Pueblo of Sandia Project 17.06a

5-yr Post Treatment Monitoring Report - 2025

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New Mexico Forest and Watershed Restoration Institute

for the Greater Rio Grande Watershed Alliance

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Acronyms and Abbreviations

Acronym, Abbreviation, or Term	Explanation or Definition as used by NMFWRI
CSE	Common Stand Exams
CSWCD	Coronado Soil and Water 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
PC	Plot center
SWCD	Soil and Water Conservation District
USDA	United States Department of Agriculture
WSS	Web Soil Survey, a soils database of the NRCS

Purpose of Report

This report covers the low-intensity and high-intensity pre-treatment vegetation monitoring assessments performed on the 17.06a non-native vegetation removal project submitted for the Pueblo of Sandia to the Greater Rio Grande Watershed Alliance in 2017. Following a discussion of the ecological context, and our monitoring methods, we present pertinent background, observations, and assessment results for the projects.

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 percent of all land in New Mexico (USGS, 2012). Despite this small percentage, estimates of New Mexican vertebrate species depending on wetland and riparian habitat for their survival range from 55% (New Mexico Department of Game and Fish Conservation Services Division, 2012) to 80% (Audubon New Mexico, 2013). These areas also provide flood mitigation, filtration of sediment and pollutants, and water for a variety of purposes including groundwater recharge (Audubon New Mexico, 2013). In addition, native vegetation such as cottonwoods have 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). Statewide, it is estimated that as much as 90% of New Mexico's historical riparian areas have been lost (Audubon New Mexico, 2013), and 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. We are constantly learning more about how these species can exploit and encourage a riparian fire regime, in addition to many other changes they bring to ecosystems.

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 as a whole 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.

Monitoring and Field Methods

Low intensity Field Methods – Adapted NMRAM

Low intensity pre-treatment vegetation monitoring was done using an adapted version of the biotic portion of the New Mexico Rapid Assessment Method (NMRAM), v 2.1, updating recommendations made in the Field Manual for Greater Rio Grande Watershed Alliance (GRGWA) Riparian Restoration Effectiveness Monitoring and the GRGWA Monitoring Plan, developed by Lightfoot & Stropki of SWCA Environmental Consultants in 2012.

NMRAM was developed by the New Mexico Environment Department Surface Water Quality Bureau Wetlands Program and Natural Heritage New Mexico as a "cost effective, yet consistent and meaningful tool" (Muldavin, 2011) for wetland ecological condition assessment in terms of anthropogenic disturbance as negatively correlated with quality and functionality. The portions of NMRAM we utilized are Level 2 "semi-quantitative" field measurements taken at less detail than plot level (Muldavin, 2011).

Measurements taken included relative native plant community composition, vegetation horizontal patch structure, vegetation vertical structure, native riparian tree regeneration, and invasive exotic plant species cover. The underlying method for these biotic assessments was a version of the 1984 Hink and Ohmart vertical structure classification system, modified for use in the NMRAM for Montane Riverine Wetlands version 2.0 (see Appendix IV). First, vegetation communities were mapped out by patch (polygon) according to the Hink and Ohmart system. Next, the presence of invasives, wetland species, and the two dominant species in each vertical stratum ("tree" >15 ft, "shrub" 4.5-15 ft, and "herbaceous" <4.5 ft) were recorded for each plant community. The native/exotic ratio in each of the patches was scored and weighted based on the percent of the project area each patch comprised. These scores were then combined with the additional biotic metrics of vertical and horizontal diversity, native tree regeneration, and overall (listed) invasive presence. The NMRAM rating system is based on all levels, on a scale of 1 to 4, where 4 is considered excellent condition, 3 good, 2 fair, and 1 poor.

We also assessed soil surface condition, which is a metric typically included in the abiotic section of the NMRAM, as well as the presence of surface fuels, which is not part of the NMRAM. Unlike the other 6 metrics we used, surface fuels were recorded on a rating scale from 0 to 1.0 where 1.0 is a continuous fuel matrix.

Prior to entering the field, we created maps with the project boundaries as provided by GRGWA. We combined these polygons with recent aerial imagery and identified relevant roads and other landscape features. Once on the ground, the vegetation community polygons (as determined by the modified Hink and Ohmart classification system) were hand-drawn onto this map and served as the basis for other biotic metric assessments. Upon return to the office, this polygon map and the photopoints were digitized by the monitoring technician and/or specialist. All of the adapted NMRAM methods were collected both pre- and post-treatment.

Low intensity Field Methods - Photopoints

Photopoints were established to capture images where vegetation shifts were observed and/or at representative locations throughout the site. Waypoints were marked with a GPS unit and named sequentially by site. Photos were taken facing north, east, south and west at each point. Information about the photopoints was collected according to the methods laid out in David Lightfoot's Forest Thinning Project Repeat Photo Points for Restoration Effectiveness Monitoring (David Lightfoot, 2014). Photopoints were collected both pre- and post-treatment.

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 photopoint 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 plot center in each cardinal direction. Photos were taken from plot center in each cardinal direction and from a distance of 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 determination was made for the 1/10th acre plot. Finally, all plant species observed within the 1/10^{th-}acre area with over 1% cover were recorded, as were other comments on conditions at the plot.

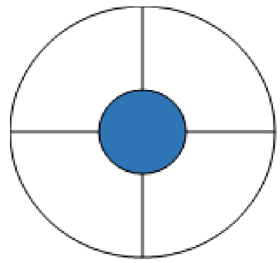

Figure 1 Example of CSE plot layout. The outer circle represents the 1/10-acre plot and the blue circle is the 1/100-acre plot.

Personnel Involved

2017 New Mexico Forest and Watershed Restoration Institute Monitoring & GIS Work:

- Kathryn R Mahan, Ecological Monitoring Specialist
- Ernesto Sandoval, Ecological Monitoring Technician
- Daniel Hernandez, Ecological Monitoring Technician

Other persons contacted:

- Fred Rossbach, Field Coordinator, Greater Rio Grande Watershed Alliance
- Michael Scialdone, Pueblo of Sandia Environment Department

2024 New Mexico Forest and Watershed Restoration Institute Monitoring & GIS Work:

- Patrick Clay Goetsch, Riparian Crew Lead
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- Abigail Han, Monitoring Technician
- Alex Withnall, Technician Assistant
- Taryn Schlosser, Technician Aide
- Michael Branch, Technician Aide
- Kathryn R Mahan, Ecological Monitoring Program Manager
- Carmen Melendez, Crew Logistics
- Corey Beinhart, Data Manager

Other persons contacted:

- Dierdre Tarr, District Manager for Claunch-Pinto SWCD, Greater Rio Grande Watershed Alliance
- Michael Scialdone, Pueblo of Sandia Environment Department

Pueblo of Sandia

Project Context

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, the impact of 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 last decade or two, several 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.

2017, which this project was submitted, is the fifth year the Pueblo of Sandia had collaborated on nonnative 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 over 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 that was considered to have "escaped management" after a 2018 respray was observed ineffective.

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 Stats, 2016). According to the NRCS Web Soil Survey there are several soil map units in 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 amounts of shrubs and short grasses (USDA NRCS n.d.)

Project 17-06a Retreat-WUI-Pt Bar

Low-intensity pre-treatment monitoring (i.e., NMRAM and photopoints) was conducted at this 14-acre site on September 19, 2017, as part of a restoration project targeting non-native phreatophytes submitted for 2017. Treatment occurred between November 8th - 14th, 2019. The post-treatment monitoring occurred December 4th and 5th, 2024. 5-yr post-treatment monitoring fell outside of the target collection window due to delays in contracting. This project is on the site of a 2005 Army Corps of Engineers restoration project that opened up the canopy and allowed native grasses to take hold (Rossbach, 2019).

The project is located on the Pueblo of Sandia in Sandoval County. The project boundaries include the Rio Grande on the west and Project 17-06b on the east. The Coronado Soil and Water Conservation District (CSWCD) and the Pueblo of Sandia Environment Department Bosque Program sponsored the project.

The project had been previously treated in 2005 and was left as an open cottonwood clearing full of native grasses. The 2017 proposal includes treatment of Russian olive, Siberian elm, and salt cedar through extraction and mastication (GRGWA, 2017). Cheatgrass was also noted on-site but is not one of the target species in the proposal (). The project removed and treated non-native phreatophyte tree species including Russian olive, Siberian elm and salt cedar trees. The preference was to concentrate mastication material to protect native vegetation especially cottonwoods. Extracted trees were placed in windrows or piles away from native vegetation. The Pueblo of Sandia has a recent concern with eroding riverbanks, so target trees were treated on the upper one third of the riverbank of the Rio Grande; treatment avoided trees located down to the Ordinary High-Water Mark waterline. A few isolated target trees in the fence line including tree-of heaven trees were identified in the project area and will be treated with an herbicide (Garlon) using a dormant season, basal bark spray method.

