Tecolote Northridge Post-fire Immediate
Field Inventory Summary / November 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 2,350 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 crew followed the protocols linked here: https://nmfwri.org/wp-content/uploads/2020/07/NMFWRI_Forest_Monitoring_Protocols-1.pdf which 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.

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.

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. 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 (**Table 1**). 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 (**Table 6**).

From pre-treatment to immediate post-fire measurements, total ladder fuel cover decreased in all fuel categories and total average biomass decreased as well (**Table 7**). Surface fuel loads also decreased in all categories immediately post-fire (**Table 8**), with all remaining thousand hour fuels classified as sound in decay class 2 (**Figure 15**).

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.*

	Average (if applicable)	
Metric	**2011 PreTreatment**	**2023 Post Wildfire Immediate**
Dominant live tree	ponderosa pine	ponderosa pine
Dominant live seedling	Gambel oak	Gambel oak
Dominant live sapling	ponderosa pine	N/A
Dominant live shrub (seedling class)	alderleaf mountain mahogany	Fendler’s ceanothus
Dominant live shrub (sapling class)	N/A	N/A
Dominant snag	ponderosa pine	ponderosa pine
Dominant sick tree	ponderosa pine	ponderosa pine
Average slope (%)**	19%	17%
Dominant aspect	east	east
Trees per acre (growing stock)	330	70
Basal area (growing stock, ft^2/acre)	130	55
QMD (inches, growing stock)	8.96”	12.6”
Average tree height (ft)	36’	48’
Height of tallest tree (ft)	78’	81.8’
Average LiCrBHt (ft)	19’	28’
Live seedlings per acre	3,480	9,320
Live saplings per acre	30	0
Live shrub seedlings per acre	10	980
Tree canopy cover (%)	65%	38%
Grass & Forb cover (%)	10.9%	14.4%
Total tons surface fuels per acre	18	6.7

** Minor slope changes may have occurred due to post-fire erosion, however this variation is within the margin of error for clinometer use.

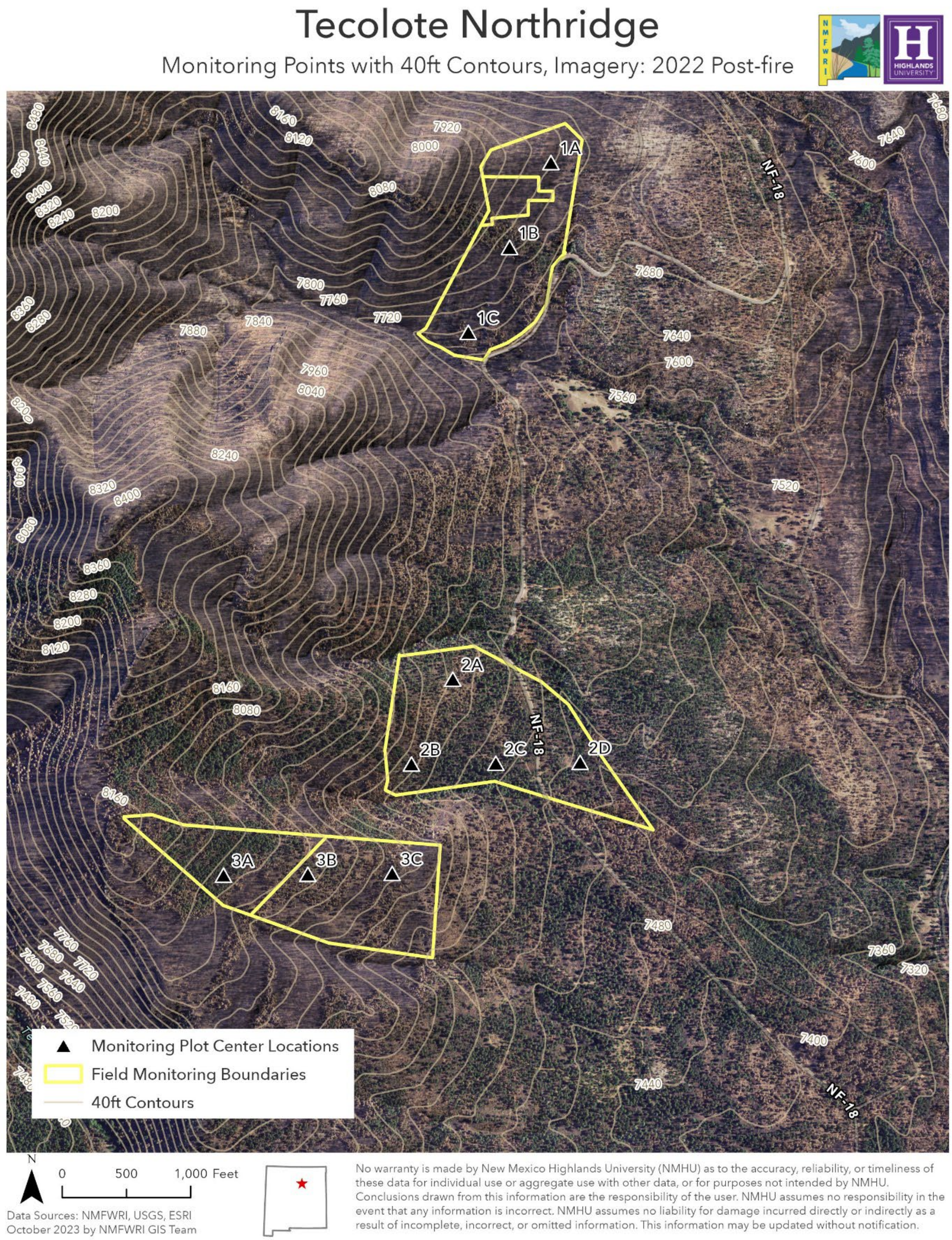


***Figure 1**. Map of Tecolote Northridge project areas and plots with post-fire satellite imager*

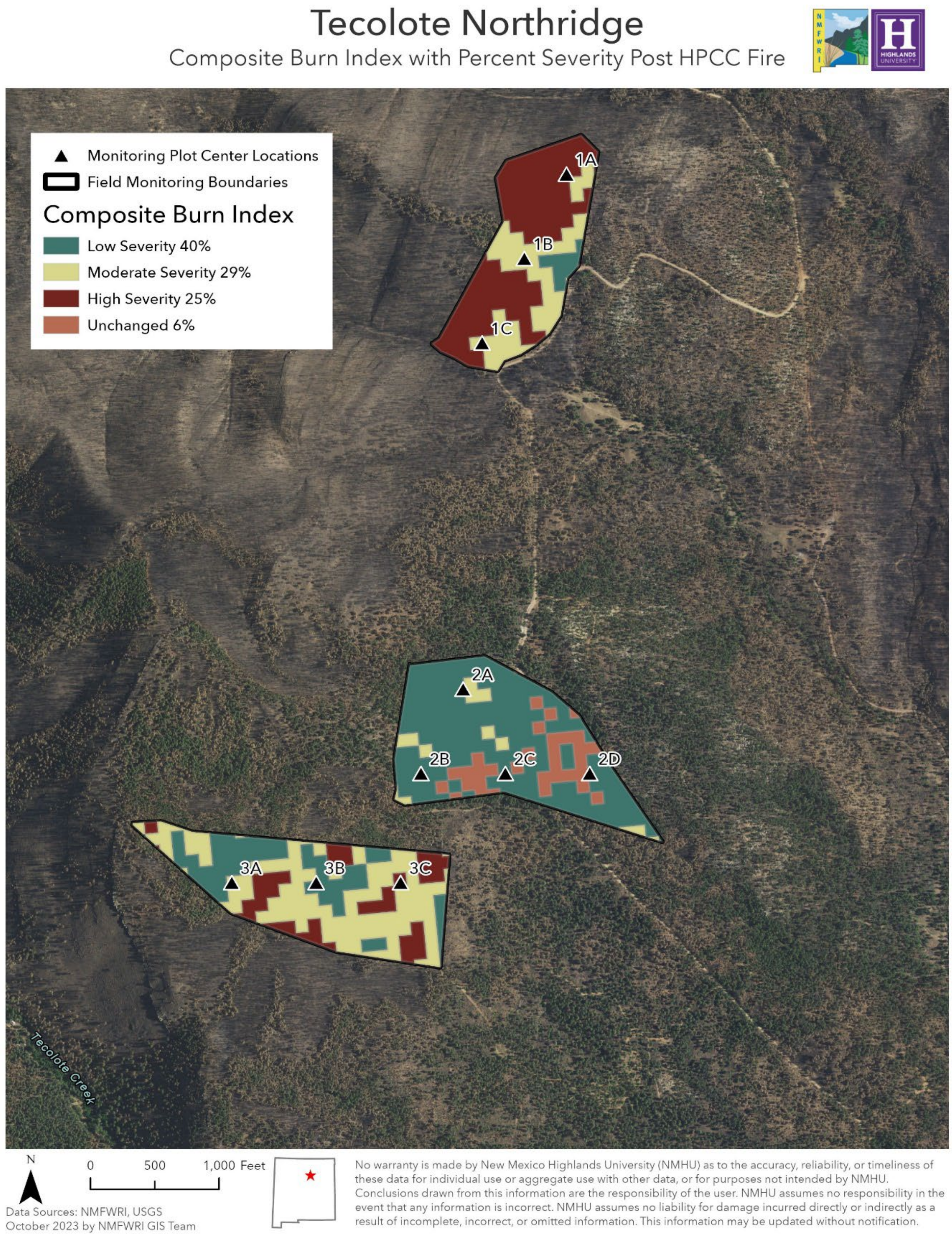


Figure 2. *Map of Tecolote Northridge project areas and plots overlaid on composite burn index from the Hermit's Peak Calf Canyon fire. Percent coverage of each burn severity category within the project area is listed in the legend.*

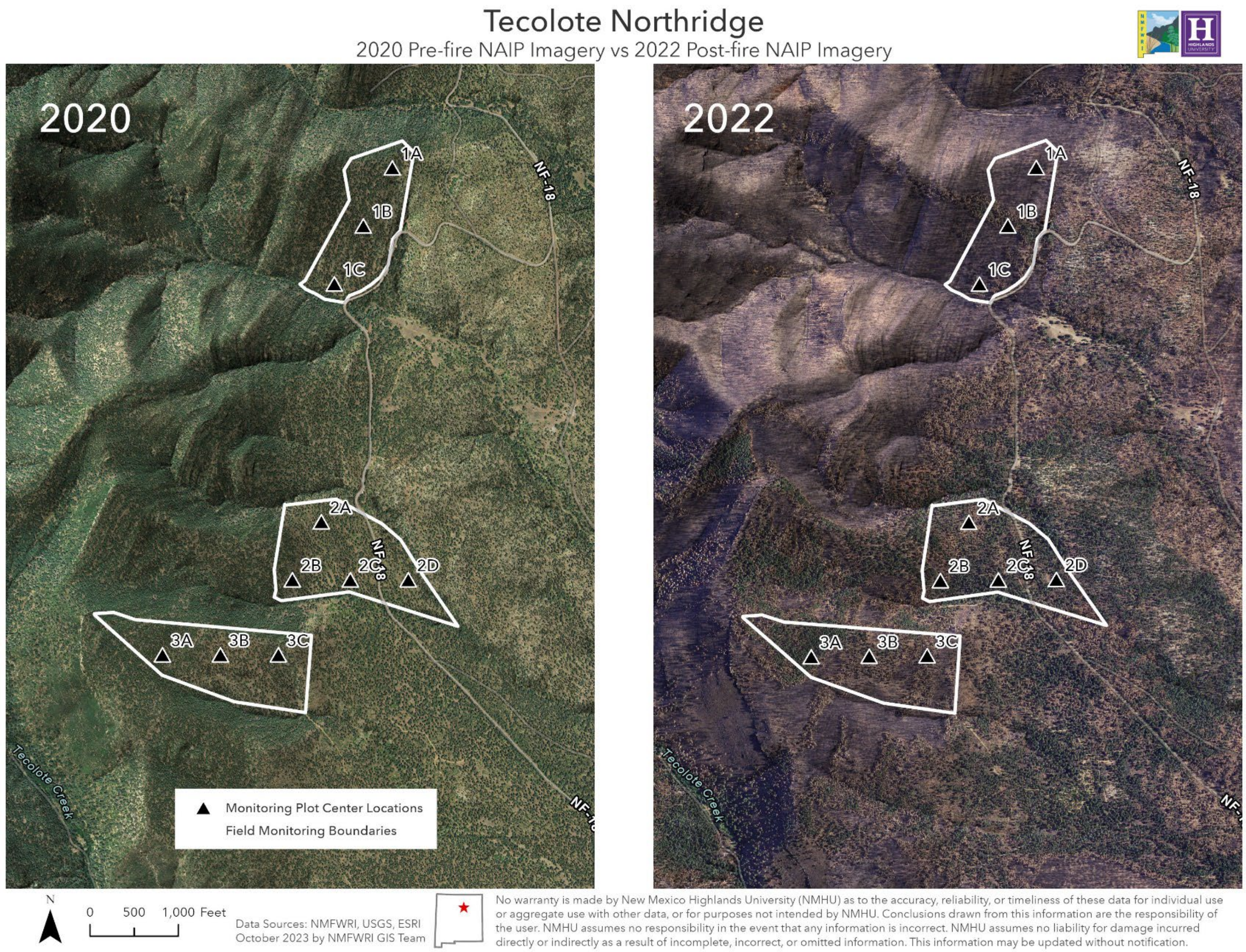


Figure 3. *Map of Tecolote Northridge project area and plots with 2020 pre-fire satellite imagery and 2022 post-fire satellite imagery following the Hermits Peak Calf Canyon fire*

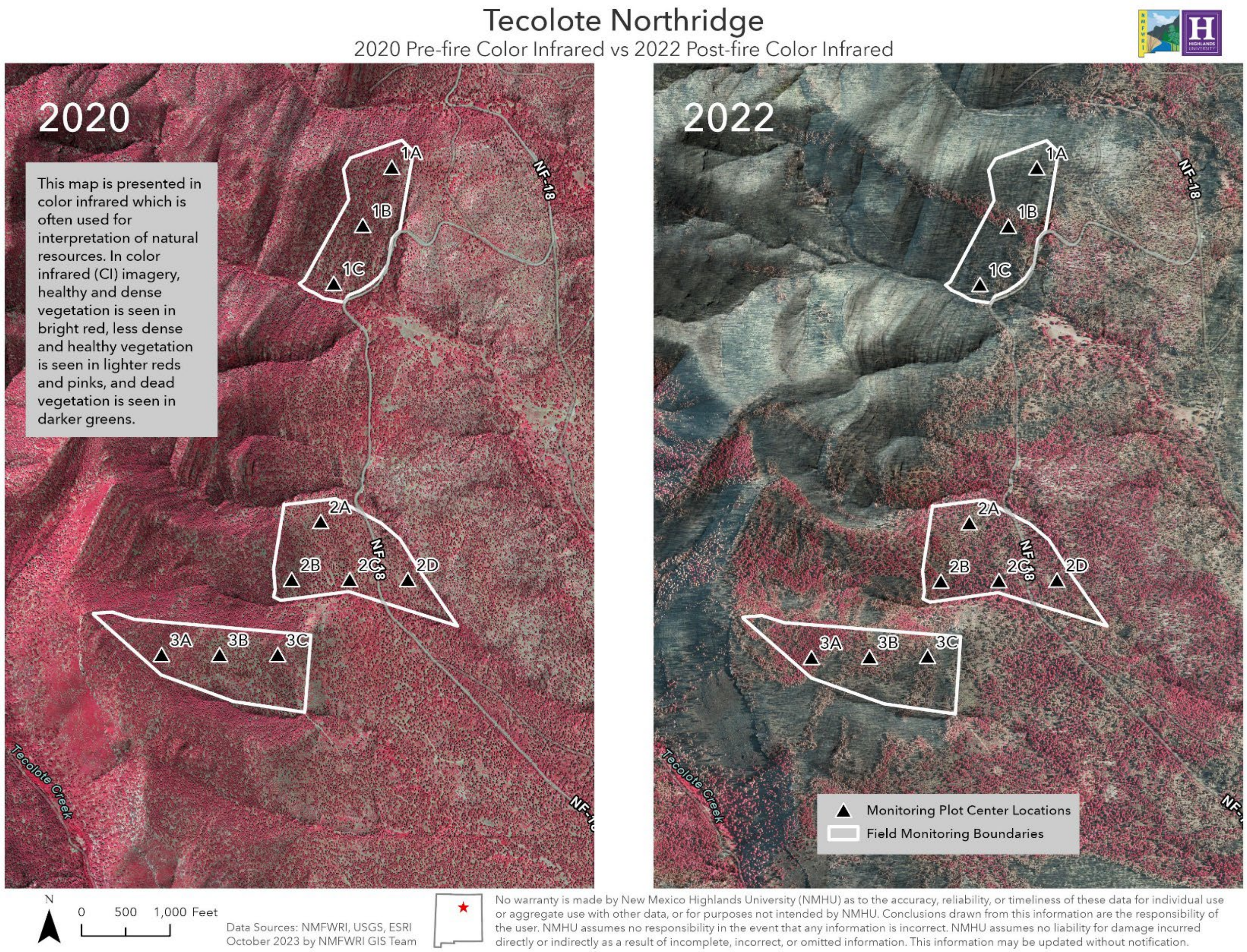


Figure 4. *Map of Tecolote Northridge project area and plots with 2020 pre-fire color infrared imagery and 2022 post-fire color infrared imagery following the Hermits Peak Calf Canyon fire*

Monitoring Detail - Tree Component

Overstory Trees

The overstory was dominated by ponderosa pine across all monitoring statuses for live trees, sick 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.

