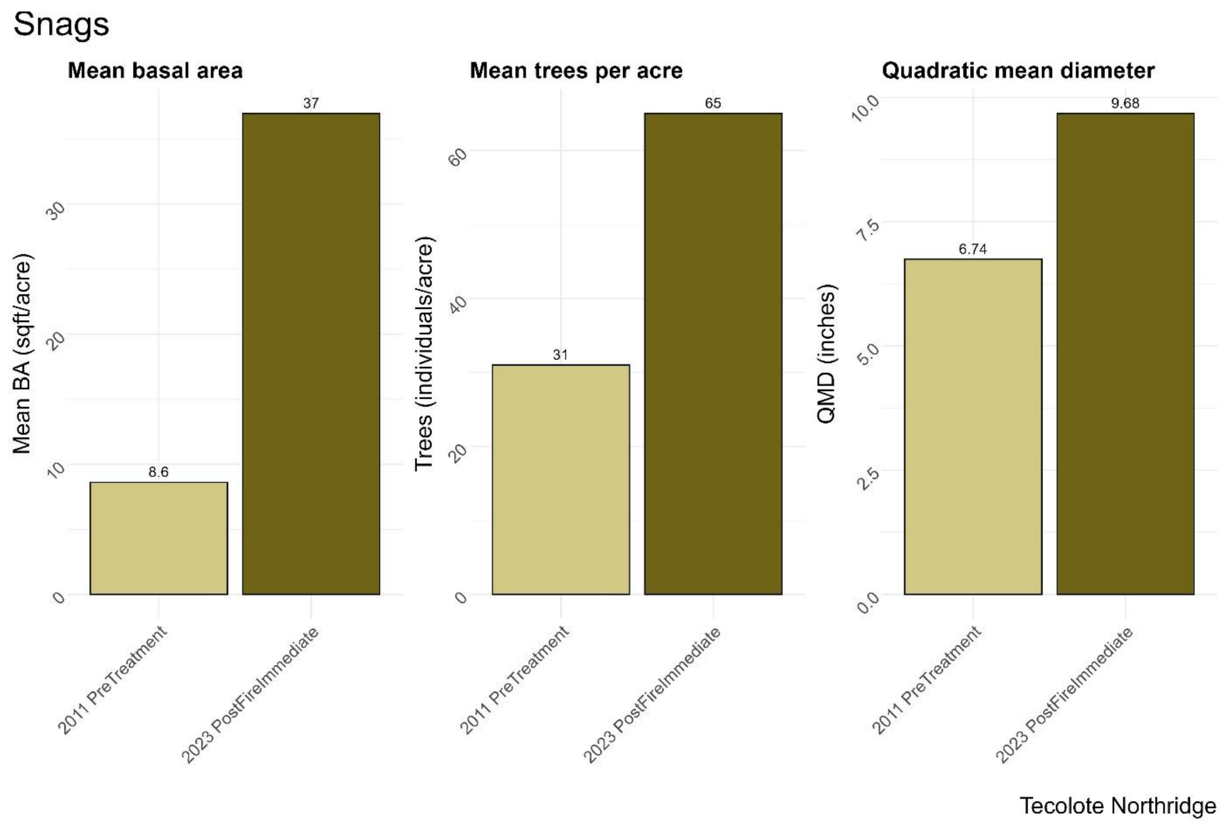


Figure 9. *Mean basal area, mean trees per acre, and quadratic mean diameter for snags across both measurement periods (>1” DBH). Mean values represent averages of plot means for each monitoring status.*

A histogram of the size profile of snags by diameter show an increase in snags in larger diameter and height classes from the pre-treatment to post-fire immediate measurements. Notably, the density of snags in the shorter height classes decreases (due to removal during treatments and consumption during fire) while the density of snags in taller height classes increases substantially as live trees were killed during fire.

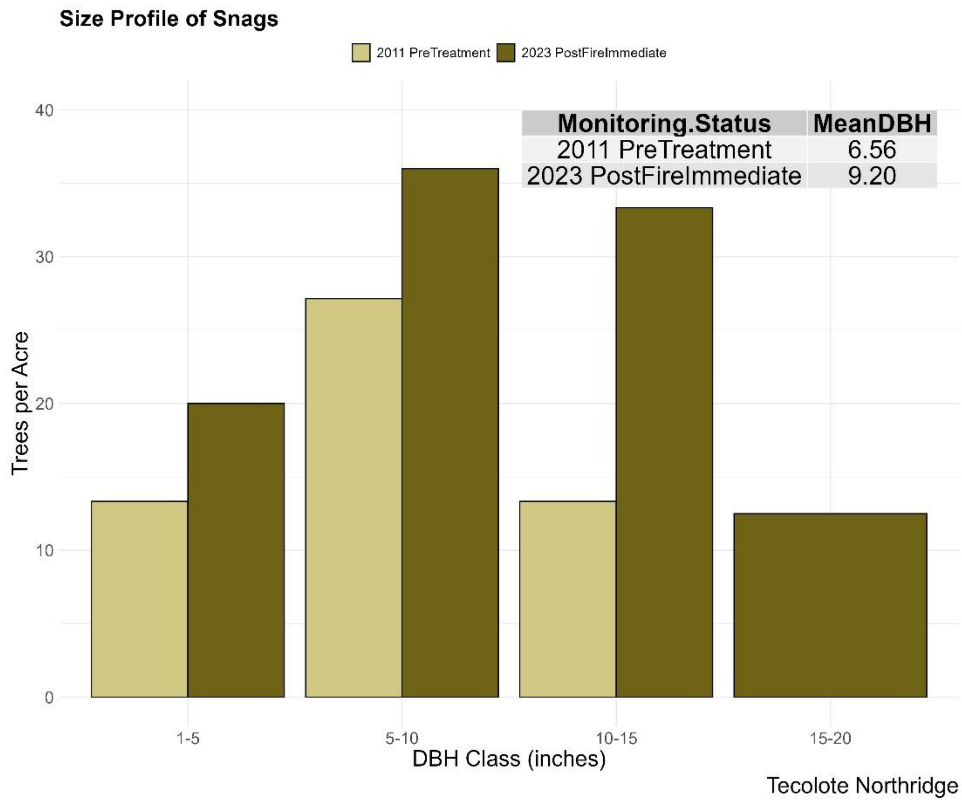


Figure 10. *Histograms of snags per acre by diameter class and height class.*

Damages

Damage codes were not recorded in the 2011 pre-treatment measurement. The observations that are shown here were added through individual tree comments. Immediately post wildfire in 2023, the most common damage recorded for growing stock trees was char or scorch. The severity of this damage is recorded as char and scorch heights in the following section of this report. There were additionally 13 observations of bird damage, 9 observations of bark beetle, and 8 observations each of mistletoe and witches broom deformities. Note that count represents the number of observations of each damage type, individual trees may have more than one damage recorded.

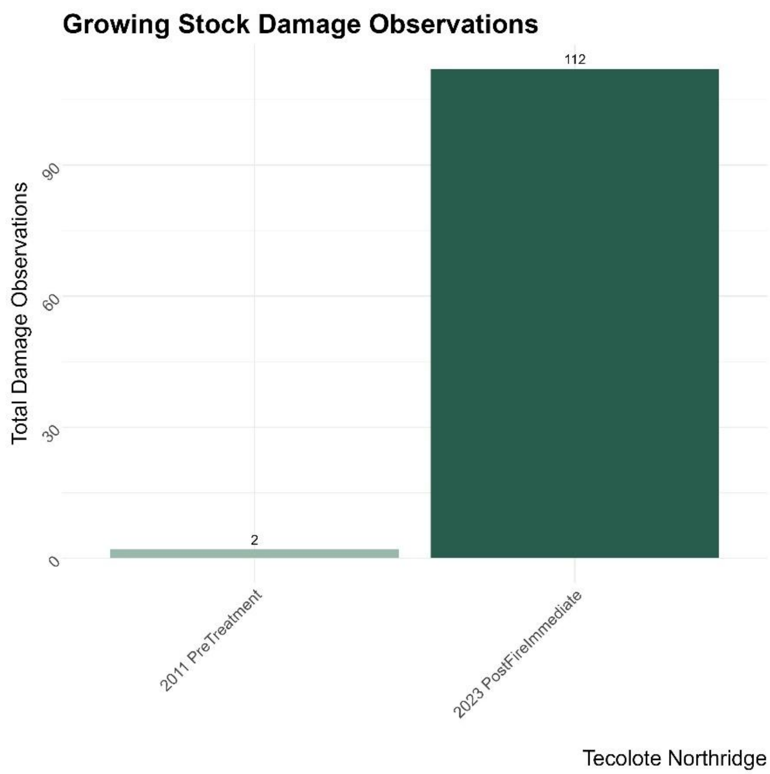


Figure 11. *Counts of damages recorded to growing stock trees in each monitoring year.*

Table 3. *List of damages observed on living 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*

Tecolote Northridge : Growing Stock Trees by Damage Code			
Monitoring.Status	**Damage**	**Count**	**Description**
2011 PreTreatment	23,001	1	Mistletoe
	99,026	1	Wounds or cracks
2023 PostFireImmediate	30,000	69	Fire scar, char and/or scorch
	41,010	13	Bird damage
	11,000	9	Bark beetles
	23,001	8	Mistletoe
	25,000	8	Witches' broom
	99,036	2	Fire scar (catface)
	10,000	1	General insects
	99,002	1	Dead top
	99,004	1	Uncharacteristic forked top, above or below DBH

The 2 PreTreatment damages reported for snags were entered retrospectively based on individual tree comments. As with growing stock trees, the most common damage reported for snags was fire damage, followed by bird damage. Note that bird damage on dead trees is a natural component of forest decay processes.