Project 17.06a Boundary

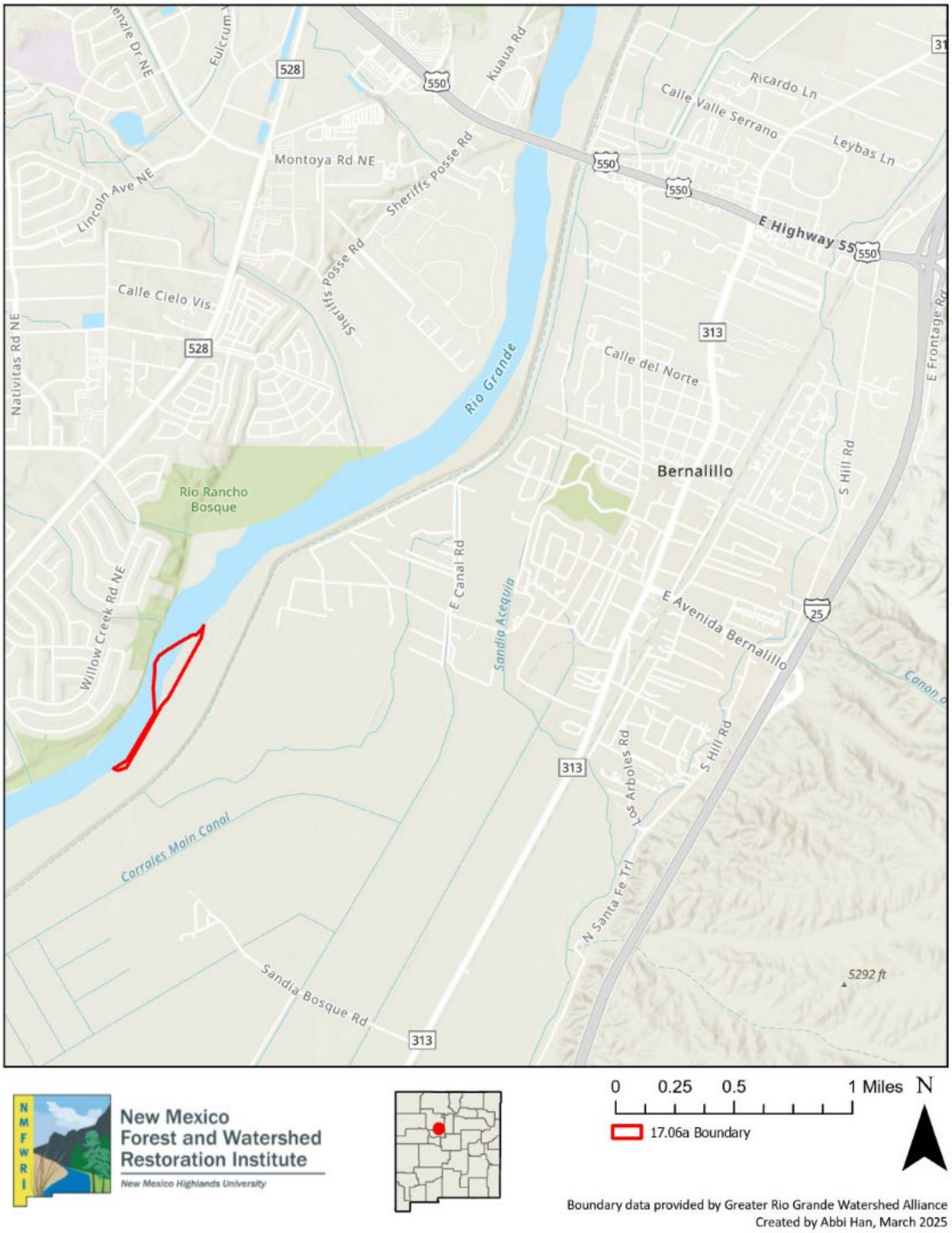

Figure 1. Project 17.06a Boundary and relative location.

According to the NRCS Web Soil Survey, the project area is comprised of 58.5% Water, 37.8% Gilco loam, 1 to 4 percent slopes, unprotected, and 3.7% Aga loam, 1 to 3 percent slopes, unprotected. Ecological sites within this project include water, R042XA057NM Bottomland, and R036XA005NM Riverine Riparian (USDA NRCS, 2016).

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.).

The Riverine Riparian ecological site is made up of sediments adjacent to perennial streams and vegetation is determined largely by local hydrology. Examples of typical species at different strata include Fremont cottonwood, sandbar willow, Western wheatgrass, and Nebraska sedge (USDA NRCS n.d.).

Field crew observations on this site included exotic species like salt cedar, Siberian elm, Russian olive, and Tree-of-Heaven and cheatgrass. Native vegetation included Rio Grande cottonwood, coyote willow, narrowleaf cottonwood, honey locust, dropseed grass, sacaton, ricegrass, silverleaf nightshade, silverleaf buffalo berry, ironweed, Rocky Mountain juniper, and rubber rabbitbrush. Throughout the project there are many Russian olives. Also noted was an unknown forb with yellow flowers, about two feet tall.

Figure 2. Project 17.06a Monitoring Locations.

Monitoring Results – Low-intensity Adapted NMRAM

As described above, the NMRAM uses a series of assessments of assign a score between 1-4 (where 1= Poor and 4 = Excellent) for the following metrics:

Metrics 17-06a	**Pre-tx 9-19-2017**	**5-yr-post-tx 11-21-2024**
Relative Native Plant Community Composition	1	2
Vegetation Horizontal Patch Structure	1	4
Vegetation Vertical Structure	3	3
Native Riparian Tree Regeneration	2	1
Exotic Invasive Plant Species Cover	1	1
Project Biotic Score (based on above ratings)	1.5	2.3
Project Biotic Rating	D/Poor	C/Fair
Soil Surface Condition	4	3
Surface Fuels	0.7	0.75

Table 1 NMRAM Scores for 17-06a comparing 2017 and 2025.

Low scores for this project pre-treatment came in the Relative Native Plant Community Composition, Vegetation Horizontal Patch Structure and Exotic Invasive Plant Species Cover metrics, due to high percentage of invasive plants, lack of new regeneration of native riparian trees, and a low diversity of plant communities within the project area. The project scored highest in Soil Surface Condition. This site scored a 1.5 out of 4 overall pre-treatment, which was a “D” or “Poor” biotic rating. Post-treatment, however, the Relative Native Plant Community Composition score increased. Despite the persistence of invasive species at various strata, the ratio of native: exotic species had improved over pre-treatment conditions. The overall coverage estimates for invasive species on the site went from 31% pre-treatment to 23% 5 years post-treatment. The Vegetation Horizontal Patch Structure score also improved, as the site had more diverse vegetation communities post-treatment (Figure 4). Native riparian tree regeneration decreased, however, with less than 1% observed pre-treatment and none observed on the post-treatment visit. The soil surface condition score also decreased compared to pre-treatment, with a noted increase in bare areas, tire tracks and trash.

Of note is that at least one member of the same crew collected both pre- and post-treatment NMRAM measurements on this site. For additional discussion of the use of the adapted NMRAM, please see Appendix III – Discussion of the Adaptation of NMRAM.

17-06a Pueblo of Sandia

1 inch = 327 feet

Legend

Photopoints
17.06a_1NESW

Modified Hink & Ohmart Structure Class
1 (13 Acres) 2 (1.5 Acres)

* Polygon numbers correspond to vegetation communities recorded by field crew.

Figure 3. 17.06a Pre-treatment post-treatment vegetation community polygon map (from 2017).

Figure 4. 17.06a 5 year post-treatment vegetation community polygon map

Monitoring Results – High-Intensity CSE Plot

This site had 2 plots. These CSE plots reflect 5-yr post-treatment conditions only.

Monitoring Detail – Tree Component

Overstory Trees

The overstory (trees >5” DBH) showed low diversity with two species represented, Siberian elm (*Ulmus pumila*) and Russian olive (*Elaeagnus angustifolia*). Russian olive dominated the overstory (Figure 5).

