Lava SWCD Grants Projects 15.15 and 15.20

10-yr Post Treatment Monitoring Report – 2025

Prepared by:

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for the *Greater Rio Grande Watershed Alliance* and the *Lava & McKinley Soil & Water Conservation District*

Contents

Acronyms and Abbreviations

Acronym, Abbreviation, or Term	Explanation or Definition as used by NMFWRI
CSE	Common Stand Exam
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

1 Purpose of Report

This report covers low- and high-intensity post-treatment vegetation monitoring assessments performed on two non-native phreatophyte removal projects submitted by the Lava SWCD on behalf of the City of Grants and landowners to the Greater Rio Grande Watershed Alliance in 2015. 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 Low intensity Field Methods – Adapted NMRAM

Low intensity pre-treatment vegetation monitoring was conducted 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 E. B., 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 E. B., 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 III). 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, at 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 returning to the office, this polygon map and the photo points were digitized by the monitoring technician and/or specialist. All of the adapted NMRAM methods were collected for both pre- and post-treatment.

3.2 Low intensity Field Methods – Photo Points

Photo points 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 photo points 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). Photo points were collected for both pre- and post-treatment.

3.3 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. Finally, all plant species observed within the 1/10^{th-}acre area with over 1% cover were recorded, as were other comments regarding conditions at the plot.

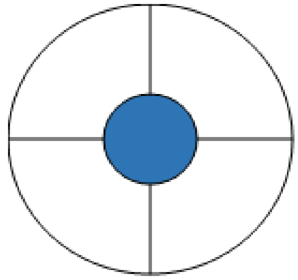


Figure 1: Example of CSE plot layout. The outer circle represents the 1/10-acre plot and the blue circle is the 1/100-acre plot.

3.4 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.

3.5 Personnel Involved

2015 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

- Kathryn R Mahan, Ecological Monitoring Specialist

2015 New Mexico Forest and Watershed Restoration Institute GIS Team:

- Patti Dappen, GIS Specialist
- Adrienne Miller, GIS Specialist

2021 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

- Kathryn R Mahan, Monitoring Program Manager
- Carmen Briones, Crew Logistics Support/ Assistant Manager
- Raymundo Melendez, Ecological Monitoring Technician
- Alex Makowicki, Ecological Monitoring Technician

2021 New Mexico Forest and Watershed Restoration Institute GIS Team:

- Patti Dappen, GIS Program Manager
- Katie Withnall, GIS Specialist

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

- Patrick Clay Goetsch, Riparian Crew Lead
- Abbi Han, Monitoring & GIS Specialist
- Vincent Vispo, Monitoring Technician
- Kathryn R Mahan, Ecological Monitoring Program Manager
- Corey Beinhart, Data Manager

Other persons contacted:

- Todd Haines, Field Coordinator, Greater Rio Grande Watershed Alliance
- Larry Winn, Lava Soil & Water Conservation District
- Dierdre Tarr, District Manager for Claunch-Pinto SWCD, Greater Rio Grande Watershed Alliance

4.0 Site Description and Ecological Context: 15.15 and 15.20 Grants

Projects 15-15 and 15-20 are in and to the south of the city of Grants, New Mexico. Grants receives an average of 10.4 inches of rain annually. Temperatures range from an average high of 88 degrees Fahrenheit in July to an average low of 14 degrees Fahrenheit in January (City-stats, 2016).

According to the NRCS Web Soil Survey, project area 15-15 is 44% Warm Springs loam, which is ecological site type R036XB009NM Salt Meadow, 30% Lava flows, 17% Viuda-Penistaja-Rock outcrop complex (ecological sites R036XB007NM Malpais and R035XA112NM Loamy), and 8% Venadito clay loam, ecological site type R035XA119NM Clayey Bottomland. Project 15-20 is 100% Venadito clay loam and R035XA119NM Clayey Bottomland. The Salt Meadow ecological site typically supports a grassland state dominated by alkali sacaton and inland saltgrass; fourwing saltbush is the dominant shrub. In a deteriorated state, the site supports a plant community dominated by inland saltgrass, seepweed, iodinebush, salt cedar and bare ground. Other common grasses could include salsedge, foxtail barley, mat muhly, western wheatgrass, nuttall alkaligrass and alkali cordgrass (Sylvester, 2002). The Clayey Bottomland ecological site typically supports a grassland state dominated by western wheatgrass, blue grama, galleta, and alkali sacaton. It can also be found in a shrub-dominated state where dominant vegetation is rabbitbrush, fourwing saltbush, galleta and other grasses, as well as a bare state with sparse annual vegetation (USDA NRCS, 2005). The Malpais ecological site typically supports a grassland state dominated by blue grama and sideoats grama. Other common vegetation includes western wheatgrass, little bluestem, spike muhly, black grama, galleta, New Mexico feathergrass, alkali sacaton, winterfat, fourwing saltbush, broom snakeweed, and scattered piñon and juniper. In a detoriated state the grass community may become sod-bound, dominated by blue grama sod, threeawns, wolfstail and snakeweed. (USDA NRCS, n.d.) The Loamy ecological site typically supports a grassland state dominated by blue grama, western wheatgrass, galleta, ring muhly, dropseeds, and/or threeawns. It can also be found in a piñon-juniper invaded state (dominated by piñon, juniper, and blue grama), a grass/succulent-mix state (dominated by blue grama, cholla and prickly pear), a shrub-dominated state (dominated by rabbitbrush or horsebrush and blue grama), as well as a bare state with sparse grass. (USDA NRCS, 2002)

5.0 Project History: 15.15 and 15.20 Grants

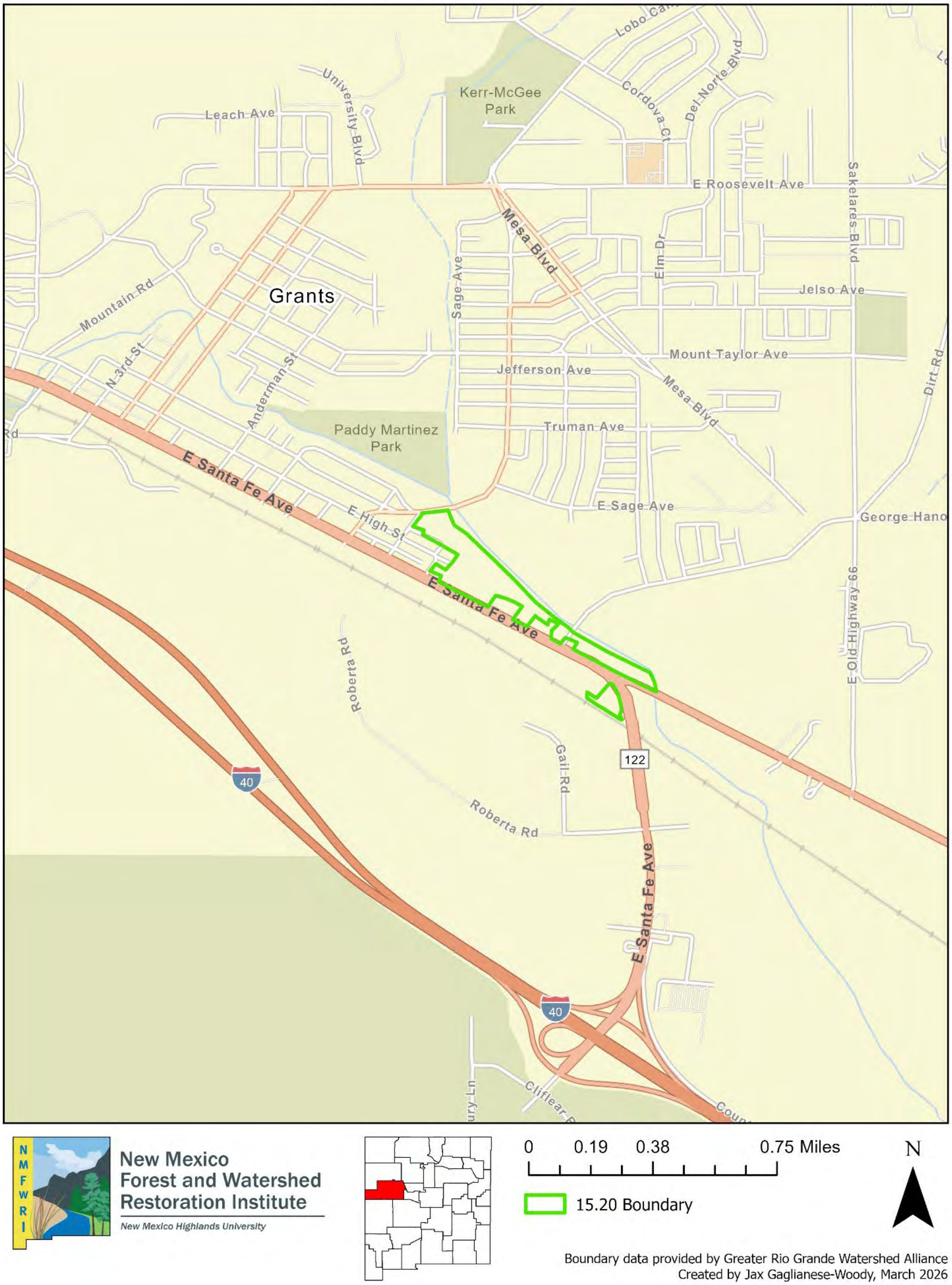
Pre-treatment monitoring was first conducted at these sites on September 16, 2015 as part of a restoration project targeting non-native phreatophytes scheduled for 2015-2016. The sites are located within Cibola County, NM, on the southeast side of the city of Grants. Post-treatment monitoring occurred on December 7th, 2021.