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*

*Dead/burned and lacking identifying characteristics

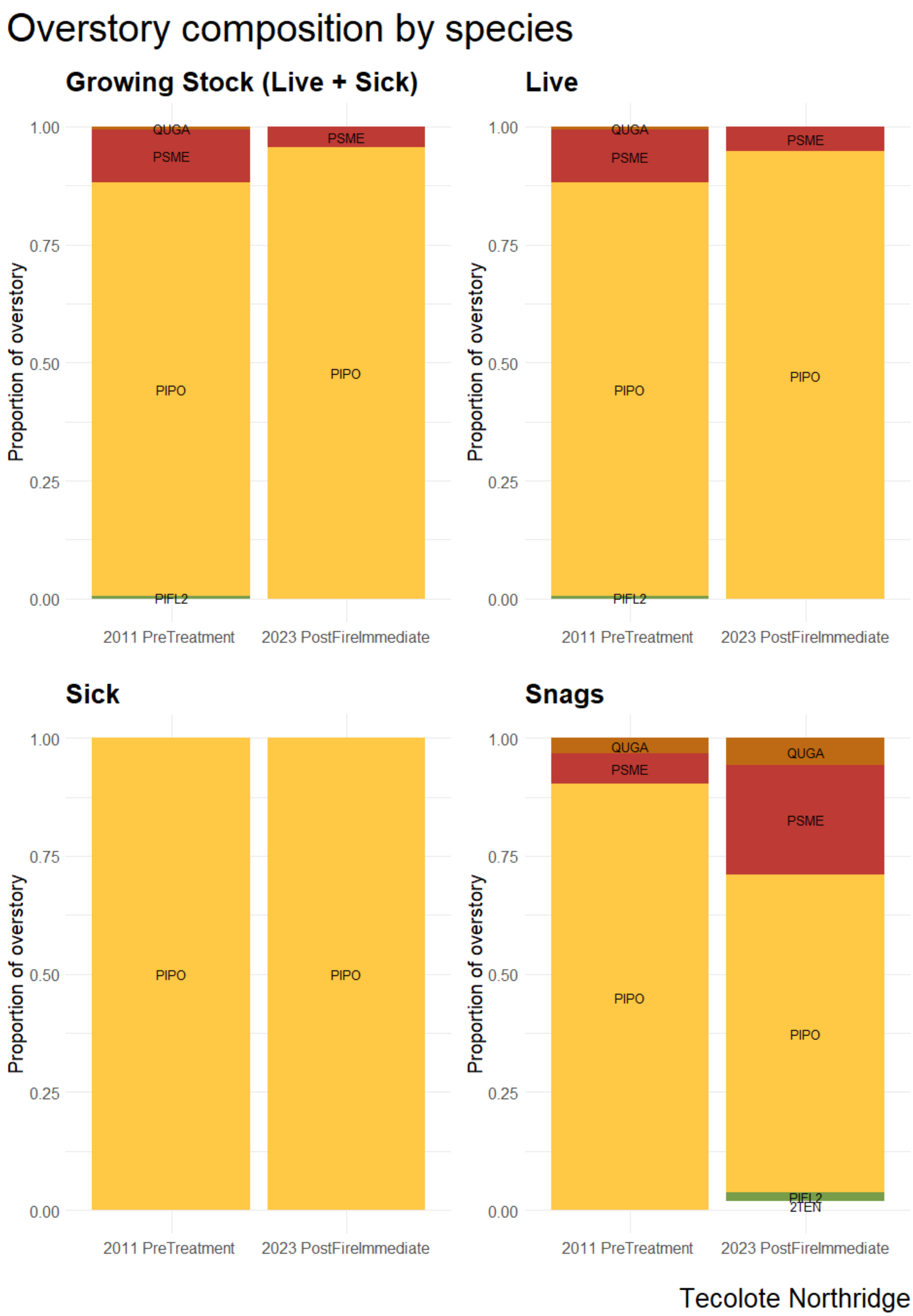


Figure 5. *Species composition by status across both measurement periods for all trees (>1" DBH).*

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. 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.

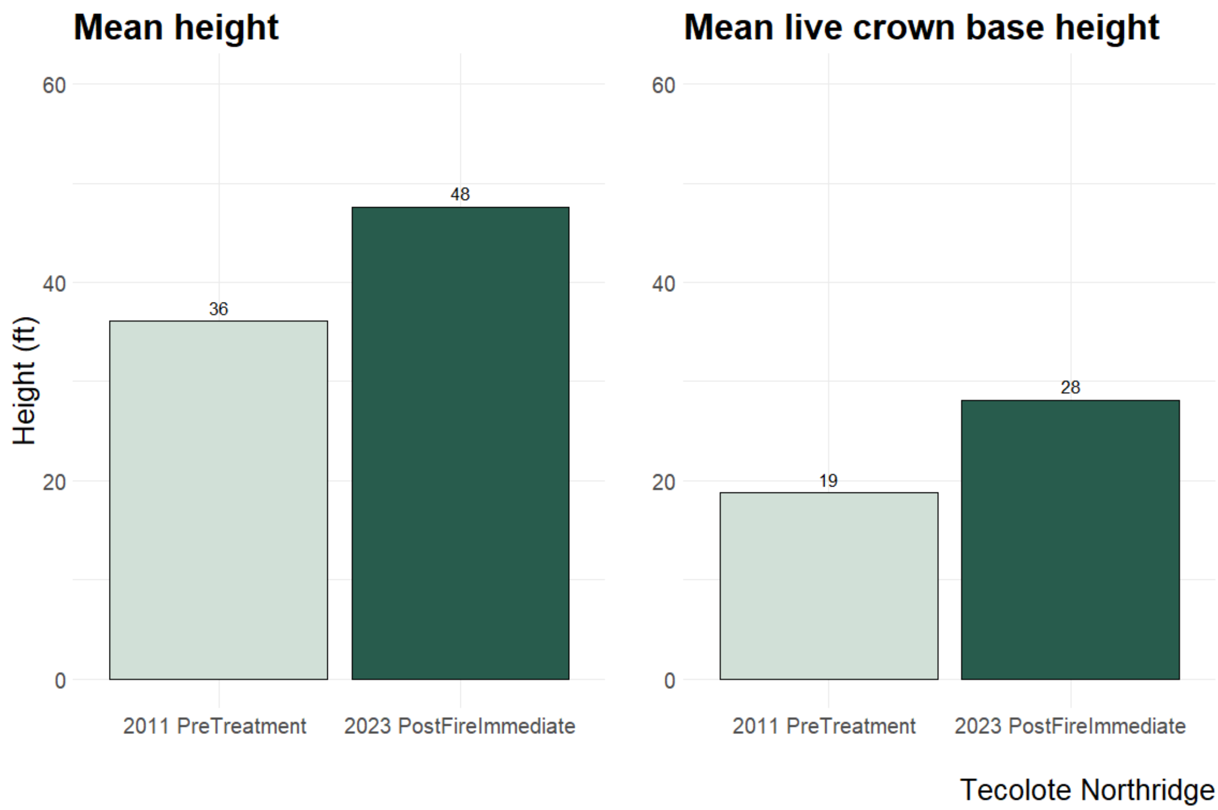


Figure 6. *Mean height and live crown base height for growing stock trees (>1" DBH, live + sick status). Mean values represent averages of plot means for each monitoring status.*

Growing stock mean basal area decreased from 130 sqft/acre pre-treatment to 55 sqft/acre immediately post fire. Mean tree density also decreased, from 330 trees per acre pre-treatment to 70 trees per acre immediately post-fire. In contrast, quadratic mean diameter (QMD) increased from 8.96" pre-treatment to 12.6" immediately post-fire. These patterns illustrate a shift to fewer, larger trees in the growing stock category following treatment and fire.

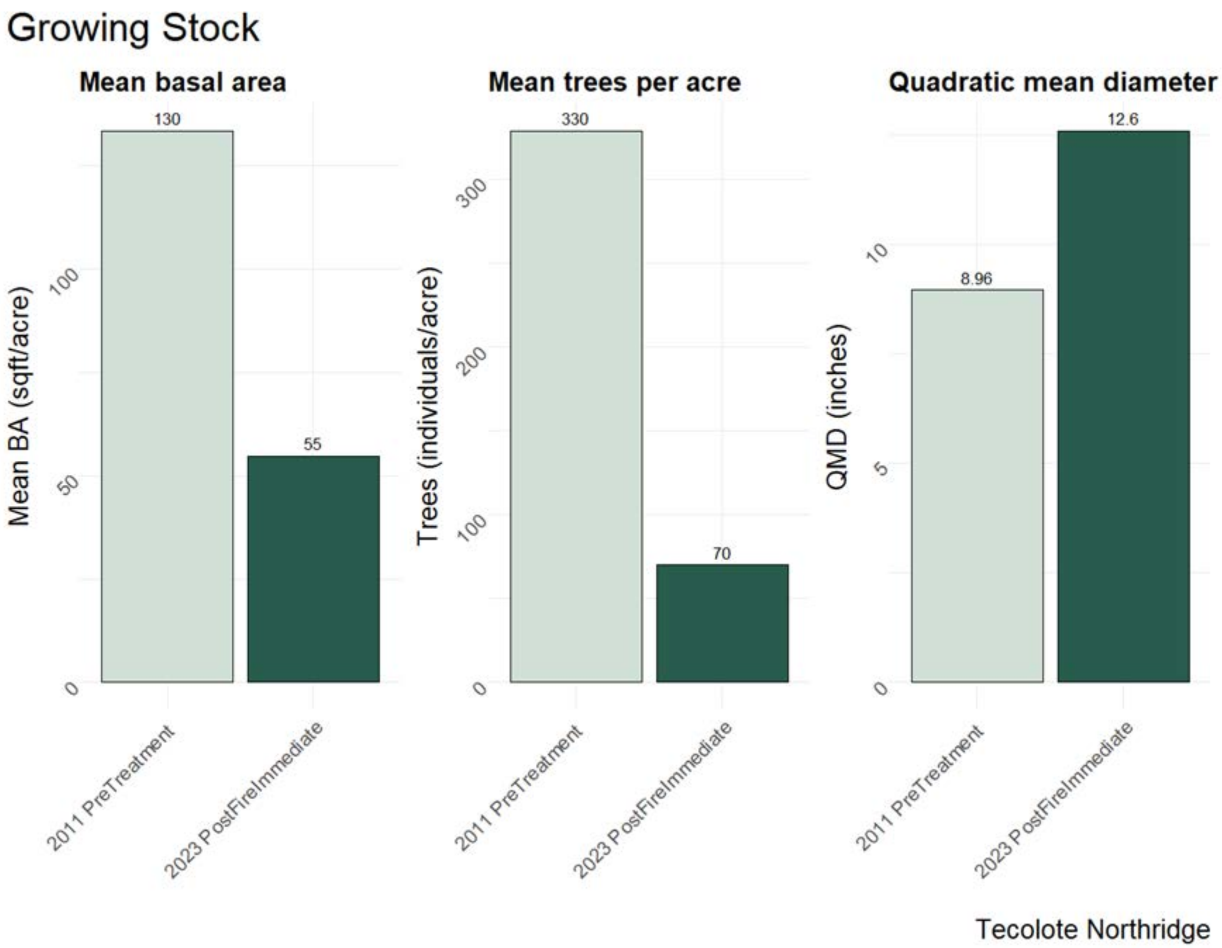


***Figure 7**. Mean basal area, mean trees per acre, and quadratic mean diameter for growing stock trees across both measurement periods (>1" DBH, live + sick status). Mean values represent averages of plot means for each monitoring status.*

Histograms 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.