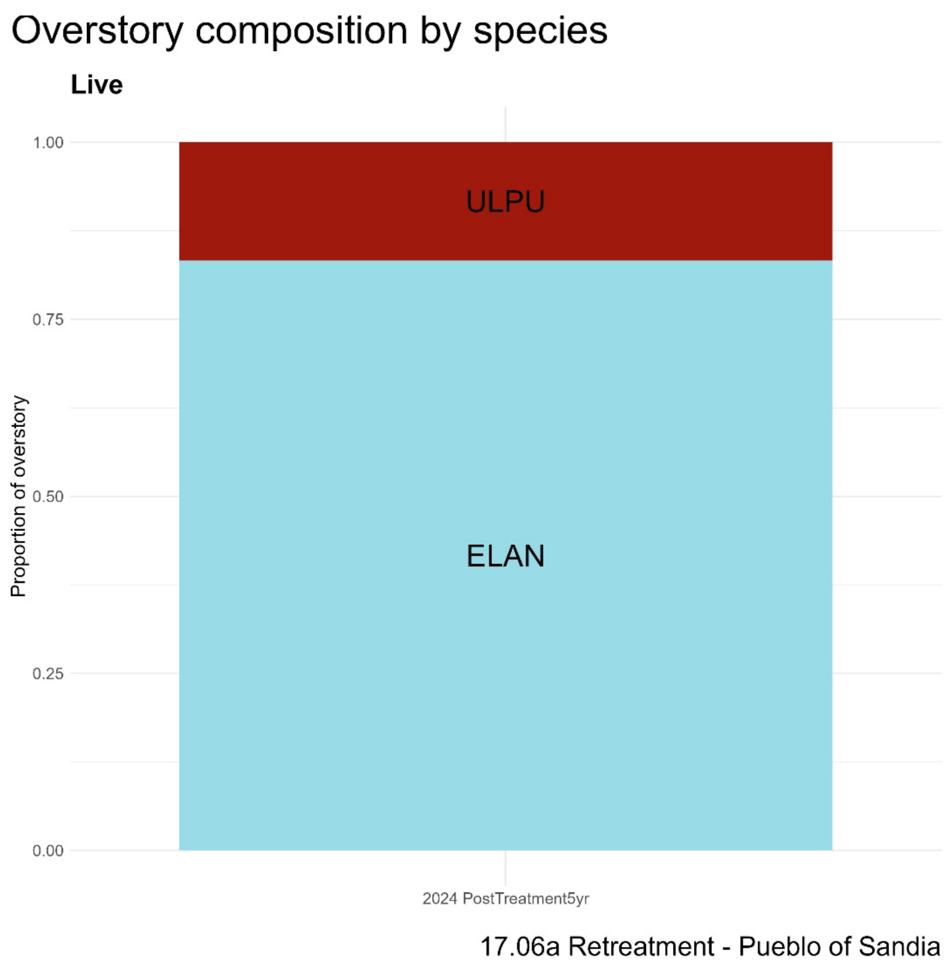

Figure 5. Proportion of overstory composition by species, growing stock. No snags were observed in 2024.

Growing Stock, Snags, Damages

Mean height for this project was 24ft, and mean live crown base height was 3.1ft (Figure 6).

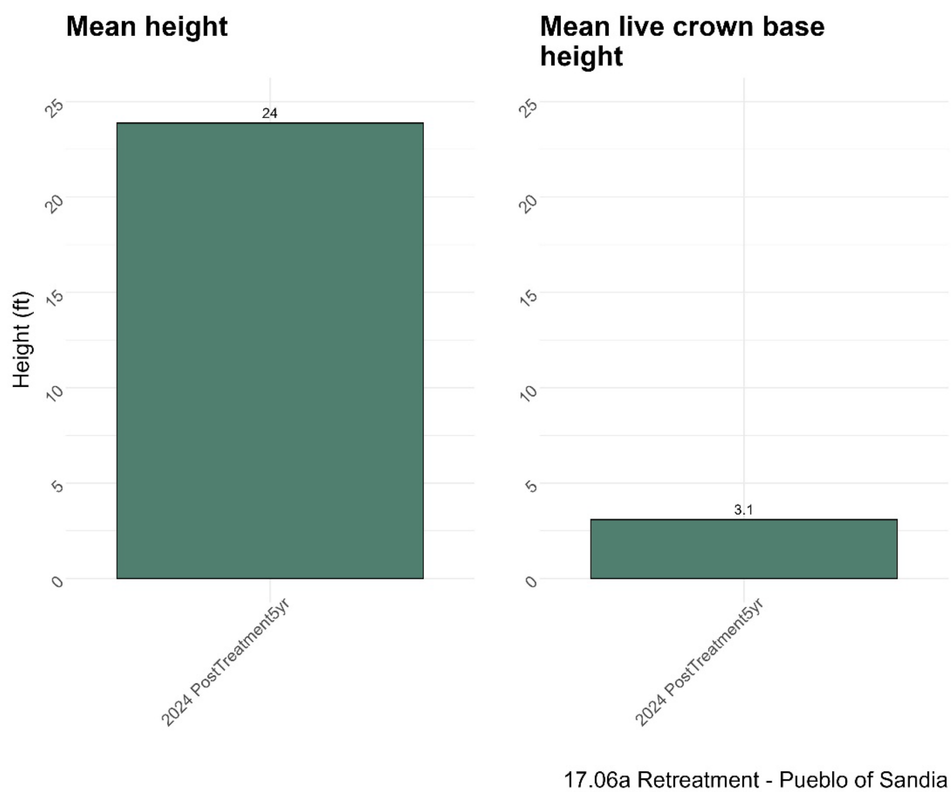

Figure 6. Mean heights and live crown base heights of growing stock trees across all plots.

TPA, BA, QMD

Figure 7 shows mean trees per acre, mean basal area, and quadratic mean diameter across all CSE plots for growing stock. Extrapolated from plot data, the project area has 30 growing stock trees per acre. Mean basal area was 5.1, and the quadratic mean diameter of growing stock trees was 5.54 inches. Siberian elm was taller (35ft), and had a larger QMD (6.3in) than Russian olive (22ft and 5.4in respectively). Russian olive had the highest trees per acre at 25tpa, in contrast to the Siberian elm at 10tpa (Figure 8).

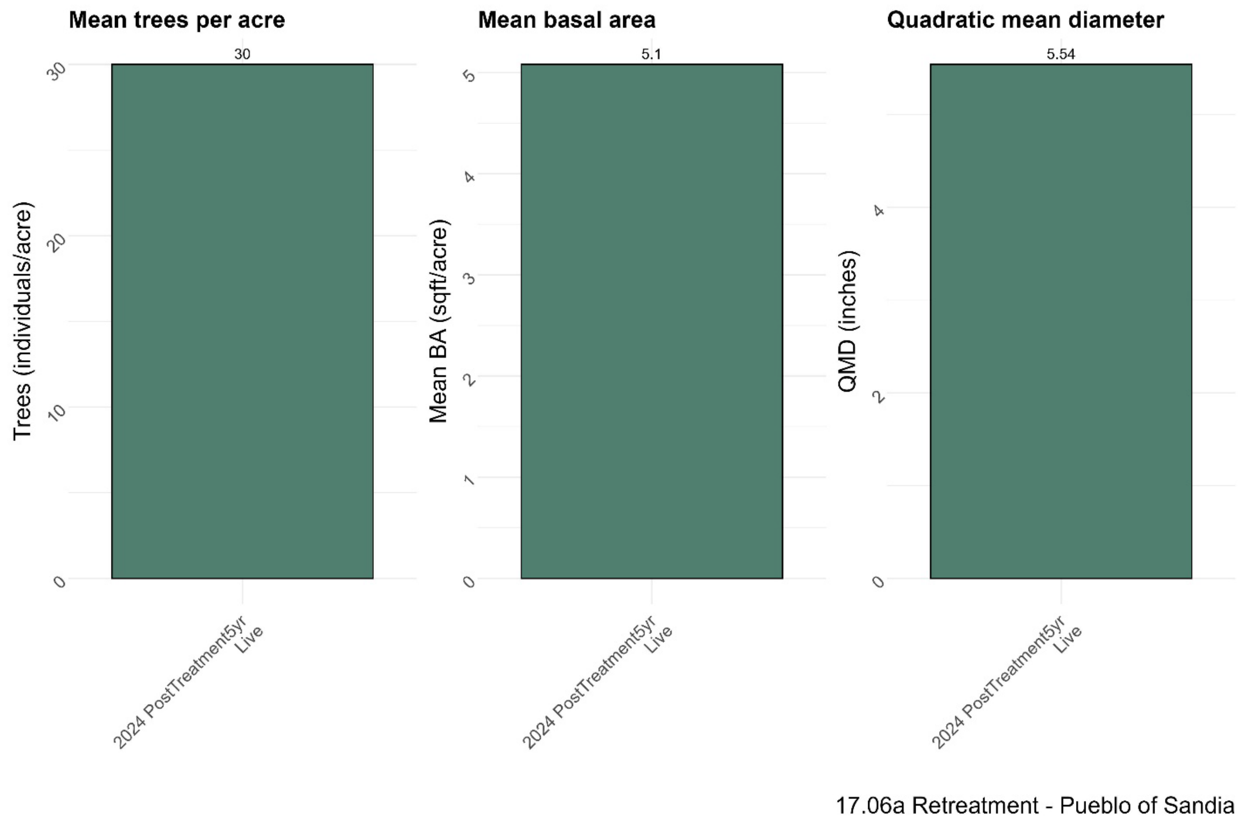

Figure 7. Growing stock metrics - mean trees per acre, mean basal area, and quadratic mean diameter.

