Pueblo of Sandia 25.15 and 25.16

Pre-Treatment Monitoring Report – 2025

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Contents

Acronyms and Abbreviations

Acronym, Abbreviation, or Term	Explanation or Definition as used by NMFWRI
BEMP	Bosque Ecosystem Monitoring Program, small rectangular plot types
CSE	Common Stand Exam
CSWCD	Coronado Soil and Conservation District
GIS	Geographic Information Systems
GRGWA	Greater Rio Grande Watershed Alliance
NMFWRI	New Mexico Forest and Watershed Restoration Institute
NMHU	New Mexico Highlands University
NMRAM	New Mexico Rapid Assessment Method, version 2.0
NRCS	Natural Resource Conservation Service
QMD	Quadratic Mean Diameter
PC	Plot center
SWCD	Soil and Water Conservation District
TPA	Trees Per Acre
USDA	United States Department of Agriculture

1 Purpose of Report

This report covers low- and high-intensity pre-treatment vegetation monitoring assessments performed on the 25.15 and 25.16 project submitted for the Pueblo of Sandia to the Greater Rio Grande Watershed Alliance in 2025. Following a discussion of the ecological context, and our monitoring methods, we present pertinent background, observations, and assessment results for the projects.

2 Ecological Context of Bosque Restoration

Neither the challenges nor the importance of working in the bosque and other riparian areas in New Mexico today should be underestimated. According to the New Mexico Department of Game and Fish Conservation Division, wetlands and riparian areas comprise approximately 0.6% of all land in New Mexico (2012).

Despite this small percentage, it is estimated that an average of 55% of New Mexican vertebrate species (can be higher for certain taxa) depend on wetland and riparian habitat for their survival (New Mexico Department of Game and Fish Conservation Services Division, 2012). For example, the relatively few miles of riparian habitat of the San Juan and Gila river valleys helped support up to 17% of the avian species of the entirety of North America in the past, due to their use as feeding grounds for migrating birds (Hubbard, 1971). 62% of 117 vertebrate species in the Middle Rio Grande sampled in a RMRS study were found to be vulnerable to changes in their habitat (Friggens, M. et al, 2013). These areas also provide flood mitigation, filtration of sediment and pollutants, and water for a variety of purposes including groundwater recharge (Patten, 1998). In addition, native vegetation, such as cottonwood forests, holds cultural significance to many communities. As much as these areas are disproportionately important to ecosystems and human communities, they are equally disproportionately impacted by disturbance. Anthropogenic impacts with major consequences for our riparian areas include dams, reservoirs, levees, channelization, acequias and ditches, jetty jacks, riprap and Gabion baskets, urbanization, removal of native phreatophytes, grazing by domestic livestock, excessive grazing pressure by native ungulate populations absent natural predation cycles, beaver removal, logging, mining, recreation, transportation, introduction and spread of invasive exotic species, groundwater extraction, altered fire and flood regimes drought and climate change. (Committee on Riparian Zone Functioning and Strategies for Management, et al., 2002). Approximately 39% of our remaining perennial stream miles are impaired (New Mexico Department of Game and Fish Conservation Services Division, 2012).

New Mexico is fortunate enough to have the Middle Rio Grande Bosque, the largest remaining bosque in the Southwest (USDA USFS, 1996). However, over the past two decades, the number of fires in the bosque has been increasing. Historically, the primary disturbance regime in the bosque has been flooding, not fire, which means the system is not fire-adapted. In fact, native species like cottonwood resprout from their roots after floods and need wet soils to germinate from seed. Flooding also promotes decomposition of organic material and keeps the soil moist, which reduces the likelihood of fire. Today, overbank flow is uncommon in many areas of the Rio Grande due to the heavy alteration of the channel and flow regimes (two obvious examples are the structures defining the upper and lower extent of the Middle Rio Grande: Cochiti Dam and Elephant Butte Reservoir). This has led to low fuel moisture content and high fuel loads, as well as increased human presence in the riparian area. As a result, bosque fires are more common and more severe: they kill cottonwoods and other native species, creating spaces which are filled by non-native species such as salt cedar, Russian olive, Siberian elm, and Tree-of-Heaven.

Efforts geared toward the removal of these nonnative species can help to reduce fire risk, preserve native vegetation, and be part of a larger effort to restore the bosque and the watershed to a more natural and functional ecosystem. The Greater Rio Grande Watershed Alliance (GRGWA) has been working on these issues with a variety of collaborating organizations and agencies within the Rio Grande basin for several years. Since 2013, the New Mexico Forest and Watershed Restoration Institute (NMFWRI) has been working with GRGWA and the Claunch-Pinto Soil and Water Conservation District (SWCD) to begin construction of a geodatabase for all of GRGWA's non-native phreatophyte removal projects as well as to perform the formal pre- and post-treatment monitoring, utilizing the field methods explained below as well as LIDAR analysis where appropriate and available.

3 Monitoring and Field Methods

3.1 High-intensity Field Methods – CSE Plots

For post-treatment monitoring, we added additional riparian-adapted Common Stand Exams (CSE). CSE plot locations are synonymous with pre-treatment photo point locations where possible; in some cases, additional plots are established to reach the target sampling density. Once the plot location was determined, a 1/100- and 1/10-acre radius plot was established by placing pin-flags at 11’ 9” and 37’ 3” from the plot center in each cardinal direction. Photos were taken from plot center in each cardinal direction and from 75’ north of plot center toward plot center. Ocular estimates were made of understory aerial and ground cover within the 1/10-acre plot. Overstory canopy cover was estimated using a concave spherical densiometer, with measurements made in four cardinal directions, at the edge of the 1/100-acre plot. This method provides an estimate of canopy cover for a 1/10-acre area centered on the plot. A Hink & Ohmart and modified Hink & Ohmart structure class was determined for the 1/10th acre plot (Appendix I). Finally, all plant species observed within the 1/10th-acre area with over 1% cover were recorded, as were other comments regarding conditions at the plot.

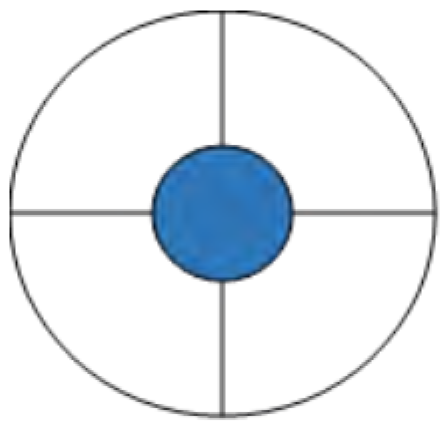

Figure 1: Example of CSE plot layout. The outer circle represents the 1/10-acre plot and the blue circle is the 1/100-acre plot.

3.2 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 areas 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.

3.3 Personnel Involved

2025 New Mexico Forest and Watershed Restoration Institute Monitoring & GIS Work:

- Michael Branch, Crew Lead
- Andrew Persante, Student Technician
- Abigail Han, Monitoring & GIS Specialist
- Jax Gaglianese-Woody, Ecological Monitoring Technician
- Clay Goetsch, Riparian Crew Lead
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- Todd Haines, Field Coordinator, Greater Rio Grande Watershed Alliance
- Michael Scialdone, Pueblo of Sandia Environment Department

4 Site Description and Ecological Context: 25.15 and 25.16

The Pueblo of Sandia is a 39 square mile reservation north of Albuquerque and south of Bernalillo, New Mexico, at the base of the Sandia Mountains. The historical western boundary of the Pueblo is the Rio Grande. Today, the Pueblo is the steward of one of the largest remaining intact stretches of Rio Grande Bosque in the area. The bosque has a long history of ecological and cultural importance for the Pueblo, but in recent years it has been subject to the same stressors discussed above, especially drought, increased flooding and debris/sediment flow from the 2011 Las Conchas fire, and fires on Pueblo lands (e.g. the 2012 Romero Fire). Human modifications to the river are easily observed on aerial maps – side channels; including the Albuquerque Main Canal, the Corrales Main Canal, the Albuquerque Riverside Drain, the Alameda Drain, the Bernalillo Interior Drain, the Atrisco Feeder Canal, and the Sandia Acequia, among others; intersect and diverge from the river throughout the western side of the Pueblo (MRGCD, n.d.) .