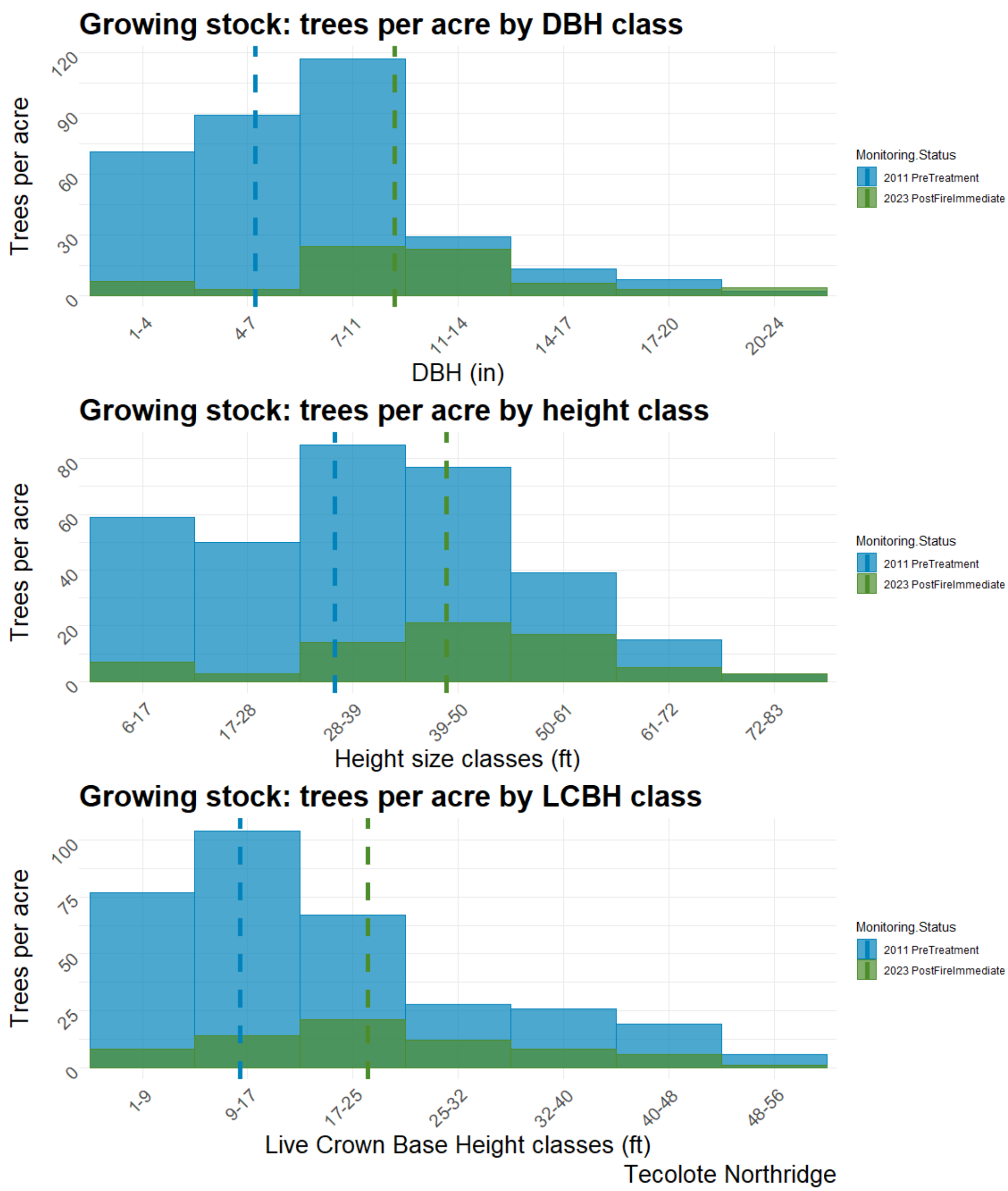


Figure 8. *Histograms of growing stock trees per acre by diameter class, height class, and live crown base height class*

Snags

Snag mean basal area increased substantially from 8.6 sqft/acre pre-treatment to 30 sqft/acre immediately post-fire. Following a similar trend, mean snags per acre increased from 31 trees per acre pre-treatment to 52 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.

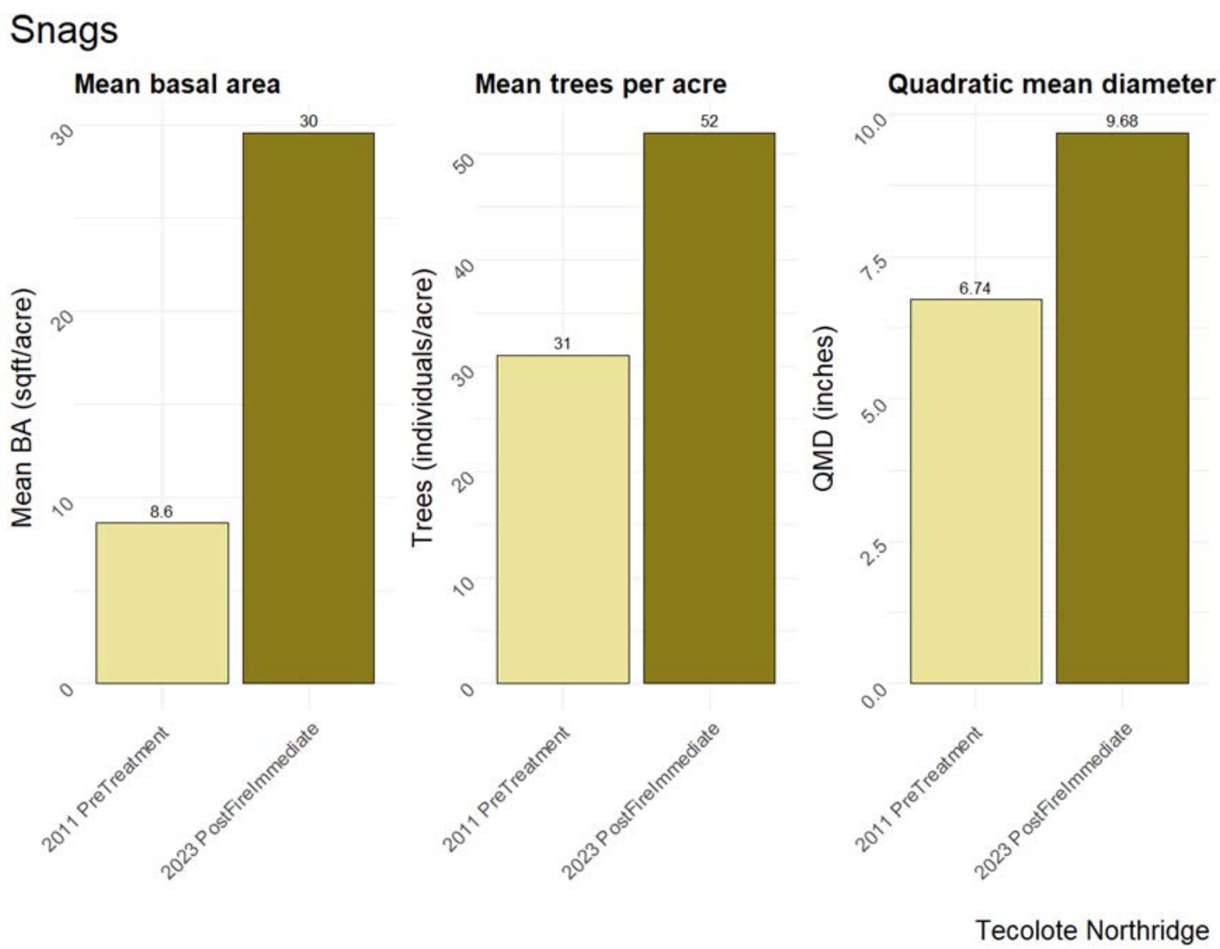


Figure 9. *Mean basal area, mean trees per acre, and quadratic mean diameter for snags across both measurement periods (>1" DBH). Mean values represent averages of plot means for each monitoring status.*

Histograms 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.

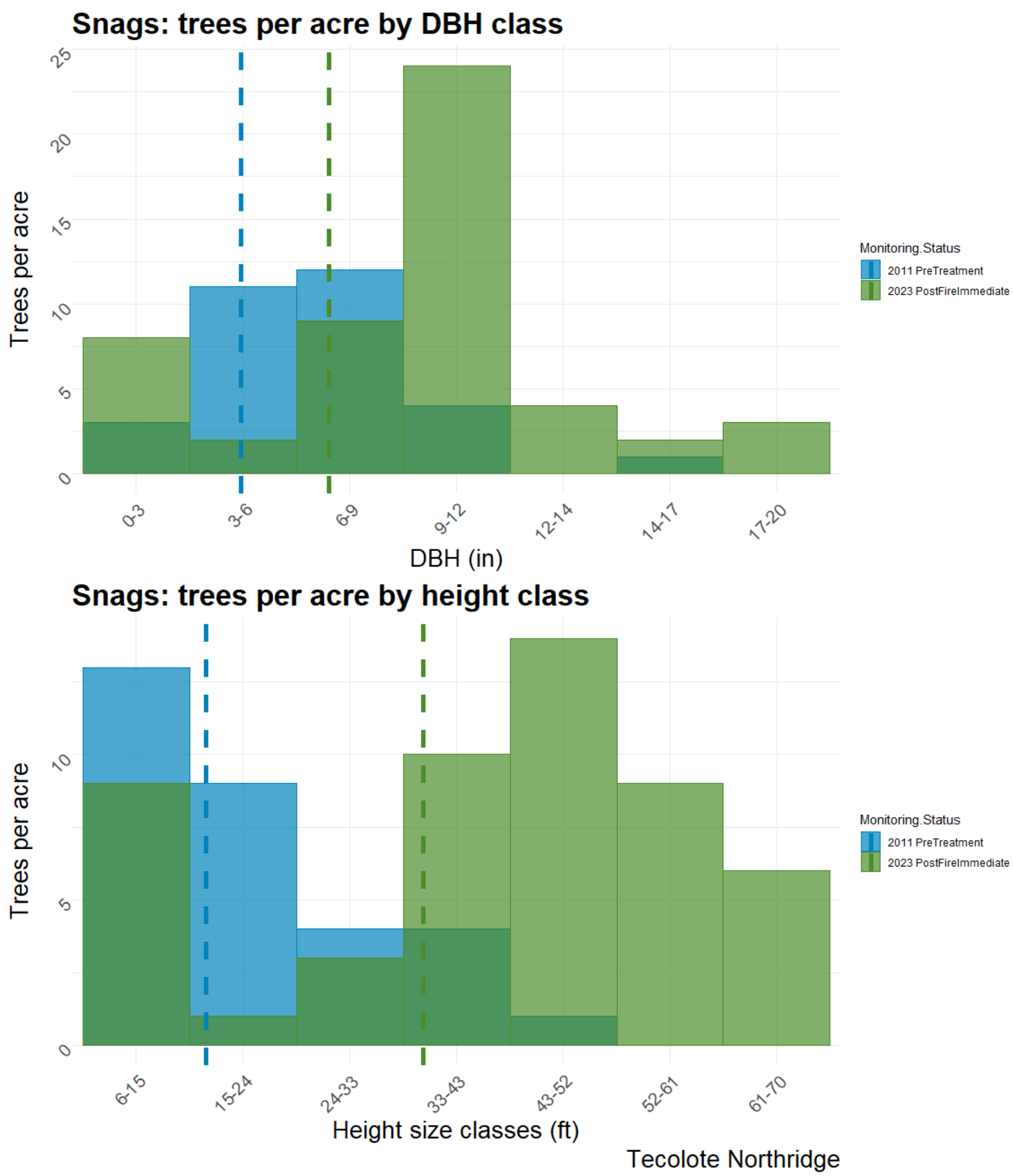


Figure 10. *Histograms of snags per acre by diameter class and height class*

Sick Trees

Sick tree mean basal area increased substantially from 0.29 sqft/acre pre-treatment to 9.6 sqft/acre immediately post-fire. Following a similar trend, mean snags per acre increased from one tree per acre pre-treatment to 13 trees per acre immediately post-fire. Sick tree quadratic mean diameter also increased from 7.3" pre-treatment to 11.2" immediately post-fire. These patterns illustrate an increase in sick trees, and an increase in the size of sick trees following treatments and fire.

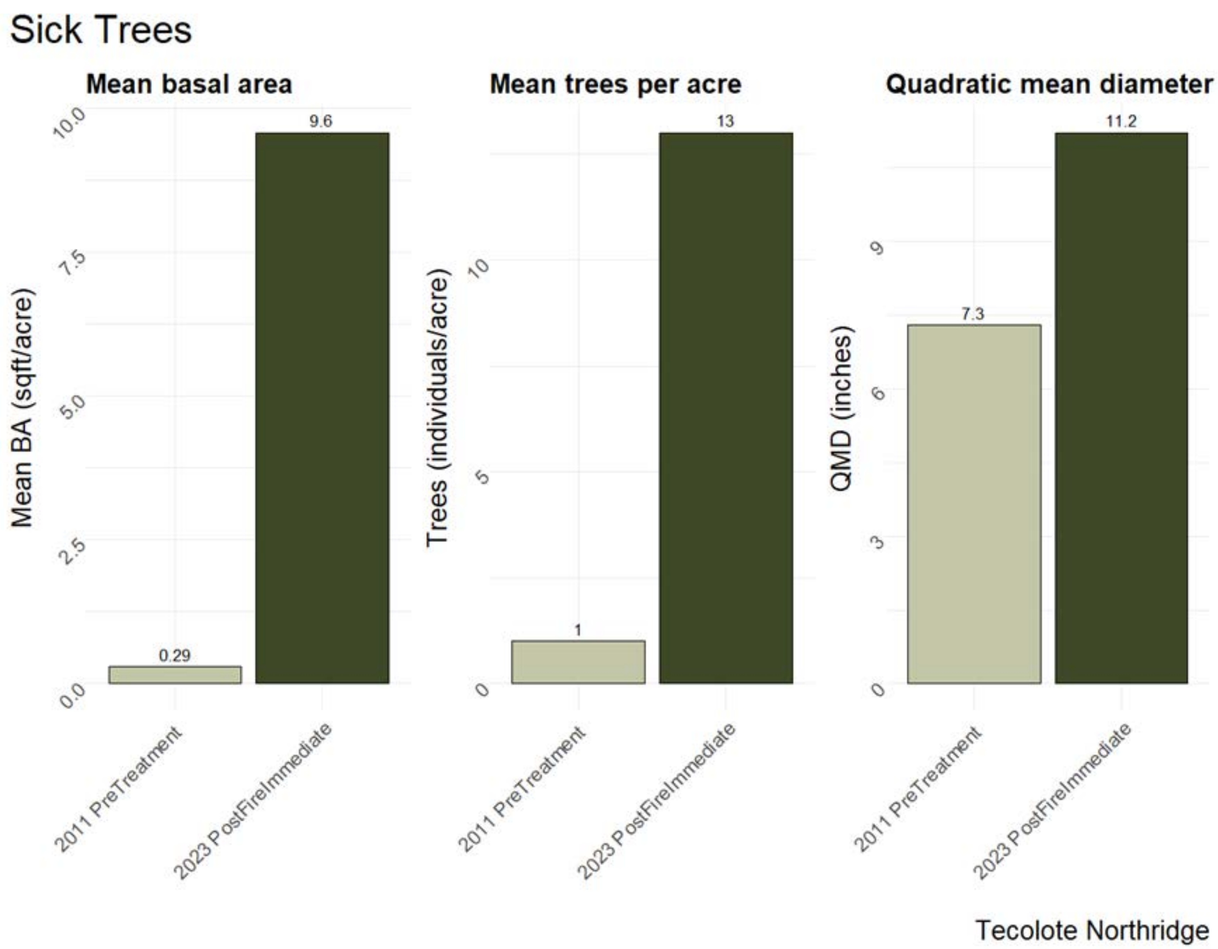


Figure 11. *Mean basal area, mean trees per acre, and quadratic mean diameter for sick trees across both measurement periods (>1" DBH). Mean values represent averages of plot means for each monitoring status.*

In the pre-treatment measure, a single occurrence of mistletoe was the only damage recorded. Immediately post-fire the most frequent damage code was fire char and/ or scorch with 13 recorded occurrences. Mistletoe was the second most frequent damage with 8 recorded occurrences immediately post fire. Trees designated as sick are expected to experience mortality from their disease/damage agent within coming years, and likely some additional post-fire mortality will occur among heavily burned trees.

Tecolote Northridge: Sick Trees by Damage Code

Table 2. *List of damages observed on sick trees across all measurement periods by code and description. Count represents the number of observations of each damage type, individual sick trees may have more than one damage recorded.*

Monitoring Status	Damage Code	Count	Description
2011 PreTreatment	23001	1	Mistletoe
2023 PostFireImmediate	11000	2	Bark beetles
2023 PostFireImmediate	23001	8	Mistletoe
2023 PostFireImmediate	25000	1	Foliage disease
2023 PostFireImmediate	30000	13	Fire char and/or scorch
2023 PostFireImmediate	41010	1	Bird damage
2023 PostFireImmediate	99036	1	Fire scar/catface

Char & Scorch

Immediately post-fire, char height averaged 22 ft and scorch height averaged 34 ft across all trees in the project. Plot to plot these values varied extensively, with some trees experiencing complete char/scorch of total tree height and others minimally affected.

