Santa Fe-Pojoaque SWCD Puerta del Cañon Project 11.15

10-year Monitoring Report

2022

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for the
Greater Rio Grande Watershed Alliance

Santa Fe-Pojoaque SWCD

Contents

Acronyms and Abbreviations

Acronym, Abbreviation, or Term	Explanation or Definition as used by NMFWRI
FSA	Farm Service Agency, a department of the USDA
GIS	Geographic Information Systems
GRGWA	Greater Rio Grande Watershed Alliance
LIDAR	Light detecting and ranging, a remote sensing technique using light to gather elevation data
NHNM	Natural Heritage New Mexico
NMDGF	New Mexico Department of Game and Fish
NMED SWQB	New Mexico Environment Department Surface Water Quality Bureau
NMFWRI	New Mexico Forest and Watershed Restoration Institute
NMHU	New Mexico Highlands University
NMRAM	New Mexico Rapid Assessment Method, version 2.1
NRCS	Natural Resource Conservation Service
PC	Plot center
RGIS	Resource Geographic Information System
SWCD	Soil and Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WQCC	Water Quality Control Commission
WSS	Web Soil Survey, a soils database of the NRCS

Purpose of Report

This report covers pre-treatment and 5-year-post-treatment vegetation monitoring assessments performed on a non-native phreatophyte removal project south of Santa Fe, NM, submitted by the Santa Fe-Pojoaque Soil and Water Conservation District to the Greater Rio Grande Watershed Alliance in 2011. Following a discussion of the ecological context, and our monitoring methods, we present pertinent background, observations, and assessment results for the project.

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 (2012). Despite this small percentage, estimates of New Mexican vertebrate species depending on wetland and riparian habitat for their survival ranges 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 a range of field methods as well as LIDAR analysis where appropriate and available.

Monitoring and Field Methods

Original (2011) protocols

Due to the short timeframe between project selection and implementation in 2011, only a narrow window was available to perform pre-treatment monitoring. That window was outside the optimum season for performing vegetation monitoring in this type of landscape. For that reason, a hasty monitoring protocol was developed. This protocol was based on placing photo point plots at locations distributed across the project area and representative of the diversity of the project area. In addition, an estimate of ground and canopy cover by percent within a 1/10 acre circular plot centered at the photo point was determined using ocular estimates. Overstory canopy was determined for a 1/10 acre circular area, also centered at the photo point. Finally, a Hink & Ohmart style vegetation structure assessment was performed. Vegetation species that were observed at each plot and in the project area were recorded. The plot size and density of observations limit the utility of this monitoring for describing overall site conditions or for generating any meaningful statistics.

Cover (%)											
Tree canopy	**Seedlings/saplings <5'/5 – 15'**		**Shrubs**		**Gramanoid**	**Forbs**	**Litter**	**Bare Soil**	**Rock**	**Gravel**	**Water or wet**

Figure 1.Categories used for 2011 percent cover estimates.

A base map of the project location was constructed using project boundary data provided by New Mexico State Forestry. Planned photo points were selected by visual inspection of May 2011 true-color digital orthorectified aerial photography obtained from the United States Department of Agriculture (http://datagateway.nrcs.usda.gov/). A GIS file for the photo point plots was created using ArcGIS software. Coordinates were derived from the GIS file and loaded into a Garmin GPS 60 CSx Global Positioning System and a Trimble 2005 GeoXM Global Positioning System. The Garmin GPS was used to navigate to the general location of the planned photo point. The actual location of the photo point was determined by visual inspection of the area and selection was based on the ability to physically occupy a position at or near the planned point. The coordinates of the photo point were then collected using the more precise Trimble GeoXM GPS.

Once the plot location was determined, a 1/100 acre radius plot was established by placing pin-flags at 11’ 9” from plot center in each cardinal direction. Photos were taken from plot center in each cardinal direction and from a distance north of plot center (66’, where possible) toward plot center. Ocular estimates were made of understory canopy and ground cover within the 1/100 plot. Overstory canopy cover was estimated using a concave spherical densiometer, with measurements made in four cardinal directions, approximately mid-way between plot center and 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 structure class determination was made using a worksheet developed by SWCA Environmental Consultants (see datasheet example in Appendix III). Finally, plant species observed within the 1/10 area around the plot were recorded, as were other comments documenting conditions at the plot.

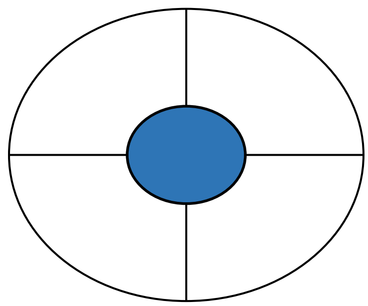


Figure 2. example of plot layout. The outer circle represents the 1/10 acre plot and the blue circle is the 1/100 plot

5 and 10-year revisits (2016 and 2022) protocols

To allow comparisons between site conditions, the original site protocols were employed for the 5 and 10-year revisits as well as newer protocols for the 10-year revisit.