Particularly in the past two decades, a number of bosque restoration efforts have been led by the Pueblo's Environment Department in collaboration with agencies and organizations including the Bureau of Reclamation, the Middle Rio Grande Conservancy District, the US Army Corps of Engineers and the Greater Rio Grande Watershed Alliance.

2025, when this project was submitted, was the ninth year the Pueblo of Sandia had collaborated on non-native phreatophyte removal projects with the GRGWA. In 2013, project numbers 13-02, 13-03 and 13-04 worked on restoration after the Romero Fire; in 2014, project 14-01 worked at Sandia Lakes; projects 14-03 and 14-04 worked in the Bosquecito, projects 14-05 and 14-06 worked in the Sandia Wash area, and project 14-07 worked in the Riverside Drain. In 2015, projects 15-01 through 15-05 were distributed the length of the Pueblo; in 2016 projects 16-01 through 16-05 took place throughout the bosque. Projects 17-01 through 17-07 were submitted for 2017; many were re-treatments of previous projects in need of maintenance. In 2021 projects 21.02 and 21.03 were proposed as re-treatments of a 2013 project after a 2018 respray was observed ineffective (Haines, 2023).

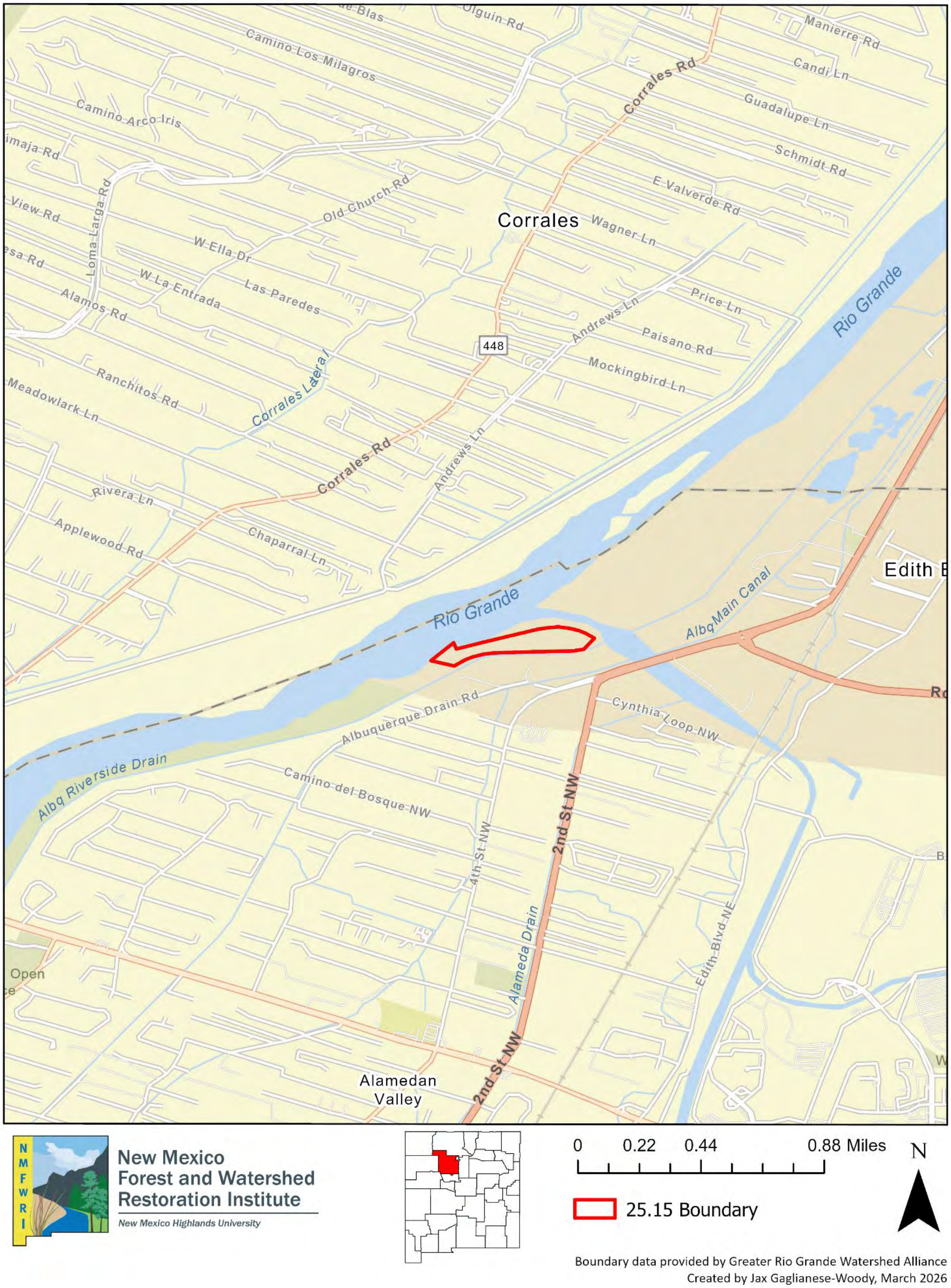
The project area covered by projects 25.15 and 25.16 may have been treated previously through other funding sources but have not been previously treated via the GRGWA or monitored by NMFWRI.

The elevation at the Village of Sandia Pueblo is just over 5,000 feet. The area receives an average of 10 inches of rainfall per year, with temperatures ranging from an average high of 91 degrees Fahrenheit in July to an average low of 20 degrees Fahrenheit in January (City Data, 2025). According to the NRCS Web Soil Survey, there are several soil map units in the area of the Pueblo of Sandia, but most soils are sand and clay loams; the dominant ecological sites are R042XA057NM Bottomland and R042XA055NM Salty Bottomland (USDA NRCS, 2013).