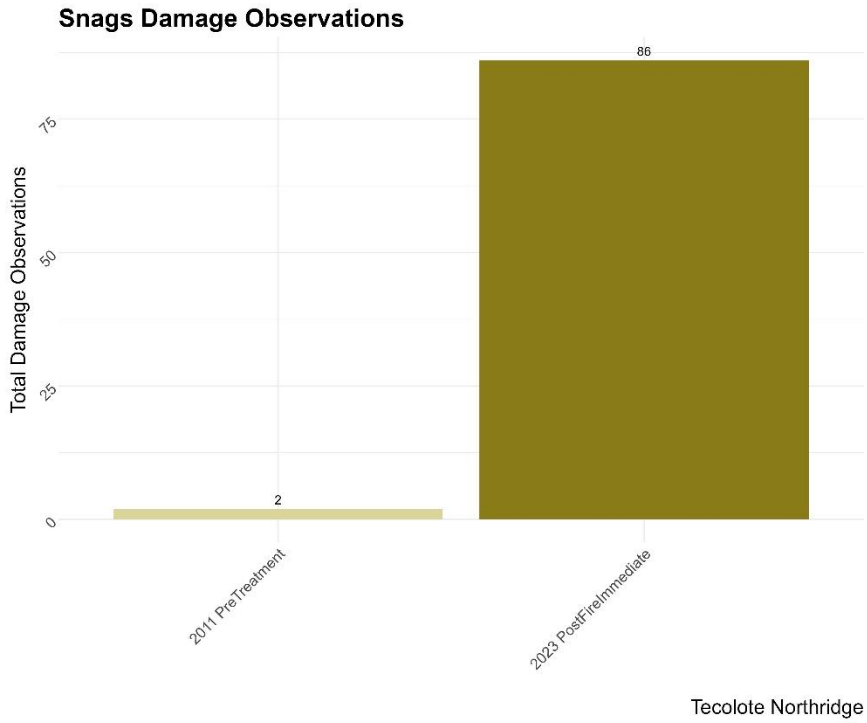


Figure 12. *Counts of damages recorded for dead trees in each monitoring year.*

Table 4. *List of damages observed on dead 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.*

Tecolote Northridge : Snags by Damage Code			
Monitoring.Status	**Damage**	**Count**	**Description**
2011 PreTreatment	99,001	2	Broken top
2023 PostFireImmediate	30,000	51	Fire scar, char and/or scorch
	41,010	21	Bird damage
	11,000	6	Bark beetles
	99,004	4	Uncharacteristic forked top, above or below DBH
	25,000	3	Witches' broom
	99,001	1	Broken top

Char & Scorch

Immediately post-fire, char height (highest point of blackened bark) averaged 22 ft and scorch height (highest point of heat-killed needles) averaged 34 ft across all trees, living or dead, in the project. 97.5% of all trees were charred, but only 76.0% of trees were scorched. Plot to plot, these values varied extensively, with some trees experiencing complete char/scorch of total tree height and others minimally affected.

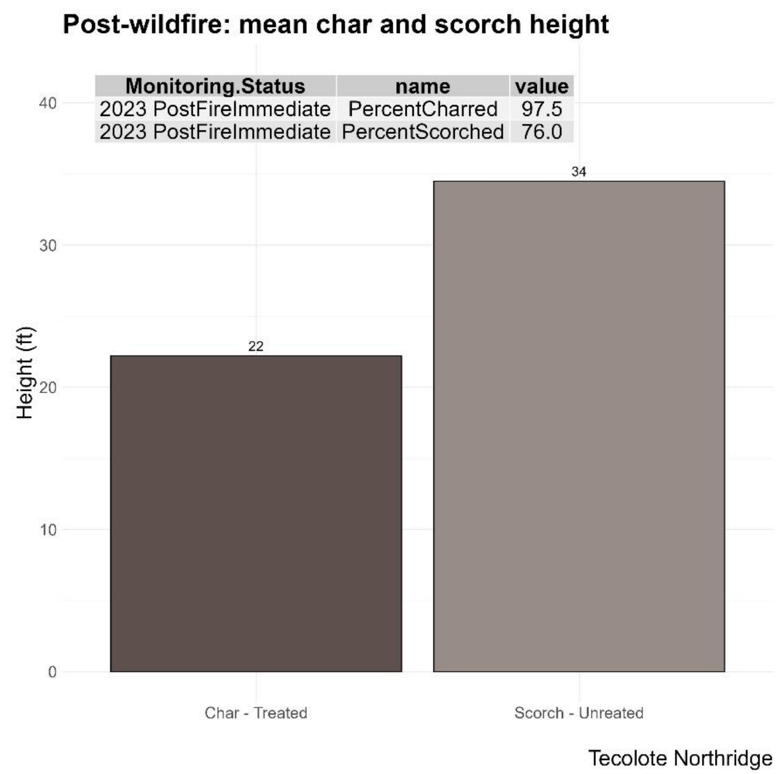


Figure 13. *Mean tree char and scorch heights. Mean values represent averages of plot means for each monitoring status.*

Seedlings, Saplings, & Shrubs

Mean live tree seedling density was approximately 3,500 individuals/acre pre-treatment and increased to 9,300 individuals/acre immediately post-fire. Mean dead tree seedling density also increased from 20 individuals/acre pre-treatment to 3,000 individuals/acre immediately post-fire. Shrub regeneration was not recorded pretreatment, but was recorded at 970 individuals/acre immediately post-fire.

Mean live tree sapling density was 30 individuals per acre pre-treatment, but no live tree saplings were detected in the immediate post-fire measurement. No dead tree saplings were detected pre-treatment, but immediately post-fire dead tree sapling density was 10 individuals per acre. No live or dead shrubs were recorded in the sapling class in either measurement period.

These results show an increase in dead seedlings and saplings following fire, but also an increase in live regeneration in the seedling class post-fire. Tree seedling regeneration was composed almost entirely of oak species. See Supplementary Figures for species breakdown of regeneration densities (Figures 28-30).

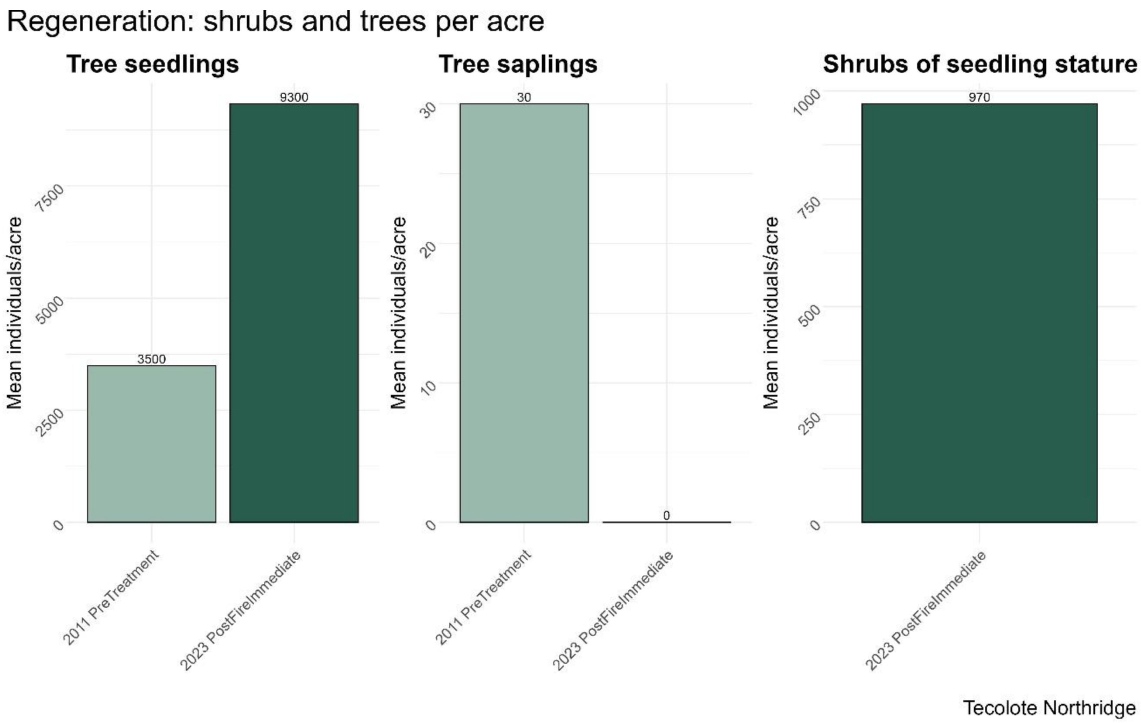


__Figure 14__. Regeneration densities of trees and shrubs in the seedling and sapling classes across both measurement periods. Shrub regeneration was not recorded in 2011 Pretreatment.