Plot locations as recorded in 2011 and 2016 were found using a Garmin GPS, and all plot setup and measurements were the same as in 2011 and 2016, with a few exceptions. In 2016 a ground cover category was added for plant basal/bole, which was omitted from the ground cover in 2011. Further, for both 2016 and 2022 monitoring, in addition to the original Hink and Ohmart structural classification, we recorded the structure type within a modified Hink and Ohmart classification system (see Appendix II). This second Hink and Ohmart-based system is used by the NMED as part of the modified NMRAM protocol employed for pre-treatment monitoring on GRGWA projects beginning in 2013. Additions in 2022 were the inclusion of NMFWRI's Riparian Common Stand Exam-based protocols (https://nmfwri.org/wpcontent/uploads/2020/07/GRGWA_plotprotocols_Instructions_datasheets_withcheatsheets_3.1.2020km.pdf) which added measurements of soil texture; ground and aerial cover on the entire plot as well as aerial cover by individual species, seedling and sapling tallies and individual tree measurements (Appendix III). Individual tree measurements included establishing a witness tree when available, measuring tree height, diameter at breast height (DBH), live crown base height and overall health of the tree. Fuel transects were also established. (Appendix IV).

For the sake of continuity, site visits were made around the same time of year as 5 and 10 years prior, even though this was not the ideal season for plant identification in either case. It is worth noting that the winter of 2016/2017 was warmer than the winter of 2011/2012, so even though site visits were conducted around the same time of year, plant communities differed. This is especially obvious in the photographs (Appendix V).

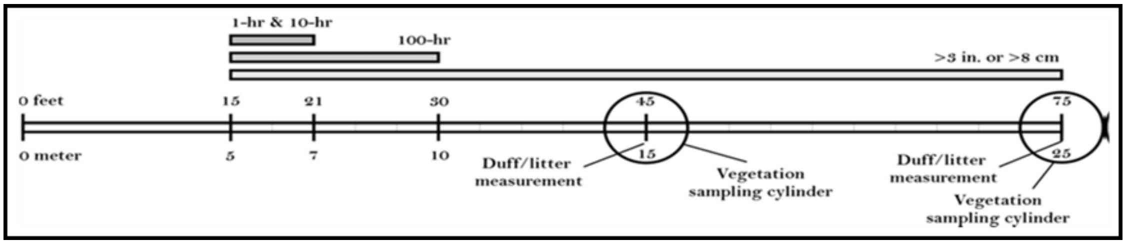


Figure 3. Example of fuels transect

Personnel Involved

2011 Monitoring Team:

- Joe Zebrowski, New Mexico Forest and Watershed Restoration Institute
- Terrell Treat, New Mexico State Forestry

2016 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

- Kathryn R Mahan, Ecological Monitoring Specialist
- Christopher B Martinez, Monitoring Technician (NMHU Student Intern)

2022 Monitoring Team:

- Alex Makowicki, Ecological Monitoring Technician
- Clay Goetsch, Ecological Monitoring Technician
- Jordan Martinez, Ecological Monitoring Technician

Other persons contacted:

- José Varela-Lopez, Santa Fe-Pojoaque Soil and Water Conservation District

SFP1 Puerta del Cañon Project

SFP1 is a five-acre project in Santa Fe County, south of the city of Santa Fe. The project follows the Santa Fe River through a rocky canyon just north of La Cienega. The nearest city of Santa Fe receives an average of 14.21 inches of rainfall annually. The average high temperature is 86 degrees in July, and the average low is 17 in December and January (U.S. Climate Data, 2017).

According to the NRCS Web Soil Survey, the project area is comprised of 54% Ildefonso-Rock outcrop-Rubble land complez, 30 to 70 percent slopes; 26% Truehill-Penistaja family-Rock outcrop complex, 4 to 50 percent slopes; and 20% Cuyamungue-Riverwash complex, 0 to 2 percent slopes, flooded. Ecological sites present include R035XA112NM Loamy, R035XG114NM Gravelly, and F036XA005NM Riverine Riparian. (USDA NRCS, 2016)

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 n.d.).

The Gravelly ecological site type typically supports grassland with minor shrub and piñon-juniper components. Common dominant grass species include blue, black and sideoats grama, little bluestem, spike muhly, Western wheatgrass, New Mexico feathergrass, Indian ricegrass, and squirreltail. Common shrubs include fourwing saltbush, winterfat, Apache plume, rabbitbrush, soapweed yucca, sagebrush and broom snakeweed. The site can also be found in a shrub-encroached state dominated by rabbitbrush and blue grama; erosion is more common in this state (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.).