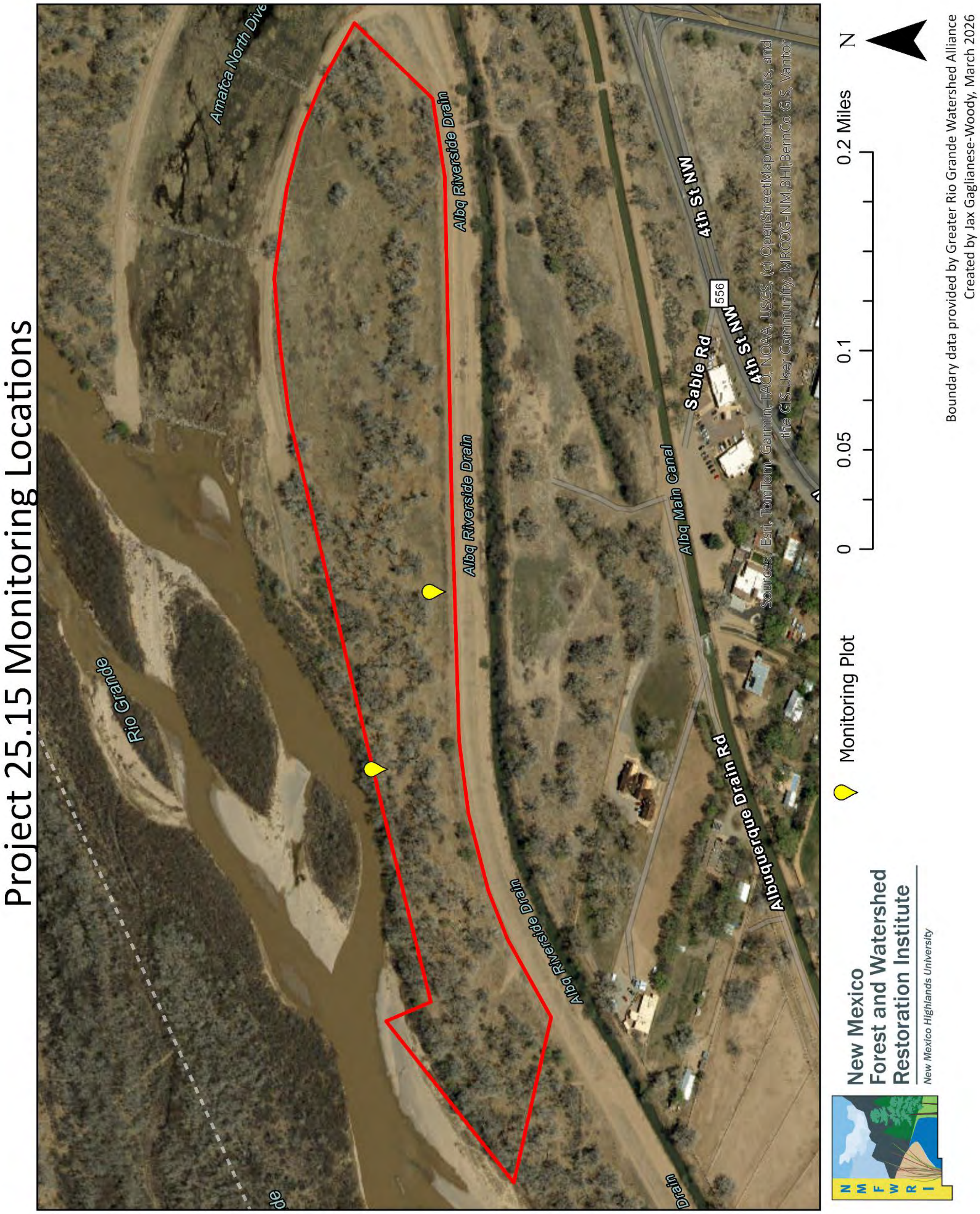
The Bottomland ecological site is dominated by either giant sacaton or alkali sacaton. Vinemesquite grass and sideoats grama may also be present. Reduced cover and hummocking of these grasses characterize initial stages of degradation, typically due to overgrazing and/or changes in hydrology. Transitions to first tobosa- and then to burrograss-dominated states may occur in response to the redistribution of run-in water from overgrazing and subsequent erosion and gullying. Shrub invasion is not usually observed (USDA NRCS n.d.).

Salty Bottomland can support a range of plant communities which typically include cottonwood, salt cedar, mixed exotics (dominated by Russian olive/ Russian knapweed/ etc.), saltgrass and saltgrass-sacaton, and bottomland grassland (possibly dominated by saltgrass, giant sacaton, dropseed, muhly, burrograss, alkali sacaton, galleta, vinemesquite, and/or tobosa). Typically, the vegetation consists of a shrub/grass mixture characterized by fourwing saltbush and greasewood. Tall, mid-grass, and short grasses are present. Blue grama, foxtail, sand dropseed, spike dropseed, giant dropseed, New Mexico feathergrass and tansymustard are common. When the plant community deteriorates, there is an increase in densities of shrubs and short grasses (USDA NRCS n.d.)

Project 25.15 Boundary

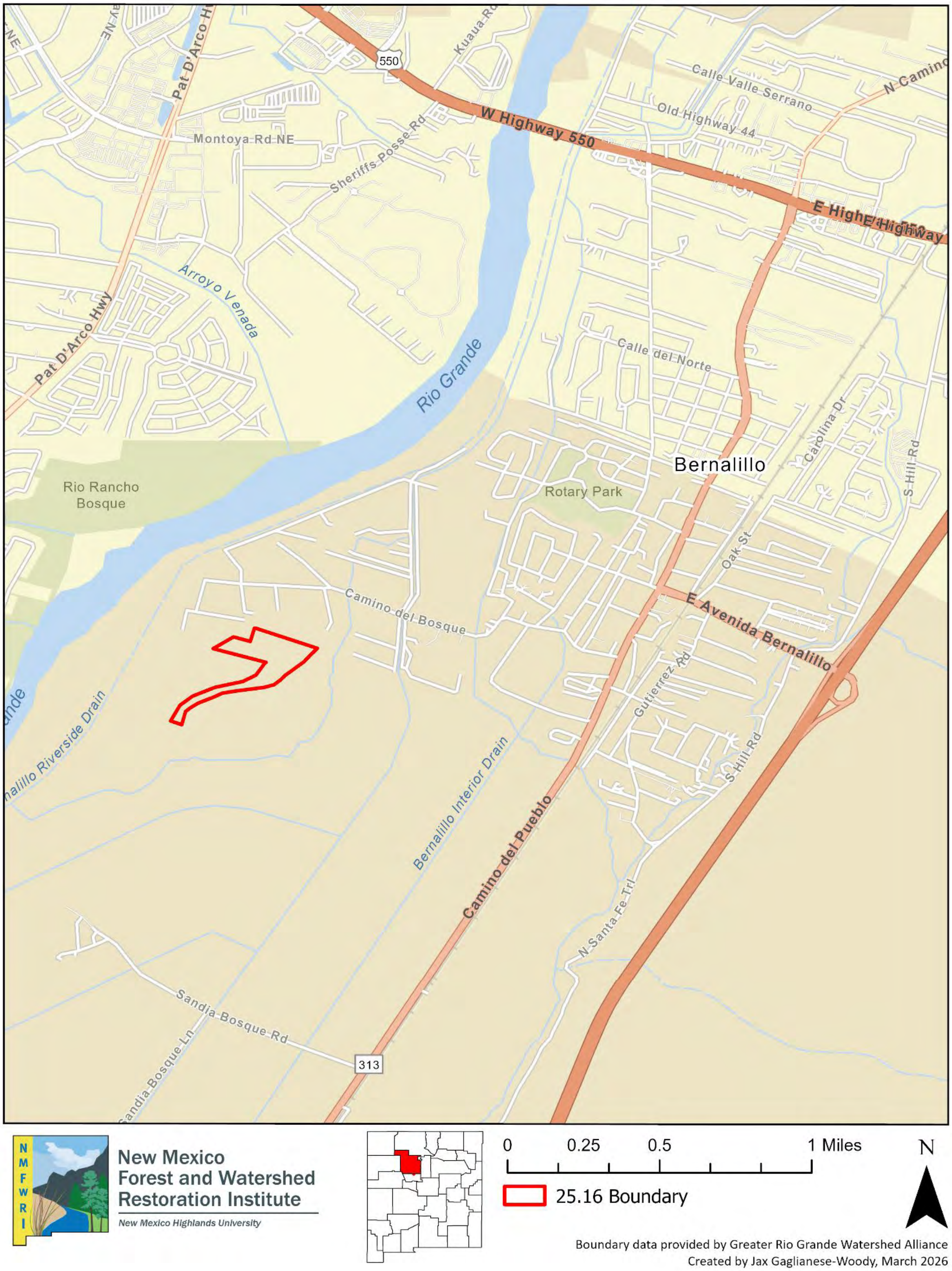


Map 1: Project 25.15 location.