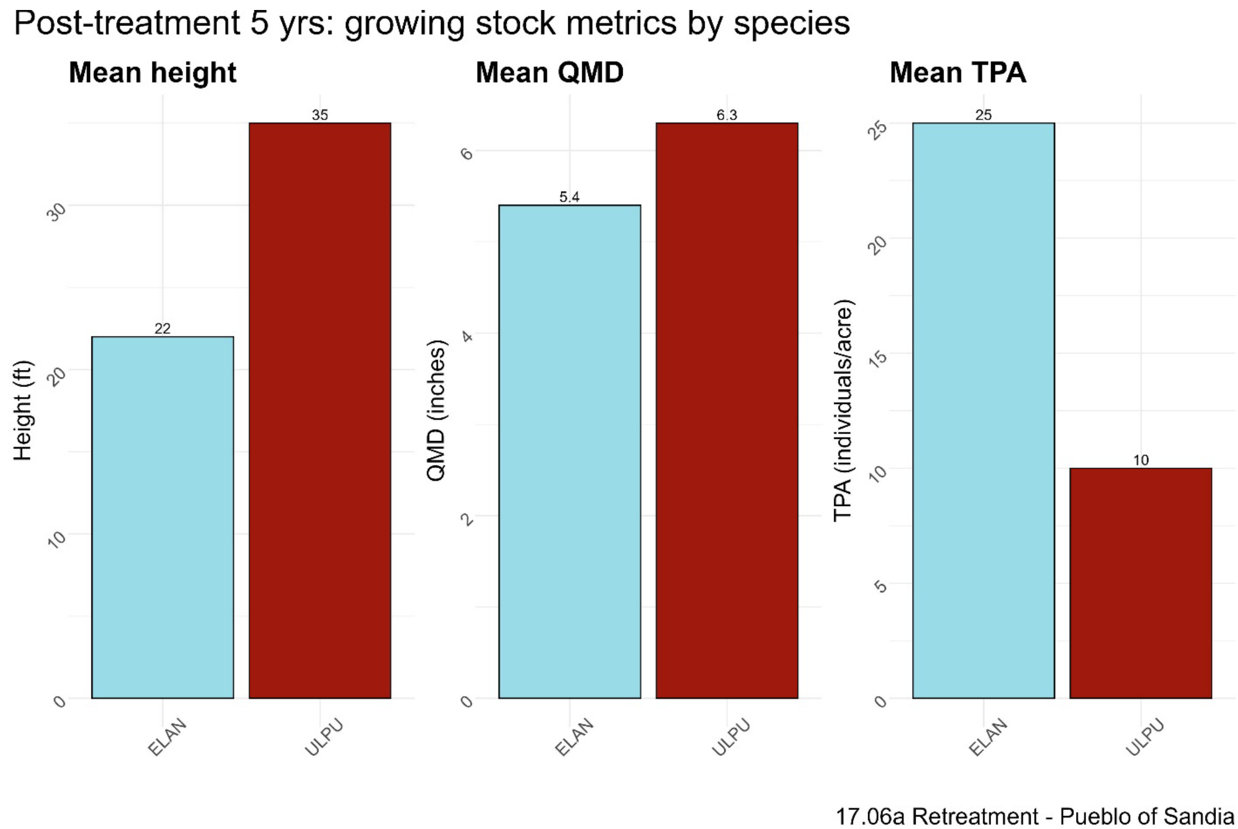

Figure 8. Growing stock metrics by species - mean height, Quadratic mean diameter, and mean trees per acre.

Regeneration: Trees & Shrubs

For *Salix exigua*, coyote willow, there are an estimated 220 living seedlings/acre on this site, and 180 dead seedlings/acre. *Baccharis salicina*, willow baccharis, had 20 living seedlings/acre and no dead seedlings. The coyote willow had 2400 living saplings/acre, and 1100 dead saplings/acre. The willow baccharis had 160 living saplings/acre and no dead saplings (Figure 9).

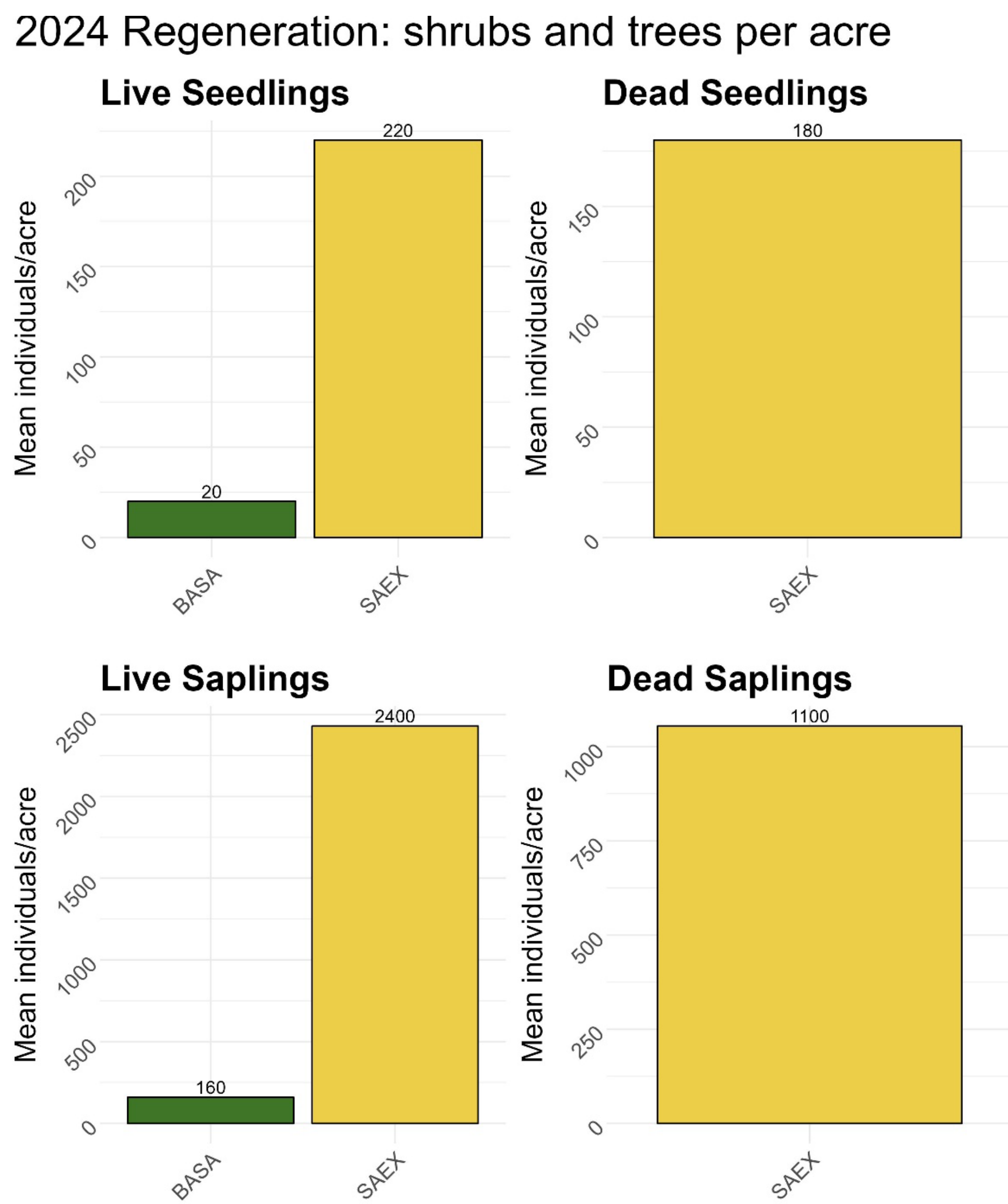

Figure 9 Mean seedlings and saplings per acre, by species, across plots.

Understory & Forest Floor Component

Ground Cover

Ground cover on CSE plots was dominated by Litter (87%), and followed by Bole (11%) (Figure 10).

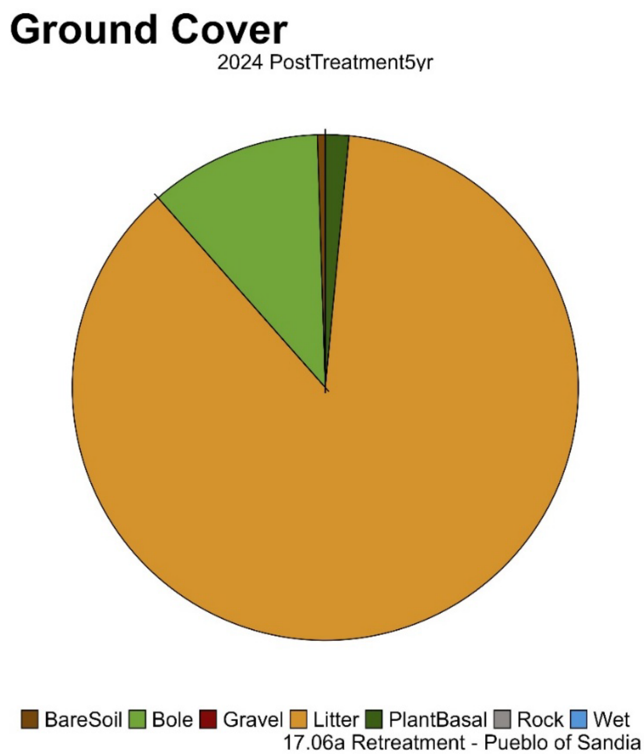

Figure 10. Mean percent ground cover by cover class across plots.