Pre-treatment monitoring was conducted at this site on November 17, 2011 as part of a restoration project non-native phreatophytes scheduled for 2011-2012. Post-treatment monitoring was conducted September 30, 2016. The treatment prescription from New Mexico State Forestry included the removal of all invasive trees including juniper in the river bottom, followed by cut-stump herbicide to prevent resprouts. Cut material in accessible areas under 3 inches in diameter was to be chipped and spread to depths of 2 inches or less in non-grassy areas. Larger material (over 3 inches in diameter) was to be left in 4 foot lengths, above the high water mark. In inaccessible areas, slash was to be limbed and piled above the high water mark in piles not more than 4' x 4' x 4' for burning at a later point. Material over 3 inches in diameter was to be piled separately. Restoration goals include restoring the area for wildlife with native species, restoring more natural conditions through the creation of a more open canopy, and removing exotic, high-water consuming plants to increase surface water in low-lying areas and drainages (Stropki et al., 2010).

According to available inspection reports, herbicide retreatments of stump sprouts occurred on this site on October 22, 2013 and again in October 2014. The treated area totaled 2.7 acres each year. The second retreatment was expected to "be the last treatment needed to achieve a 90%+ non-native phreatophytes mortality rate." (Fred Rossbach, GRGWA, 2014) Re-treatment maps can be found in Appendix IV.

Figure 4. 11.15 in geographic context.

Puerta del Cañon Site Summary

2011 11.15 Site observations: The project area follows a portion of the Santa Fe River. The project area begins in a relatively open area and then descends into a narrow canyon. An acequia runs parallel to the river through the canyon. Vegetation consists of a patchy mosaic of shrubs and trees, with a few dense stands of Russian olive and a few grassy areas. Plot SFP1_1 is in a relatively open area near the river bank. Plot SFP_1_2 is a rocky site, with a mix of shrubs, grasses, and a few nearby Russian olive. Plot SFP_1_3 is in a thick stand of Russian olive and salt cedar. SFP_1_4 is a relatively grassy area, with Russian olive, salt cedar, and one-seed juniper in the area. Since monitoring was done so late in the fall, relatively sparse forb and grasses cover may be attributed to seasonal dormancy. These plots were assessed to fall in Hink & Ohmart Structure Classes 1, 3, 4, and 6.

2016 11.15 Site observations: This site is rocky with steep slopes, following the meanders of the Santa Fe River. The site has grassy banks with sparse cottonwood overstory. Juniper and Apache plume are common on the side slopes. Grazing is evident throughout the project area. Piles of slash, presumably from treatment, are found in the western portion of the project. Plots were assessed to fall in Hink and Ohmart structure classes 3, 5 and 6.

2022 11.15 Site Observations: The project area was mostly in a canyon, where cottonwoods and Gooding's black willow and juniper in higher, drier locations. The terrain was very rocky and open to the sky, the groundcover dominated by grasses and forbs. Upriver and away from the canyon the terrain next to the river was wider and allowed a larger floodplain of grasses and forbs, with no trees next to the banks.