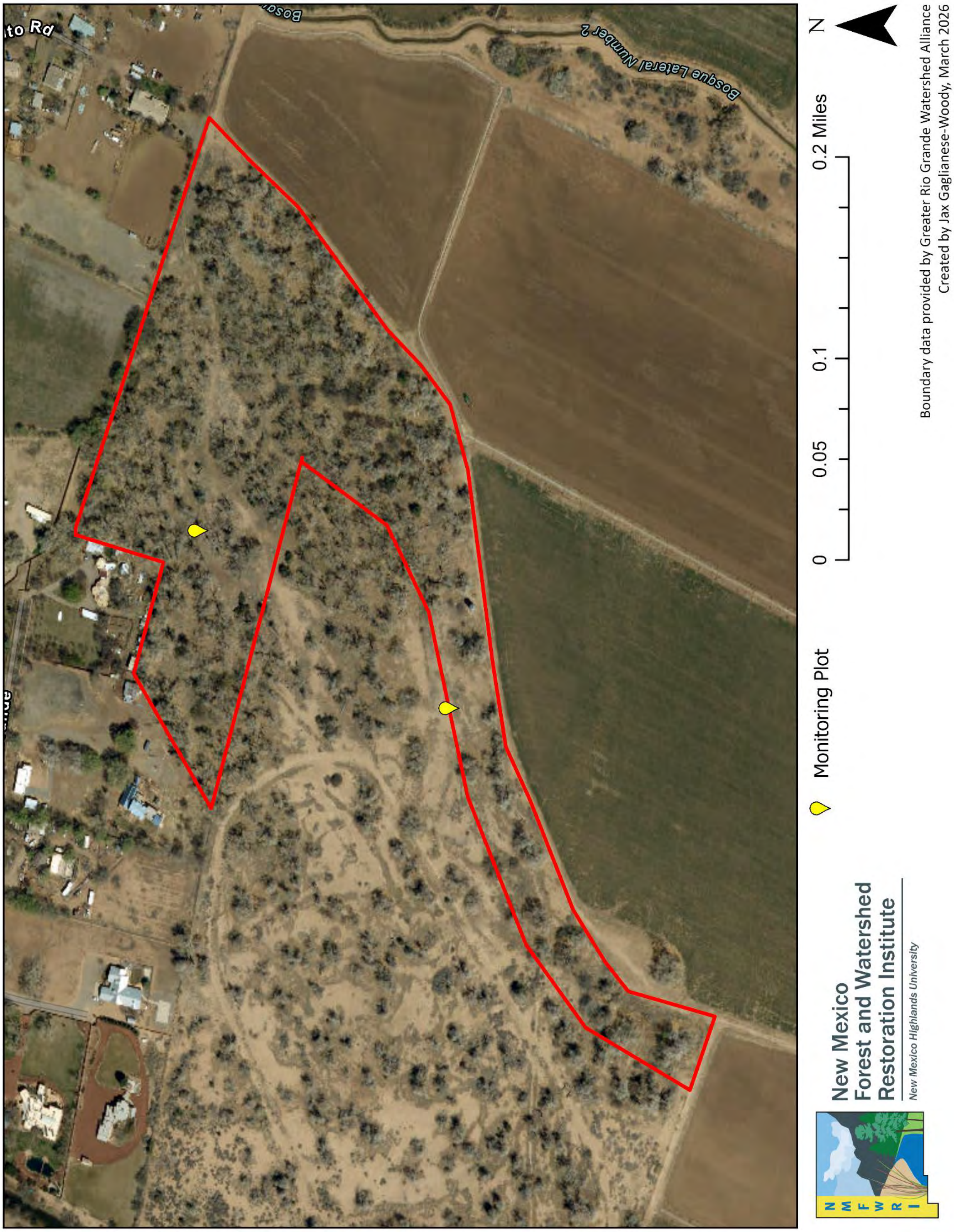
Map 2: Project 25.15 monitoring plots.

Project 25.16 Boundary



Map 3: Project 25.16 location.

Project 25.16 Monitoring Locations



Map 4: Project 25.16 monitoring plots.

6 Monitoring Results

6.1 Trees

		Saplings	Mature trees							Total
	Diameter class (in., skipped classes were empty)	*4-6*	*12-14*	*18-20*	*20-22*	*22-24*	*24-26*	*30-32*	*32+*	
PODEW	**Count**	2	1	1	3	1	1	1	3	13
	TPA	5	2.5	2.5	7.5	2.5	2.5	2.5	7.5	32.5
	BA/AC	0.35	2.23	4.03	16.86	6.19	7.53	12.35	99.21	148.76
	Avg Ht	16.94	42.50	41.80	51.19	49.30	48.60	62.00	55.22	
Summary by Class	***TPA***	*5*	*27.50*							*32.50*
	TPA %	*15.38%*	*84.62%*							*100.00%*
	BA/AC	*0.35*	*148.41*							*148.76*
	BA/AC %	*0.23%*	*99.77%*							*100.00%*
	QMD	*3.58*	*31.46*							*28.97*
	Avg Ht	*17*	*54*							*54*

Table 1: Trees in the 25.15 and 25.16 project area.

The only trees recorded on plots in the 25.15 and 25.16 project areas were Rio Grande cottonwoods (Populus deltoides; USDA code PODEW). These were distributed across a wide range of size classes, though the stand is significantly weighted toward mature individuals, which account for 84.62% of the total 32.5 trees per acre (TPA) and nearly 100% of the total basal area (148.76 sq ft/acre).

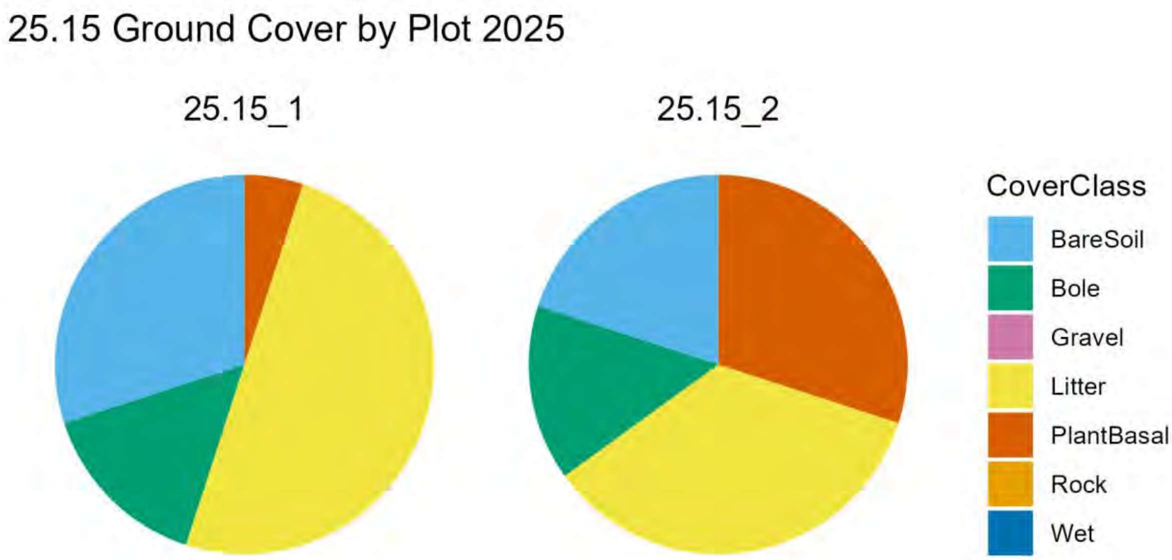
While saplings were present at a density of 5 TPA, the structure is dominated by large, mature trees that average 54 feet in height, with the largest individuals exceeding 32 inches in diameter. The distribution of these trees is not uniform across the project areas; monitoring data shows that some plots are classified as low structure forest (Class 2) with canopy cover reaching 47%, while others remain entirely herbaceous (Class 6H) with 0% canopy cover. Additionally, some of the larger cottonwoods at project 25.15 were noted to have significant leans, and at least one dead individual was recorded within the 25.16 project area.