Table 2. Mean percent ground cover values by cover class across plots.

17.06a Retreatment - Pueblo of Sandia		
Monitoring Status	**Cover Class**	**% Cover**
2024 PostTreatment5yr	PlantBasal	1.5
	Bole	11.0
	Litter	87.0
	BareSoil	0.5
	Rock	0.0
	Gravel	0.0
	Wet	0.0

Aerial Cover

Aerial cover is recorded across the entire microplot, by species. The living Tree Regeneration had the most cover, at 17% cover, followed by living shrubs at 5.5% (Figure 11). The dominant species is Coyote Willow at 45%. Of all the species recorded in aerial cover, 42.9% were native and 28.6% were non-native (Figure 12).

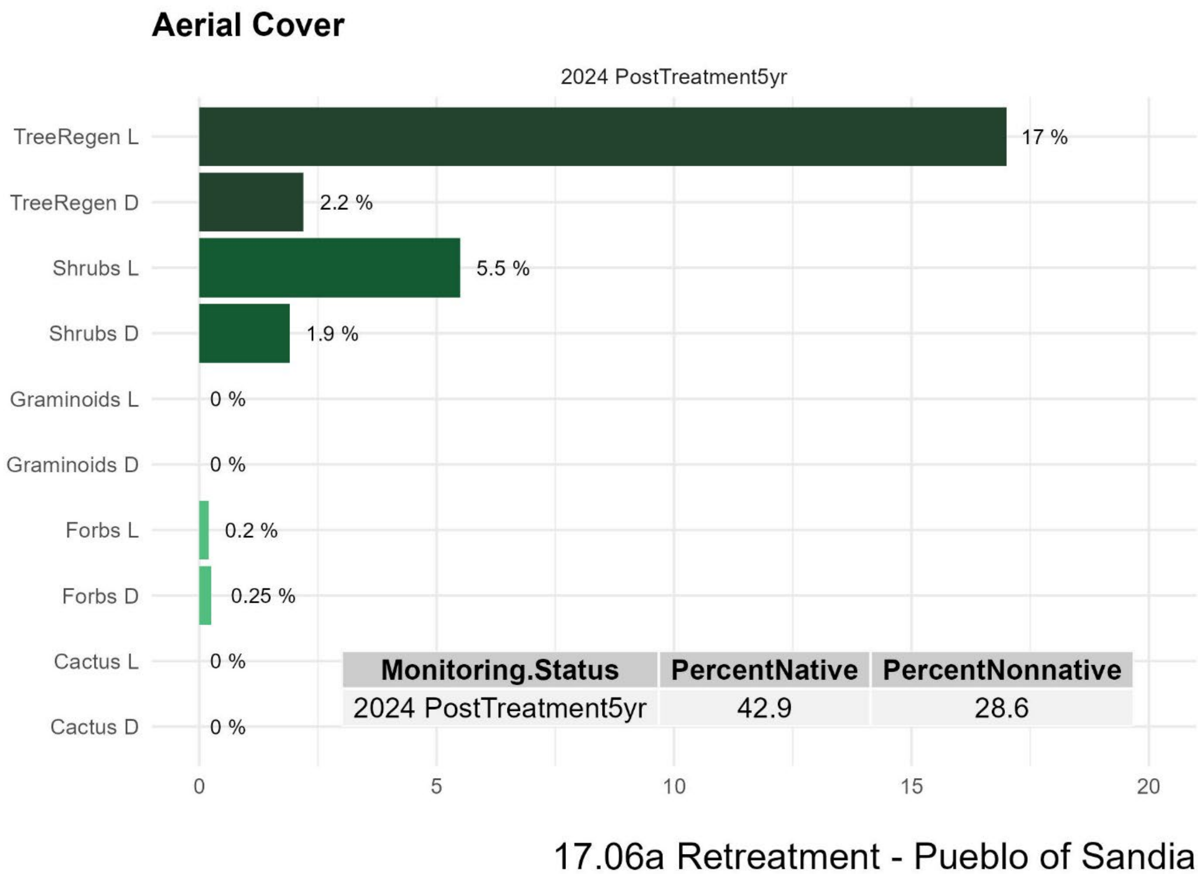

Figure 11. Mean percent aerial cover by vegetation class, living (L) and dead (D). Inset table shows percentage of species which are native versus nonnative.

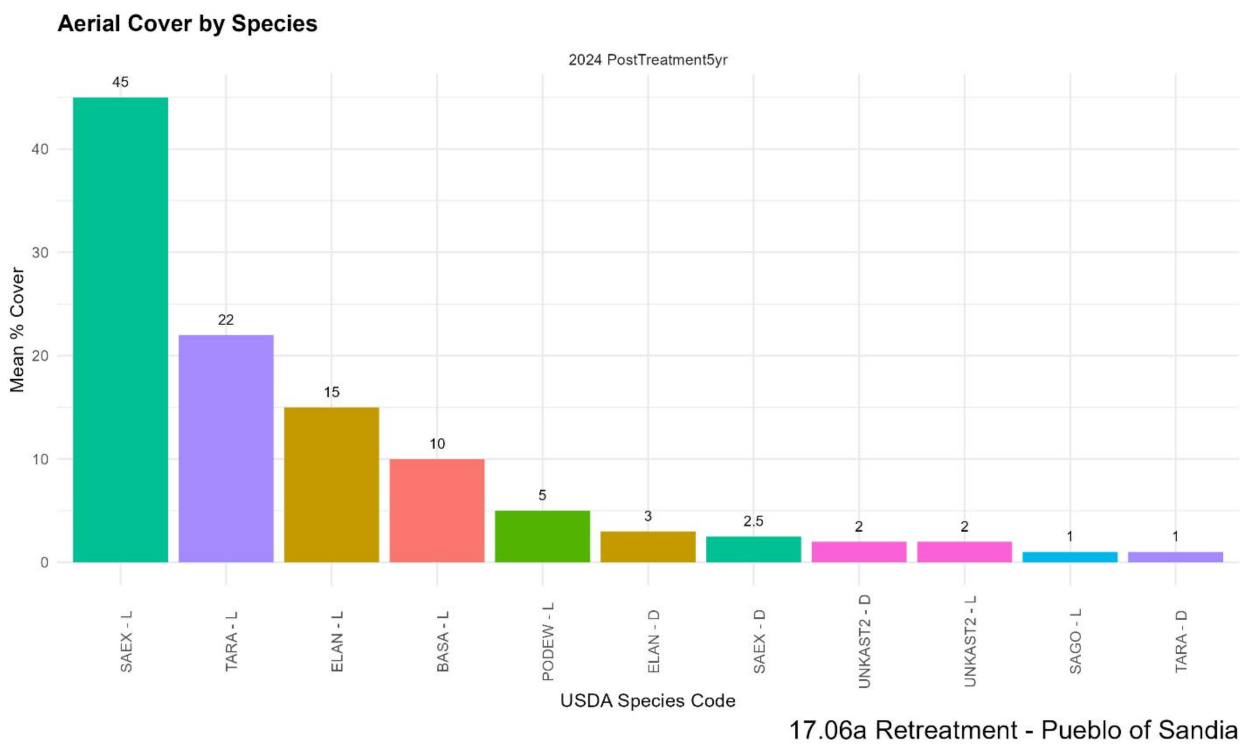

Figure 12. Mean percent aerial cover by species, living (L) and dead (D). Reference Table for interpretation of USDA species codes.

Table 3 USDA PLANTS database codes with their corresponding scientific names.