Project 15-15 (Maps 1 & 3 on the following pages) covers a large area along the railroad and US I-40 which is largely undeveloped. There are salt flats/alkali sink/playas on the NE side, and saltgrass scattered across the southern half of the site. There is no evidence of water movement across most of the site. Salt cedar was found to be common during pre-treatment monitoring, particularly in the eastern half of the site. One main road (Robert Rd) leads to a building near the center of the project, and several smaller two-tracks crisscross the project allowing access to billboards on the south side. Project 15-20 (Maps 2 & 4) is comprised of a number of private properties in the city of Grants. The project can be accessed either through these private properties or from levees on the north side of the site. Exotic species observed during the September 2015 site visit included salt cedar of various age classes, Russian thistle and kochia. Native species included fourwing saltbush, *Suaeda nigra* (Mojave seablite), chamisa (rubber rabbitbrush), *Senecio wootonii* (Wooton's ragwort), alkali sacaton, Helianthus, greasewood and *Xanthium strumarium (*cocklebur).

Project 15.15 Boundary

Map 1: 15.15 Project Location

Project 15.20 Boundary



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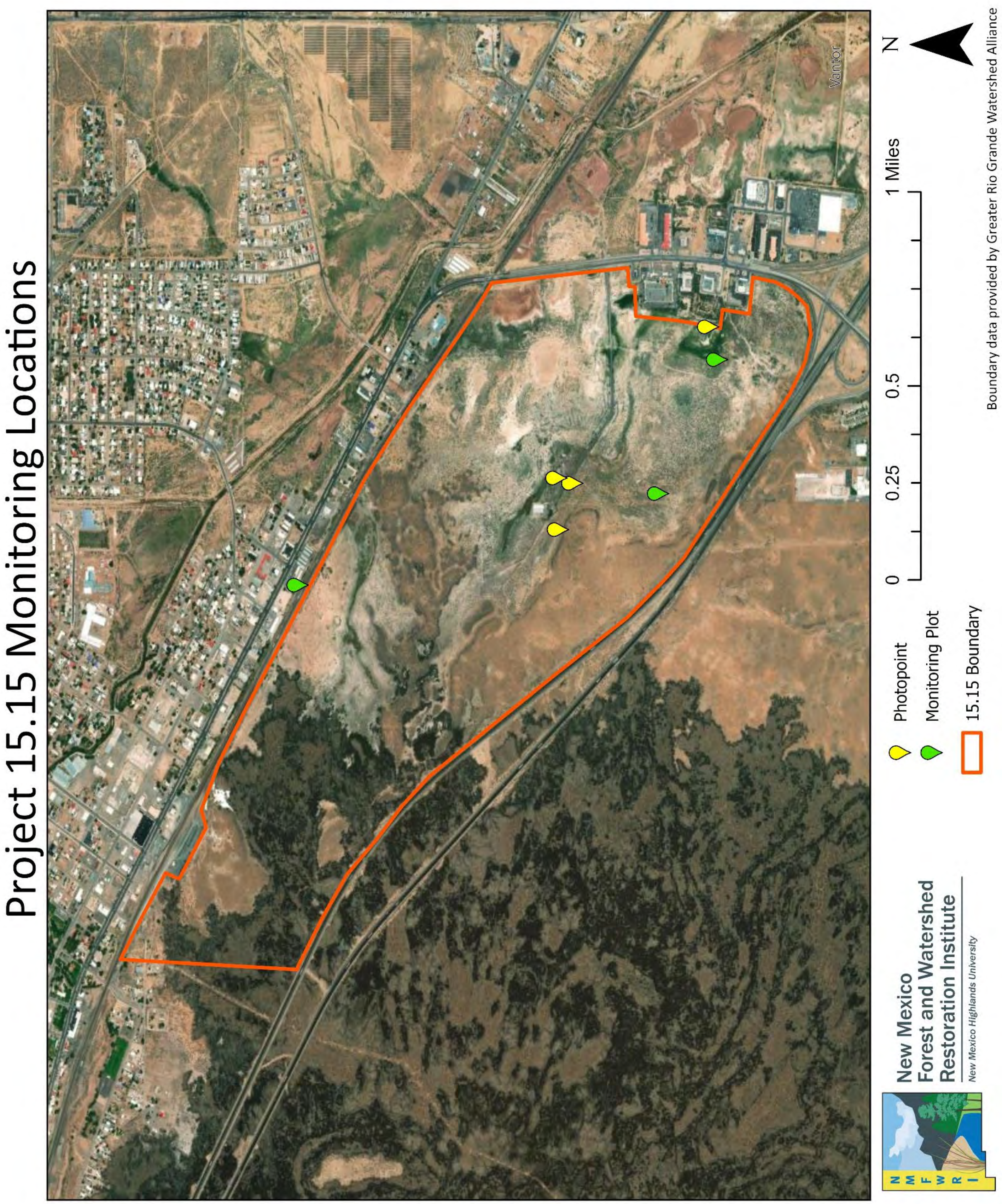
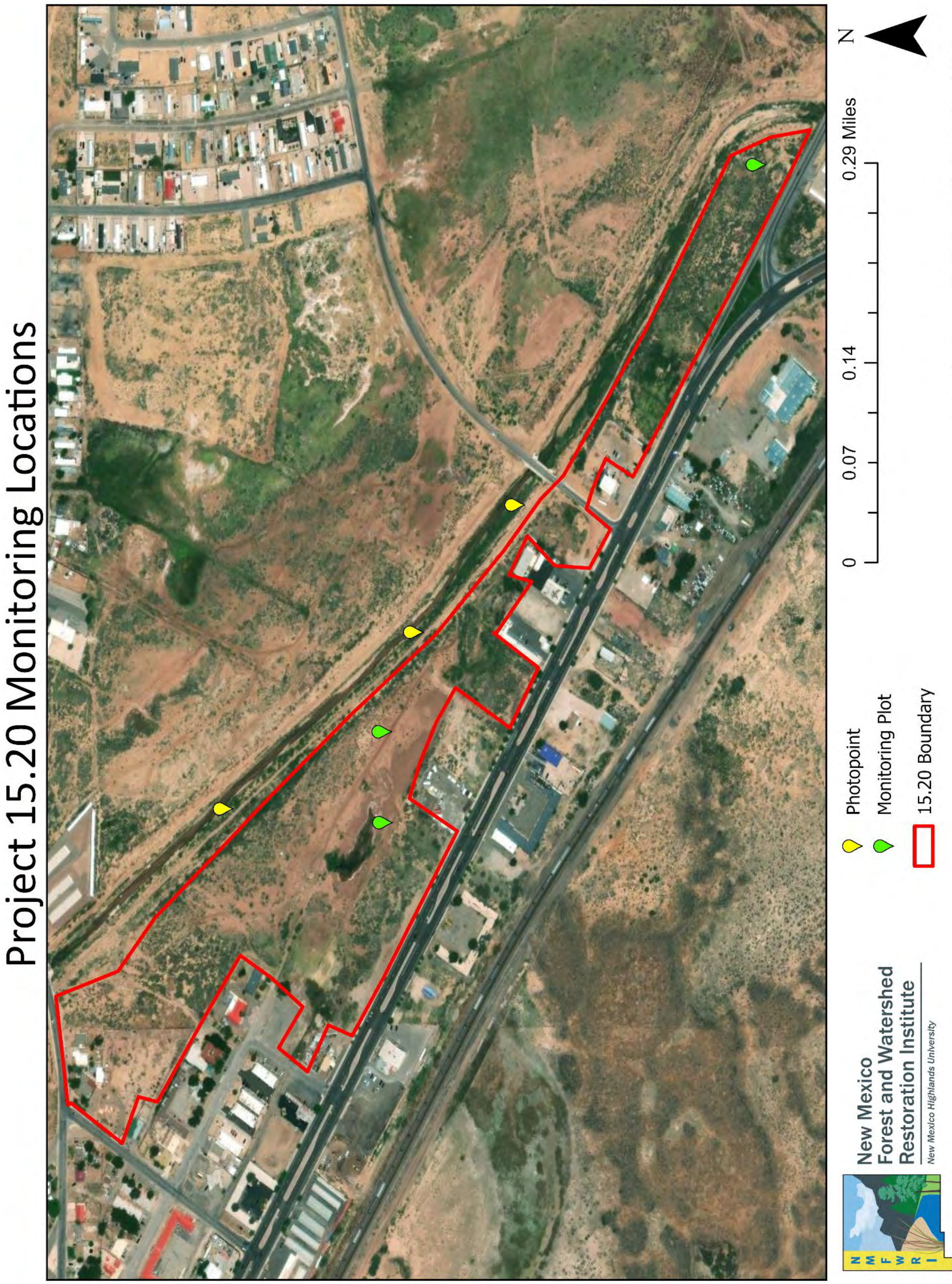
Map 2: 15.20 Project Location



Map 3: 15.15 Monitoring Locations



Map 4: 15.20 Monitoring Locations

6.0 Monitoring Results

6.1 Low-intensity Adapted NMRAM

As described above, the NMRAM uses a series of assessments to assign a score between 1-4 (where 1= Poor, 2 = Fair, 3 = Good, and 4 = Excellent) for the following metrics. The NMRAM community vegetation maps for 2015, 2021, and 2025 for both 15.15 and 15.20 project areas are on the subsequent pages.

Metrics 15.15	Pre-treatment 9-16-2015	5-year post-treatment 12-7-2021	10-year post-treatment 10-13-2025 & 10-14-2025
Relative Native Plant Community Composition	2		4
Vegetation Horizontal Patch Structure	4		3
Vegetation Vertical Structure	2		2
Native Riparian Tree Regeneration	1		1
Exotic Invasive Plant Species Cover	1		2
Project Biotic Score (based on above ratings)	2.1		2.7
Project Biotic Rating	C / Fair		B / Good
Soil Surface Condition	3	3	2
Surface Fuels	0.8	0.85	0.55

Table 1: NMRAM Scores for 15-15

Metrics 15.20	Pre-treatment 9-16-2015	5-year post-treatment 12-7-2021	10-year post-treatment 10-16-2025
Relative Native Plant Community Composition	1		2
Vegetation Horizontal Patch Structure	4		4
Vegetation Vertical Structure	2		1
Native Riparian Tree Regeneration	1		1
Exotic Invasive Plant Species Cover	1		1
Project Biotic Score (based on above ratings)	1.8		1.9
Project Biotic Rating	C / Fair		C / Fair
Soil Surface Condition	1	2	2
Surface Fuels	0.52	0.3	0.3

Table 2: NMRAM Scores for 15.20.