6.2 Regeneration: Seedlings and Saplings

Figure 2: 25.15_1 seedling count by size class (height in feet) and species.

Saplings (stems >4.5 feet in height and <5 inches in diameter) were not observed on any of the 25.15 or 25.16 project plots, and few seedlings (any woody stem <4.5 feet in height and <5 inches in diameter) were observed on 25.15_1 (Fig. 2). Seedling size classes on 25.15_1 ranged from >0-0.5 feet to >1.5-2.5 feet, and eight of the 10 observed seedlings fell in the size class >0.5-1.5 feet. All 10 seedlings were Siberian elm (*Ulmus pumila*).

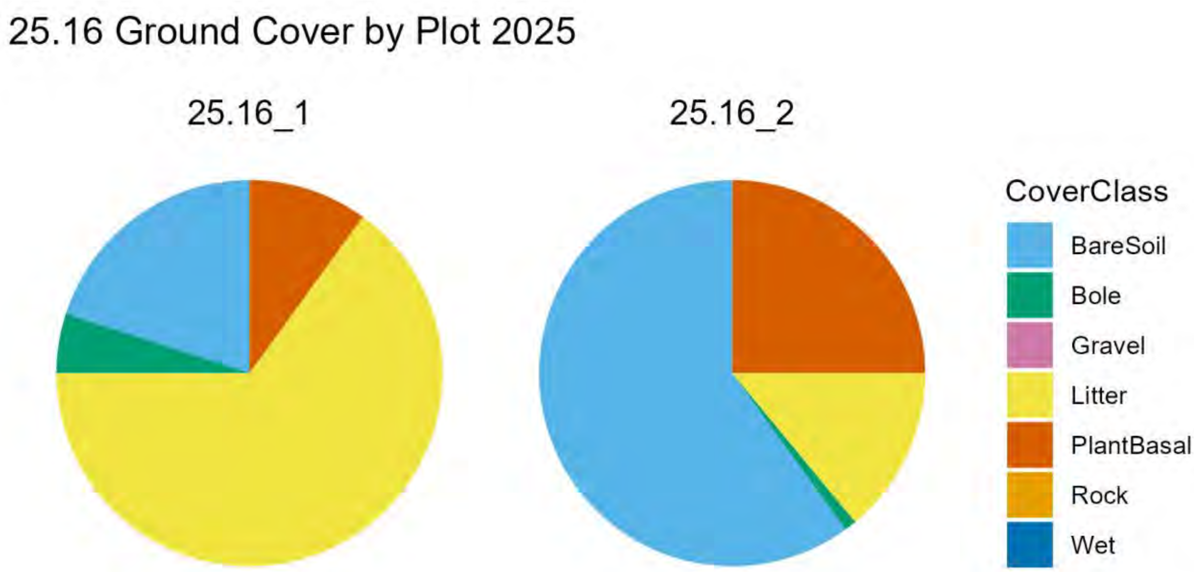
6.3 Ground Cover



Project ID	Plot ID	Cover Class	% Cover
25.15	25.15_1	Wet	0
25.15	25.15_1	PlantBasal	5
25.15	25.15_1	Bole	15
25.15	25.15_1	Litter	50
25.15	25.15_1	BareSoil	30
25.15	25.15_1	Rock	0
25.15	25.15_1	Gravel	0

Project	Plot ID	Cover Class	% Cover
25.15	25.15_2	Wet	0
25.15	25.15_2	PlantBasal	30
25.15	25.15_2	Bole	15
25.15	25.15_2	Litter	35
25.15	25.15_2	BareSoil	20
25.15	25.15_2	Rock	0
25.15	25.15_2	Gravel	0

Figure 3: 25.15 percent ground cover by cover class and plot.



Project ID	Plot ID	Cover Class	% Cover
25.16	25.16_1	Wet	0
25.16	25.16_1	PlantBasal	10
25.16	25.16_1	Bole	5
25.16	25.16_1	Litter	65
25.16	25.16_1	BareSoil	20
25.16	25.16_1	Rock	0
25.16	25.16_1	Gravel	0

Project ID	Plot ID	Cover Class	% Cover
25.16	25.16_2	Wet	0
25.16	25.16_2	PlantBasal	25
25.16	25.16_2	Bole	1
25.16	25.16_2	Litter	14
25.16	25.16_2	BareSoil	60
25.16	25.16_2	Rock	0
25.16	25.16_2	Gravel	0

Figure 4: 25.16 percent ground cover by cover class and plot.

Ground cover in all 25.15 and 25.16 plots consisted of plant basal, bole, litter, and bare soil (Fig. 3-4). Litter was the largest ground cover class on 25.15_1 (50%) and 25.16_1 (65%), while bare soil was dominant on 25.16_2 (60%). Litter (35%) and plant basal (30%) were the primary cover classes on 25.15_2, which also had the largest plant basal coverage among all project plots. Plant basal coverage was lowest on 25.15_1 (5%) and 25.16_1 (10%), and bole coverage was consistently low across all plots, ranging from 1% to 15%.