USDA Plant Code	Common Name	Scientific Name	Nativity
AIAL	Tree of heaven	Ailanthus altissima (Mill.) Swingle	I
ARPUF	Fendler's threeawn	Aristida purpurea Nutt. var. fendleriana (Steud.) Vasey	N
BASA	Willow baccharis	Baccharis salicina Torr. & A. Gray	N
BASC5/KOSC	Burning bush	Bassia scoparia (L.) A.J. Scott	I
BOER4	Black grama	Bouteloua eriopoda (Torr.) Torr.	N
BRTE	Cheatgrass/downy brome	Bromus tectorum L.	I
DEPI	Western tansymustard	Descurainia pinnata (Walter) Britton	N
ELAN	Russian olive	Elaeagnus angustifolia L.	I
ELYMU	Wildrye species	Elymus sp. L.	I, N
ELEL5	Squirreltail	Elymus elymoides (Raf.) Swezey	N
FOPU2	Stretchberry	Forestiera pubescens Nutt.	N
LASA3	Garden lettuce	Lactuca sativa L.	I
LASE	Prickly lettuce	Lactuca serriola L.	I
MAAQ	Hollyleaved barberry	Mahonia aquifolium (Pursh) Nutt.	N
MACHA	Tansyaster	Machaeranthera Nees	N
PLJA	James' galleta	Pleuraphis jamesii Torr.	N
PODEW	Rio Grande Cottonwood	Populus deltoides W. Bartram ex Marshall	N
SAEX	Coyote willow	Salix exigua Nutt.	N
SAGO	Goodding's willow	Salix gooddingii C.R. Ball	N
SATR12	Prickly Russian thistle	Salsola tragus L.	I
SOEL	Silverleaf nightshade	Solanum elaeagnifolium Cav.	N
SPAI	Alkali Sacaton	Sporobolus airoides (Torr.) Torr.	N
SPCO4	Scarlet globemallow	Sphaeralcea coccinea (Nutt.) Rydb.	N
SPORO	Dropseed species	Sporobolus sp. R. Br.	I, N
TACH2	Five stamen tamarisk	Tamarix chinensis Lour.	I
TARA	Salt cedar	Tamarix ramosissima Ledeb.	I
ULPU	Siberian elm	Ulmus pumila L.	I

Canopy Cover

Canopy cover is recorded as closed canopy by spherical densiometer. Mean canopy cover was 83%.

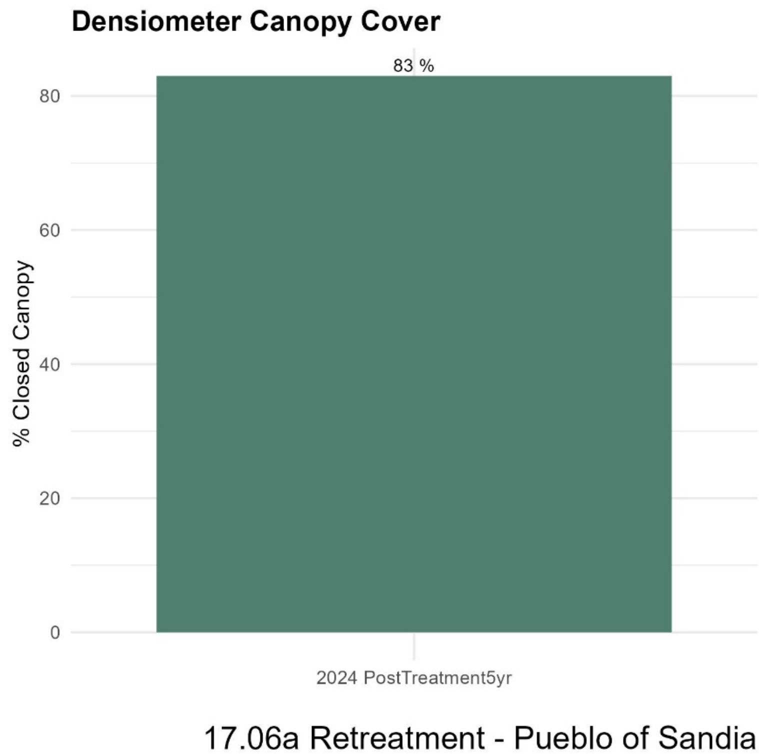

Figure 13. Mean percent canopy cover as measured by densiometer.

Soils

Four samples of soil texture are taken at each CSE plot in order to help determine site potential. The figure and table below display total frequency of textures. The soil textures observed on site were loamy sand, silty clay, and silty clay loam, with the loamy sand constituting the largest portion (Figure 14).

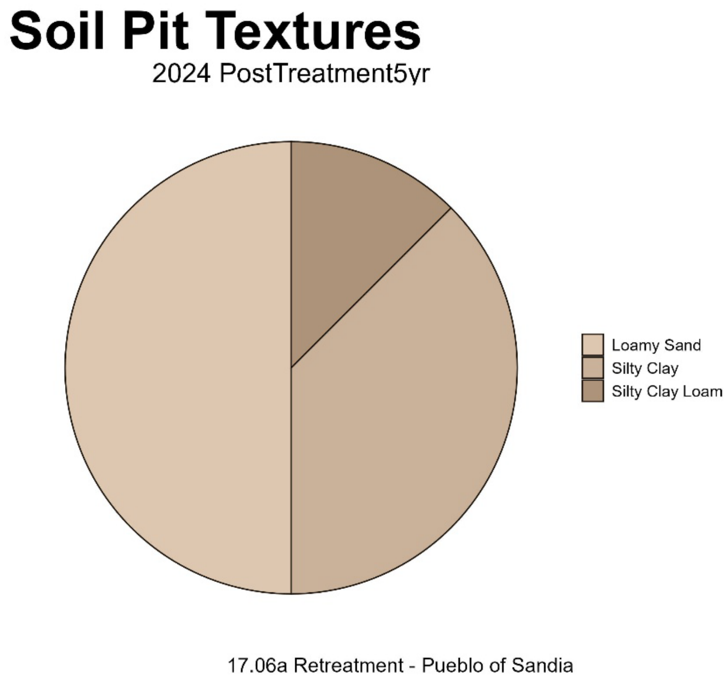

Figure 14. Frequency of soil textures across plots.

Table 4. Frequency of soil textures across plots.

Soil Texture Frequency: 17.06a Retreatment - Pueblo of Sandia		
Monitoring Status	**Soil Texture**	**Count**
2024 PostTreatment5yr	Loamy Sand	4
	Silty Clay	3
	Silty Clay Loam	1

Surface Fuels

Total surface fuels in this project area are estimated to be 11 tons per acre. Total fine fuels is estimated to be 3.8 tons per acre; total woody fuels at 5 tons per acre, making up the vast majority of total fuel loads (Table 5).

Table 5. Surface fuel loads across all plots.

17.06a Retreatment - Pueblo of Sandia									
Monitoring Status	**1-hr (tons/acre)**	**10-hr (tons/acre)**	**100-hr (tons/acre)**	**1000-hr sound (tons/acre)**	**Litter (tons/acre)**	**Duff (tons/acre)**	**Total Fine Fuels (tons/acre)**	**Total Wood Fuels (tons/acre)**	**Total Surface Fuels (tons/acre)**
2024 PostTreatment5yr	0.58	3	0.21	1.2	3.8	2.5	3.8	5	11

Litter and Duff

Litter and duff make up a combined 6.3 tons per acre of surface fuels. The average depth of litter is 0.76 inches; duff is 0.29 inches. This is significant because high litter levels can present increased fire risk (Figure 15).

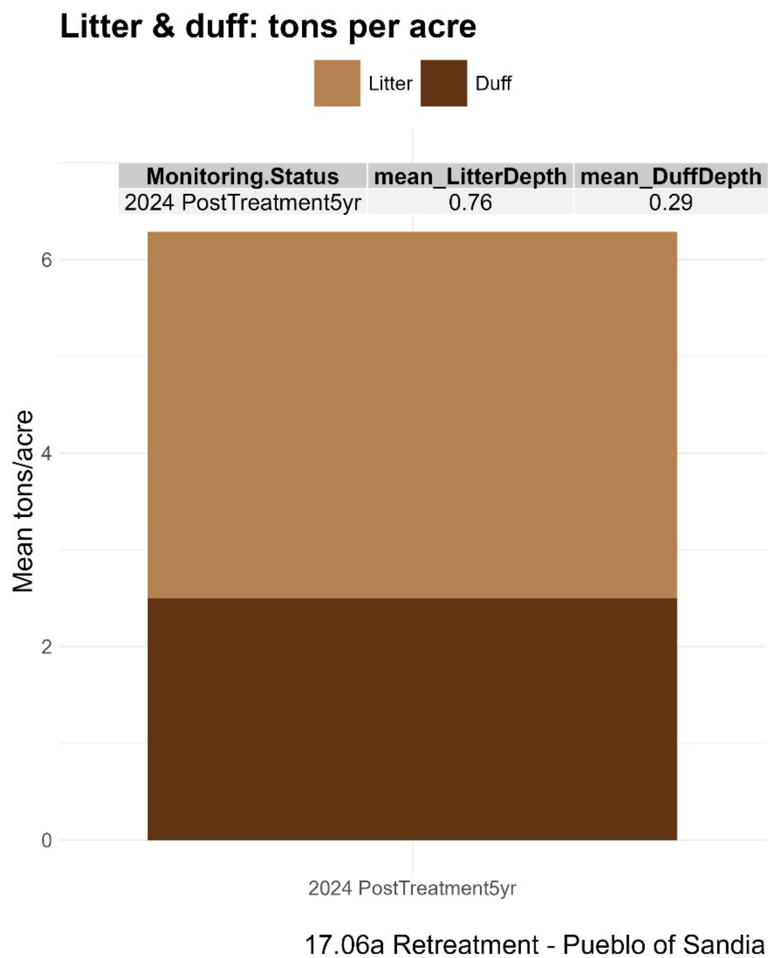

Figure 15. Mean litter and duff loads in tons per acre across plots. Inset table shows mean litter and duff depths in inches.