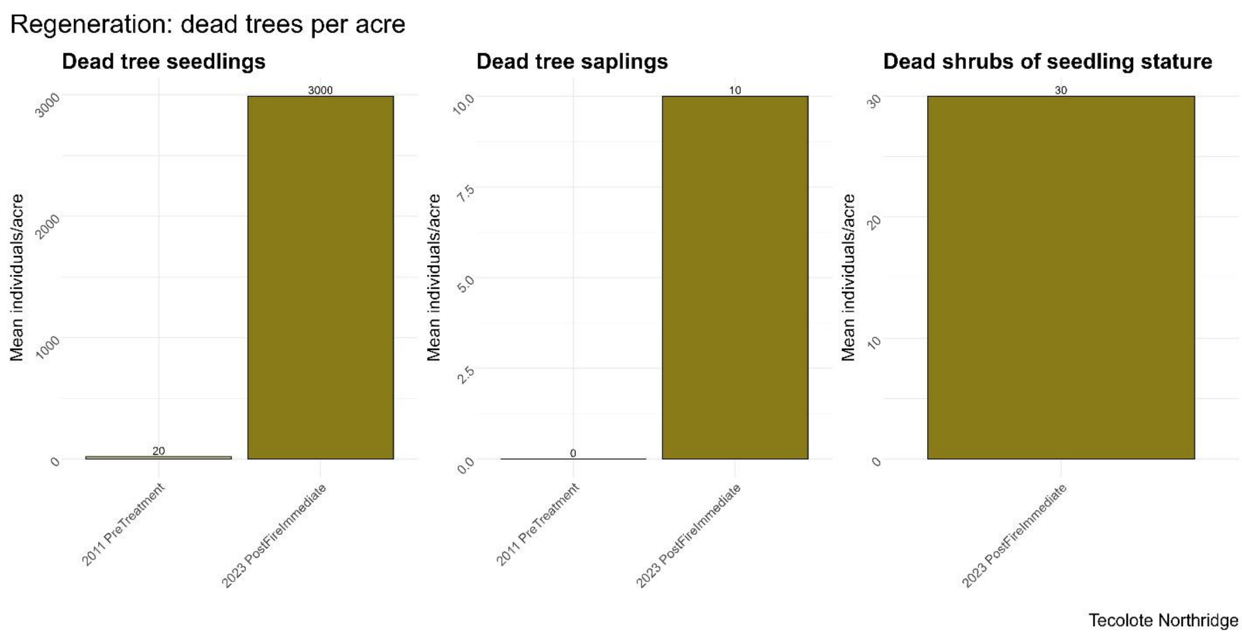


__Figure 15__. Regeneration densities of dead trees and shrubs in the seedling and sapling classes across both measurement periods. Shrub regeneration was not recorded in 2023 PostFireImmediate.

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.

Table 5. *Stand table of forestland species metrics for the 2011 pre-treatment measurement period.*

Forestland Species		Saplings			Pole			Mature Trees											Total by Species & Covertype	%Species for all G-Stock
Diameter Class		*0*	*2*	*4*	*6*	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*	*28*	*30*	*32*		
PIPO Ponderosa pine	COUNT	0	37	37	58	57	51	17	13	8	1	8	1	0	0	0	0	0	*288*	
	TPA	0.00	37.00	37.00	58.00	57.00	51.00	17.00	13.00	8.00	1.00	8.00	1.00	0.00	0.00	0.00	0.00	0.00	*288*	*88%*
	BA/AC	0.00	0.85	3.37	11.16	19.78	27.41	12.80	13.43	10.92	1.91	16.81	2.43	0.00	0.00	0.00	0.00	0.00	*121*	*91%*
	AVE HT. (HL)	0.00	13.84	25.53	33.06	40.10	44.35	49.16	55.75	56.63	58.00	61.39	76.00	0.00	0.00	0.00	0.00	0.00		
PSME Douglas-fir	COUNT	0	11	4	6	6	4	1	4	1	0	0	0	0	0	0	0	0	*37*	
	TPA	0.00	11.00	4.00	6.00	6.00	4.00	1.00	4.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*37*	*11%*
	BA/AC	0.00	0.19	0.37	1.22	2.07	2.26	0.73	3.98	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*12*	*9.3%*
	AVE HT. (HL)	0.00	13.46	21.31	33.34	37.85	42.12	55.00	54.18	49.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
PIFL2 Limber pine	COUNT	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*2.0*	
	TPA	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*2.0*	*0.61%*
	BA/AC	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*0.011*	*0.0082%*
	AVE HT. (HL)	0.00	8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Forestland Species Sub-total	*COUNT*	*0*	*50*	*41*	*64*	*63*	*55*	*18*	*17*	*9*	*1*	*8*	*1*	*0*	*0*	*0*	*0*	*0*	*327*	
	TPA	*0.00*	*50.00*	*41.00*	*64.00*	*63.00*	*55.00*	*18.00*	*17.00*	*9.00*	*1.00*	*8.00*	*1.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*327*	*100%*
	BA/AC	*0.00*	*1.06*	*3.75*	*12.38*	*21.85*	*29.67*	*13.54*	*17.41*	*12.42*	*1.91*	*16.81*	*2.43*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*133*	*100%*
	AVE HT. (HL)	*0.00*	*14*	*25*	*33*	*40*	*44*	*49*	*55*	*56*	*58*	*61*	*76*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*		
Summary by Size Class for Forestland Species	*TPA*	*91*			*182*			*54*											*327*	
	TPA %	*28%*			*56%*			*17%*											*100%*	
	BA/AC	*4.8*			*64*			*65*											*133*	
	BA/AC %	*3.6%*			*48%*			*48%*											*100%*	
	QUADRATIC MEAN DIA.	*3.11*			*8.02*			*14.8*											*8.64*	
	AVE HT. (HL)	*23*			*41*			*57*											*48*	

Stand Total		Saplings			Pole			Tree or Sawlog											Total by Class, Growing Stock & Dead	% by Class, Growing Stock vs Dead
Diameter Class		*0*	*2*	*4*	*6*	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*	*28*	*30*	*32*		
Growing Stock (All living trees in woodland & forestland)	COUNT	0	50	43	64	63	55	18	17	9	1	8	1	0	0	0	0	0	***329***	
	TPA	0.00	50.00	43.00	64.00	63.00	55.00	18.00	17.00	9.00	1.00	8.00	1.00	0.00	0.00	0.00	0.00	0.00	***329***	***91%***
	BA/AC	0.00	1.06	3.85	12.38	21.85	29.67	13.54	17.41	12.42	1.91	16.81	2.43	0.00	0.00	0.00	0.00	0.00	***133***	***94%***
	AVE HT, HL	0.00	14	25	33	40	44	49	55	56	58	61	76	0.00	0.00	0.00	0.00	0.00		
Summary by Size Class (All living trees in woodland & forestland)	TPA	93.00			182.00			54.00											***329***	
	TPA %	28.27%			55.32%			16.41%											***100%***	
	BA/AC	4.90			63.90			64.52											***133***	
	BA/AC %	3.68%			47.93%			48.39%											***100%***	
	QMD MEAN DIA.	3.11			8.02			14.80											***8.62***	
	AVE HT, HL	22			41			57											***48***	
Dead (All dead trees in woodland & forestland)	COUNT	0	2	6	11	7	1	3	1	0	0	0	0	0	0	0	0	0	***31***	
	TPA	0.00	2.00	6.00	11.00	7.00	1.00	3.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***31***	***8.6%***
	BA/AC	0.00	0.05	0.49	2.16	2.20	0.46	2.11	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***8.6***	***6.1%***
	AVE HT, HL	0.00	18	16	26	23	10	15	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***19***	
Total for all sample trees including Growing Stock and Dead	COUNT	0	52	49	75	70	56	21	18	9	1	8	1	0	0	0	0	0	***360***	
	TPA	0.00	52.00	49.00	75.00	70.00	56.00	21.00	18.00	9.00	1.00	8.00	1.00	0.00	0.00	0.00	0.00	0.00	***360***	***100%***
	BA/AC	0.00	1.11	4.34	14.54	24.06	30.13	15.64	18.56	12.42	1.91	16.81	2.43	0.00	0.00	0.00	0.00	0.00	***142***	***100%***

Table 6. *Stand table of forestland species metrics for the 2023 post-wildfire immediate measurement period.*

Forestland Species		Saplings			Pole			Mature Trees											Total by Species & Covertype	%Species for all G-Stock
Diameter Class		*0*	*2*	*4*	*6*	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*	*28*	*30*	*32*		
PIPO Ponderosa pine	COUNT	0	7	1	2	11	11	20	3	5	0	5	2	0	0	0	0	0	*67*	
	TPA	0.00	7.00	1.00	2.00	11.00	11.00	20.00	3.00	5.00	0.00	5.00	2.00	0.00	0.00	0.00	0.00	0.00	*67*	*96%*
	BA/AC	0.00	0.05	0.13	0.40	3.80	6.04	15.53	3.13	7.02	0.00	10.87	5.38	0.00	0.00	0.00	0.00	0.00	*52*	*96%*
	AVE HT. (HL)	0.00	6.93	20.20	25.36	34.09	46.71	49.20	52.77	53.48	0.00	66.44	79.95	0.00	0.00	0.00	0.00	0.00		
PSME Douglas-fir	COUNT	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	*3.0*	
	TPA	0.00	0.00	0.00	0.00	1.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*3.0*	*4.3%*
	BA/AC	0.00	0.00	0.00	0.00	0.31	0.00	0.00	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*2.3*	*4.3%*
	AVE HT. (HL)	0.00	0.00	0.00	0.00	33.90	0.00	0.00	55.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Forestland Species Sub-total	*COUNT*	*0*	*7*	*1*	*2*	*12*	*11*	*20*	*5*	*5*	*0*	*5*	*2*	*0*	*0*	*0*	*0*	*0*	*70*	
	TPA	*0.00*	*7.00*	*1.00*	*2.00*	*12.00*	*11.00*	*20.00*	*5.00*	*5.00*	*0.00*	*5.00*	*2.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*70*	*100%*
	BA/AC	*0.00*	*0.05*	*0.13*	*0.40*	*4.11*	*6.04*	*15.53*	*5.15*	*7.02*	*0.00*	*10.87*	*5.38*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*55*	*100%*
	AVE HT. (HL)	*0.00*	*7*	*20*	*25*	*34*	*47*	*49*	*54*	*53*	*0.00*	*66*	*80*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*		
Summary by Size Class for Forestland Species	*TPA*	*8.0*			*25*			*37*											*70*	
	TPA %	*11%*			*36%*			*53%*											*100%*	
	BA/AC	*0.18*			*11*			*44*											*55*	
	BA/AC %	*0.33%*			*19%*			*80%*											*100%*	
	QUADRATIC MEAN DIA.	*2.02*			*8.79*			*14.8*											*12.0*	
	AVE HT. (HL)	*16*			*41*			*58*											*55*	