6.4 Aerial Cover

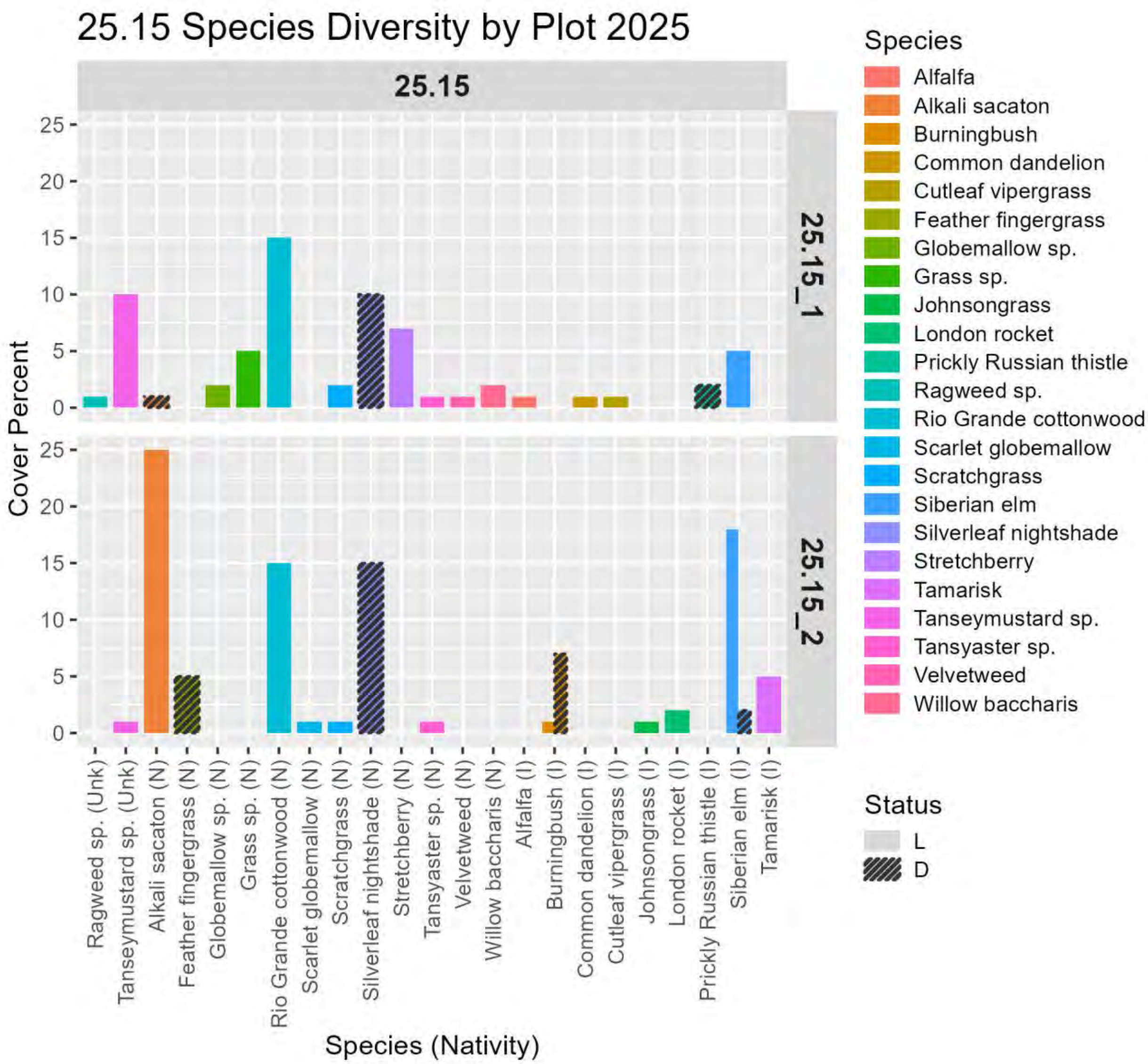


Figure 5: 25.15 species diversity by plot.

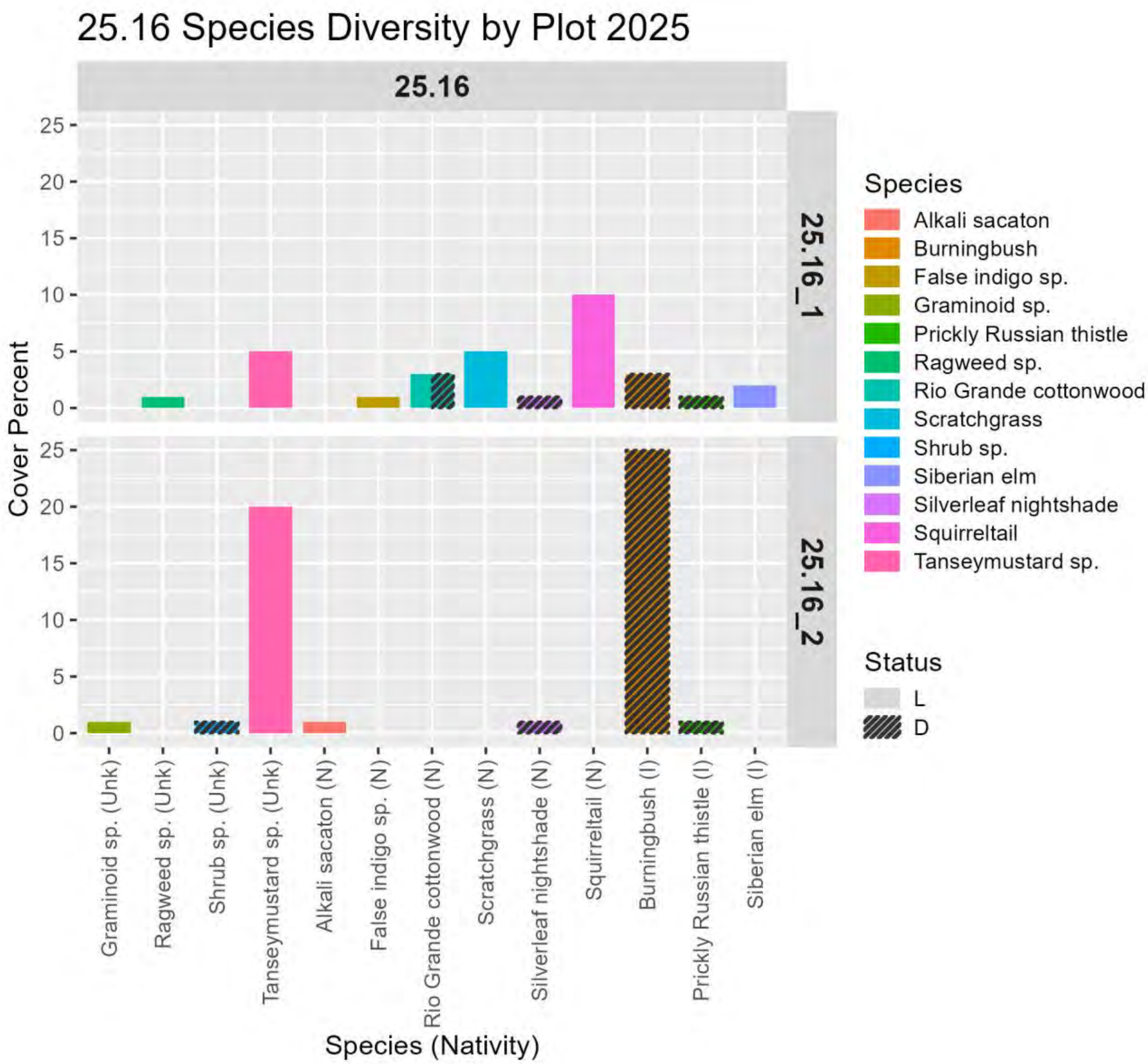


Figure 6: 25.16 species diversity by plot.

Aerial cover is an estimate of the total portion of a plot covered by the foliage of each species found there (that accounts for at least 1% of the plot area). It does not necessarily add up to 100%, since there may be bare soil left unshaded or foliage from different species may be layered and add up to more than 100%.

Twenty-three species were observed in project area 25.15, 12 of which were native (N) and 9 non-native (I). Both 25.15 plots showed diversity in growth forms, with graminoids, forbs, shrubs, and trees (Fig. 5). In plot 25.15_2, Alkali sacaton (*Sporobolus airoides*), Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*), silverleaf nightshade (*Solanum elaeagnifolium*), and Siberian elm (*Ulmus pumila*) each covered 15% or more of the area. Alkali sacaton (25%) was the most common species on 25.15_2, and Siberian elm (~20%, living and dead) was the second most common. In contrast, plot 25.15_1 had less total aerial coverage than 25.15_2, with Rio Grande cottonwood (15%), an unidentified tansymustard species (*Descurainia* sp., 10%), silverleaf nightshade (10%), and stretchberry (*Forestiera pubescens*, ~7%) being the dominant species. The only non-native species present on both 25.15 plots was Siberian elm.

Project area 25.16 was less species-rich than project area 25.15, and plot 25.16_1 had the least amount of vegetative aerial cover among all project plots (Fig. 6). Seven native species and 3 non-native species were present in plot 25.16_1, with Squirreltail (*Elymus elymoides*, 10%) being the most common. There were 5 native and 2 non-native species in plot 25.16_2, and burningbush (*Bassia scoparia*, 25%) and a tansymustard species (20%) were the most common. All other observed species on 25.16_2 comprised less than 2% of aerial coverage each. Burningbrush and prickly Russian thistle were present in both 25.16 plots.