The headline finding from the NMRAM assessment is that the overall condition of both project areas has improved slightly compared to the pre-treatment monitoring conducted in 2015. Reliable biotic measurements were not taken in 2021 and are thus not presented in these tables.

The Relative Native Plant Community Composition score improved from “Fair” to “Excellent” for the 15.15 project area between monitoring visits and from “Poor” to “Fair” for the 15.20 site. This metric reflects the prevalence of native species within the plant communities and is weighted to give greater importance to species in the highest stratum of the community. Trees are the most important where they exist; if there are no trees, the community score is determined by the shrubs present and if there are no trees or shrubs, the score is determined by the herbaceous layer. While one plant community in the 15.15 project area had predominately native species in the herbaceous species strata, it still earned a poor score because the few shrubs that grew there were Russian olive (*Elaeagnus angustifolia*).

The change in this score during the 10 years post-treatment for both projects was largely driven by a decrease in the area covered by plant communities with non-native saltceder (*Tamarix ramosissima*). In 2015 this was 28% of the 15.15 project area, decreasing to 10% in 2025. In the 15.20 project area, saltcedar coverage decreased from 71% to 19%.

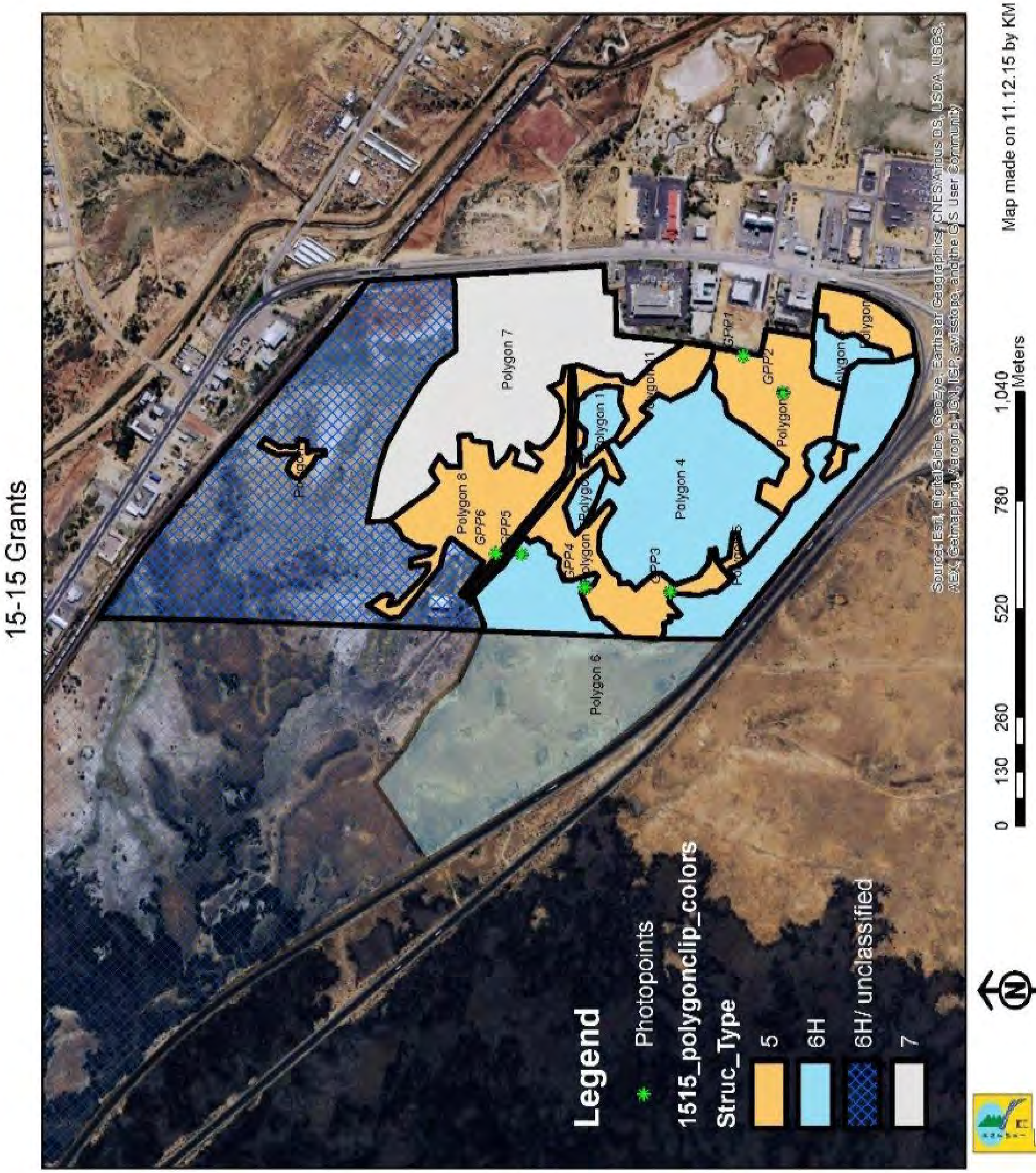
Ground cover in the 15.15 project area before treatment included natives such as fourwing saltbush (*Atriplex canescens*, present in 31% of the project area), *Sporobolus* species (jointly 24%), Indian ricegrass (*Achnatherum hymenoides*, 12%), and broom snakeweed (*Gutierrezia sarothrae*, 12%). The most common non-native was kochia (*Bassia scoparia*, 13%). By 2025 species composition had changed significantly with fourwing saltbush spreading across 96% of the project, alkali sacaton (*Sporobolus airoides*) increasing to 55%, rubber rabbitbrush (*Ericameria nauseosa*) over 51%, and muhly (*Muhlenbergia sp.*) at 35%. Remarkably, no non-native was a dominant species in plant communities comprising more than 10% of the project area.

For 15.20, the pre-treatment monitoring revealed that greasewood (*Sarcobatus vermiculatus*) was present in 25% of the project area. Alkali sacaton (*Sporobolus airoides*) and sunflower species (*Helianthus spp.*) were both present at 15% and fourwing saltbush (*Atriplex canescens*) covered 13%. The predominant non-natives were kochia (*Bassia scoparia*, 13%) and saltlover (*Halogeton glomeratus*, 10%). After treatment, greasewood (*Sarcobatus vermiculatus*) was still prevalent at 33%, but was joined by pickleweed (*Salicornia sp.*, 52%) while *Sporobolus* and *Helianthus* species were not recorded. Kochia (*Bassia scoparia*) expanded its range, being found in plant communities comprising 31% of the project area.

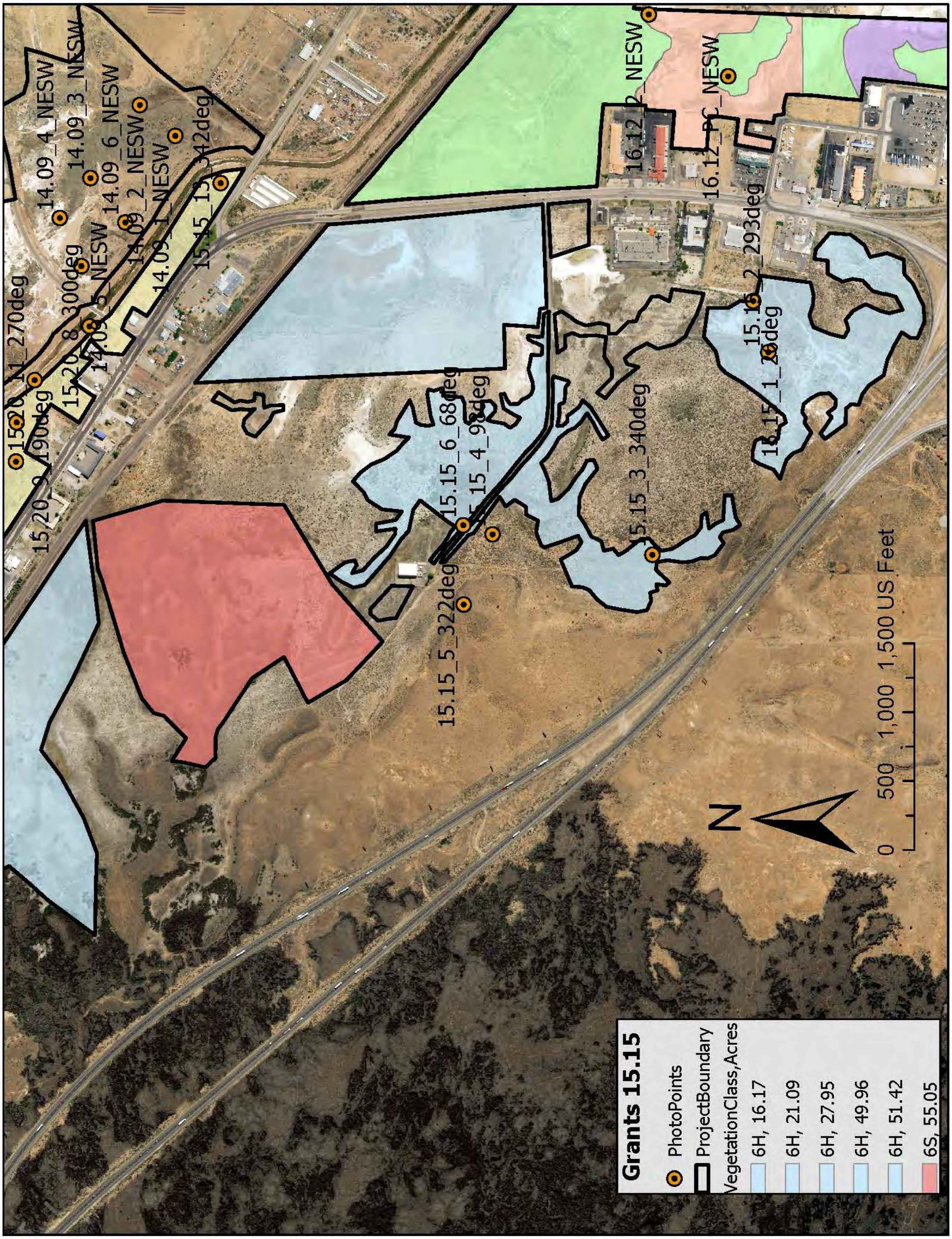
Metrics for vegetation patch structure had slightly lower scores in 2025 compared to 2015, likely because the removal of non-natives led to a decrease in the variety of community structures in the project areas. The removal of an entire strata of woody plants can decrease the habitat available for many species and without native replanting following removal, this is likely unavoidable.