Stand Total		Saplings			Pole			Tree or Sawlog											Total by Class,Growing Stock & Dead	% by Class, Growing Stock vs Dead
Diameter Class		*0*	*2*	*4*	*6*	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*	*28*	*30*	*32*		
Growing Stock	COUNT	0	7	1	2	12	11	20	5	5	0	5	2	0	0	0	0	0	***70***	
(All living trees	TPA	0.00	7.00	1.00	2.00	12.00	11.00	20.00	5.00	5.00	0.00	5.00	2.00	0.00	0.00	0.00	0.00	0.00	***70***	***57%***
in woodland &	BA/AC	0.00	0.05	0.13	0.40	4.11	6.04	15.53	5.15	7.02	0.00	10.87	5.38	0.00	0.00	0.00	0.00	0.00	***55***	***65%***
forestland)	AVE HT, HL	0.00	7	20	25	34	47	49	54	53	0.00	66	80	0.00	0.00	0.00	0.00	0.00		
Summary by	TPA	8.00			25.00			37.00											***70***	
Size Class (All	TPA %	11.43%			35.71%			52.86%											***100%***	
living trees in	BA/AC	0.18			10.55			43.95											***55***	
woodland &	BA/AC %	0.33%			19.29%			80.38%											***100%***	
forestland)	QMD MEAN DIA.	2.02			8.79			14.76											***12.0***	
	AVE HT, HL	16			41			58											***55***	
Dead (All dead	COUNT	1	7	1	3	7	14	12	2	2	2	1	0	0	0	0	0	0	***52***	
trees in	TPA	1.00	7.00	1.00	3.00	7.00	14.00	12.00	2.00	2.00	2.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	***52***	***43%***
woodland &	BA/AC	0.00	0.08	0.06	0.60	2.53	7.43	8.71	2.11	2.85	3.23	1.97	0.00	0.00	0.00	0.00	0.00	0.00	***30***	***35%***
forestland)	AVE HT, HL	6	11	10	30	38	47	54	58	66	38	53	0.00	0.00	0.00	0.00	0.00	0.00	***50***	
Total for all	COUNT	1	14	2	5	19	25	32	7	7	2	6	2	0	0	0	0	0	***122***	
sample trees	TPA	1.00	14.00	2.00	5.00	19.00	25.00	32.00	7.00	7.00	2.00	6.00	2.00	0.00	0.00	0.00	0.00	0.00	***122***	***100%***
including Growing Stock and Dead	BA/AC	0.00	0.14	0.19	1.00	6.64	13.47	24.24	7.26	9.87	3.23	12.84	5.38	0.00	0.00	0.00	0.00	0.00	***84***	***100%***

Understory & Forest Floor Component

Ground & Aerial Cover

Cover data was taken under a different protocol during the pre-treatment measure in 2011; therefore, values are not directly comparable to each category of cover data collected immediately post-fire in 2023. According to NMFWRI's current protocol, ground cover is visualized as a two-dimensional slice of the ground surface, whereas aerial cover is visualized as shadow cast by the vegetative component.

Litter was recorded with the highest cover value pre-treatment, while litter and bare soil were recorded with the highest cover values immediately post-fire. This likely indicates that litter was consumed by the HPCC wildfire and more bare soil was exposed as a result.

***Table 7**. Mean percent cover by category for 2011 Pretreatment monitoring period.*

Monitoring Status	Seedlings/ Saplings	Bare soil	Shrubs	Graminoids	Forbs	Litter	Rock	Gravel
2011 PreTreatment	5.3%	0%	11%	8.3%	2.6%	79%	4.2%	0%

***Table 8.** Mean percent cover by category for 2023 PostFireImmediate Monitoring Period*

Tecolote Northridge		
Monitoring Status	**Cover Class**	**% Cover**
2023 PostFireImmediate	PlantBasal	15.0
	Bole	3.5
	Litter	23.0
	BareSoil	23.0
	Rock	17.0
	Gravel	18.0

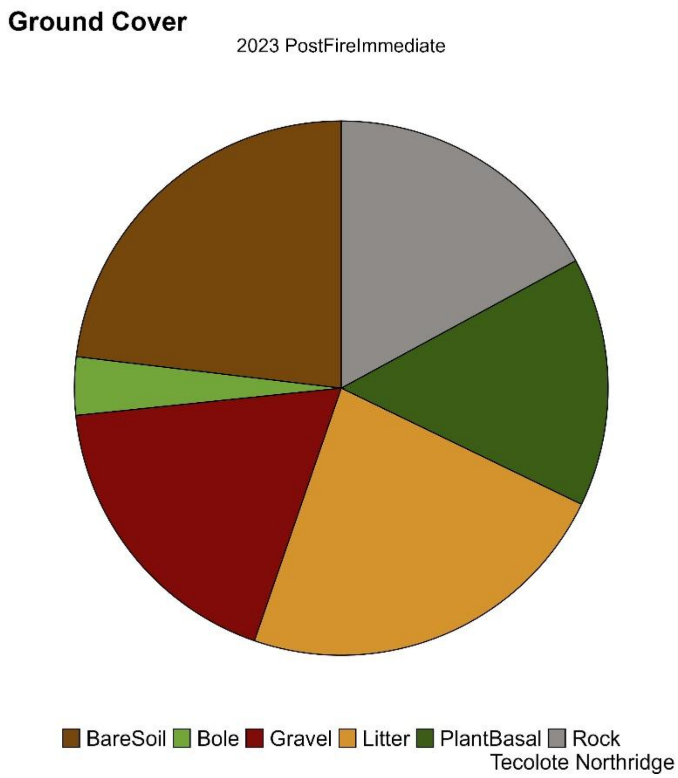


Figure 16. Mean percent ground cover by category for 2023 PostFireImmediate monitoring period.

Aerial cover immediately post-wildfire was dominated by forb cover, likely made up of weedy plants that take advantage of disturbance.

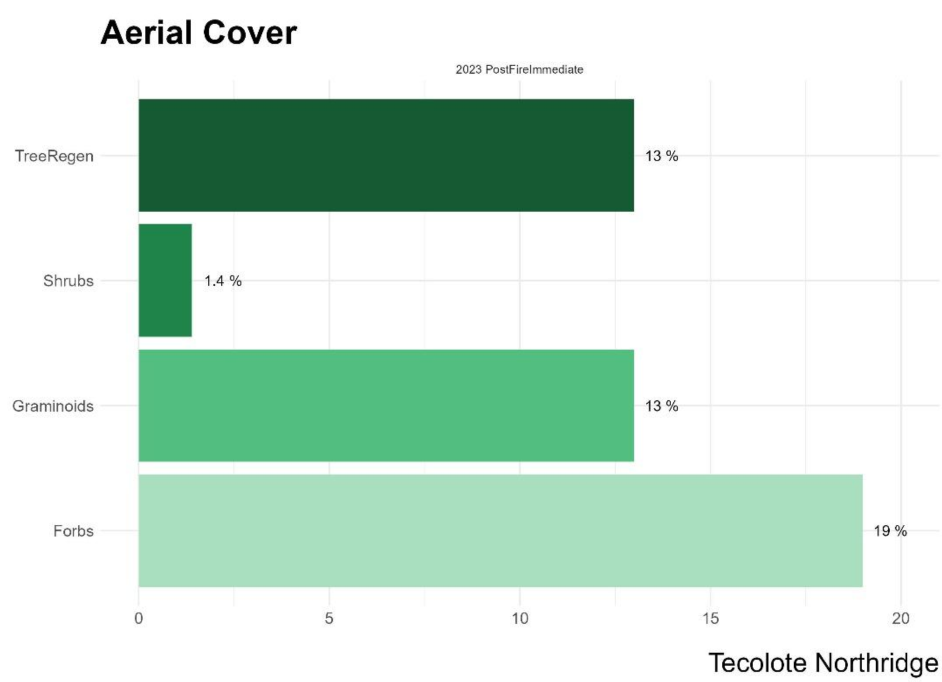


Figure 17. Mean percent aerial cover by category for the 2023 PostFireImmediate monitoring period.

Canopy Cover

Closed canopy cover at plots is recorded using a spherical mirror densiometer. Canopy decreased from 65% pretreatment to 2023 immediately post-fire. This is consistent with the high mortality rate seen in growing stock trees after thinning treatments and fire.