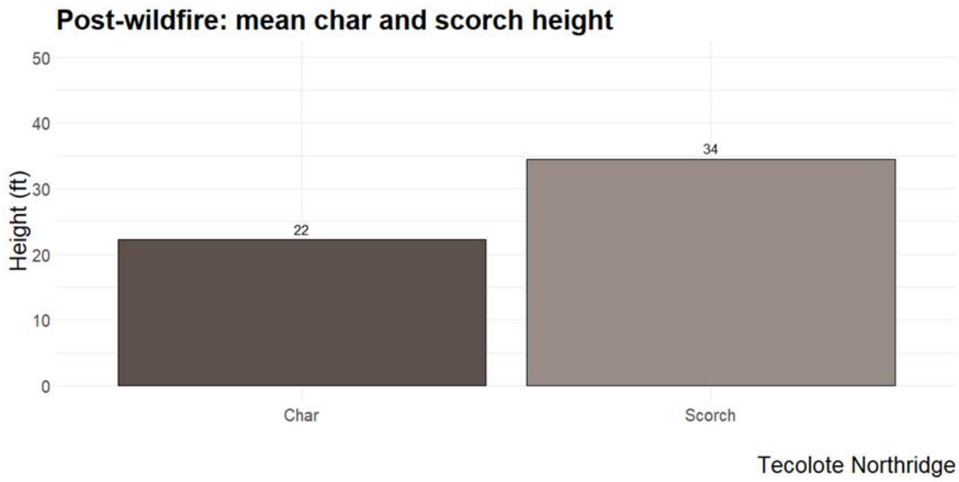


Figure 12. *Mean tree char and scorch heights. Mean values represent averages of plot means for each monitoring status.*

Seedlings, Saplings, & Shrubs

Mean live tree seedling density was 3,480 individuals/acre pre-treatment and increased to 9,320 individuals/acre immediately post-fire. Mean dead tree seedling density also increased from 20 individuals/acre pre-treatment to 2990 individuals/acre immediately post-fire. Mean live shrub seedling density was 10 individuals/acre pre-treatment and 980 individuals/acre immediately post-fire. No dead shrub seedlings were recorded pre-treatment but 30 individuals/acre were recorded 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 Additional Figures section for species breakdown of regeneration densities.

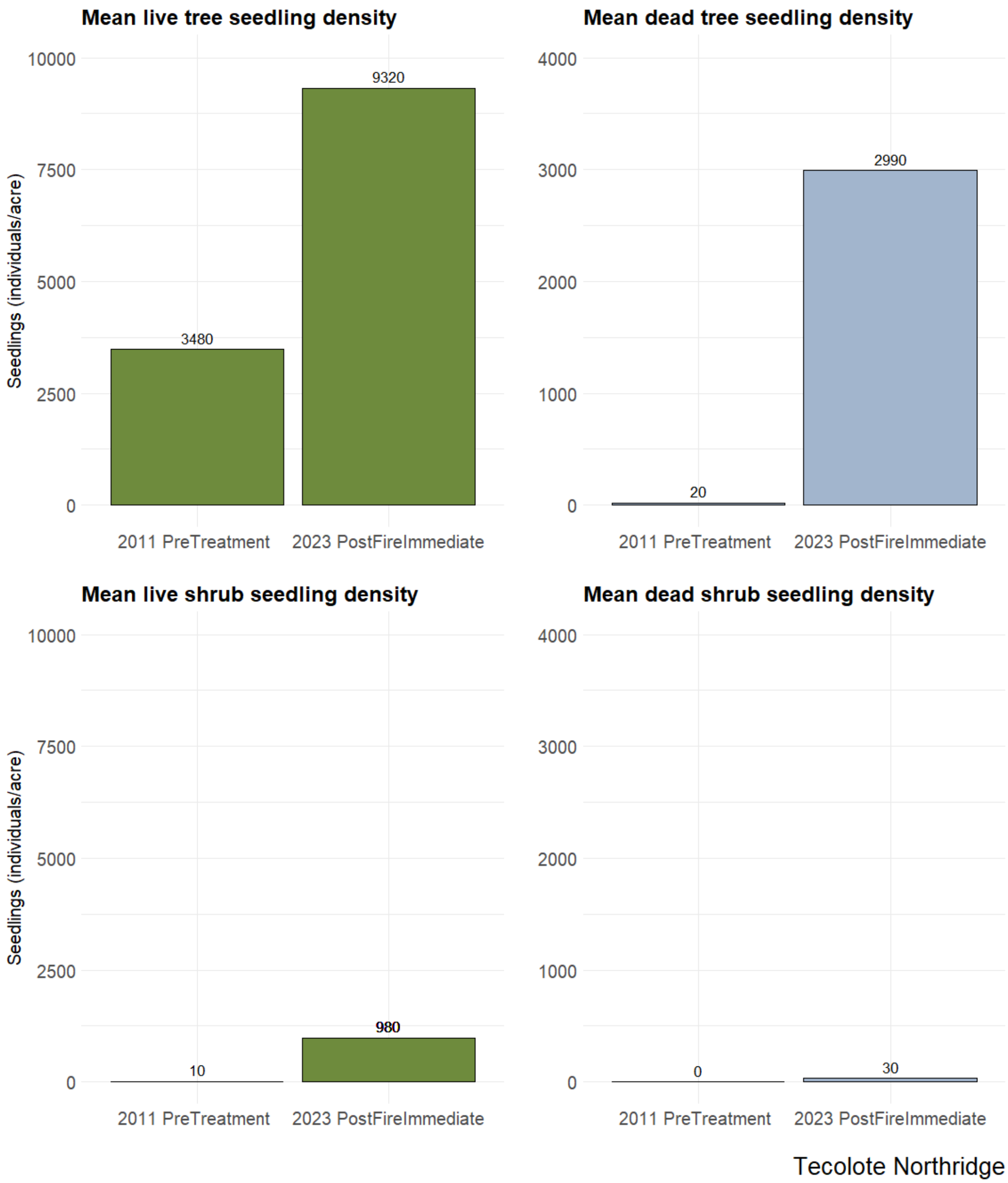


Figure 13. *Regeneration densities of trees and shrubs in the seedling class across both measurement periods*

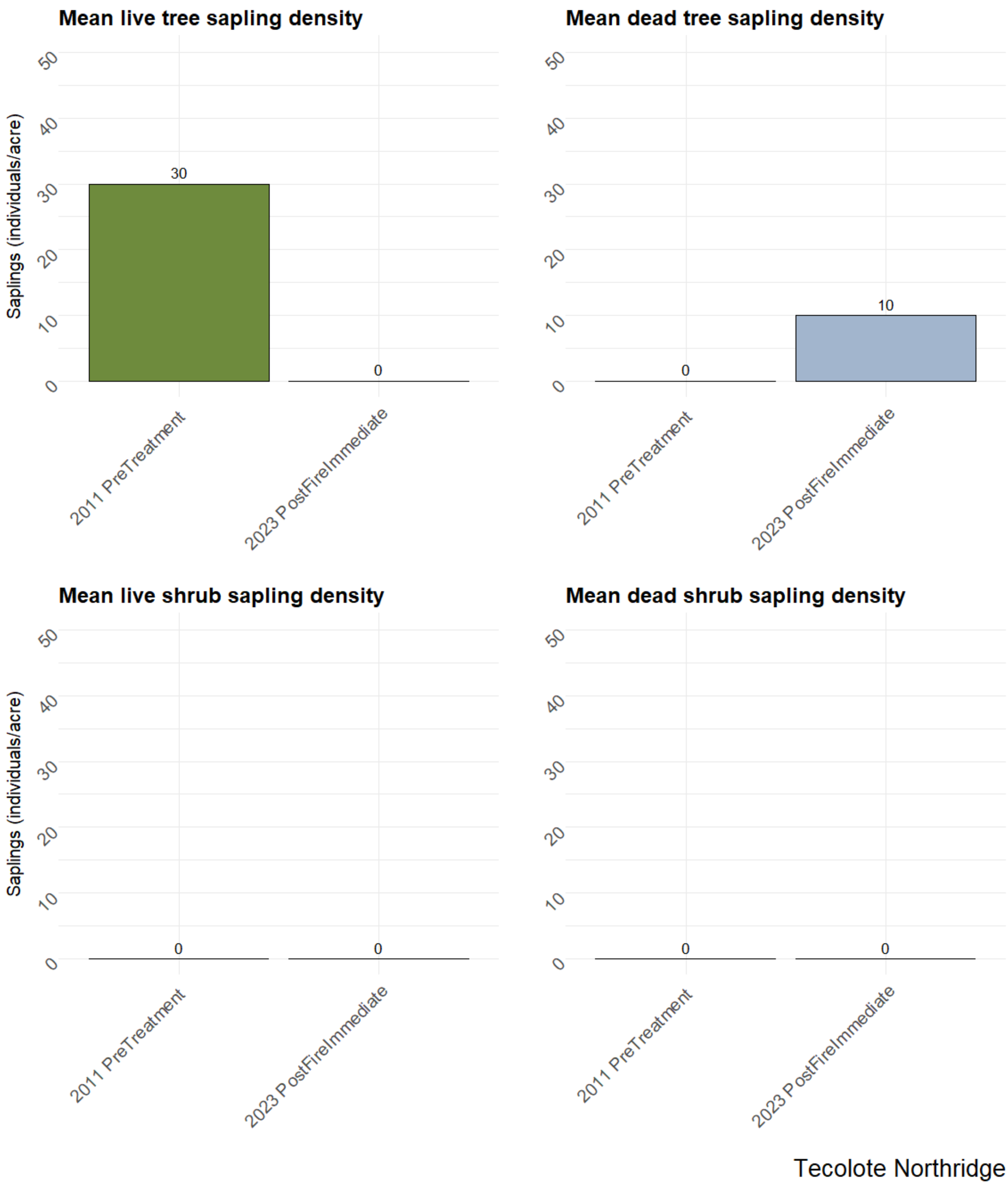


Figure 14. *Regeneration densities of trees and shrubs in the sapling class across both measurement periods*

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.

2011 Pre-treatment

***Table 3**. 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*	*99%*
	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%*

2023 Post-fire immediate

Table 4. *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 (All living trees in woodland & forestland)	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*	*57%*
	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%*
	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 (All living trees in woodland & forestland)	TPA	8.00			25.00			37.00											*70*	
	TPA %	11.43%			35.71%			52.86%											*100%*	
	BA/AC	0.18			10.55			43.95											*55*	
	BA/AC %	0.33%			19.29%			80.38%											*100%*	
	QMD MEAN DIA.	2.02			8.79			14.76											*12.0*	
	AVE HT, HL	16			41			58											*55*	
Dead (All dead trees in woodland & forestland)	COUNT	1	7	1	3	7	14	12	2	2	2	1	0	0	0	0	0	0	*52*	
	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%*
	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%*
	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 sample trees including Growing Stock and Dead	COUNT	1	14	2	5	19	25	32	7	7	2	6	2	0	0	0	0	0	*122*	
	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%*
	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 and values are not directly comparable to each category of cover data collected immediately post-fire in 2023. However, comparable canopy cover values show a decrease from 65% cover pre-treatment to 38% immediately post-fire following the loss of live trees from thinning and fire. 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.

Tecolote Northridge: Cover 2011

***Table 5**. Mean percent cover by category*

Monitoring Status	Canopy	Seedlings/ Saplings	Bare soil	Shrubs	Graminoids	Forbs	Litter	Rock	Gravel
2011 PreTreatment	65%	5.3%	0%	11%	8.3%	2.6%	79%	4.2 %	0%

Tecolote Northridge: Ground Cover 2023

***Table 6.** Mean percent ground cover by category*

Monitoring Status	Plant Basal	Bole	Litter	BareSoil	Rock	Gravel
2023 PostFireImmediate	15 %	3.5 %	23 %	23 %	17 %	18 %

Tecolote Northridge: Aerial Cover 2023

***Table 7.** Mean percent aerial cover by category*

Monitoring Status	Canopy	TreeRegen	Shrubs	Graminoids	Forbs
2023 PostFireImmediate	38 %	13 %	1.4 %	13 %	19 %

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 herbaceous fuels (HD and HL) increased from pre-treatment to immediately post-fire while the average height of both woody fuels (SD and SL) decreased from pre-treatment to post-fire.

Total average biomass decreased from 2.0 tons per acre pre-treatment to 1.0 tons per acre immediately post-fire. However, average biomass remained constant for herbaceous dead (HD) and increased for herbaceous live (HL) from pre-treatment to immediately 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.

***Table 8**. Ladder fuel average percent cover, height, and biomass for each category and monitoring status*

2011 Pre-treatment

Fuel	Avg Cover (%)	Avg. Ht (ft)	Avg. Biomass (tons per acre)
HD	5.3	0.4	0.1
HL	7.3	0.4	0.1
SD	1.7	3.5	0.3
SL	15	2.4	1.5
Total			**2.0**

2023 Post-fire Immediate

Fuel	Avg Cover (%)	Avg. Ht (ft)	Avg. Biomass (tons per acre)
HD	1.3	0.9	0.1
HL	5.6	1.1	0.3
SD	0.8	2.2	0.2
SL	5.3	1.2	0.4
Total			**1.0**

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 5.9 tons per acre pre-treatment to 1.7 tons per acre immediately post-fire. Total surface fuels (wood fuels + duff/litter) decreased from 18 tons per acre pre-treatment to 6.7 tons per acre immediately post-fire. These decreases are consistent with surface fuel consumption from fire.

Table 9*. Fuel loads by type and monitoring status*

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)
2011 PreTreatment	0.06	1.1	0.76	2.4	1.6	6.1	5.5	**1.9**	**5.9**	**18**
2023 PostFireImmediate	0.038	0.25	0.21	1.2	0	2.7	2.2	**0.5**	**1.7**	**6.7**

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.

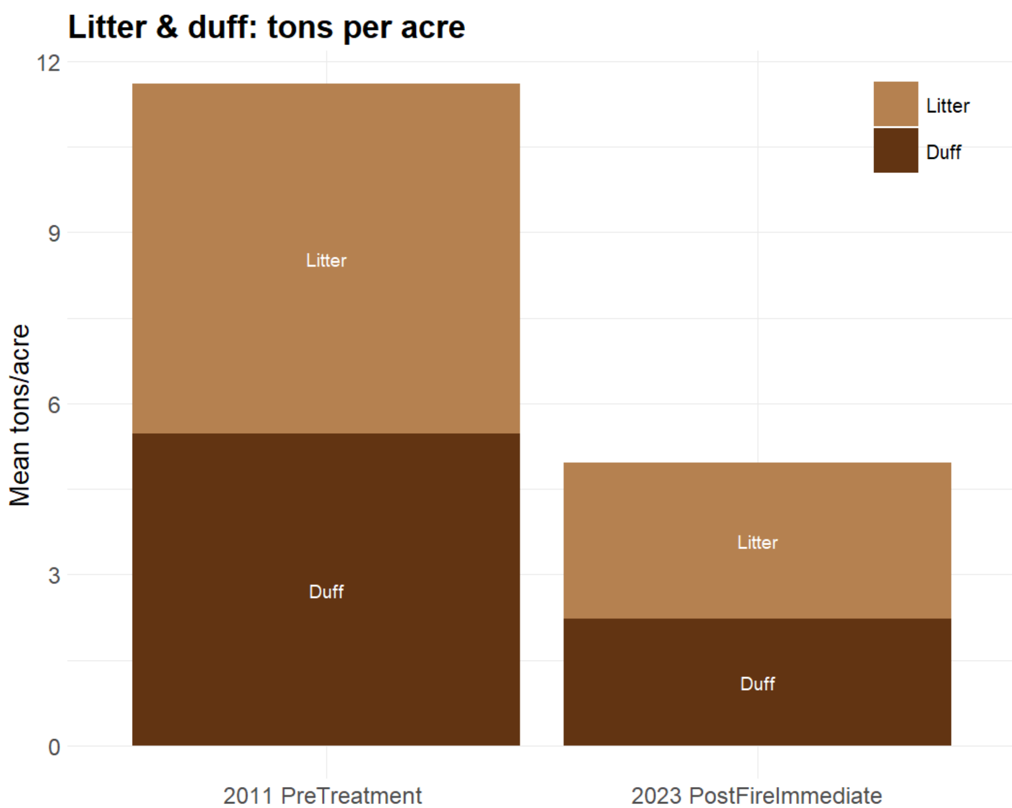


Figure 15*. Mean litter and duff loads by monitoring status*

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.