6.5 Soils

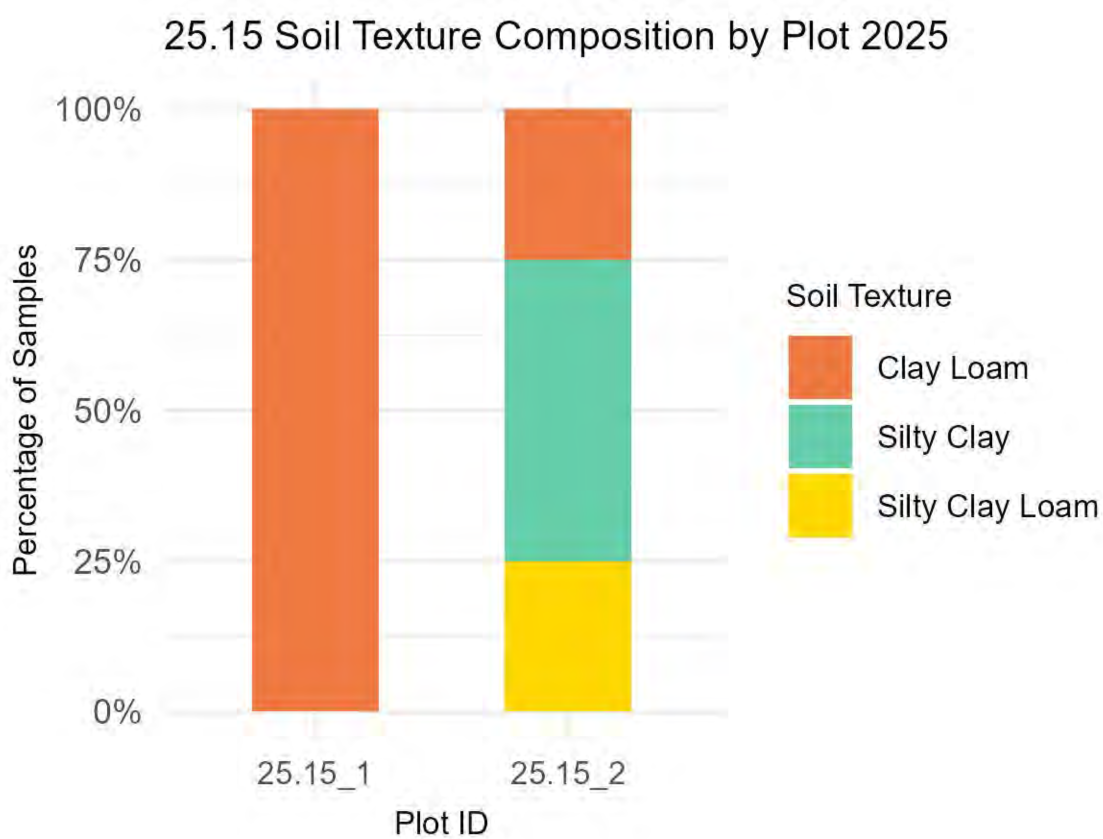


Figure 7: 25.15 soil texture by plot.

Soil Texture Frequency:			
ProjectID	**Plot ID**	**Soil Texture**	**Frequency**
25.15	25.15_1	Clay Loam	4
25.15	25.15_2	Clay Loam	1
25.15		Silty Clay	2
25.15		Silty Clay Loam	1

Table 2: 25.15 soil texture frequency.

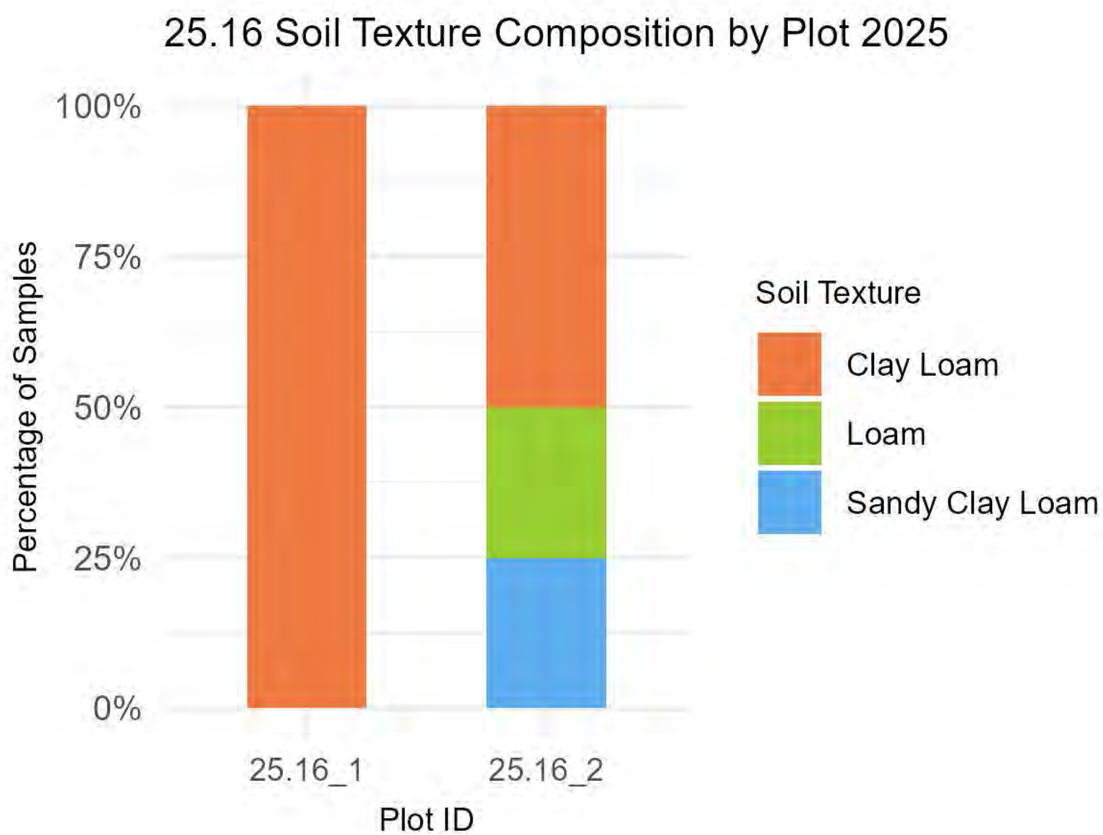


Figure 8: 25.16 soil texture by plot.

Soil Texture Frequency:			
ProjectID	**Plot ID**	**Soil Texture**	**Frequency**
25.16	25.16_1	Clay Loam	4
25.16	25.16_2	Clay Loam	2
25.16		Loam	1
25.16		Sandy Clay Loam	1

Table 3: 25.16 soil texture frequency.

Soil on all 25.15 and 25.16 monitoring plots were predominately composed of clay (<0.002mm), and plots 25.15_1 and 25.16_1 contained only clay (Figs. 7-8). While all soil on plots 25.15_2 and 25.16_2 contained clay, sand (0.05-2mm) and silt (0.002-0.05 mm) particles were also present. Soils with majority small particles (i.e., clay particles) may have high nutrient content but are susceptible to compaction and wind erosion (Berry et al., 2007).