Both projects received low scores for native riparian tree regeneration. There are effectively no native trees in the project areas, so there is no stock from which regeneration can occur regardless of whether the overstory niche is occupied by non-native species or not. Similarly, the scores for “Exotic Invasive Plant Species Cover” were generally poor, although the 15.15 site recovered slightly to “Fair” in 2025. This metric is weighted such that the lowest-scoring sites (those with a “Poor” rating) have more than half of their vegetation cover composed of non-native species while those with the best-possible “Excellent” rating have less than 10%. The poor scores, despite the presence of native species, stem from a lack of vegetation density. Most project areas were largely bare ground with only scattered native plants. In contrast, non-native patches were much denser and therefore, invasive species represented a disproportionately large share of the total plant population.

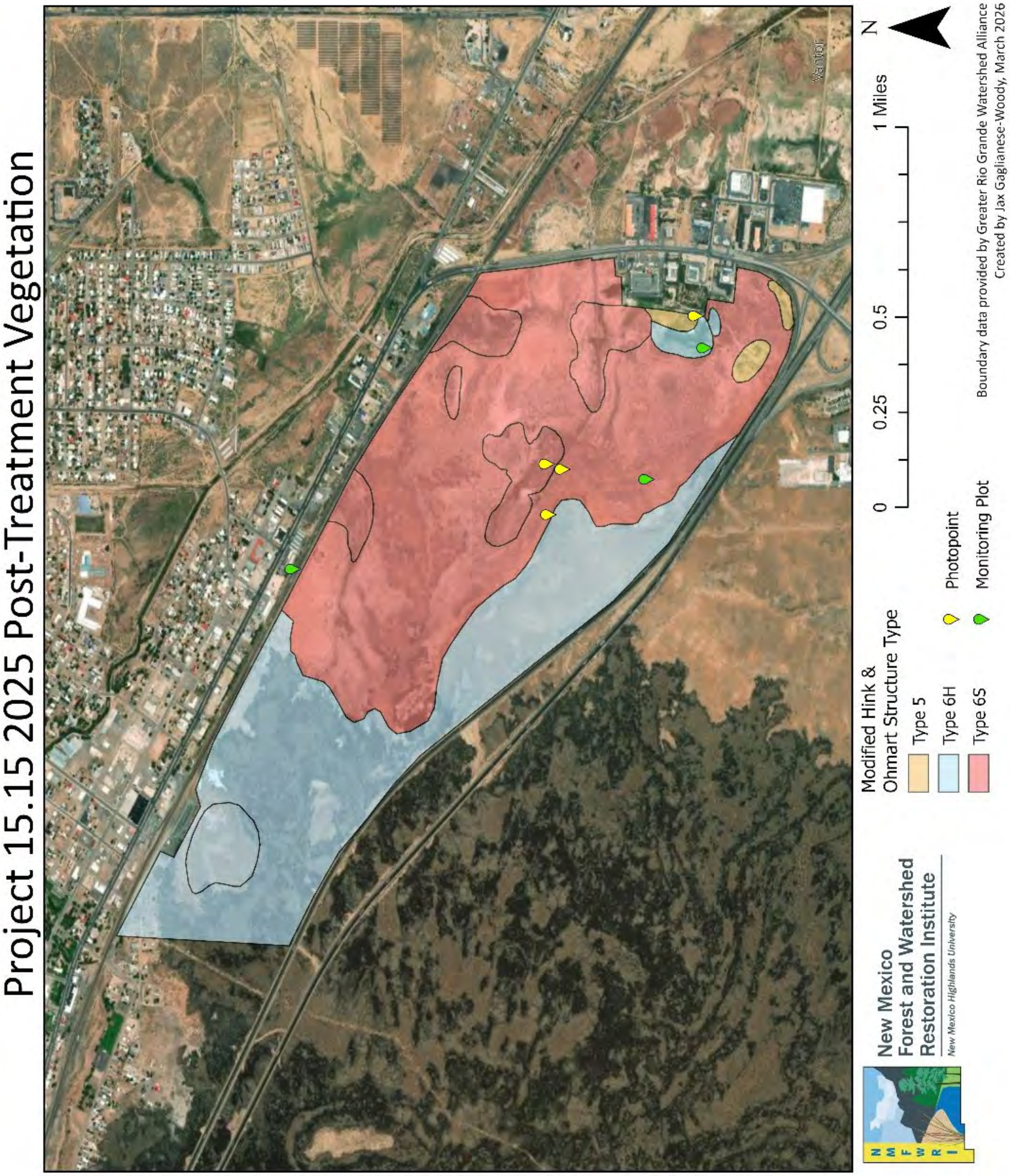
Soil surface condition in the 15.15 project area decreased from 2021 to 2025, likely because of an increase in two-tracks and off-road vehicle use. In the 15.20 project area, soil surface condition increased from 2015 to 2021 and held steady into 2025. The ability of surface fuels to carry fire was estimated as significantly less in 2025 than prior to treatment.



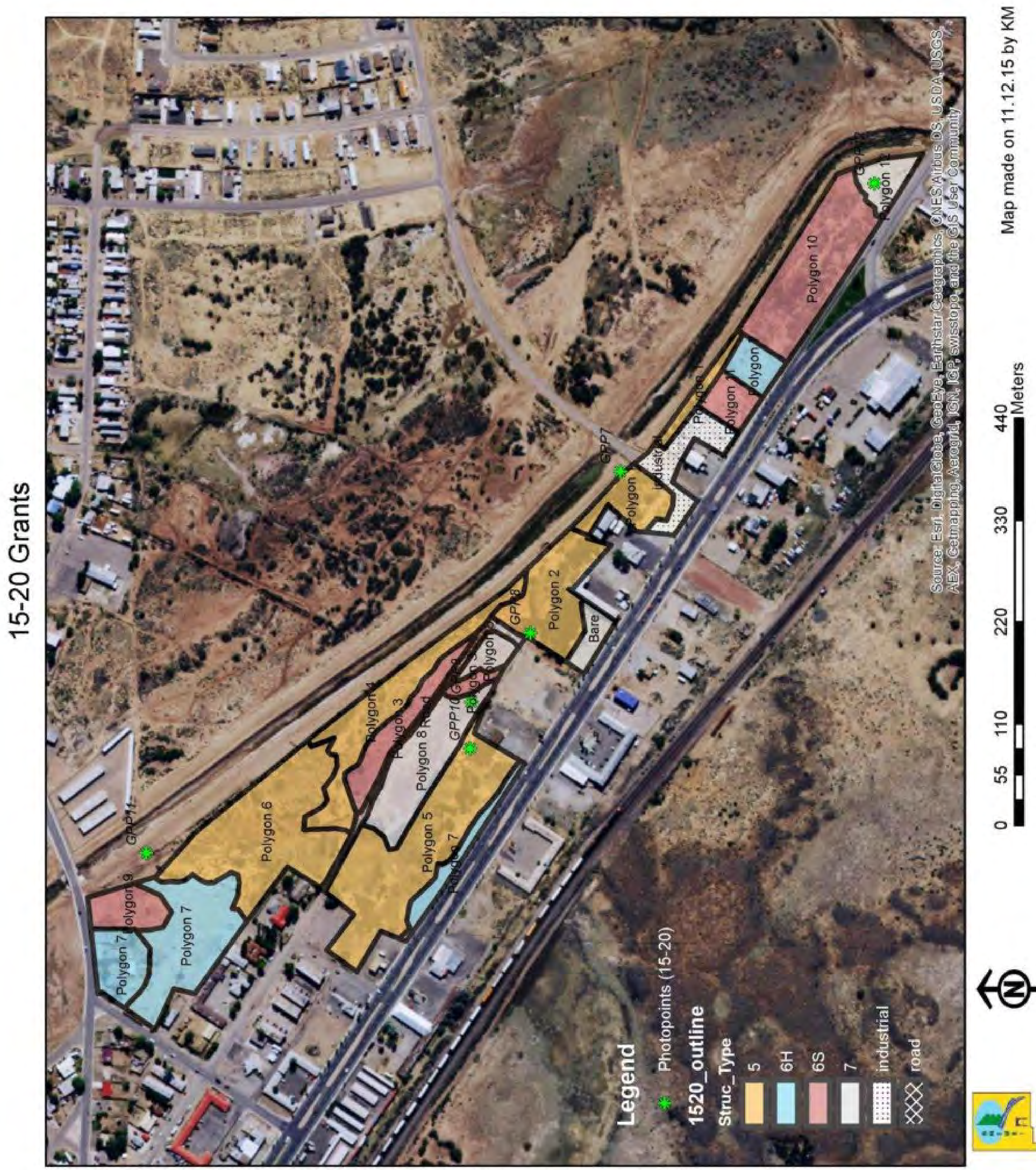
Map 5: 2015 NMRAM map representing vegetation structure distribution for Project 15.15