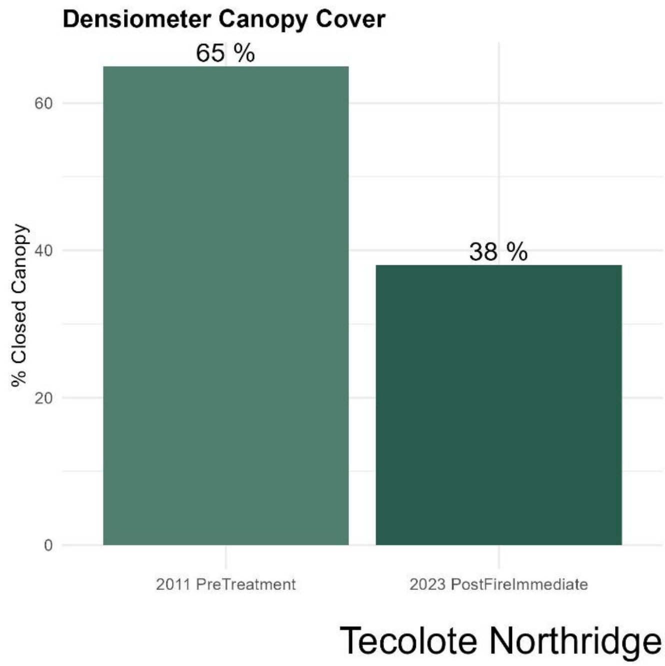


Figure 18. *Mean percent canopy cover as measured by densiometer, by monitoring period.*

Surface Fuels Vegetation (Ladder Fuels)

The average percent cover decreased for all categories of ladder fuels from the pre-treatment to immediate post-fire measurement periods. The average height of both live and dead herbaceous fuels (HD and HL) increased from pre-treatment to immediately post-fire while the average height of both live and dead woody fuels (SD and SL) decreased from pre-treatment to post-fire.

These trends are reflective of post-fire stimulation of herbaceous species and consumption of woody species. While regeneration data indicated an increase of woody species density, the height and coverage of these species is reduced in initial resprouting stages.

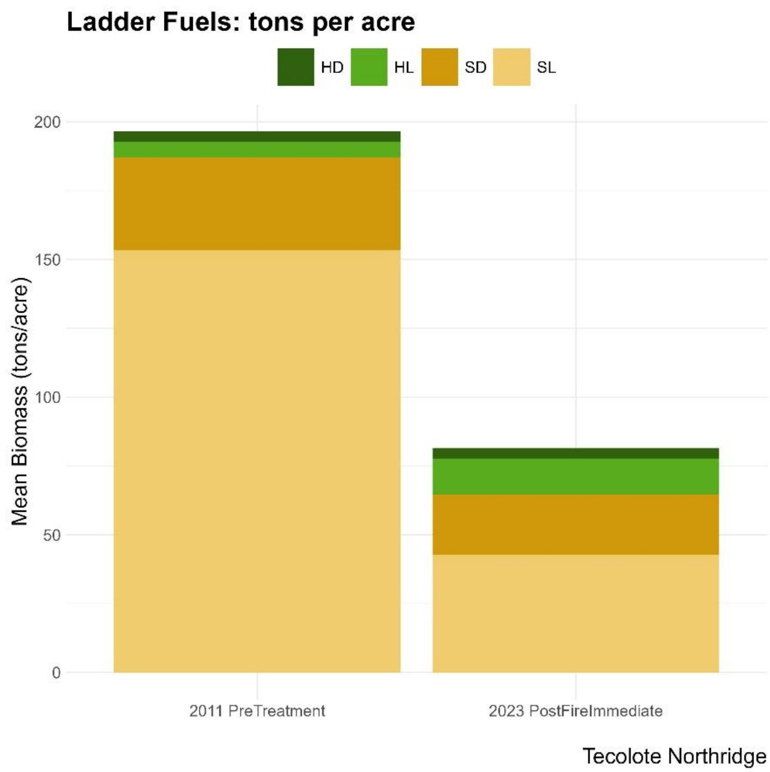


Figure 19*. Mean biomass of ladder fuels by monitoring period.*

Table 9. *Mean biomass of ladder fuels by monitoring period.*

Tecolote Northridge					
Monitoring & Treatment Status	**Vegetation**	**Mean % Cover**	**Mean Height (ft)**	**Mean Biomass (tons/acre)**	**Total Biomass (tons/acre)**
2011 PreTreatment	HD	5.3	0.36	3.8	
	HL	7.3	0.38	5.9	
	SD	1.6	3.5	34	
	SL	15	2.4	150	
					200
2023 PostFireImmediate	HD	1.3	0.92	3.9	
	HL	5.6	1.1	13	
	SD	0.78	2.2	22	
	SL	5.2	1.2	43	
					82

Surface Fuels

Total fine fuels (1-100 hr fuels), decreased from 1.9 tons per acre pre-treatment to 0.5 tons per acre immediately post fire. Total wood fuels (1-1000 hr fuels) decreased from 10 tons per acre pre-treatment to 6.4 tons per acre immediately post-fire. Total surface fuels (wood fuels + duff/litter) decreased from 22 tons per acre pre-treatment to 11 tons per acre immediately post-fire. These decreases are consistent with surface fuel consumption from fire.

Tecolote Northridge										
Monitoring & Treatment 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)**
2011 PreTreatment	0.06	1.1	0.76	4.8	3.2	6.1	5.5	1.9	10	22
2023 PostFireImmediate	0.038	0.25	0.21	5.9		2.7	2.2	0.5	6.4	11

Litter and Duff

Litter decreased from 6.1 tons/acre pre-treatment to 2.7 tons/acre immediately post-fire. Duff decreased from 5.5 tons/acre pre-treatment to 2.2 tons/acre immediately post-fire. Mean litter and duff depths also decreased – these trends are also consistent with fuel consumption following fire. The fact that duff remains post-fire indicates that fire did not burn hot enough at the soil surface to consume said duff.

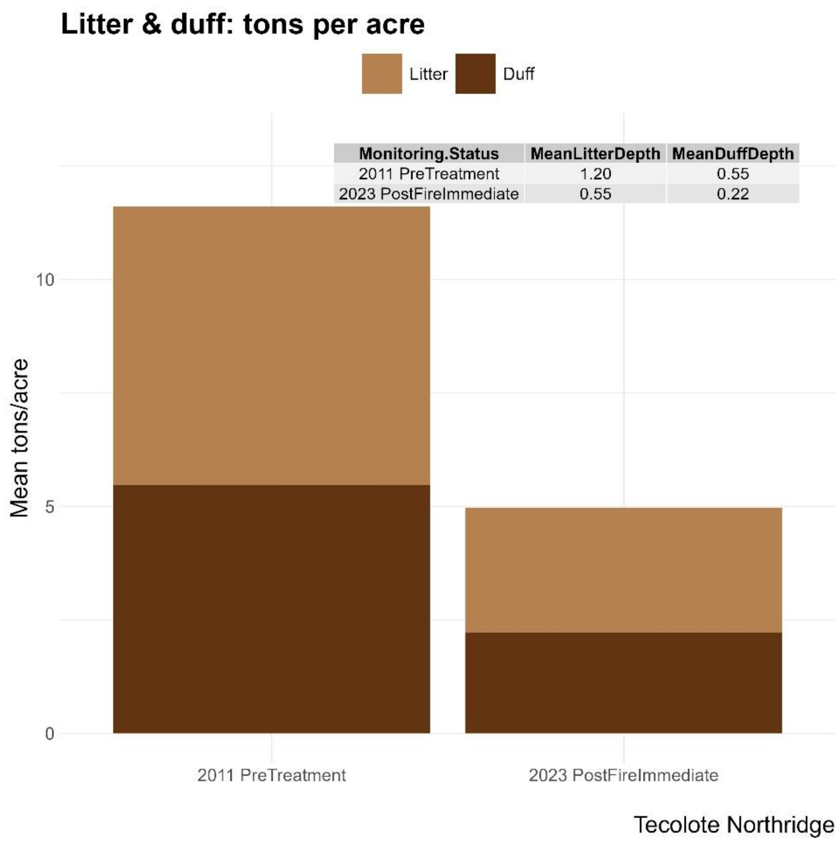


Figure 20. *Mean litter and duff loads by monitoring status.*

Fine Fuels

1-hr fuels decreased slightly from 0.06 tons/acre pre-treatment to 0.038 tons/acre immediately post-fire. 10-hr fuels decreased from 1.1 tons/acre pre-treatment to 0.25 tons/acre immediately post-fire. 100-hr fuels decreased from 0.76 tons/acre pre-treatment to 0.21 tons/acre immediately post-fire. These trends are also consistent with fuel consumption following fire.