Fine Fuels

Ten-hour fuels make up the majority of fine fuels at 3 tons per acre, followed by one-hour fuels at 0.58 tons per acre. Total fine fuels was at 3.8 tons per acre.

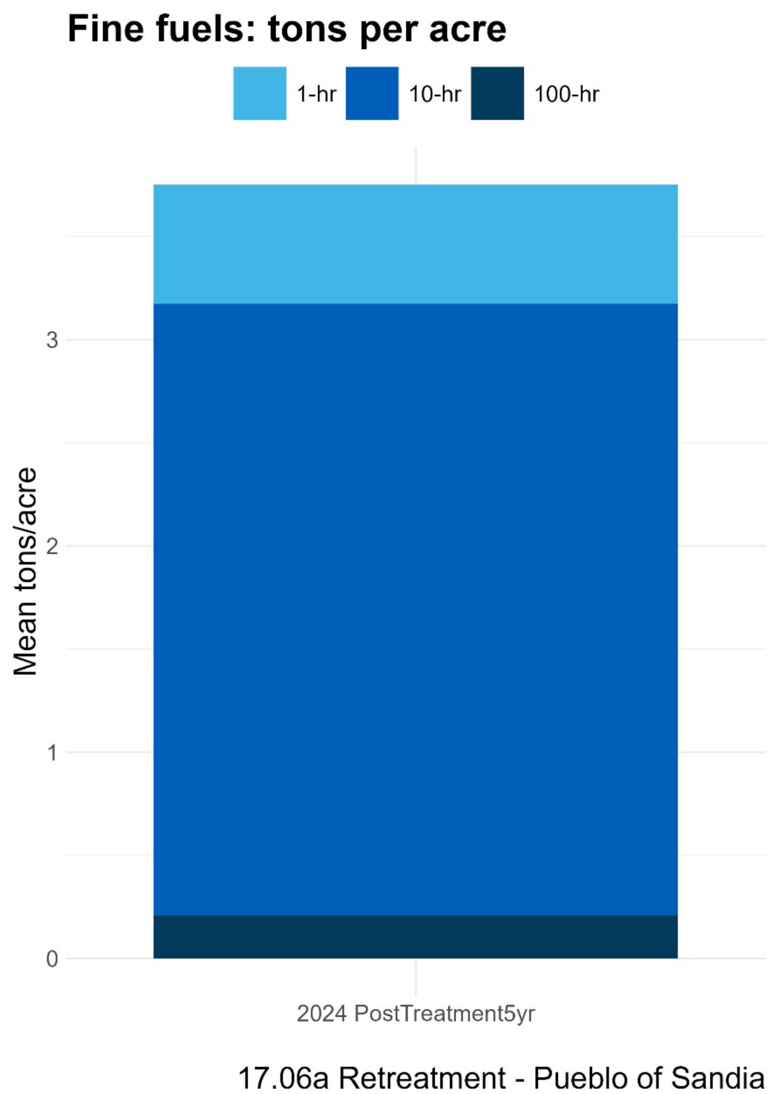

Figure 16. Mean fine fuels loads across plots in tons per acre

Thousand-Hour Fuels

Thousand-hour fuels were estimated at 1.2 tons per acre. The majority of these fuels are of sound fuels, in decay class 3 (Table 5). This is significant because sound fuels have more burn potential than rotten logs because rotten logs have higher moisture contents, so they slightly dampen fire risk.

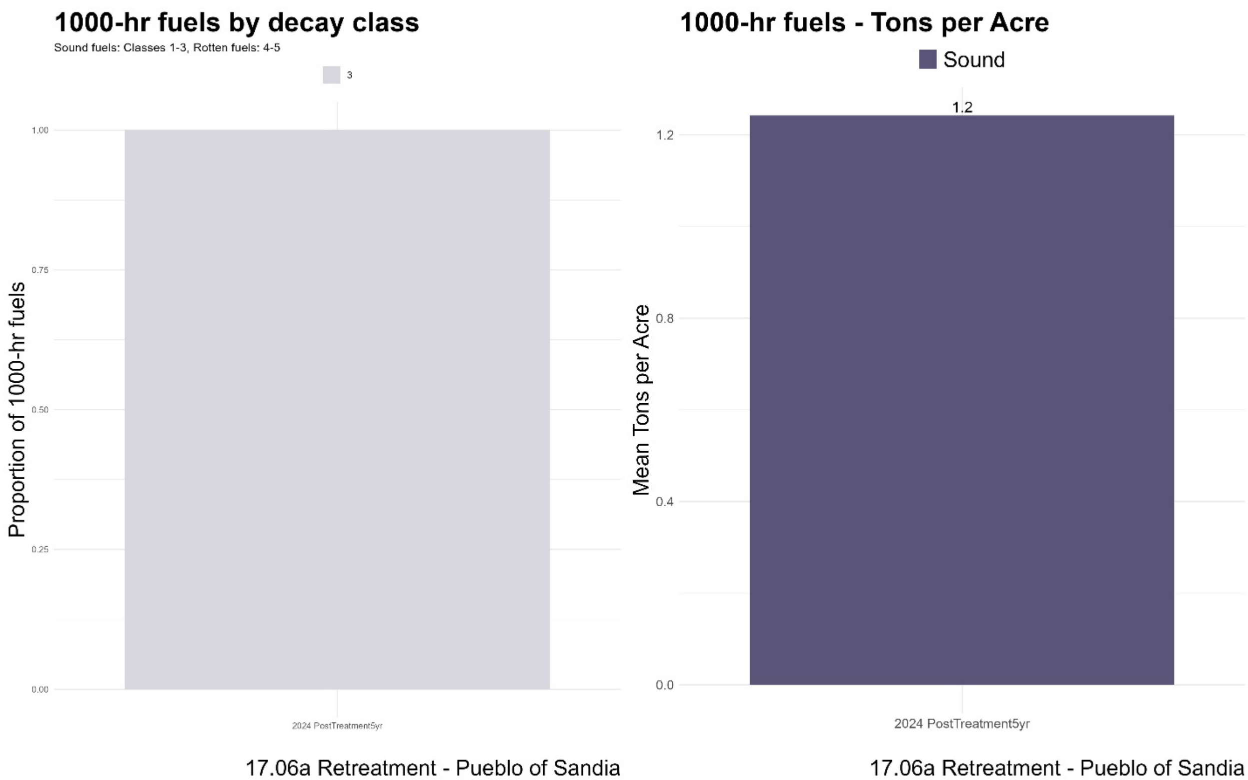

Figure 17. Proportion of 1000-hour fuels by decay class. Mean 1000-hour fuels in tons per acre.

Summary

Data Summary

NMRAM scores improved somewhat between 2017 and 2024. Relative Native Plant Community Composition, Vegetation Horizontal Patch Structure, Surface Fuels, all increased their score. Vegetation Vertical Structure and Exotic Invasive Plant Species Cover did not change. Native Riparian Tree Regeneration and Soil Surface Condition decreased in score. Despite the persistence of invasive species at various strata, the ratio of native: exotic species had improved over pre-treatment conditions. The overall coverage estimates for invasive species on the site went from 31% pre-treatment to 23% 5 years post-treatment. Project Biotic Rating, which is based on the previous scores, notably increased between the pre-treatment data and 5yr-post-treatment data, from a D rating (Poor) to a C rating (Fair) (Table 1).

Overstory trees show low diversity with only two species represented, both invasive species. The Russian olive dominated the overstory, with the Siberian elm taking the remainder (Figure 5). The mean height for the project was 24ft and mean live crown base height was 3.1ft (Figure 6). The project area had 30 growing stock trees per acre (Figure 7), with Siberian elm taller and larger in diameter than Russian olive, but Russian olive having more trees per acre (Figure 8).

Regeneration was mostly seen in coyote willow at 220 living seedlings/acre, where willow baccharis had only 20 living seedlings/acre. Coyote willow had an estimated 2400 living saplings/acre in this project. The willow baccharis had 160 living seedlings/acre (Figure 9).

Ground cover on CSE plots was dominated by Litter (87%), followed by Bole (11%) (Figure 10 and Table 2).In aerial cover the most dominant species on this site was coyote willow at 45%, followed by salt cedar at 22%. 42.9% of species were native and 28.6% were non-native (Figure 11 and Figure 12). Soil textures observed on site were loamy sand, silty clay, and silty clay loam, with the loamy sand constituting the largest portion at 50%, and the silty clay coming next at 37.5% (Figure 14 and Table 4).