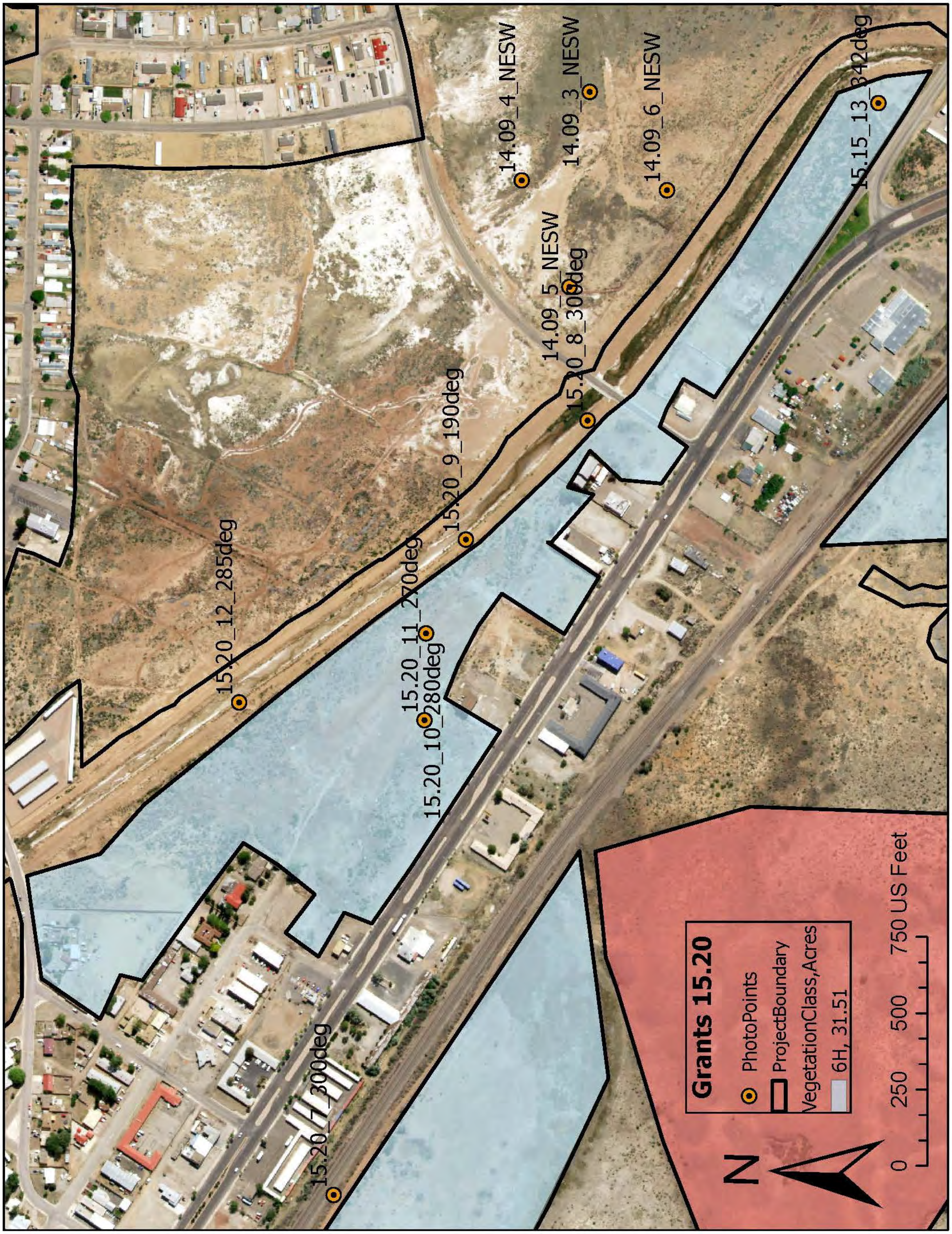
Map 6: 2021 NMRAM map of project 15.15



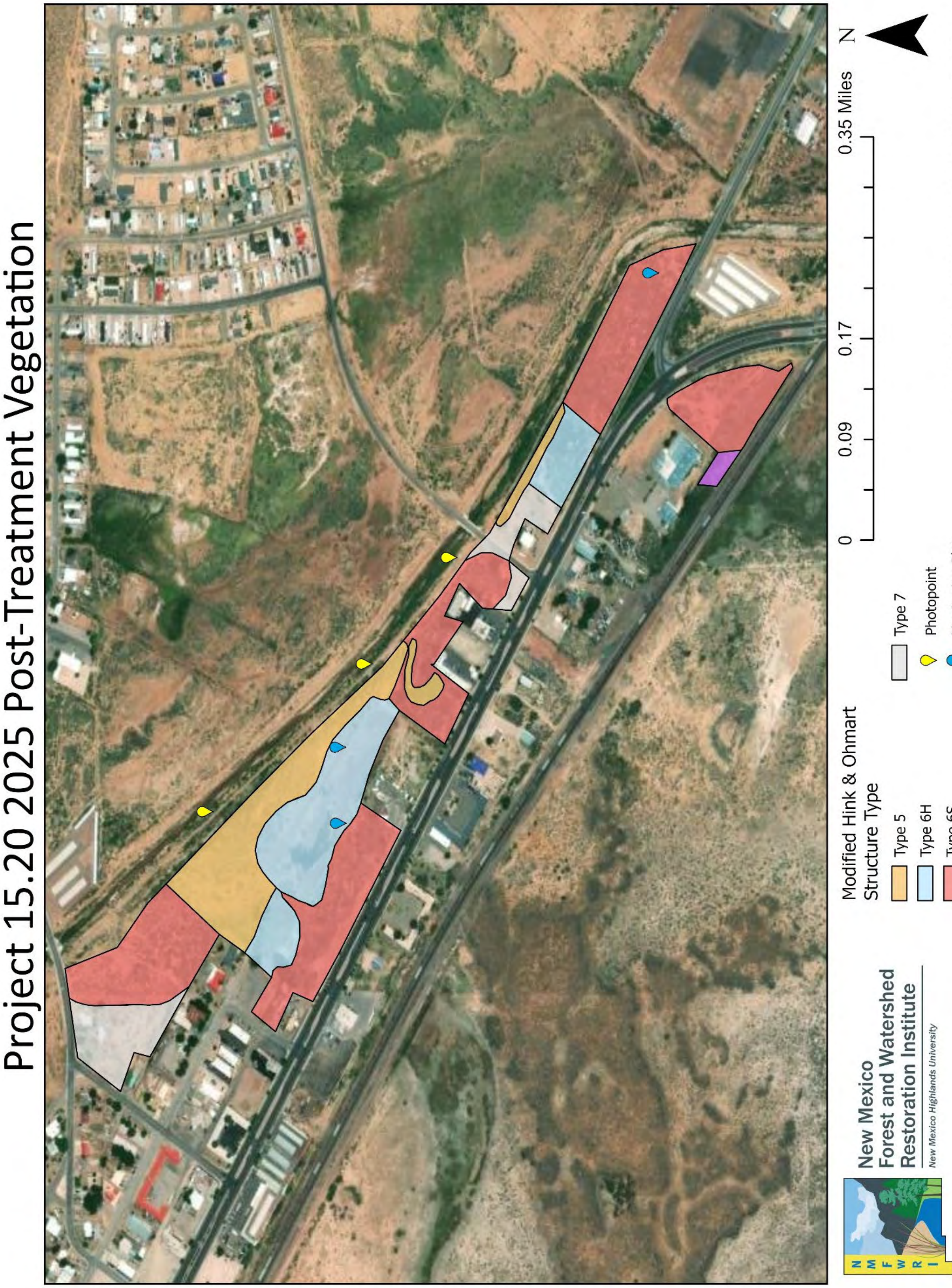
Map 7: 2025 NMRAM map of project 15.15



Map 8: 2015 NMRAM map of project 15.20



Map 9: 2021 NMRAM map of project 15.20



Map 10: 2025 NMRAM map of project 15.20

6.2 High-Intensity CSE Plot

Throughout section 6.2, USDA plant codes and scientific names for plants are used. This table describes the various codes, common names, scientific names, and nativity status used to refer to plants found on projects 15.15 and 15.20.

USDA Plant Code	Common Name	Scientific Name	Nativity
ATCA2	Fourwing saltbush	Atriplex canescens	N
BASC5	Burning bush; Kochia	Bassia scoparia (L.) A.J. Scott	I
DISP	Saltgrass	Distichlis spicata (L.) Greene	N
ELAN	Russian olive	Elaeagnus angustifolia L.	I
ERNA10	Rubber rabbitbrush; Chamisa	Ericameria nauseosa	N
ERIOG	Buckwheat	Eriogonum spp.	N
GUSA2	Broom snakeweed	Gutierrezia sarothrae	N
HELIA	Sunflower	Helianthus spp.	N
SALIX	Willow	Salix spp.	N
SARCO	Greasewood	Sarcobatus vermiculatus	N
SATR12	Prickly Russian thistle	Salsola tragus L.	I
SEWO2	Wooton's ragwort	Senecio wootonii	N
SPAI	Alkali Sacaton	Sporobolus airoides (Torr.) Torr.	N

Table 3: USDA plant codes with associated common and scientific name and nativity.