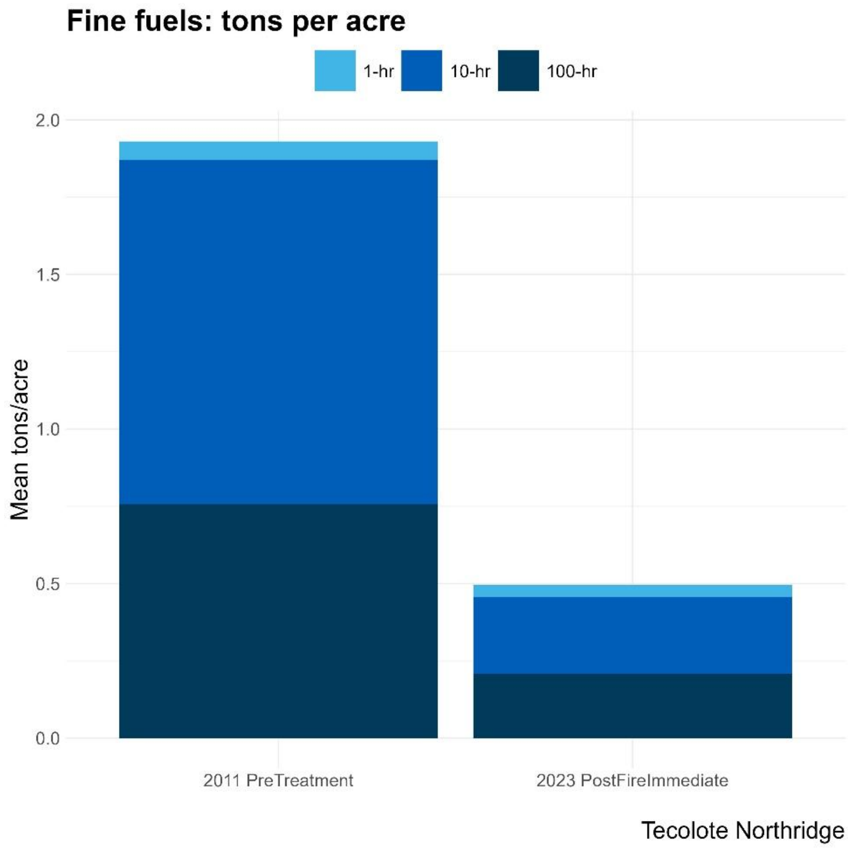


Figure 21. *Mean litter and duff loads by monitoring status.*

Thousand-Hour Fuels

Rotten thousand-hour fuel loads (decay classes 4-5) were calculated at 3.2 tons/acre pre-treatment; there were no rotten thousand-hour fuels immediately post-fire. Sound thousand-hour fuel loads (decay classes 1-3) increased from 4.8 tons/acre pre-treatment to 5.9 tons/acre immediately post-fire. The disappearance of rotten thousand-hour fuels is consistent with fuel consumption following fire. The increase in sound thousand-hour fuels could be explained by freshly fallen logs killed or destabilized by the wildfire. Decay classes displayed in figures 22 and 23 are ordered from 1 (freshly fallen logs) to 5 (heavily decayed logs). The distribution of decay class shown in figure 23 confirms that thousand-hour fuels recorded in 2023 are likely due to recently fallen logs.

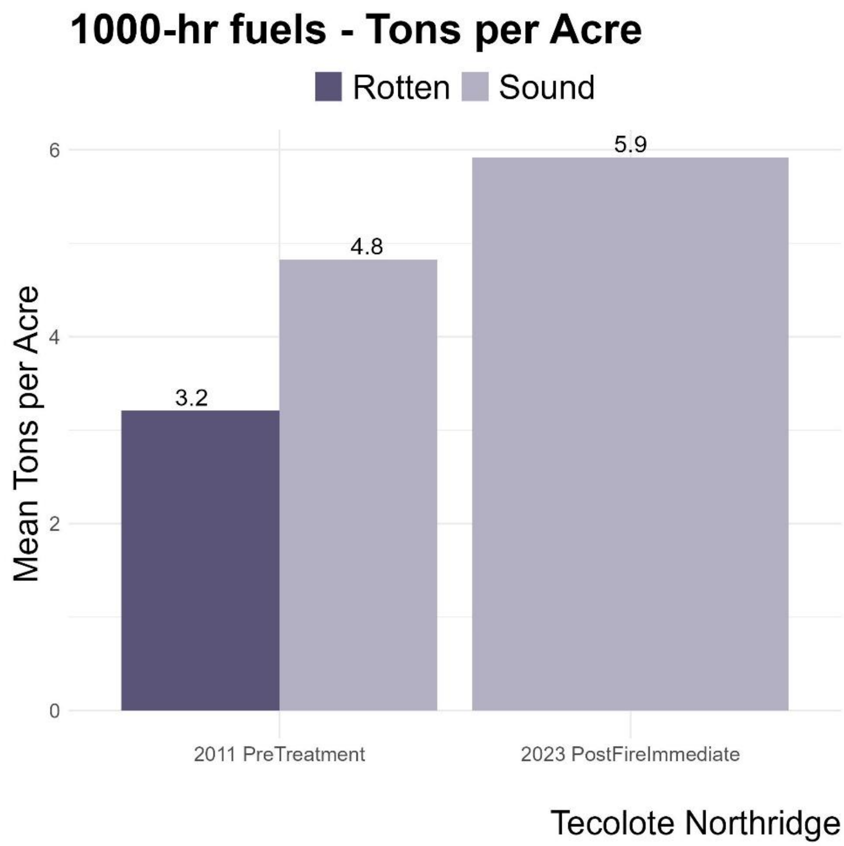


Figure 22. *Mean thousand-hour fuel loads by monitoring status.*

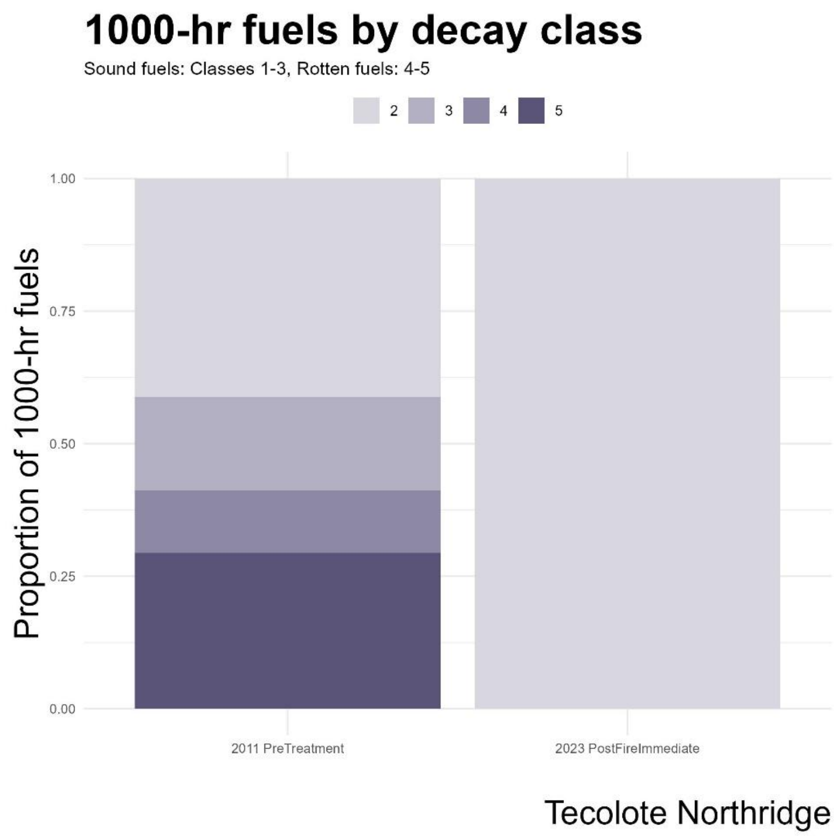


Figure 23. *Proportion of total thousand-hour fuels by decay class and monitoring status.*

Photo Comparisons

Plot NR_1A, Facing West from Plot Center

Pre-Treatment 2011

Post-Fire Immediate 2023

Plot NR_3A, Facing West from Plot Center

Pre-Treatment 2011

Post-Fire Immediate 2023

Plot NR_3C, Facing West from Plot Center

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

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. (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 10. *List of observed tree species by species symbol, scientific name, and common name*

Species Symbol	Scientific Name	Common Name
CEMO2	*Cercocarpus montanus*	alderleaf mountain mahogany
PIFL2	*Pinus flexilis*	limber pine
PIPO	*Pinus ponderosa*	ponderosa pine
PSME	*Psuedotsuga menziesii*	Douglas-fir
QUERC	*Quercus sp.*	oak sp.
QUGA	*Quercus gambelii*	Gambel oak
2TEN		unknown conifer

Table 11*. List of observed shrub species by species symbol, scientific name, and common name*

Species Symbol	Scientific Name	Common Name
CEFE	*Ceanothus fendleri*	Fendler's ceanothus
AMCA6	*Amorpha canescens*	leadplant

Plot Center Coordinates

Table 12*. List of plot center coordinates by latitude and longitude*

Plot Name	Latitude	Longitude
1A	35.673986	-105.435333
1B	35.672179	-105.436428
1C	35.670372	-105.437523
2A	35.662971	-105.437979
2B	35.661163	-105.439074
2C	35.661171	-105.436864
2D	35.661179	-105.434655
3A	35.658813	-105.444013
3B	35.658821	-105.441804
3C	35.65883	-105.439594

Abbreviations & Acronyms

Acronym/Abbreviation/Term	Definition as used by NMFWRI
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)
HPCC Fire	Hermit's Peak Calf Canyon Fire
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
WUI	Wildland Urban Interface

Supplementary Figures:

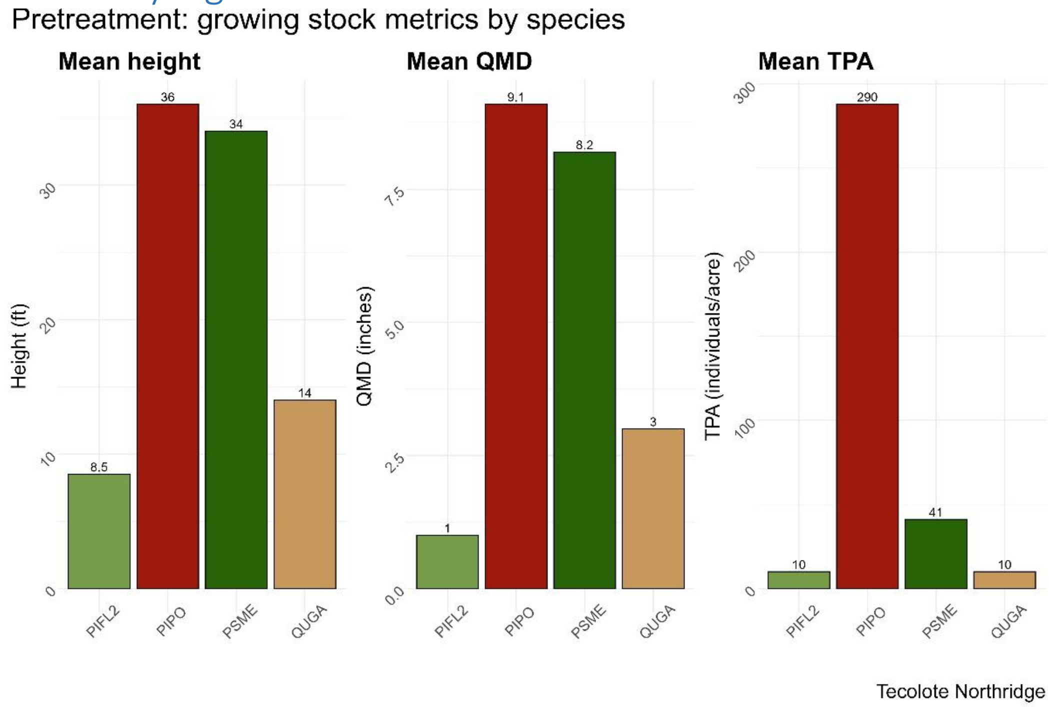


Figure 24. *2011 Pretreatment growing stock metrics by species*

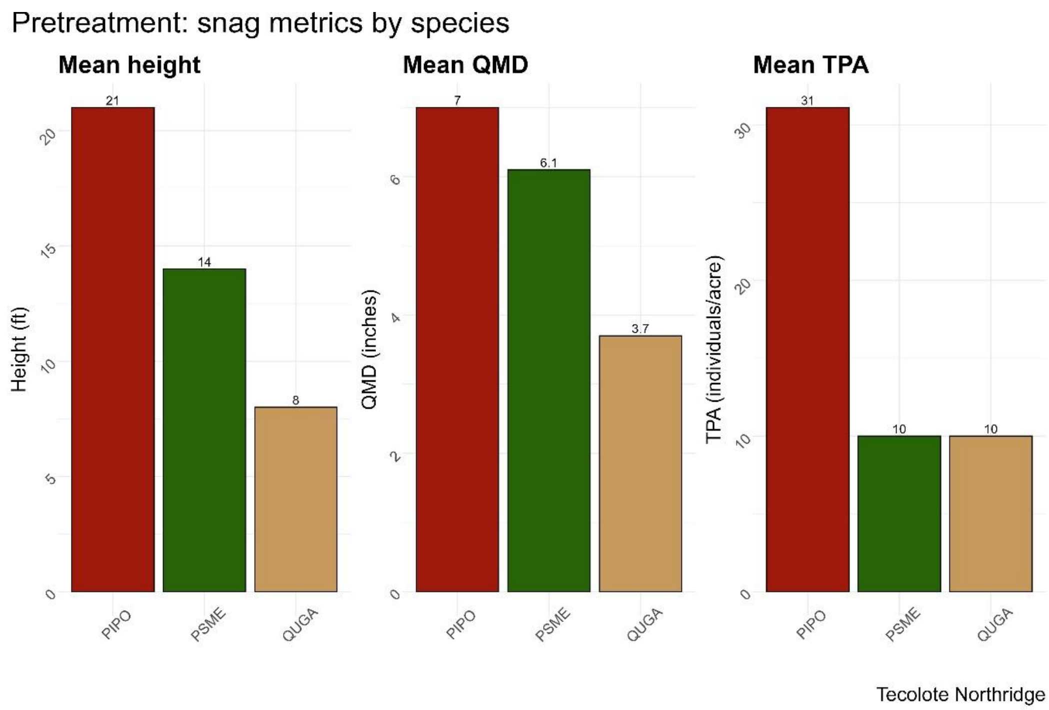


Figure 25. *2011 Pretreatment snag metrics by species.*

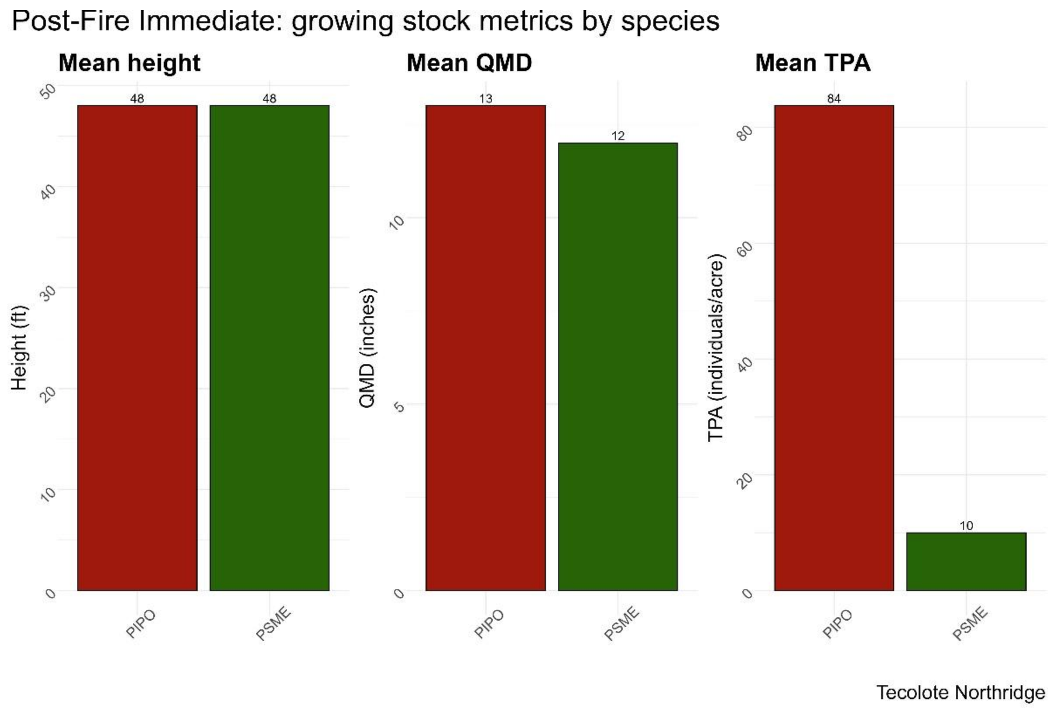


Figure 26. *2023 PostFireImmediate growing stock metrics by species.*

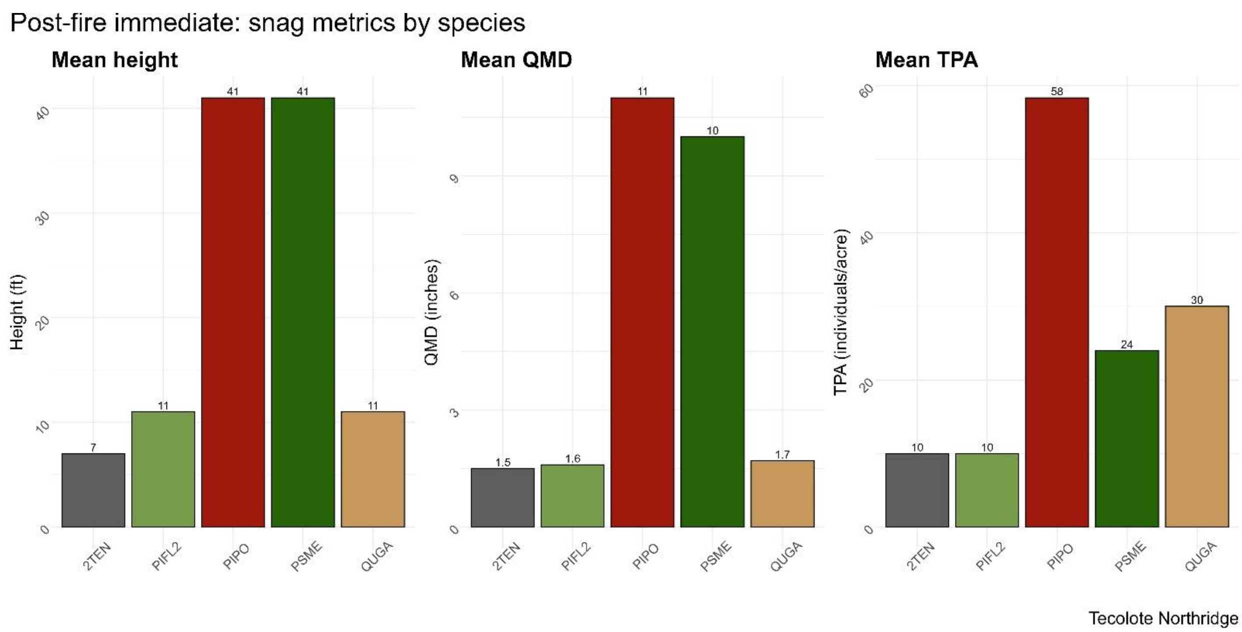
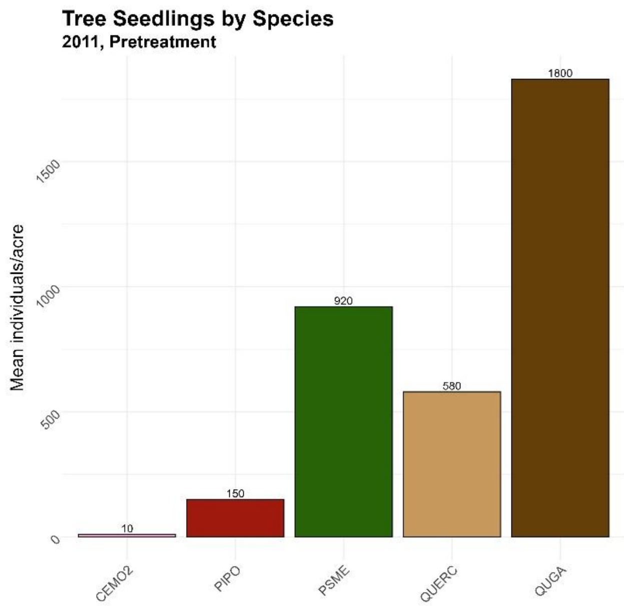