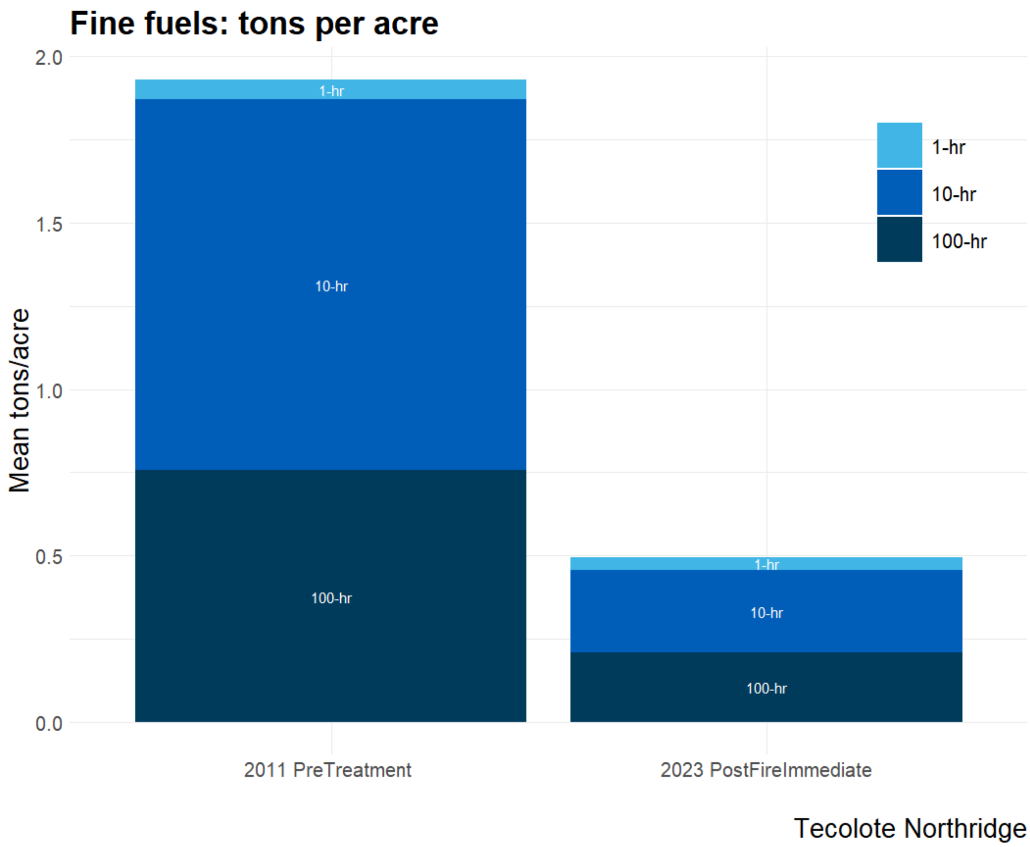


Figure 16. *Mean litter and duff loads by monitoring status*

Thousand-Hour Fuels

Rotten thousand-hour fuel loads (decay classes 4-5) were calculated at 1.6 tons/acre pre-treatment and there were no rotten thousand-hour fuels immediately post-fire. Sound thousand-hour fuel loads (decay classes 1-3) decreased from 2.4 tons/acre pre-treatment to 1.2 tons/acre immediately post-fire.

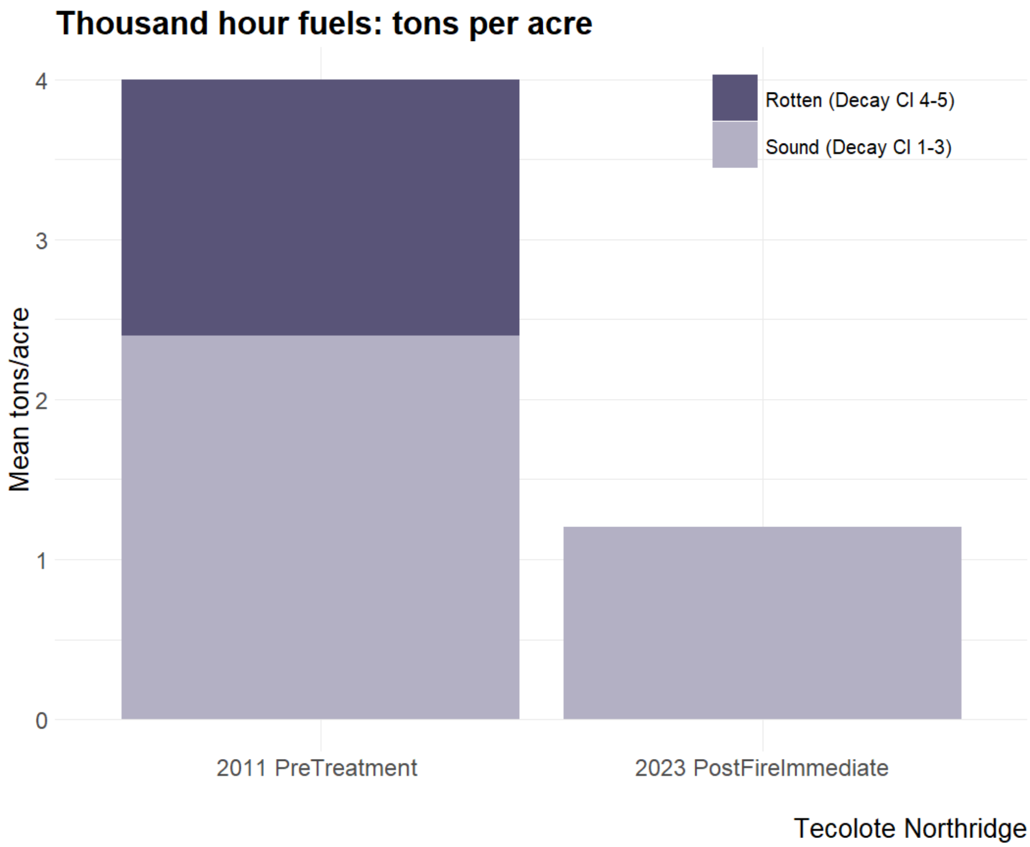


Figure 17. *Mean thousand-hour fuel loads by monitoring status*

The highest category of thousand-hour fuels pre-treatment was Decay Class 2, and all recorded thousand-hour fuels were classified as Decay Class 2 post-fire.

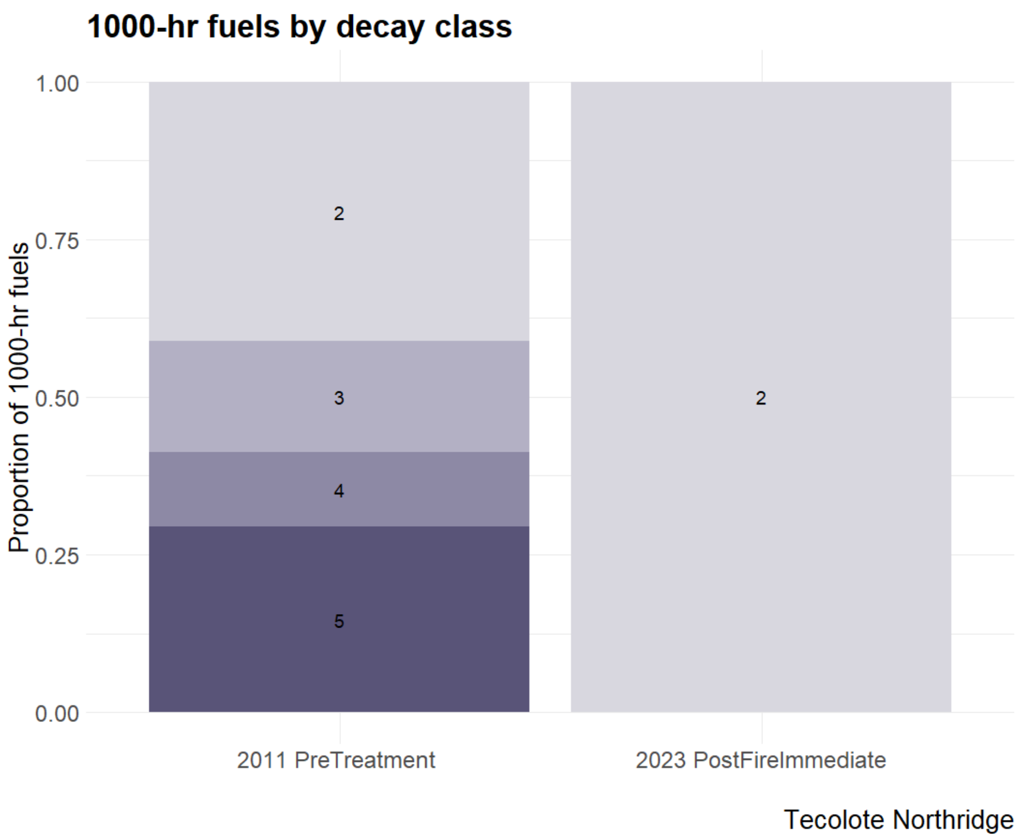


Figure 18. *Proportion of total thousand-hour fuels by decay class and monitoring status*

Photo Comparisons

Plot NR_1A_W

Pre-Treatment 2011

Post-Fire Immediate 2023

Plot NR_3A_W


Pre-Treatment 2011


Post-Fire Immediate 2023

Plot NR_3C_W

Pre-Treatment 2011

Post-Fire Immediate

Additional Resources

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-fire 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
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
CEMO2	*Cercocarpus montanus*	alderleaf mountain mahogany

Plot Center Coordinates

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

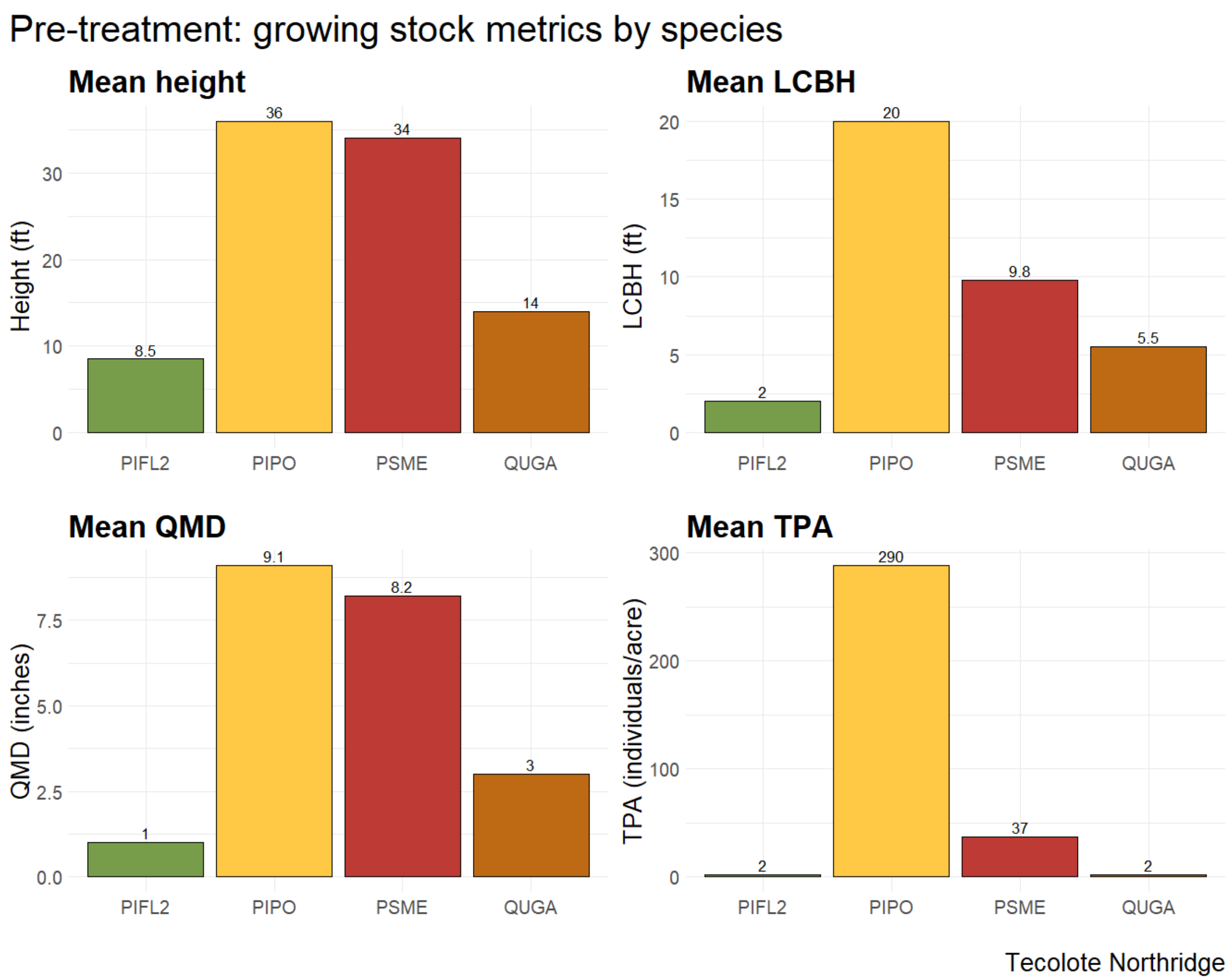
Plot Name	Latitude	Longitude
1A	35.673986	-105.435333
1B	35.672179	-105.436428
1C	35.670372	-105.437523
2A	35.662971	-105.437979
2B	35.661163	-105.439074
2C	35.661171	-105.436864
2D	35.661179	-105.434655
3A	35.658813	-105.444013
3B	35.658821	-105.441804
3C	35.65883	-105.439594