Regeneration: Trees & Shrubs

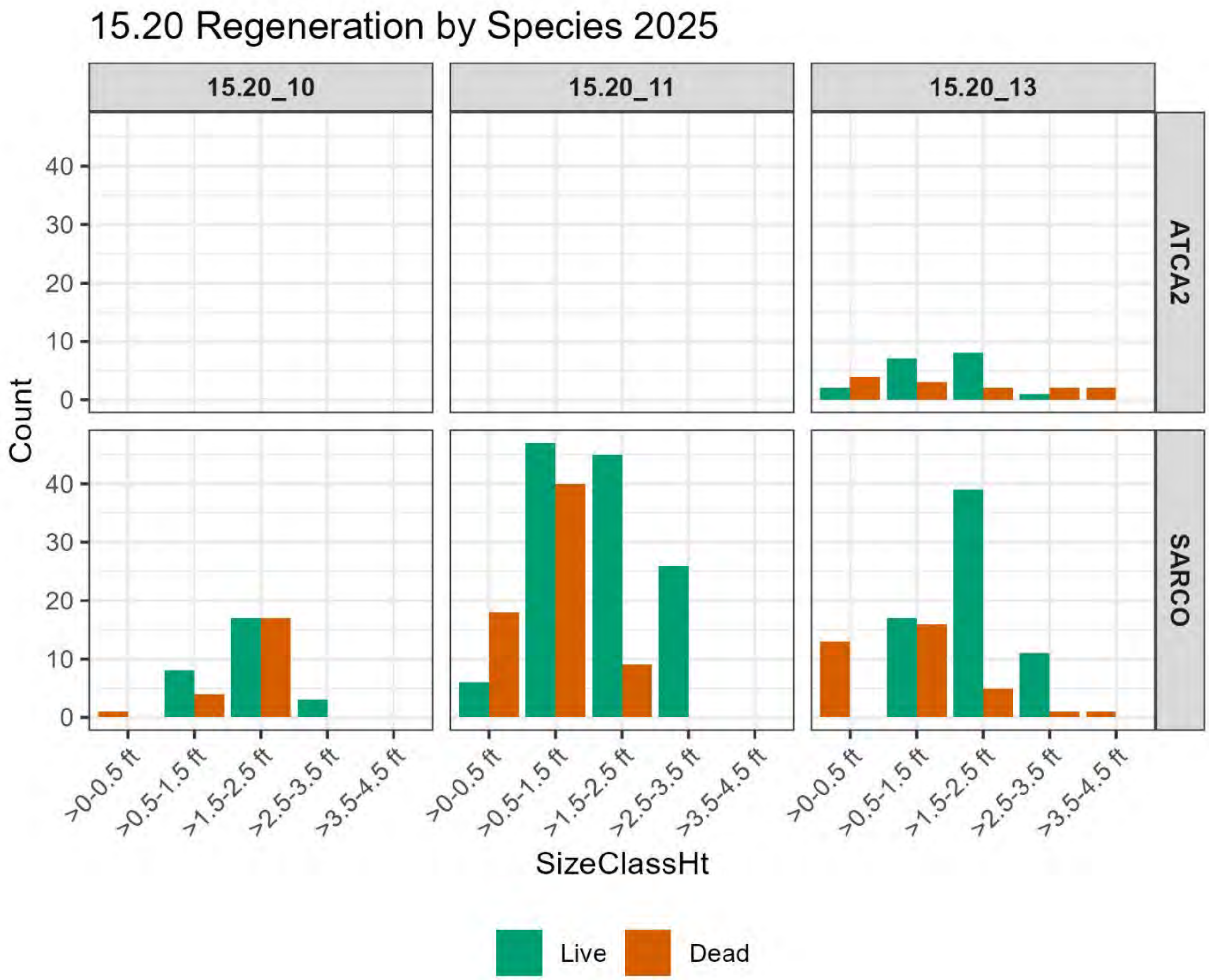
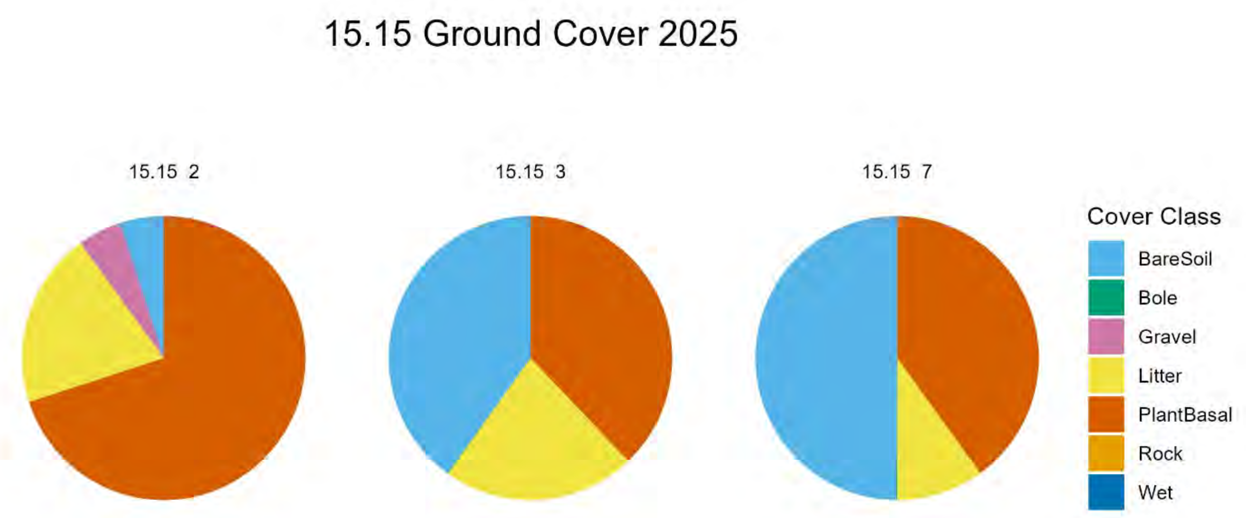


Figure 2: 15.20 number of seedlings by class height and live/dead status across plots.

There were no shrubs or trees on the 1/100th acre plots in the 15.15 project area. The 15.20 project had fourwing saltbush (*Atriplex canescens,* USDA Plant Code ATCA2) and greasewood (*Sarcobatus sp.,* likely *vermiculatus,* USDA Plant Code SARCO). Greasewood was particularly common.

Ground Cover



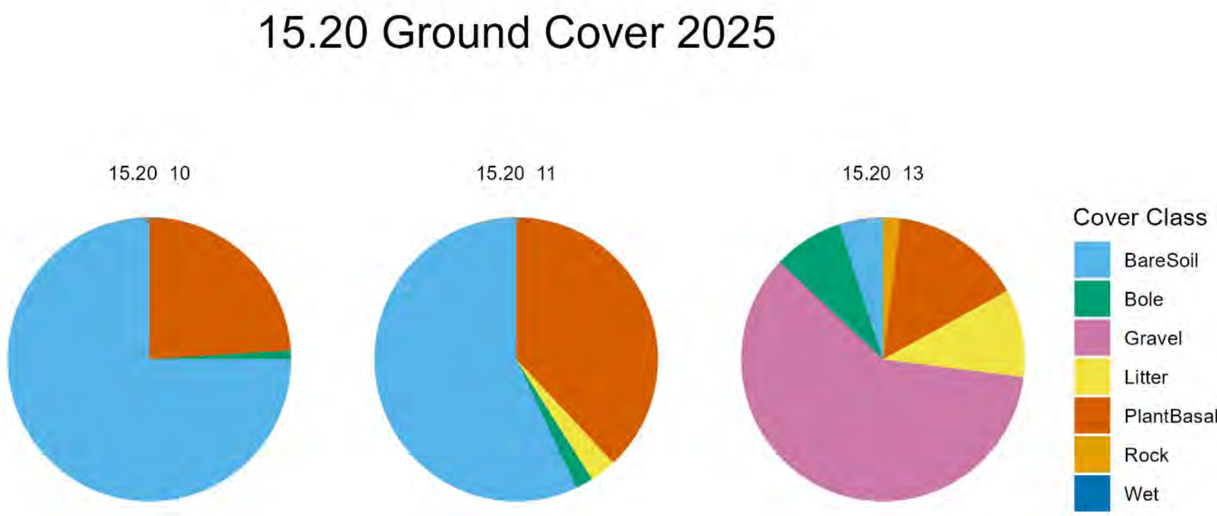
Project	Plot	Cover Class	% Cover
15.15	2	PlantBasal	70
15.15	2	Bole	0
15.15	2	Litter	20
15.15	2	BareSoil	5
15.15	2	Rock	0
15.15	2	Gravel	5
15.15	2	Wet	0

Project	Plot	Cover Class	% Cover
15.15	3	PlantBasal	37.9
15.15	3	Bole	0.1
15.15	3	Litter	22.0
15.15	3	BareSoil	40.0
15.15	3	Rock	0.0
15.15	3	Gravel	0.0
15.15	3	Wet	0.0

Project	Plot	Cover Class	% Cover
15.15	7	PlantBasal	40.0
15.15	7	Bole	0.1
15.15	7	Litter	10.0
15.15	7	BareSoil	49.9
15.15	7	Rock	0.0
15.15	7	Gravel	0.0
15.15	7	Wet	0.0

Figure 3: 15.15 ground cover by plot.

In the 15.15 project area, plant basal was consistently the largest portion of plot ground cover. For the two plots in the more open herbaceous plant community, it was around 40% with most of the remaining portion being bare soil and the final 10 to 20% covered in litter. Plot 2 is located on the edge of the denser, more shrub-dominated community type. This is reflected by 70% of its cover being plant basal and 20% litter, with bare soil and gravel only making up 10% jointly.



Project	Plot	Cover Class	% Cover
15.20	10	PlantBasal	24
15.20	10	Bole	1
15.20	10	Litter	0
15.20	10	BareSoil	75
15.20	10	Rock	0
15.20	10	Gravel	0
15.20	10	Wet	0

Project	Plot	Cover Class	% Cover
15.20	11	PlantBasal	38
15.20	11	Bole	2
15.20	11	Litter	3
15.20	11	BareSoil	57
15.20	11	Rock	0
15.20	11	Gravel	0
15.20	11	Wet	0

Project	Plot	Cover Class	% Cover
15.20	13	PlantBasal	15
15.20	13	Bole	8
15.20	13	Litter	10
15.20	13	BareSoil	5
15.20	13	Rock	2
15.20	13	Gravel	60
15.20	13	Wet	0

Figure 4: 15.20 ground cover by plot.

In the 15.20 project area there was again a distinct split between plot types. Plots 10 and 11, in the west-central portion of the site, were in the majority bear with a quarter to a third of cover from plant basal area and a small portion from woody plant boles and litter. Plot 13, located as it is in the east among piles of building material, was 60% covered in gravel. Plant basal only made up 15% of cover, with litter at 10% and bole, bare soil, and rock making up the remaining fraction.

These estimates reflect the different characteristics of the project areas. The 15.15 site is more heavily vegetated and has some litter build-up, while the 15.20 site is more disturbed, with large patches of bare soil and industrial materials.