6.6 Fuels

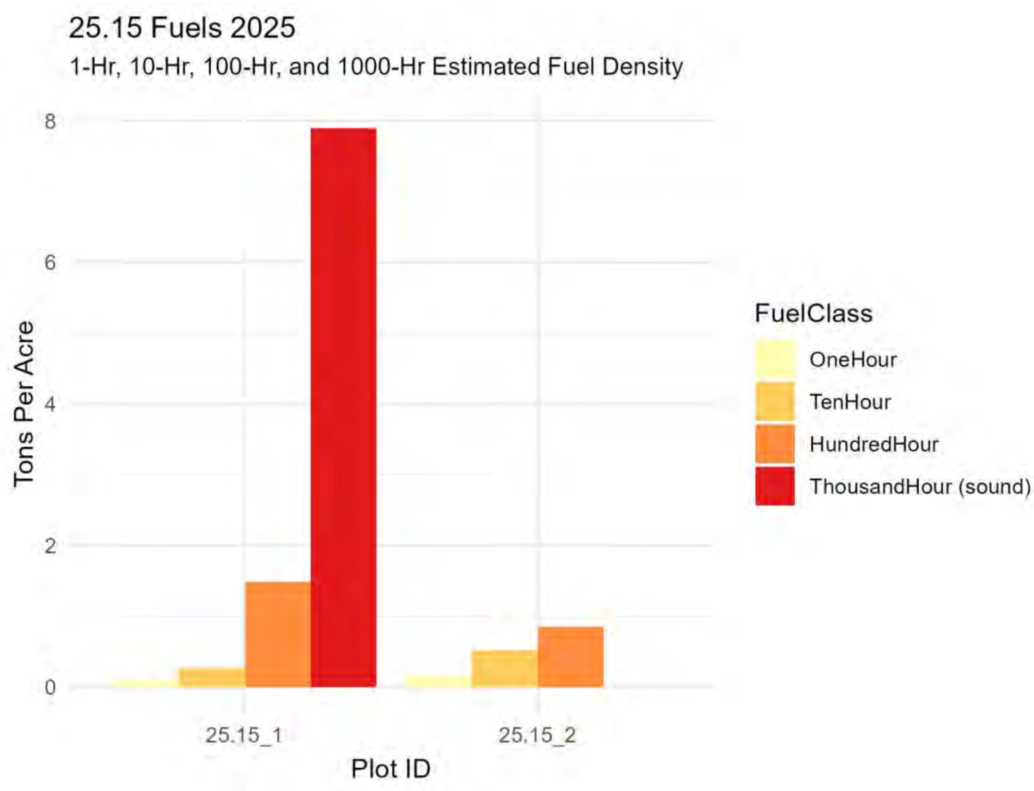


Figure 9: 25.15 fuels.

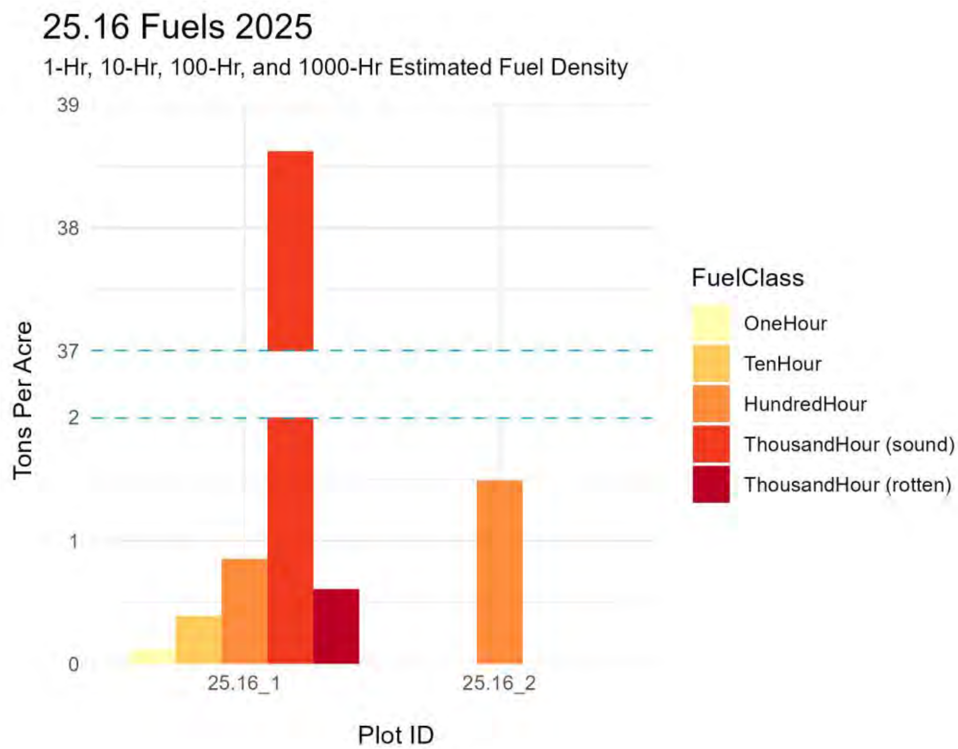


Figure 10: 25.16 fuels.

All 25.15 and 25.16 plots contained some amount of fine woody debris in the 1-hour, 10-hour, and/or 100-hour fuel classes (Figs. 9-10). Notably, plots 25.15_1 and 25.16_1 also contained coarse woody debris (1000-hour fuel class) and had significantly higher coarse-fuel densities than fine-fuel densities. For example, plot 25.16_1 had a relatively high amount of coarse woody debris, comprising an estimated 39 tons per acre. In contrast, plot 25.16_2 contained only fine woody debris in the hundred-hour fuel class with an estimated density of less than 2 tons per acre. Similarly, plot 25.15_2 contained only fine fuels, with a combined estimated density of less than 2 tons per acre.

7 Summary

Projects 25.15 and 25.16 are two new treatment sites within the Pueblo of Sandia and are part of a multi-year bosque restoration project led by the Pueblo. These project sites are characterized by a forest structure dominated by mature Rio Grande cottonwoods, which account for nearly 100% of the basal area despite a lack of sapling recruitment across all plots. Fine woody debris is present throughout, with plots 25.15_1 and 25.16_1 distinguished by higher densities of course woody debris. Vegetative composition varied with a greater number of species in 25.15 compared to 25.16. Invasive species present include Siberian elm (only in 25.15), burning bush, and Russian thistle. Ground cover is primarily a mix of litter and bare soil, with plant basal only reaching 30% at most in plot 25.15_2.

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Appendix I - Modified Hink and Ohmart categories

The following are examples of the modified Hink & Ohmart Vegetation Vertical Structure Type Definitions categories with text from (Muldavin E. , 2021). All photos credit NMFWRI.

Multiple-Story Communities (Woodlands/Forests)

Type 1- High Structure Forest with a well-developed understory. Trees (>6 m) with a canopy covering >25% of the area of the community polygon and woody understory layer of tall shrubs or short trees (1.5-6 m) covering >25% of the area of the community (polygon). Substantial foliage is in all height layers.

Type 2 -Low Structure Forest with little or no understory. Trees (>6 m) with canopy covering >25% of the area of the community polygon and minimal woody understory layer (1.5-6 m) covering <25% of the area of the community (polygon). Majority of foliage is over 7 m above the ground.

Single-story Communities (Shrublands, Herbaceous and Bare Ground)

Type 5 -Tall Shrubland. Young tree and shrub layer (1.5-6 m) covering >25% of the area of the community polygon. Stands dominated by tall shrubs and young trees, may include herbaceous vegetation underneath the woody vegetation.

Type 6S- Short Shrubland. Short stature shrubs or very young trees (>1.5 m) covering >25% of the area of the community (polygon). Stands dominated by short woody vegetation, may include herbaceous vegetation among the woody vegetation.

Type 6W- Herbaceous Wetland. Herbaceous wetland vegetation covering >10% of the area of the community polygon. Stands dominated by obligate wetland herbaceous species. Woody species absent, or <25% cover.

Type 6H- Herbaceous vegetation. Herbaceous vegetation covering >10% of the area of the community polygon. Stands dominated by herbaceous vegetation of any type except obligate wetland species. Woody species absent or <25% cover.

Type 7-Sparse Vegetation, Bare Ground. Bare ground, may include sparse woody or herbaceous vegetation, but total vegetation cover <10%. May be natural disturbance in origin (e.g., cobble bars) or anthropogenic (e.g., roads).