Abbreviations & Acronyms

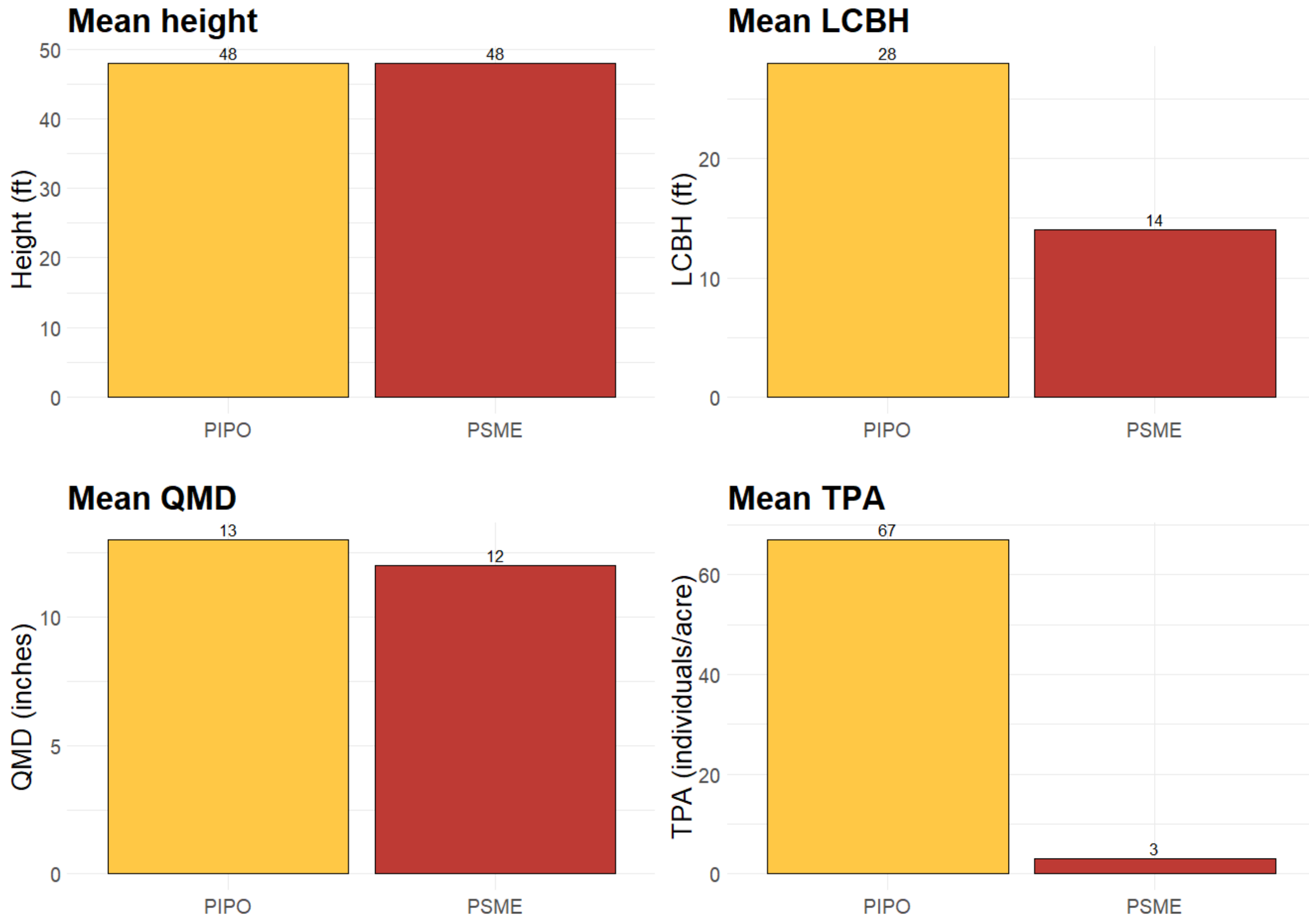
Acronym/Abbreviation/Term	Definition as used by NMFWRI
1-hr fuel	Woody surface debris < 0.25 inches in diameter
10-hr fuel	Woody surface debris 0.25 – 1 inch in diameter
100-hr fuel	Woody surface debris 1.0 – 3.0 inches in diameter
1000-hr fuel	Woody surface debris > 3.0 inches in diameter
CFRP	Collaborative 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

Additional Figures:

Figure 19. *The following figures show tree (>1") metrics by species and status across each measurement period*