Aerial Cover

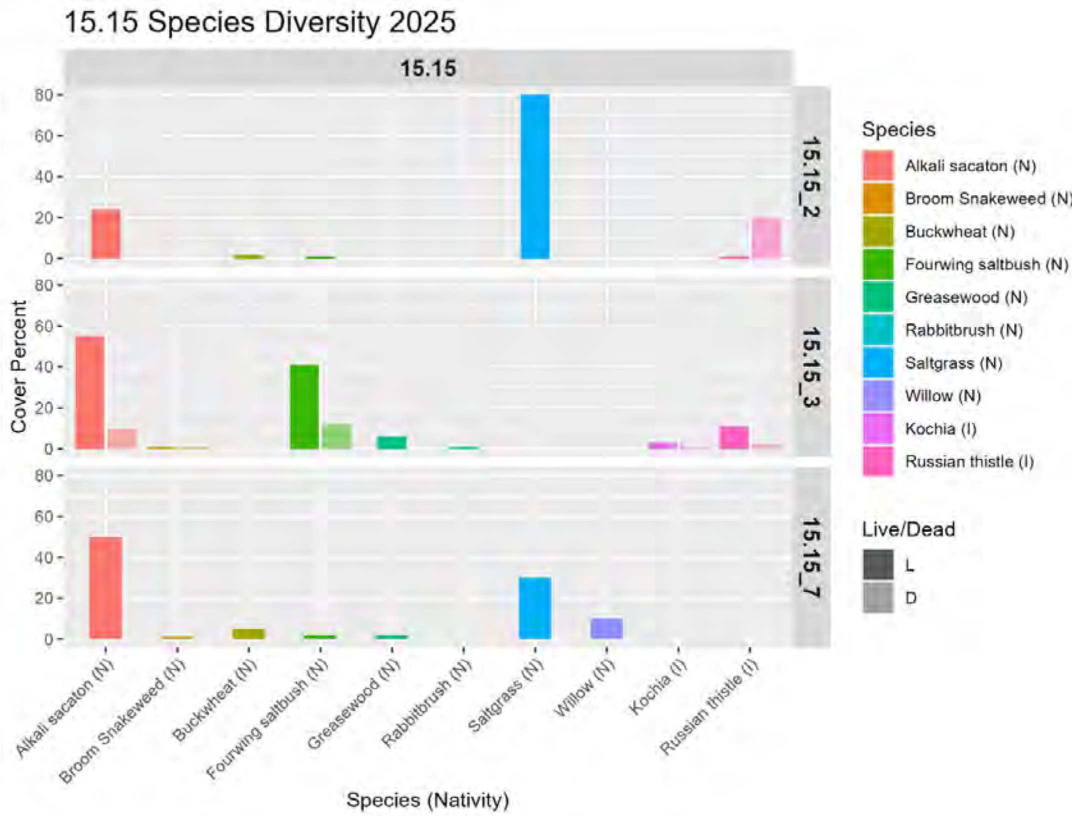


Figure 5: 15.15 aerial cover species by plot.

Aerial cover gives an impression of the species present in the project area, although it should be noted that these are only the species present on the monitoring plots, and thus the cross-section represented depends on the random placement of these locations.

In the 15.15 project, plot 15.15_2 can be considered

generally representative of the herbaceous plant communities that cover roughly half of the site. Here the most common plants were the native grasses alkali sacaton (*Sporobolus airoides*) and saltgrass (*Distichlis spicata*). Buckwheat (*Eriogonum sp.*) and fourwing saltbush (*Atriplex canescens*) were also present, as well as the non-native Russian thistle (*Salsola tragus*). This species was mostly dead during the time of monitoring, but it is an annual that can be expected to regrow where it is established.

Plots 15.15_3 and 15.15_7 were both situated in the shrubby plant communities that together made up the rest of the project area. Here the dominant species in the herbaceous layer remained alkali sacaton (*Sporobolus airoides*) and saltgrass (*Distichlis spicata*) along with small amounts of buckwheat (*Eriogonum sp.*). Russian thistle (*Salsola tragus*) was still the most common non-native, although it was joined by some kochia (*Bassia scoparia*). In the shrub layer fourwing saltbush (*Atriplex canescens*) was most common, along with some willows (*Salex sp.*)

and small numbers of greasewood (*Sarcobatus sp.*), broom snakeweed (*Gutierrezia sarothrae*), and rabbitbrush (*Ericameria nauseosa*).

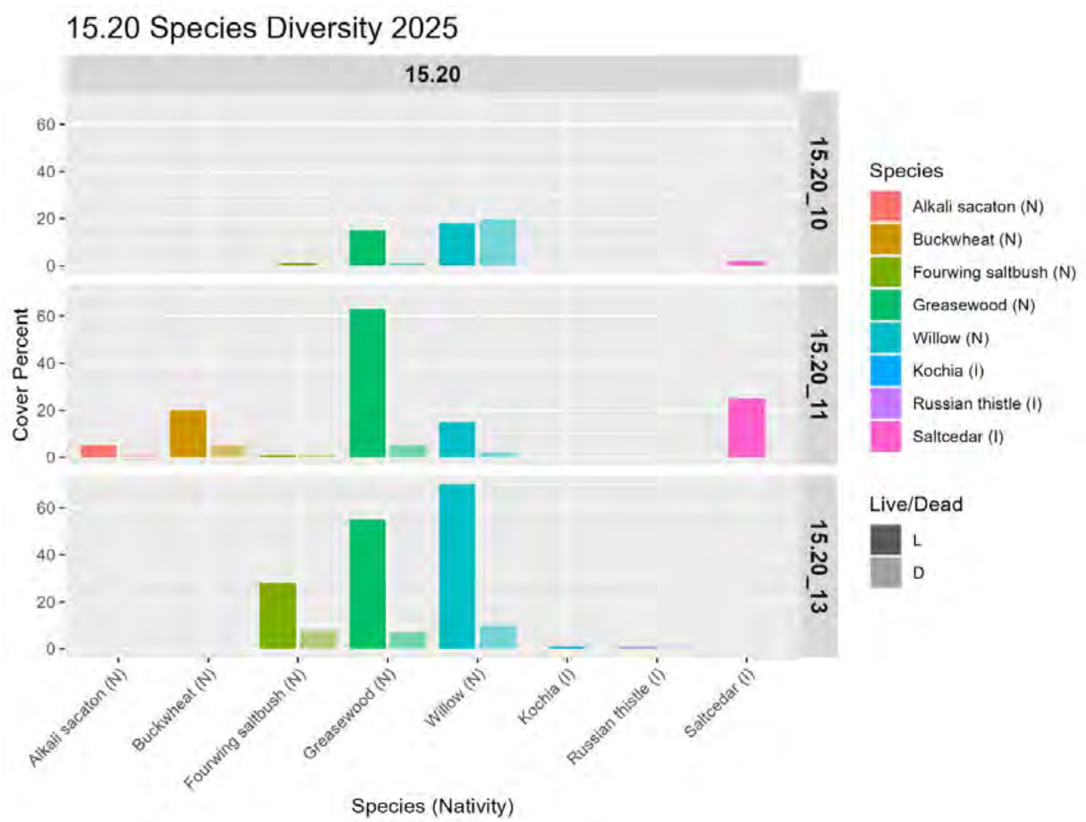


Figure 6: 15.20 aerial cover species by plot.

The 15.20 project area had more shrubs compared to 15.15. Greasewood (*Sarcobatus sp.*) was most common, followed by willows (*Salex sp.*) and fourwing saltbush (*Atriplex canescens*). The 15.20_10 and 15.20_11 plots were both in more herbaceous plant communities, which also included buckwheat (*Eriogonum sp.*) and alkali sacaton (*Sporobolus airoides*), as well as the non-native salt ceder (*Tamarix ramosissima*). The 15.20_13 plot was in a more shrub-dominated part of the project, with significantly more willow (*Salex sp.*) and small numbers of the non-natives kochia (*Bassia scoparia*) and Russian thistle (*Salsola tragus*).

Soils

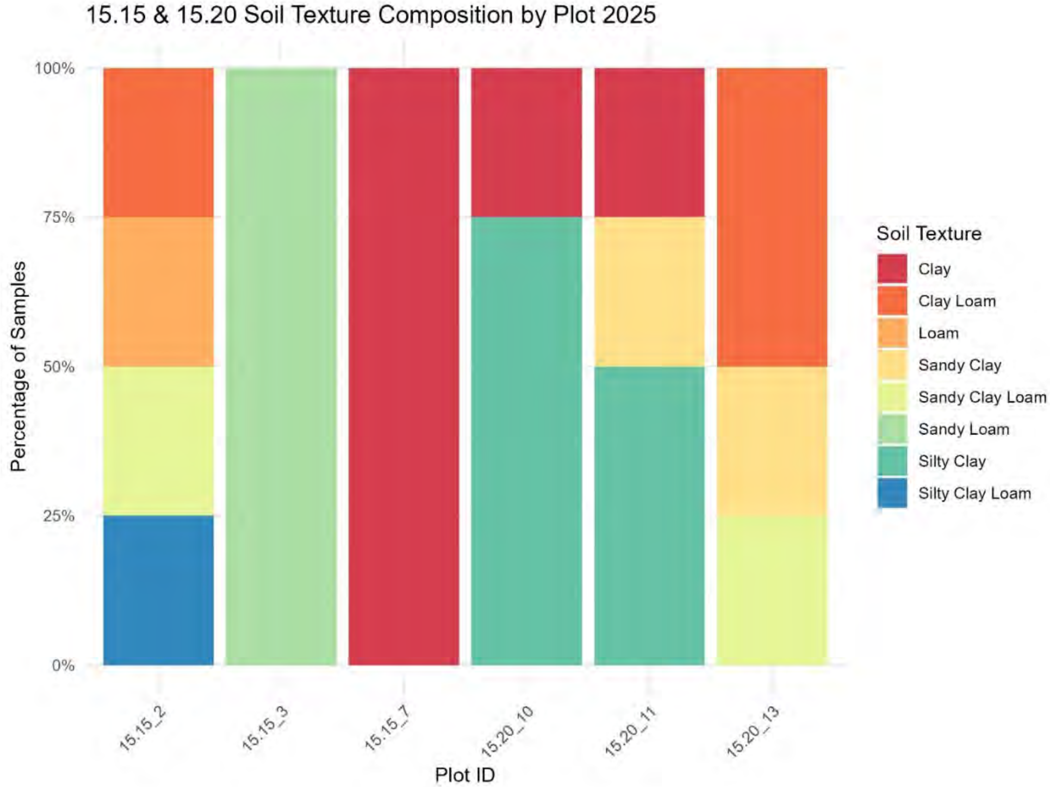


Figure 7: 15.15 & 15.20 soil texture by plot.