Figure 27. *2023 PostFireImmediate snag metrics by species.*



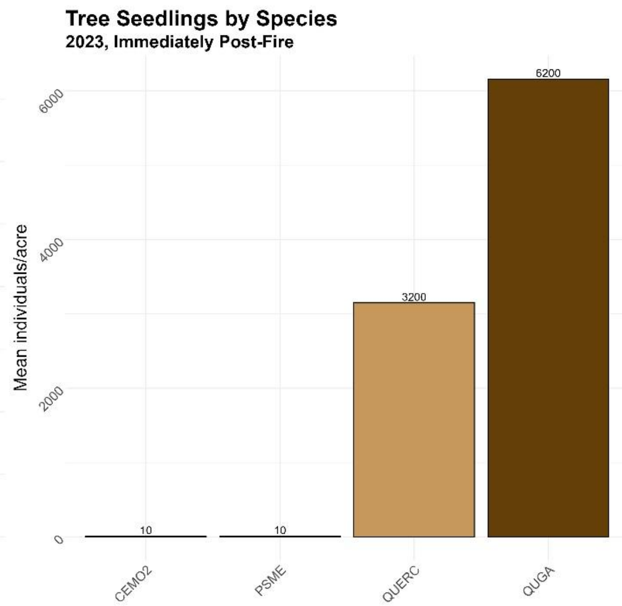


Figure 28. *Tree seedling densities by species and monitoring period.*

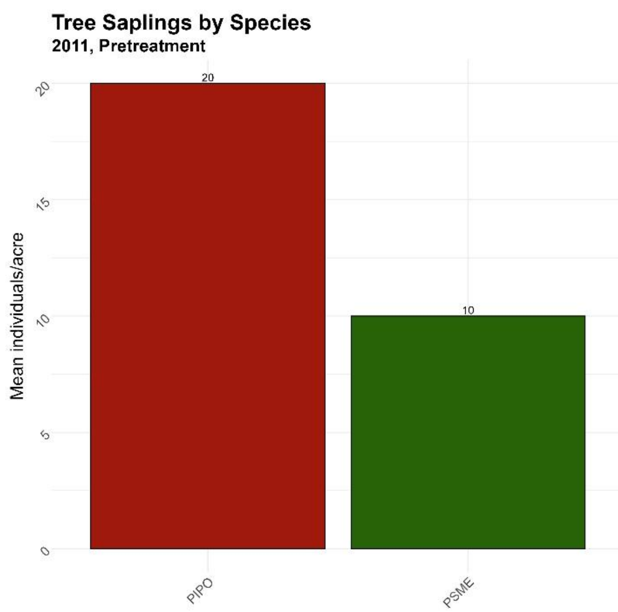


Figure 29*. Tree sapling densities by species, by monitoring status. No tree saplings were recorded in 2023 PostFireImmediate.*

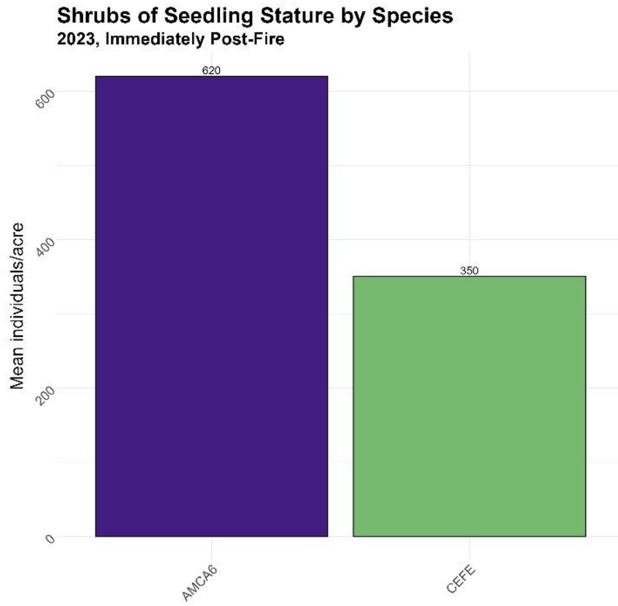


Figure 30. *Shrub seedling densities by species and monitoring status. No shrub seedlings were recorded in 2011 Pretreatment.*

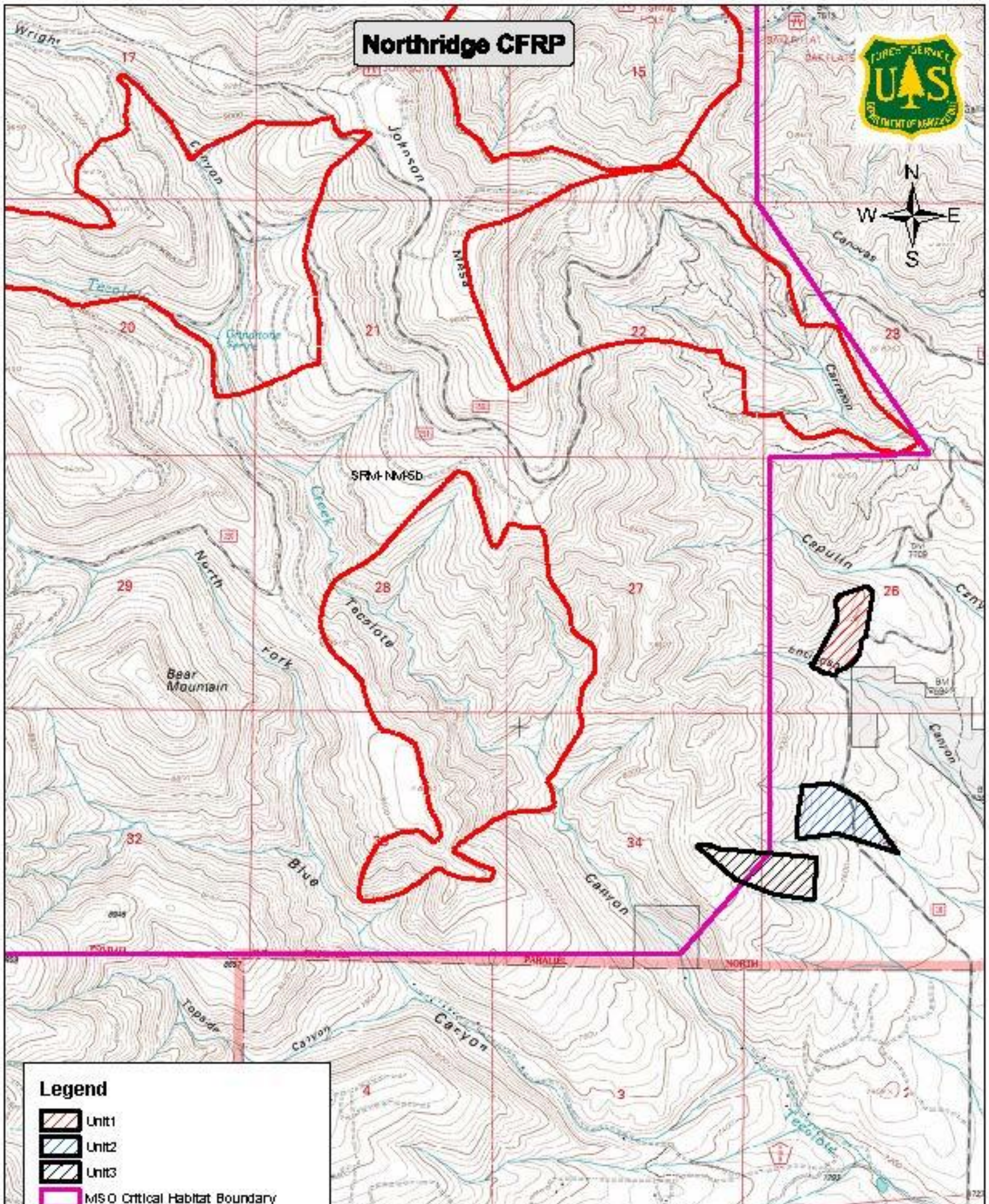


__Figure 31.__ Overview map of Tecolote Northridge project area showing Mexican Spotted Owl Critical Habitat and Protected Activity Centers from 2011