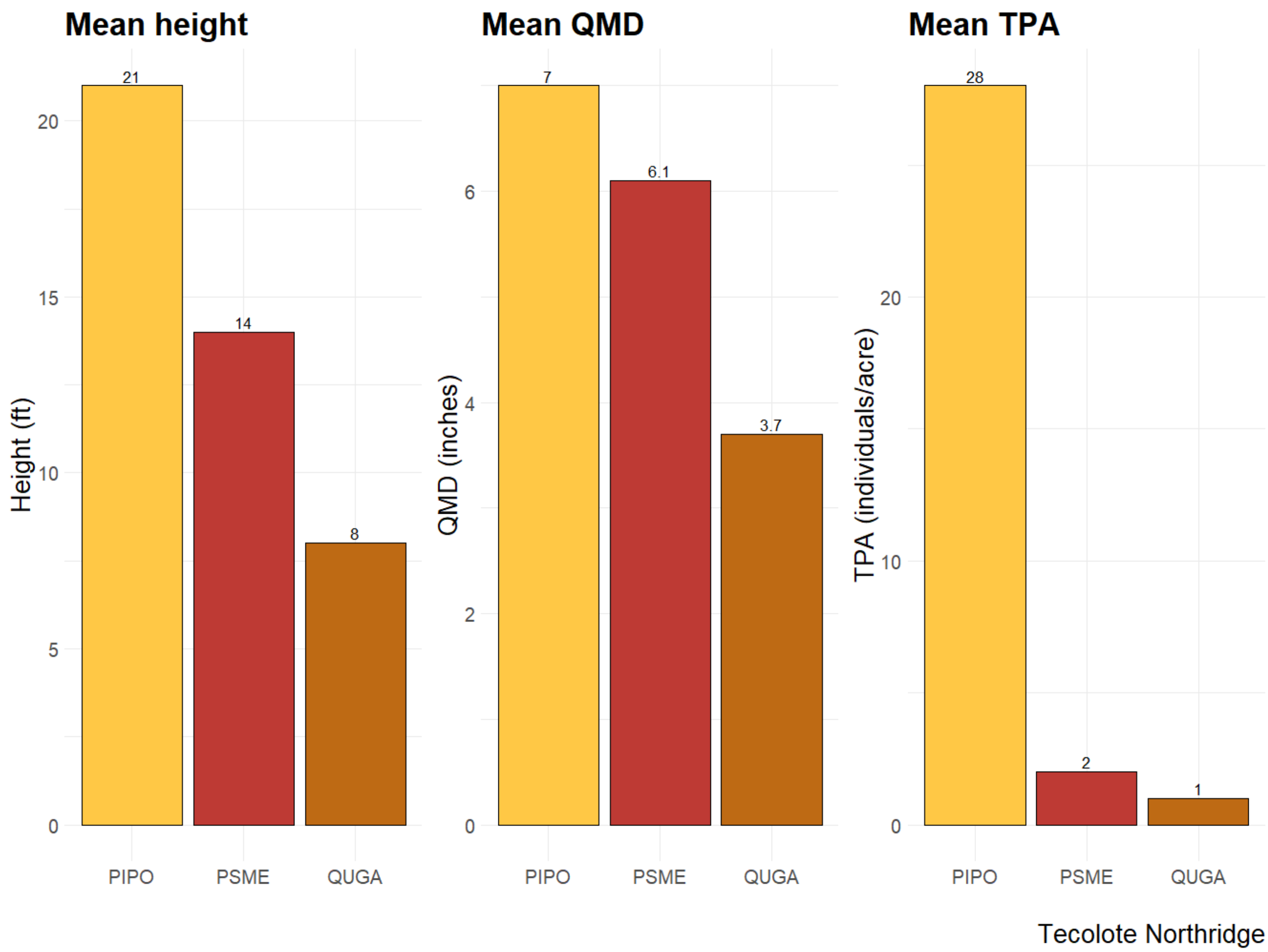


Post-fire immediate: growing stock metrics by species

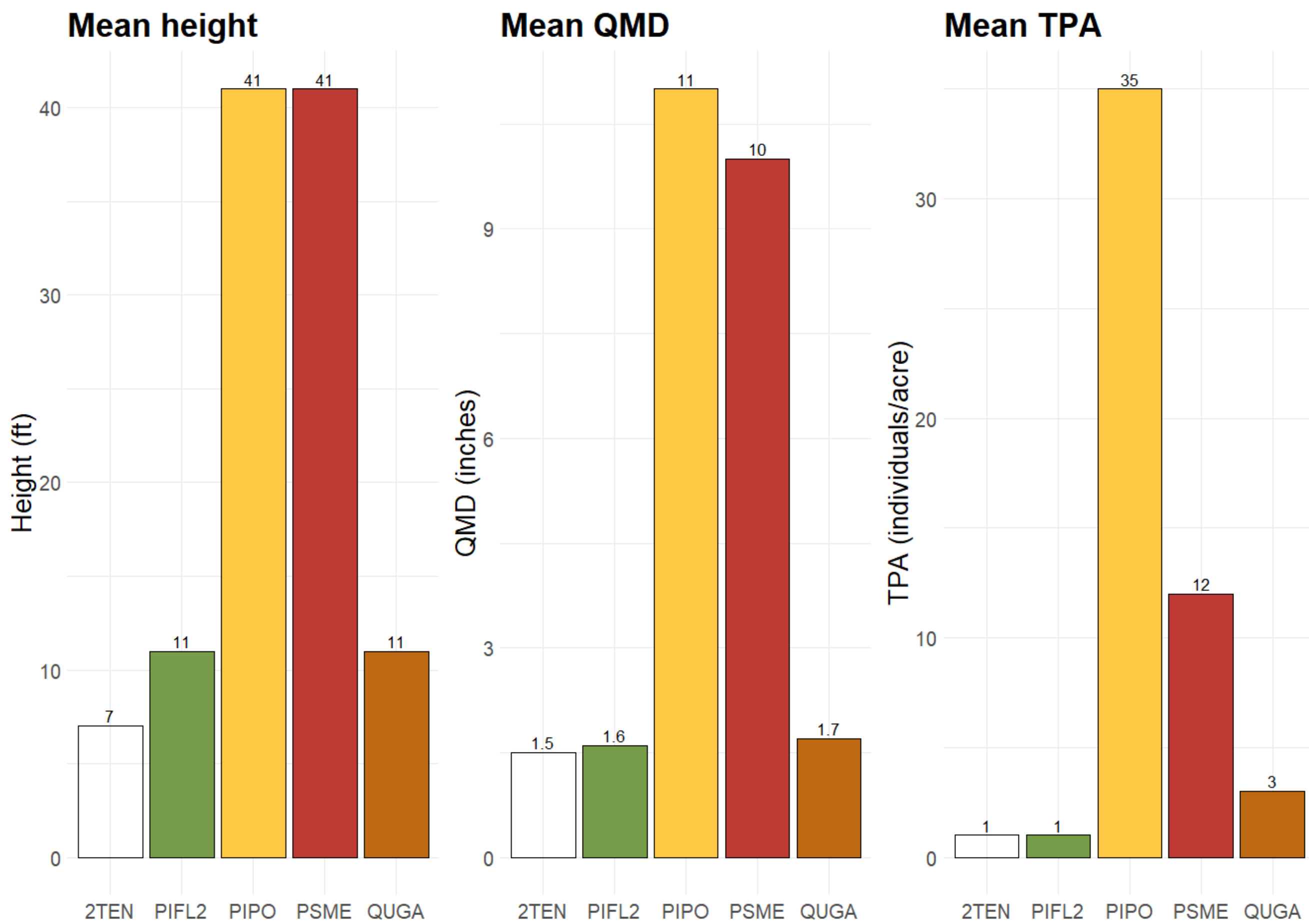


Tecolote Northridge

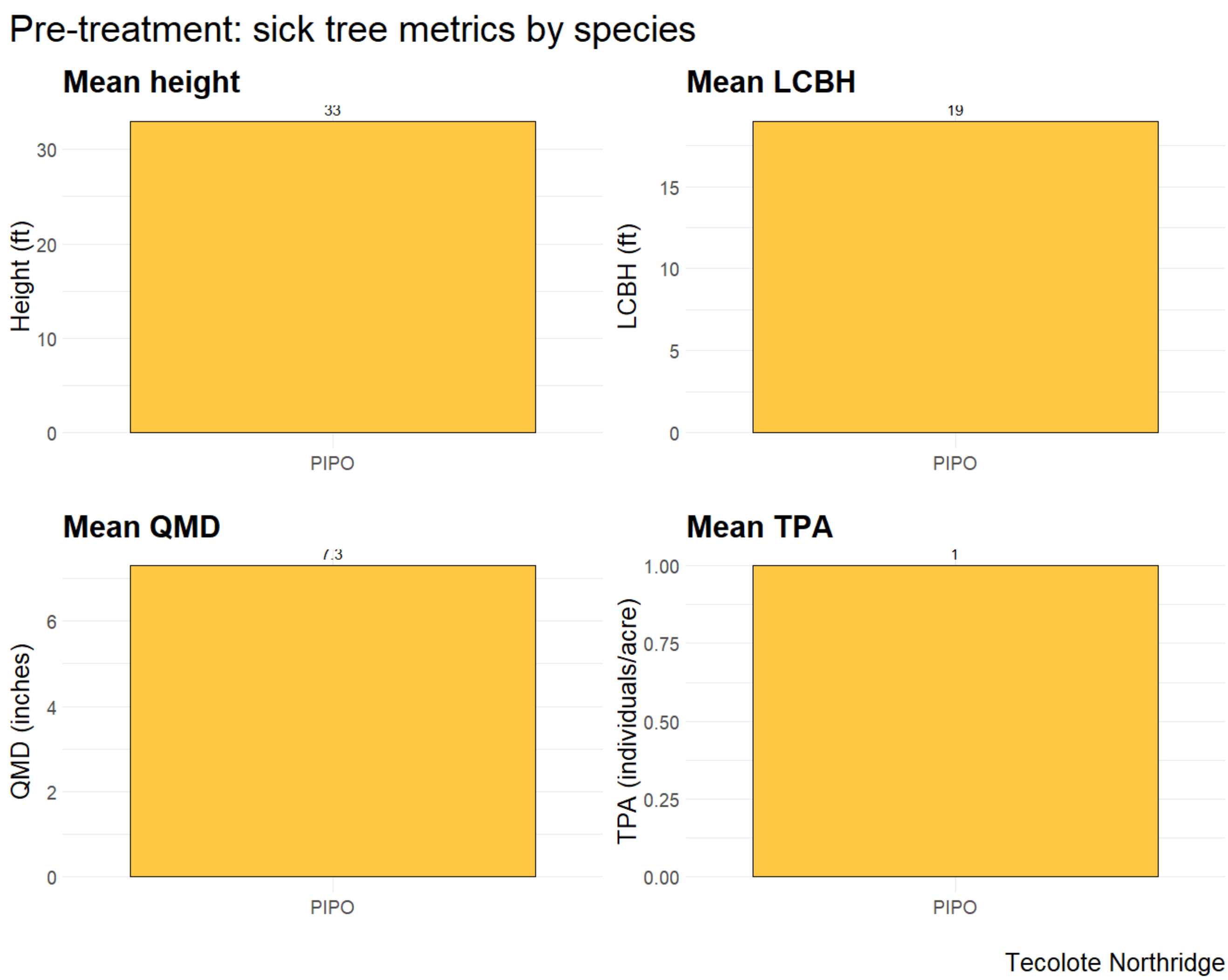
Pre-treatment: snag metrics by species



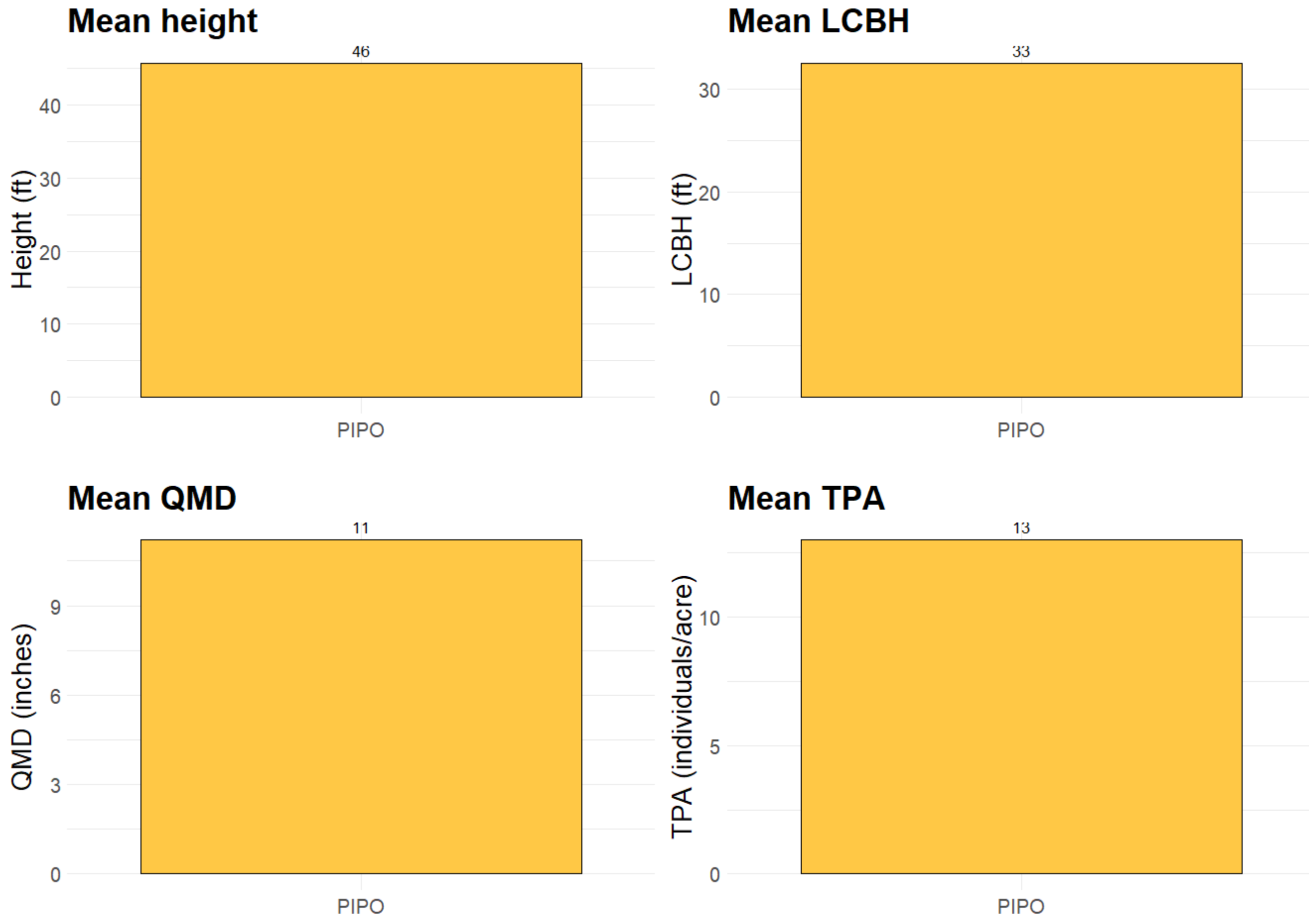
Post-fire immediate: snag metrics by species



Tecolote Northridge

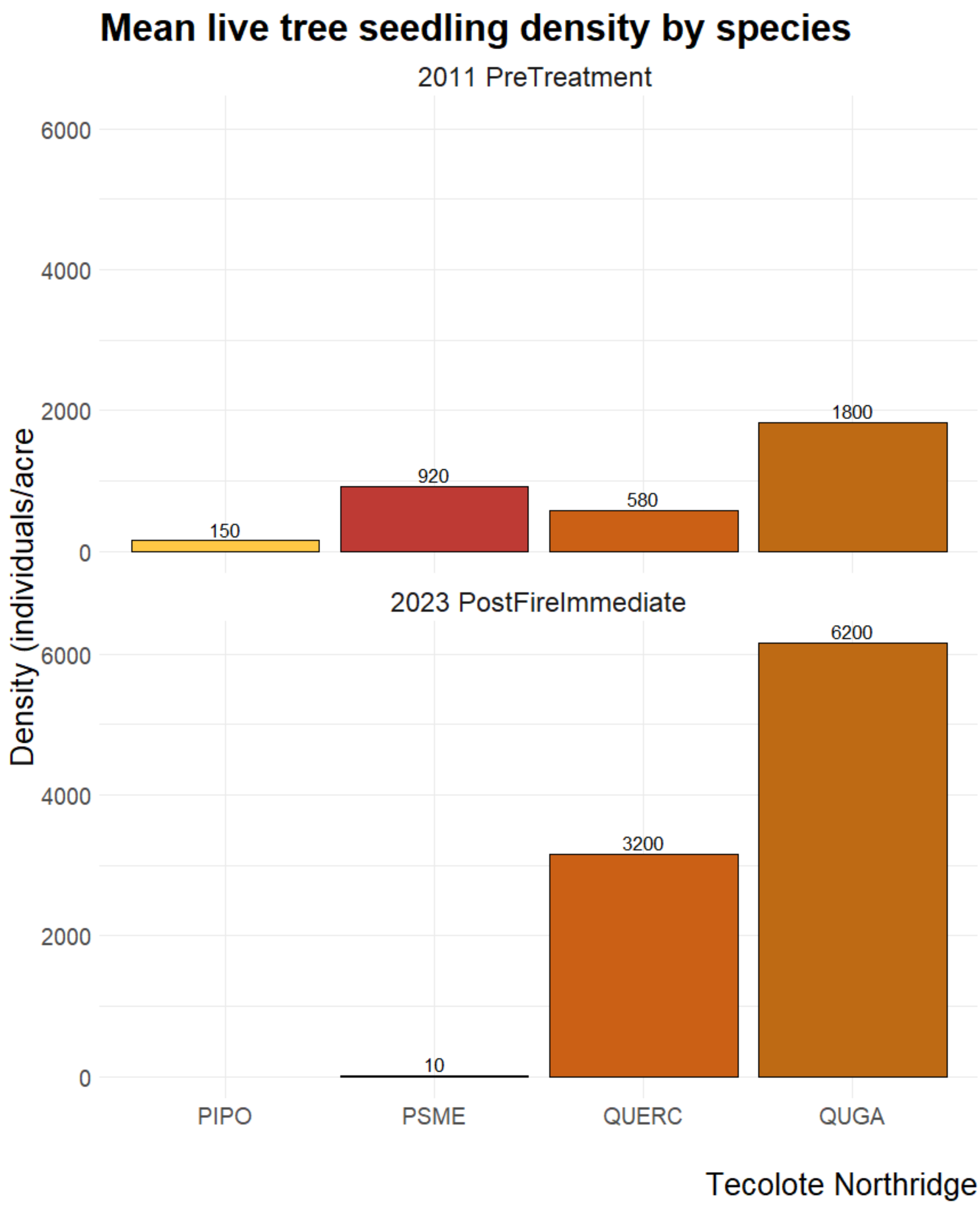

Pre-treatment: sick tree metrics by species
Mean height
33
Height (ft)
0
10
20
30
PIPO
Mean LCBH
19
LCBH (ft)
0
5
10
15
PIPO
Mean QMD
7.3
QMD (inches)
0
2
4
6
PIPO
Mean TPA
1
TPA (individuals/acre)
0.00
0.25
0.50
0.75
1.00
PIPO
Tecolote Northridge

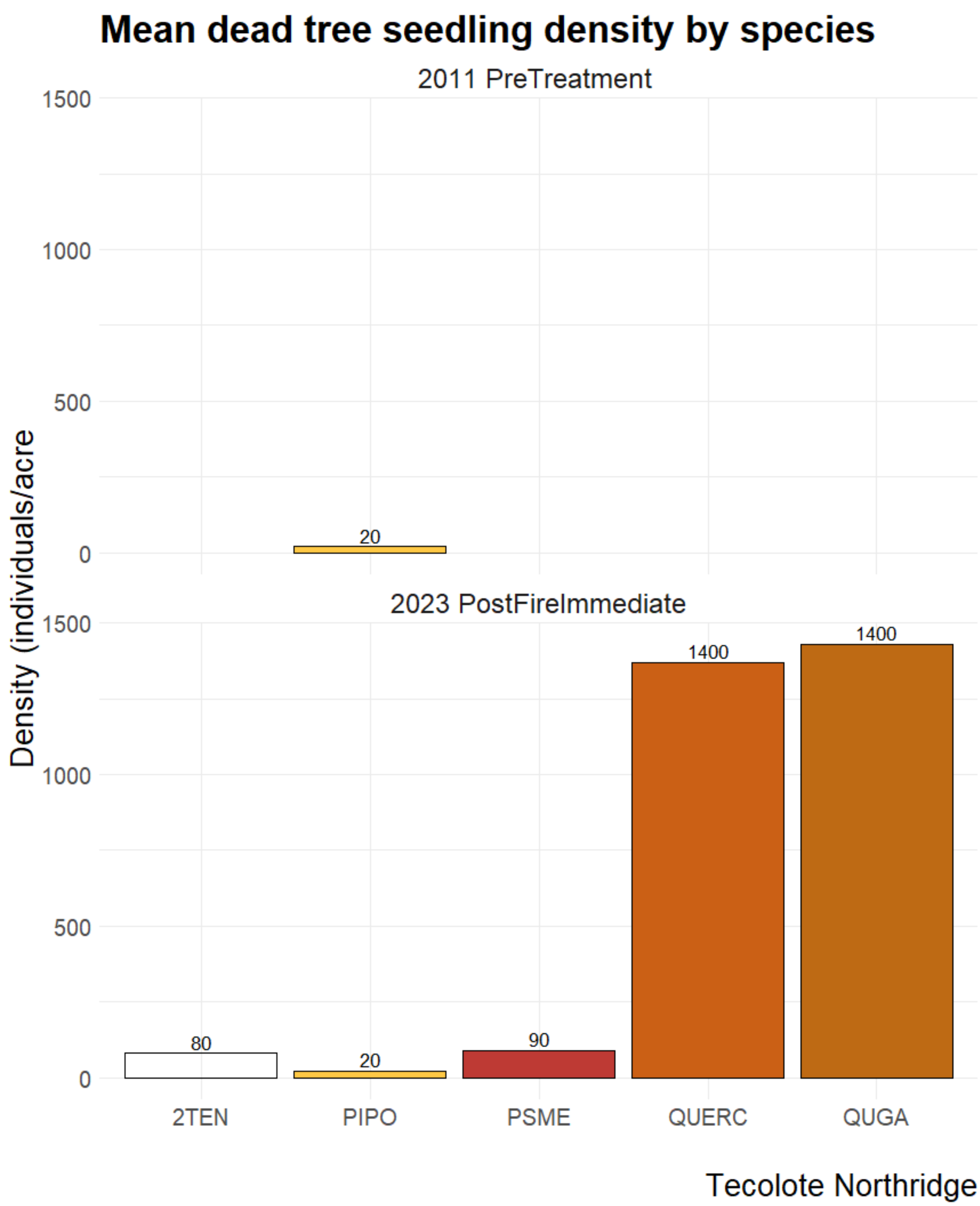
Post-fire immediate: sick tree metrics by species