Soil Texture Frequency:

Plot ID	Soil Texture	Frequency
15.15_2	Clay Loam	1
	Loam	1
	Sandy Clay Loam	1
	Silty Clay Loam	1
15.15_3	Sandy Loam	4
15.15_7	Clay	4
15.20_10	Clay	1
	Silty Clay	3
15.20_11	Clay	1
	Sandy Clay	1
	Silty Clay	2
15.20_13	Clay Loam	2
	Sandy Clay	1
	Sandy Clay Loam	1

Table 4: 15.15 & 15.20 soil texture by plot.

It should be noted that the colors in figure 7 do not reflect a particular ordering of soil types.

Soil texture varied greatly between projects and plots. Generally, the 15.15 project area had more loam, except for plot 15.15_7 which was on the edge of the project area and had only clay, like the 15.20 project area. There the soils were almost entirely clay, with some loam on the east end in plot 15.20_13. Soil texture is a balance between particles of different sizes: sand (0.05-2mm), silt (0.002-0.05mm), and clay (<0.002mm) (Berry et al. 2007).

Fine Fuels

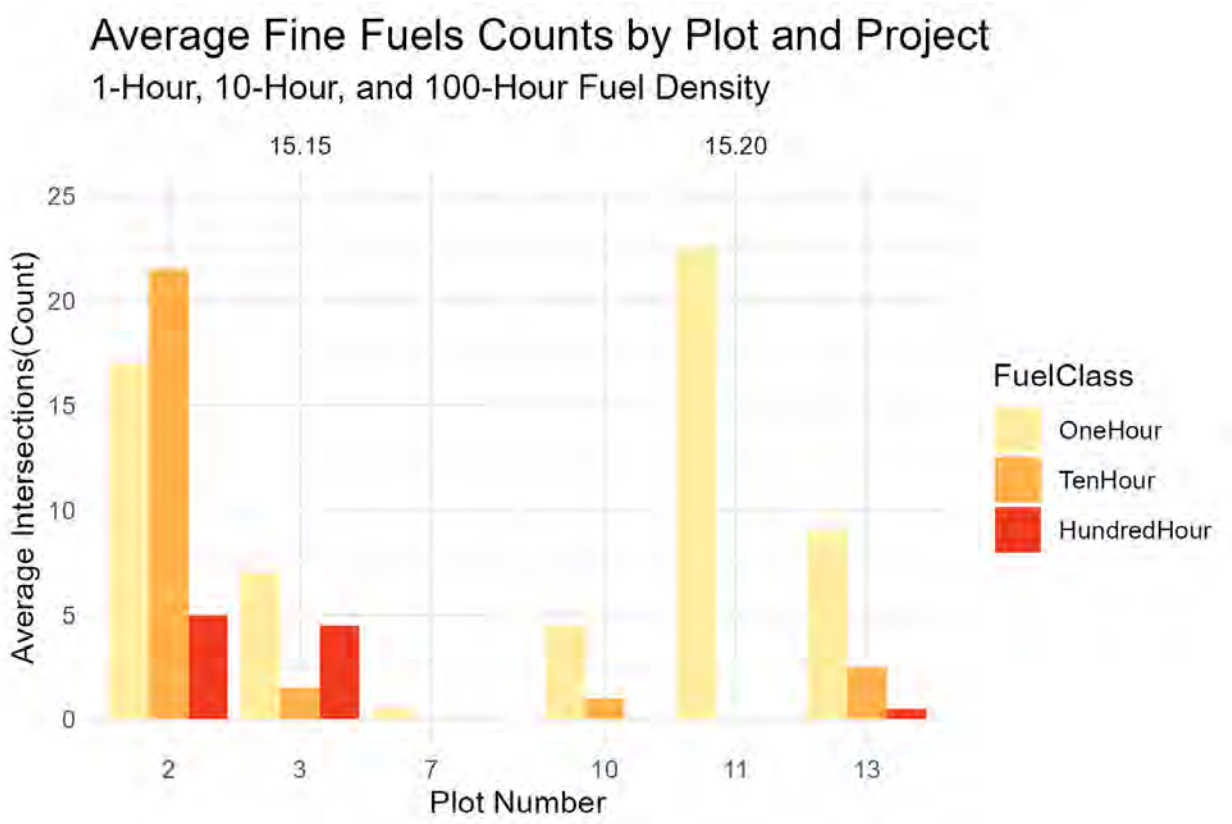


Figure 8: 15.15 & 15.20 fine fuels by plot.

There were large amounts of fine fuels present on two of the plots in the 15.15 project site. This graph does not reflect all the fuels that were observed during the monitoring visit; several slash piles were noted but did not contribute to the count of dead woody fuel. This highlights the patchy nature of the woody debris on the site. There were several large piles of slash, in places close to a foot deep, and yet there were also places with almost no fuels – such as plot 7 which had only a couple of small twigs.

The 15.20 site had almost only one-hour fuels. There were no slash piles on any plots. The sticks intersecting these transects came from the shrubs still present.

7.0 Management Implications

Projects Grants 15.15 and 15.20 successfully achieved their primary objectives regarding the removal of invasive phreatophytes. Initial treatments effectively reduced the presence of Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix ramosissima* Ledeb.) after 10 years, as evidenced by the current absence of mature invasive trees or invasive re-sprouts within the established monitoring plots. While the removal of invasive species was successful, the recovery of native vegetation varies significantly between the two project sites:

- Project 15.15: Currently exhibits no regeneration of either native or invasive woody species. This lack of recruitment indicates a site that is still in the early stages of recovery following disturbance.
- Project 15.20: Shows more promising signs of native recovery, with observed regeneration of two native shrubs: greasewood (*Sarcobatus vermiculatus*) and fourwing saltbush (*Atriplex canescens*). However, there is still a notable absence of native riparian tree regeneration, which is common in areas where altered flow regimes limit the wet soils required for species like cottonwood to germinate from seed.

These native species are often found together in harsh, droughty, salt-rich ecosystems where they can establish early after disturbances but also represent a stable successional stage depending on the site conditions. Both species are used as shelter and forage by wild and domestic animals, but fourwing saltbush is considered particularly important as a food source because its nutritional value is comparable to that of alfalfa (*Medicago sativa*). Various birds, including quail, eat its fruits. These species are also considered important for the stabilization of disturbed land: they are hardy plants that can establish where few others can and their deep roots hold soil in place and prevent wind erosion. Fourwing saltbush is also used for the improvement of marginal rangeland because of its high nutrient content (Howard 2003, Anderson 2004).

The New Mexico Rapid Assessment Method (NMRAM) scores reflect divergent trends between the sites. Between 2015 and 2025, the biotic score for 15.15 improved from "C/Fair" to "B/Good," whereas the score for 15.20 remained stagnant. It is important to interpret these scores with caution. NMRAM was originally designed for wetter, montane riverine wetlands and may not fully capture the ecological nuances of these drier, alkali sink and salt meadow sites. A primary limiting factor for both sites is the lack of consistent soil moisture, which is characteristic of the regional climate but inherently slows the pace of restoration responses. Future management planning must adjust expectations to account for this slow recovery timeline, acknowledging that ecological shifts may not be fully apparent for five to ten years.

Although very few invasive species were recorded within the specific monitoring plots, mature invasive trees remain present elsewhere on the project site. Without persistent maintenance and suppression, these individuals will serve as a seed source for re-invasion. Continued monitoring is essential to inform adjustments in management strategy. As native vegetation gradually establishes—either naturally or through human assistance—the site will move toward a more stable ecological state.

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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).

Appendix II: 15.15 Grants Photo Comparison

15.15_01_26DEG 2015

15.15_01_26DEG 2021

15.15_01_26DEG 2025

15.15_02_326DEG 2015

15.15_02_293DEG 2021

15.15_02_293DEG 2025


15.15_03_20DEG 2015


15.15_03_340DEG 2021


15.15_03_340DEG 2025

15.15_04_92DEG 2015

15.15_04_98DEG 2021

15.15_04_98DEG 2025


15.15_05_333DEG 2015


15.15_05_322DEG 2021


15.15_05_322DEG 2025

15.15_06_62DEG 2015

15.15_06_62DEG 2021

15.15_06_62DEG 2025

15.20_12_18DEG 2015

Note: 15.15_13 is in the 15.20 project area. Between 2015 and 2021 all 15.20 points were renamed and moved up one number (15.20_12 appears to have become 15.15_13).

15.15_13_342DEG 2021

15.15_13_342DEG 2025

Appendix III: 15.20 Grants Photo Comparison

Project Note: Point names seem to have been updated between 2015 and 2021 – most moved up one, i.e. 15.20_07 became 15.20_08.

15.15_13_200DEG 2015

Note: 15.20_07 is in the 15.15 project area. The 2015 photo appears to be from the same point, but is labeled as 15.15_13. In 2025 the photopoint became a plot and was moved farther into the project area for safety. The 2025 photo is from that CSE plot and was chosen because it has the closest bearing to the 2015 photo. We forgot to take the photopoint in 2025.

15.20_07_300DEG 2021

15.20_07_180DEG 2025

15.20_07_60DEG 2015

15.20_08_232DEG 2021

Note: The 2025 photo was taken to match the one from 2021, but the bearing was found to be 260 degrees.

15.20_08_260DEG 2025

15.20_08_10DEG 2015

Note: The 2015 photo may be from the same point as the photos from subsequent years, however the 2021 photo was taken at a different bearing and the 2025 photo was taken to match it.

15.20_09_190DEG 2021

15.20_09_190DEG 2025


15.20_09_80DEG 2015


15.20_10_280DEG 2021

Note: The 2015 photo had a recorded bearing of 80 degrees but subsequent photos taken to match were found to be at 280 degrees.


15.20_10_280DEG 2025


15.20_10_270DEG 2015


15.20_11_270DEG 2021


15.20_11_270DEG 2025

15.20_11_75DEG 2015

Note: The 2015 photo appears to have been taken from a different point. We attempted to locate it in 2025 and were unable to do so.

15.20_12_285DEG 2021

15.20_12_285DEG 2025