Total surface fuels were estimated at 11 tons/acre, fine fuels at 3.8 tons/acre, and total woody fuels at 5 tons/acre. Litter and duff were 3.8 tons/acre and 2.5 tons/acre respectively (Table 5). The average depth of litter is 0.76 inches; duff is 0.29 inches (Figure 15). Ten-hour fuels make up the majority of fine fuels at 3 tons per acre (Figure 16). Thousand-hour fuels were estimated at 1.2 tons/acre and were all decay class 3 (Figure 17).

Management Implications

5yr post-treatment, NMRAM field crew observations recorded mistletoe and broken tops among some younger cottonwoods, along with mortality in more mature trees. Also of note, field crew spoke with Pueblo of Sandia staff who mentioned that they had been removing some Siberian elms (Table 1). There are signs of masticated material on the ground, as well as the blocked-up wood from some of the removed trees. Litter and trash were among the signs of human activity in the area (Rossbach, 2019). 5 years post-treatment the project has increased in vegetation structure, and despite the continued presence of invasive (target) species the site has improved its Biotic Rating. The continued presence of target species, and the possible impact of continued maintenance of the area, display the importance of continued treatment of projects after the initial treatment (Table 1).

No native trees were found on the project within plots, with the exception of Coyote Willow which is treated as a woody shrub in this protocol. A site that is dominated by an overstory of non-native trees suggests further removal of invasive trees may be necessary. This is especially true considering that the CSE data shows coyote willow dominating the tree regeneration on the site, but no cottonwood or any other native trees (Figure 9). In aerial cover 42.9% of species were native and 28.6% were non-native (Figure 11 and Figure 12). In the understory, ground cover was dominated by Litter (87%), followed by Bole (11%) (Figure 10 and Table 2). Litter and Duff, at 6.3 tons per acre, and Ten-hour fuels, at 3 tons per acre, and thousand-hour fuels, at 1.2 tons per acre, along with the Litter and Duff values, show the increased risk of fire in the Bosque (Figure 15, Figure 16, and Figure 17). Altogether these results suggest the need for continued management, i.e. aggressive maintenance of the invasive species removal treatments. It may also be worth considering groundwater monitoring and related efforts to better understand the causes of the pest/disease in the cottonwoods, and what additional management actions could help achieve the Pueblo's restoration goals.

Disclaimer

NMFWRI provides this report and the data collected with the disclaimer that the information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived. It is the responsibility of the data user to use the data appropriately and within the limitations of monitoring data in general, and these data in particular. NMFWRI gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data. This data and related graphics are not legal documents and are not intended to be used as such. This includes but is not limited to using these data as the primary basis for the development of thinning prescriptions or timber sales. NMFWRI shall not be held liable for improper or incorrect use of the data described and/or contained in this report. Analysis was also done according to our standard protocols. Note that the values reported in the tables are expressed on a per acre basis, but represent only area actually sampled. We do not scale up these values to calculate volume of wood over the project area, and warn readers of this report that they are not intended for that purpose. The accompanying tables show summaries of our data, and some differences are discussed below; however, differences that seem apparent here may not stand up to rigorous statistical tests. For some estimates, the standard deviation exceeds the mean (i.e., the coefficient of variation is greater than 100 percent), and sampling errors for some estimates exceed 100 percent. Therefore, data should be used and results interpreted with appropriate caution.

References

Audubon New Mexico. (2013). Water Matters: Water for New Mexico Rivers. Albuquerque, New Mexico: Utton Transboundary Resources Center.

Committee on Riparian Zone Functioning and Strategies for Management, et al. (2002). *Riparian Areas: Functions and Strategies for Management.* Washington, D.C.: National Academy Press.

GRGWA. (2017). *GRGWA Project Proposal .* GRGWA.

New Mexico Department of Game and Fish Conservation Services Division. (2012). *Bridge and Road Construction/Reconstruction Guidelines for Wetland and Riparian Areas.*

Rossbach, F. (2019). *Forest Contractor Inspection Report 17.06a.* GRGWA.

USDA NRCS. (2016, 8 10). *Web soil Survey.* Retrieved from https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

USDA NRCS n.d. (n.d.). *Ecological Site Description Riverine Riparian F036XA005NM .*

USDA NRCS n.d. (n.d.). *Ecological Site Description Bottomland.* Retrieved from https://esis.sc.egov.usda.gov/ESDReport/fsReport.aspx?approved=yes&rptLevel=all&id=R042XA057NM#top

USDA NRCS n.d. (n.d.). *Ecological Site Description Bottomland.* Retrieved from https://esis.sc.egov.usda.gov/ESDReport/fsReport.aspx?approved=yes&rptLevel=all&id=R042XA057NM#top

USDA NRCS n.d. (n.d.). *Ecological Site Description Salty Bottomland.* Retrieved from https://esis.sc.egov.usda.gov/ESDReport/fsReport.aspx?approved=yes&rptLevel=all&id=R042XA055NM

USDA USFS. (1996, September). Ecology, Diversity, and Sustainability of the Middle Rio Grande Basin, RM-GTR-268. (D. M. Finch, & J. A. Tainter, Eds.) Fort Collins, Colorado.

Appendix I – Sample Point Location Table

Name	Latitude	Longitude	Sample Point Type
17.06a_1_NESW	35.29483	-106.58048	Pre/post photopoint, post-treatment CSE plot
17.06a_2_PCNESWB	35.29679	-106.58102	Post-treatment photopoint and CSE plot

Appendix II – Photos

** NOTE: PHOTOS ARE NOT AVAILABLE IN THIS PUBLIC-RELEASE VERSION OF OUR REPORT. PLEASE CONTACT THE PUEBLO OF SANDIA ENVIRONMENT DEPARTMENT TO REQUEST ACCESS TO MONITORING PHOTOS IF NEEDED. **

Appendix III – Discussion of the Adaptation of NMRAM

We would like to clarify that we are adapting these NMRAM metrics for our own purposes. That we are using them both inside and outside their intended site ranges, including on larger sites (NMRAM is designed to handle a site around 100 x 200 meters), sites further from the river (NMRAM is currently in use primarily for assessing riverine wetlands), and sites defined by exotic vegetation presence rather than hydrologic boundaries and upland vegetation indicators/apparent wetland extent. Site delineation and size is likely to be variable for a number of other reasons, including landowner participation, available funds, proposals received from contractors, etc. – many of which cannot be directly correlated to site disturbance or ecological function. For this reason, we do not use the entire NMRAM assessment, or place confidence in the weighted score roll-ups that are typically part of an NMRAM report. Should one be interested, rationale for the weighting in the NMRAM score roll-up can be found in the field manual for version 2.1. For more information, contact Maryann McGraw of the NMED or NMFWRI.

While we provide a biotic site score and rating for your reference, we recommend comparisons be done with individual metrics from pre-treatment and post-treatment assessment from the same site, rather than across multiple sites. Also, of note is that statistical analysis is not appropriate for NMRAM, or other low intensity, rapid field methods.

Please note that should the project area change significantly from what was originally proposed and monitored, all metrics will lose some amount of confidence on comparison as it is impractical to re-examine the original site assessment scores using new boundaries. This is an issue of concern of which GRGWA should be aware. We recommend that GRGWA attempt to minimize alterations in project boundaries once pre-treatment monitoring data has been approved for collection. We recognize that this is not always practical: boundaries change for a number of reasons and time and cost constraints can necessitate the sole use of a rapid assessment method for monitoring. We have reason to hope our outlined assessment method will still be a satisfactory indicator for site function improvement or degradation primarily because metrics in rapid assessment methods such as this are set up to have relatively low sensitivities (i.e. for a change to be reflected in the metrics, either positive or negative, disturbance on site has to be significantly altered). Since 2018, we have addressed these concerns by altering the initial monitoring regime to include high-intensity CSE-style plots whenever possible, as these can more often be repeated in their exact initial locations, allowing collection of comparable data regardless of boundary change.

From here on out, the goal of the GRGWA/ NMFWRI is that all sites will be revisited for post-treatment monitoring in 5-year intervals. It is our intention and expectation that the data collected in these intervals will reflect any significant changes in disturbance and ecological function of the site.

Appendix IV - Modified Hink and Ohmart categories, from NMRAM

The following text is from pages 39-41 in https://www.env.nm.gov/opf/wp-content/uploads/sites/18/2022/03/NMRAM-Manual_v2_0_Final-for-Website.pdf

Citation: Muldavin, E.H., E.R. Milford, and M.M. McGraw. 2021. New Mexico Rapid Assessment Method: Manual Version 2.0. New Mexico Environment Department, Surface Water Quality Bureau, Santa Fe, NM.

All photos credit NMFWRI.

Vegetation Vertical Structure Type Definitions for NMRAM

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).