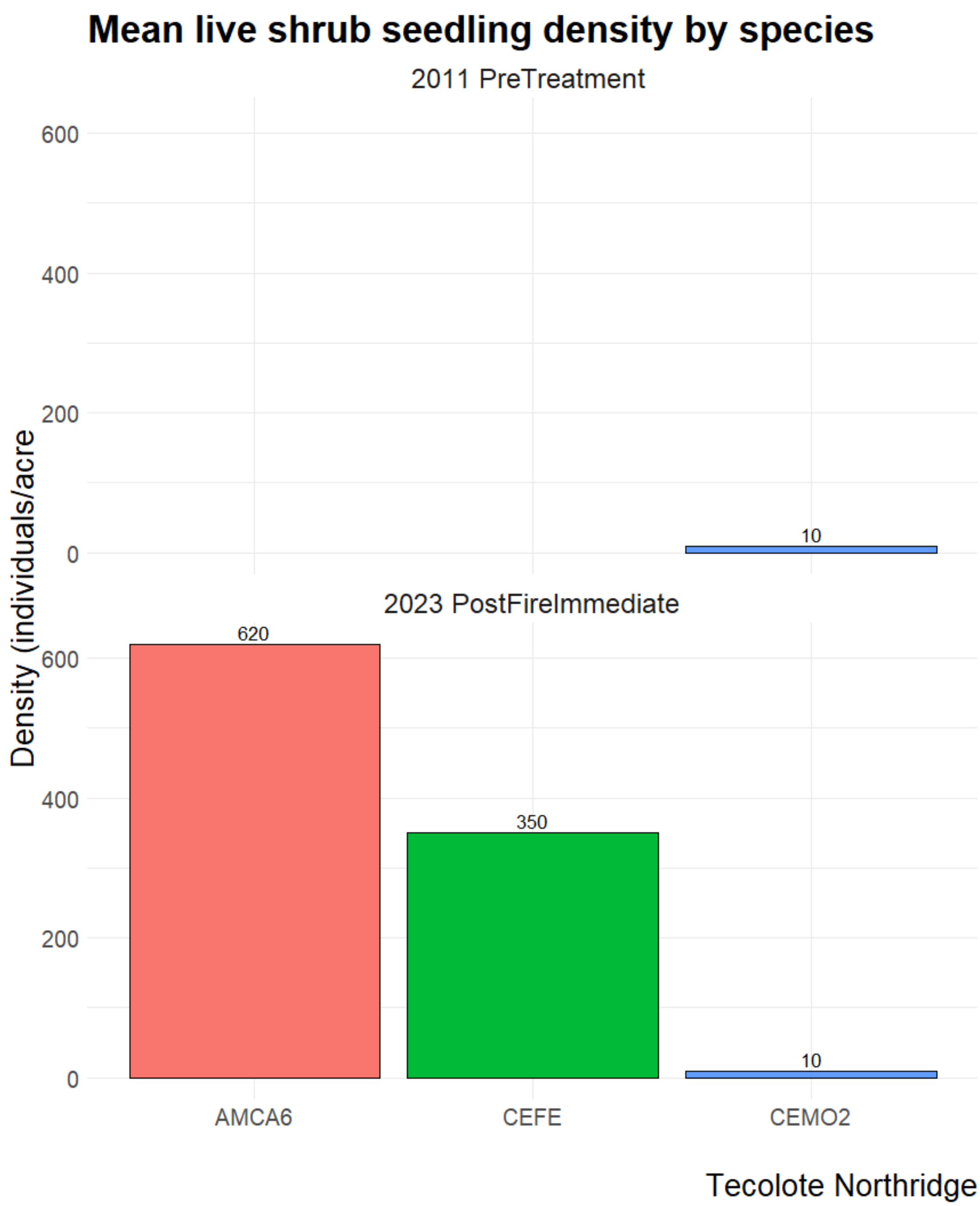


Tecolote Northridge

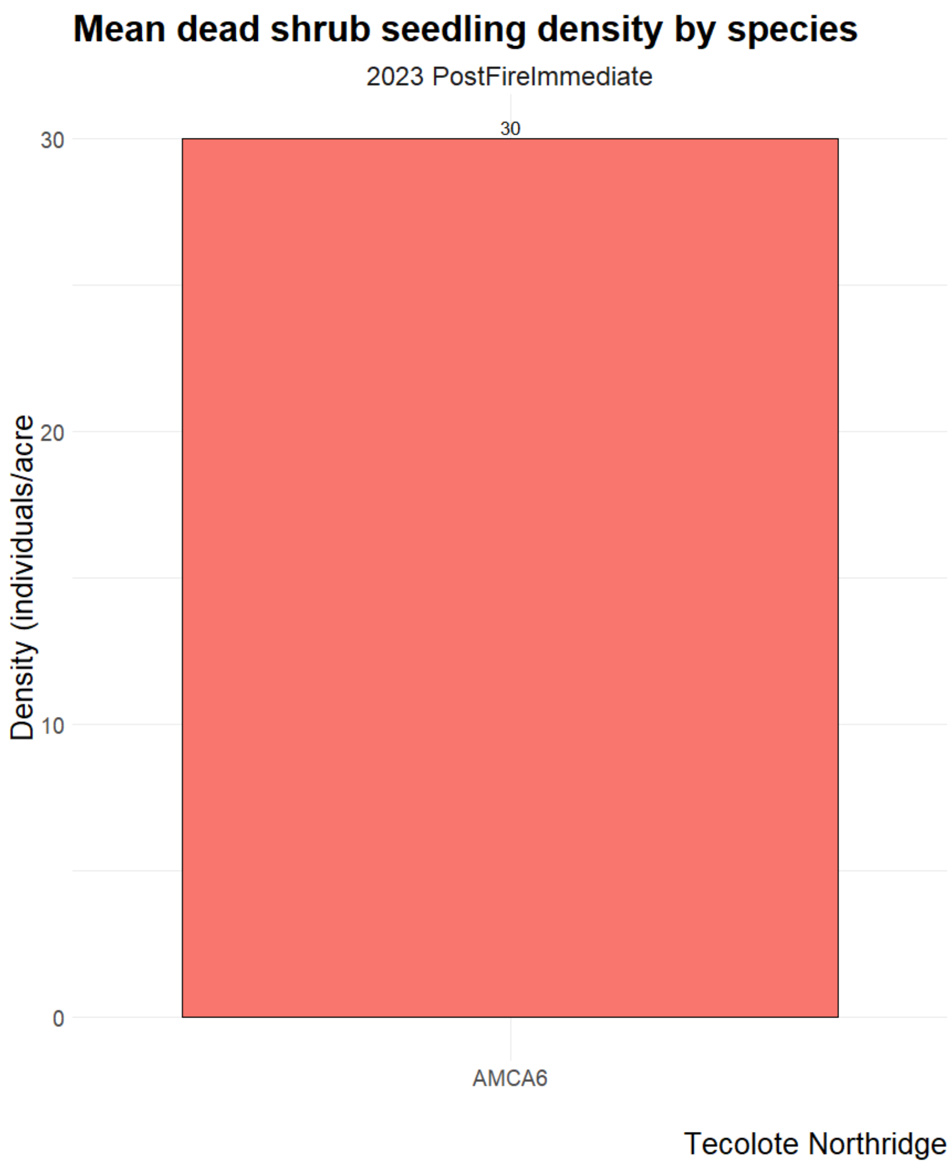
Figure 20. The following figures show seedling and sapling densities by species and status across each measurement period

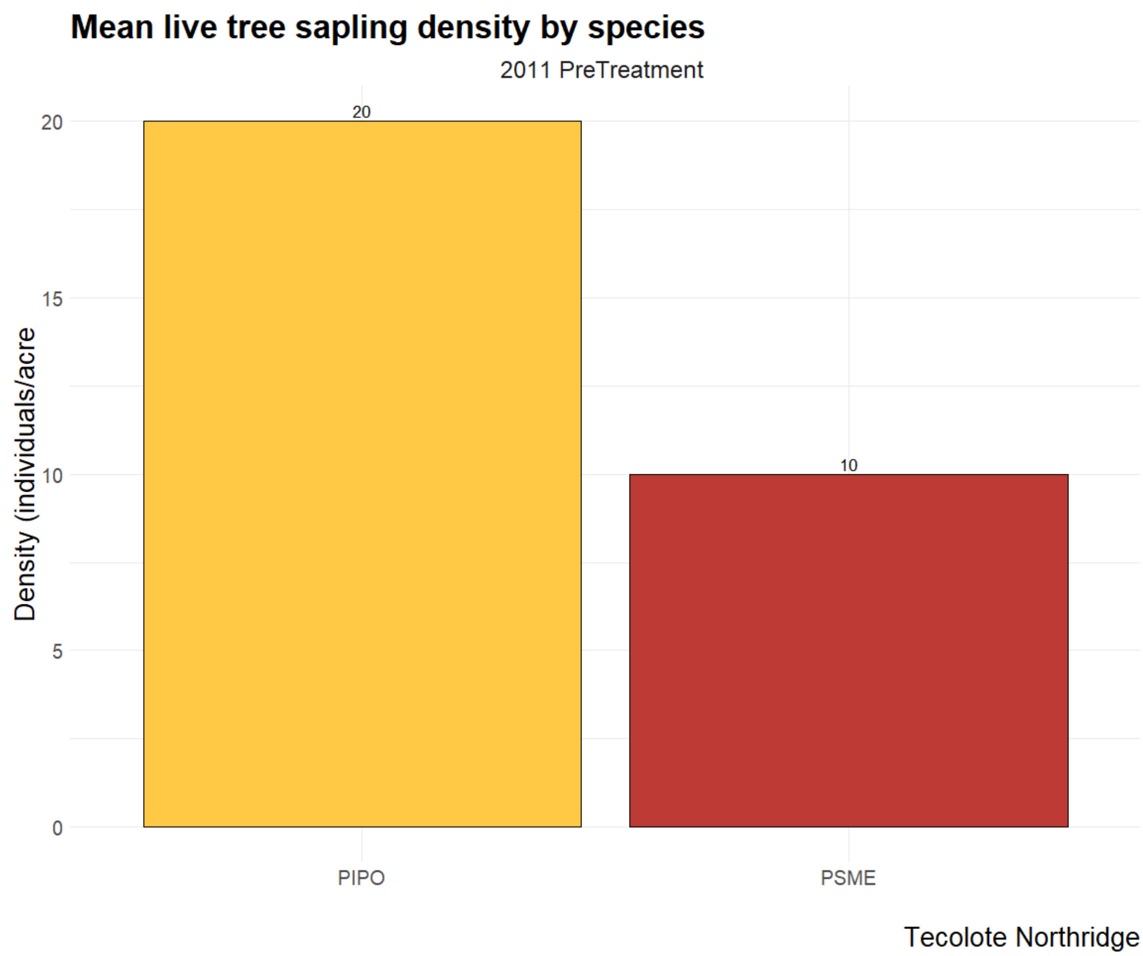



Mean dead tree seedling density by species
2011 PreTreatment
2023 PostFireImmediate
Density (individuals/acre
1500
1000
500
0
20
80
90
1400
1400
2TEN
PIPO
PSME
QUERC
QUGA
Tecolote Northridge

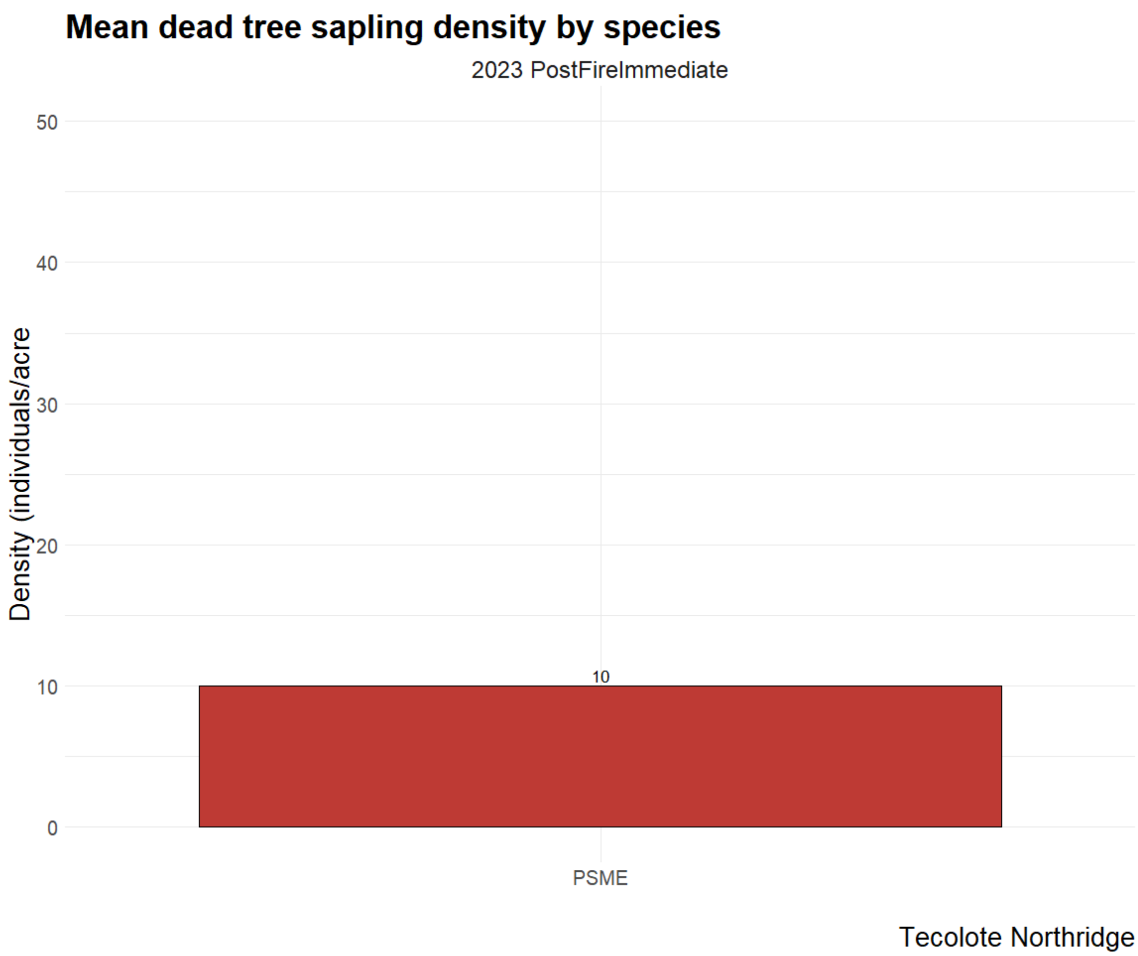


Mean live shrub seedling density by species
2011 PreTreatment
600
400
200
0
10
2023 PostFireImmediate
620
350
10
600
400
200
0
AMCA6
CEFE
CEMO2
Density (individuals/acre
Tecolote Northridge


Mean dead shrub seedling density by species
2023 PostFireImmediate
Density (individuals/acre
30
20
10
0
30
AMCA6
Tecolote Northridge



Mean live tree sapling density by species
2011 PreTreatment
Density (individuals/acre
20
15
10
5
0
20
10
PIPO
PSME
Tecolote Northridge



Mean dead tree sapling density by species
2023 PostFireImmediate
Density (individuals/acre
50
40
30
20
10
0
10
PSME
Tecolote Northridge

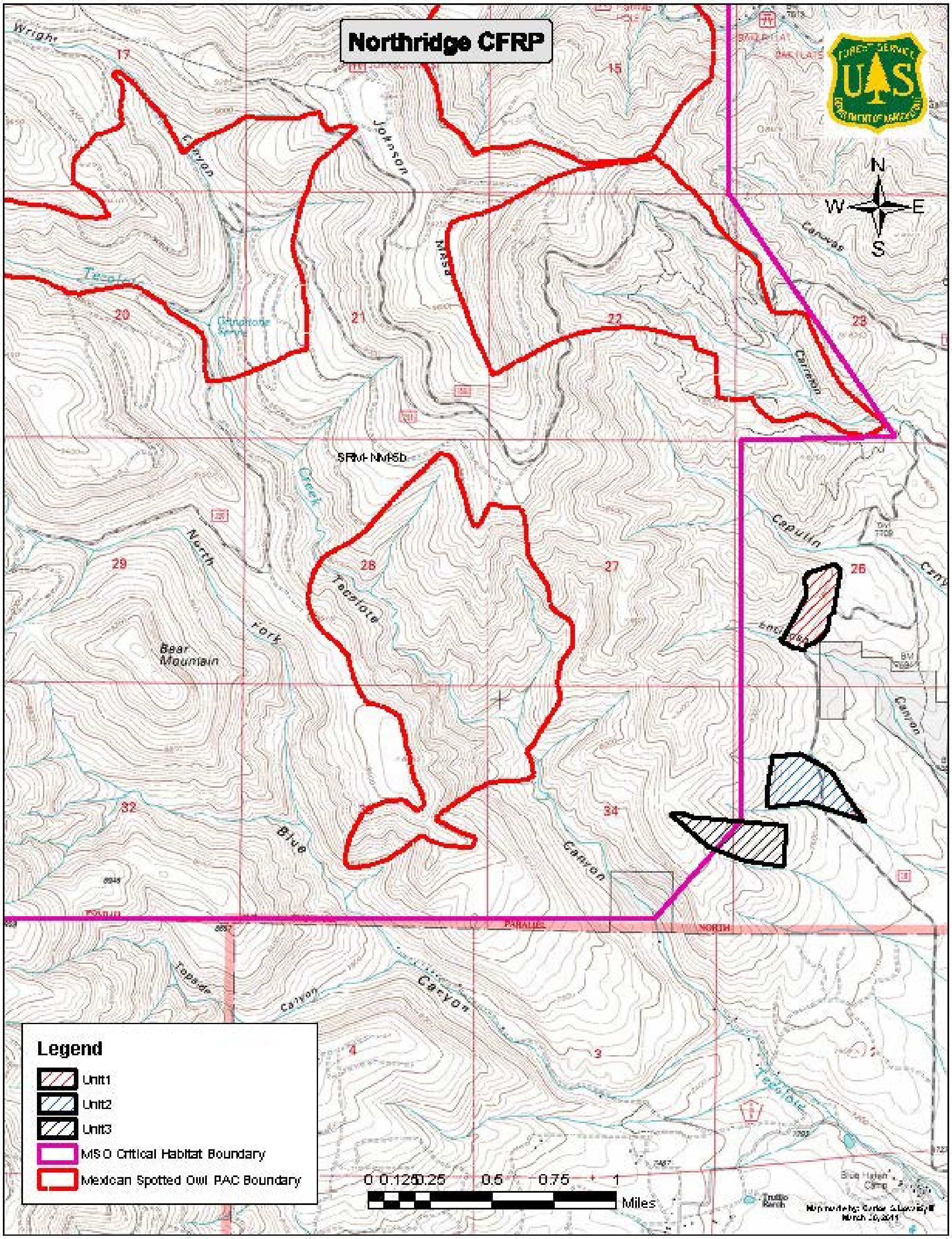


Figure 21. *Overview map of Tecolote Northridge project area showing Mexican Spotted Owl Critical Habitat and Protected Activity Centers from 2011*