Puerta del Cañon 2011-2022 - Observed plant species

11.15 Puerte del canon						
Vegetation Type/Year	***2011***		***2016***		***2022***	
Graminoid	*Bouteloua curtipendula*	*Sideoats Grama*	*Bouteloua curtipendula*	*Sideoats Grama*	*Bouteloua curtipendula*	*Sideoats Grama*
	Bothriochloa laguroides	*Silver Beardgrass/Bluestem*	*Bothriochloa laguroides*	*Silver Beardgrass/Bluestem*	*Bothriochloa laguroides*	*Silver Beardgrass/Bluestem*
			Bromus tectorum L.	*Cheat grass*	*Bromus tectorum L.*	*Cheat grass*
			Bouteloua gracilis	*Blue grama*	*Bouteloua gracilis*	*Blue grama*
			Carex sp.	*Sedges*	*Carex sp.*	*Sedges*
			Juncus sp.	*Rushes*	*Juncus sp.*	*Rushes*
			Calamagrostis sp.	*Reed canary grass*	*Bothriochloa barbinodis*	*Cane Bluestem*
			Dactylis glomerata L.	*Orchard grass*	*Festuca arundinacea*	*Tall Fescue*
			Elymus smithii	*Western wheatgrass*	*Sporobolus airoides*	*Alkali Sacaton*
			Sporobolus sp.	*Dropseed*	*Bouteloua eriopoda*	*Black Grama*
			X	*Unknown*	*Schizachrium spp*	*Little Bluestem*
			X	*Unknown 11*	*Echinochloa spp*	*Cockspur*
					Chloris spp	*Windmill grass*
					Muhlenbergia reverchonii	*Muhly grass*
					X	*Unknown 4*
					X	*Unknown 6*
					X	*Unknown 11*
					X	*Unknown 12*
					X	*Unknown 14*
Forbs	*X*	*Unknown Thistle*	*X*	*Unknown Thistle*	*Cirisum vulgare*	*Bull Thistle*
	Verbascum thapsis	*Great Mullein*	*Salsola tragus L.*	*Russian thistle*	*Verbascum thapsis*	*Great Mullein*
			Achillea millefolium	*Yarrow*	*Salsola australis*	*Russian Thistle*
			Aster sp.	*White aster*	*Amaranthus retroflexus*	*Redroot Pigweed*
			Bassia prostrata	*Kochia*	*Euphorbia spp*	*Spurge*
			Dalea candida	*White prairie clover*	*Symphyotrichum spp*	*Saltmarsh Aster*
			Descurainia pinnata	*Tansymustard*	*Medicago sativa*	*Alfalfa*
			Equisetum sp.	*Horse tail*	*Trifolium spp*	*Clover*
			Gaura parviflora	*Velvet gaura*	*Rumex crispus*	*Curly Dock*
			Senecio vulgaris	*Groundsel*	*Xanthium strumarium*	*Cocklebur*
			Taraxacum officinale	*Dandelion*	*Solanum elaeagnifolium*	*Silverleaf Nightshade*
			Verbascum thapsus L.	*Mullein*	*Sphaeralcea incana*	*Grey Globemallow*
			Xanthium strumarium L.	*Cocklebur*	*Mentzelia spp*	*Blazingstar*
			X	*Unknown Forb*	*Lactuca spp*	*Prickly Lettuce*
					Ratibida spp	*Coneflower*
					Equisetum spp	*Horsetail*
					Datura quercifolia	*Oakleaf Datura*
					Symphyotrichum ericoides	*White Heath Aster*
					Physalis spp	*Wild Ground Cherry*
					Taraxacum officionale	*Dandelion*
					Conyza canadensis	*Marestail*
					Chenopodium neomexicanum	*New Mexico Goosefoot*
					Desmodium spp	*Tick Clover*
						Unknown Bur
						Unknown 5
						Unknown 7
						Unknown 8
Cactus						
Shrubs	*Ericameria nauseosa*	*Rubber rabbitbrush*	*Ericameria nauseosa*	*Rubber rabbitbrush*	*Ericameria nauseosa*	*Rubber rabbitbrush*
	Fallugia paradoxa	*Apache plume*	*Fallugia paradoxa*	*Apache plume*	*Fallugia paradoxa*	*Apache plume*
	Gutierrezia sarothrae	*Broom snakeweed*	*Gutierrezia sarothrae*	*Broom snakeweed*	*Salix exigua*	*Coyote willow*
	Ribes inerme	*Gooseberry*	*Ribes inerme*	*Gooseberry*	*Ribes inerme*	*Gooseberry*
	Salix exigua	*Coyote willow*	*Salix exigua*	*Coyote willow*	*Artemisia frigida*	*Fringed Sagebrush*
	Cylindropuntia spp	*Cholla*	*Artemisia frigida*	*Fringed Sagebrush*	*Rhus trilobata*	*Three-Leaf Sumac*
	Ephedra spp	*Morman tea/Cota*			*Brickellia*	*Brickellbush*
Trees	*Elaeagnus angustifolium*	*Russian Olive*	*Elaeagnus angustifolium*	*Russian Olive*	*Elaeagnus angustifolium*	*Russian Olive*
	Juniperus monosperma	*Oneseed Juniper*	*Juniperus monosperma*	*Oneseed Juniper*	*Juniperus monosperma*	*Oneseed Juniper*
	Pinus edulis	*Piñon*	*Populus angustifolia*	*Narrowleaf Cottonwood*	*Populus angustifolia*	*Narrowleaf Cottonwood*
			Ulmus pumila	*Siberian Elm*	*Ulmus pumila*	*Siberian Elm*
			Tamarix ramosissima	*Salt Cedar*		
			Salix spp	*Unknown Willow*		

Figure 5. Species list for the entire project.

In 2011, some species were noted but were noted as occurring within the project area but were not recorded on any specific plots. These included crested wheatgrass (*Agropyron cristatum*), Rio Grande cottonwood (*Populus deltoides)*, and Siberian elm (*Ulmus pumila*).

The new species that were found on plots in 2016 included both natives and exotics. Cheatgrass, Russian thistle, Kochia, salt cedar and Siberian elm were among the most unwelcome additions. Russian olive, the target species, was present both pre-treatment and post-treatment.

In 2022 many unknown graminoids were observed, identification was limited due to crew's ability to identify grasses. Many forbs were observed due to monitoring occurring during the growing season.

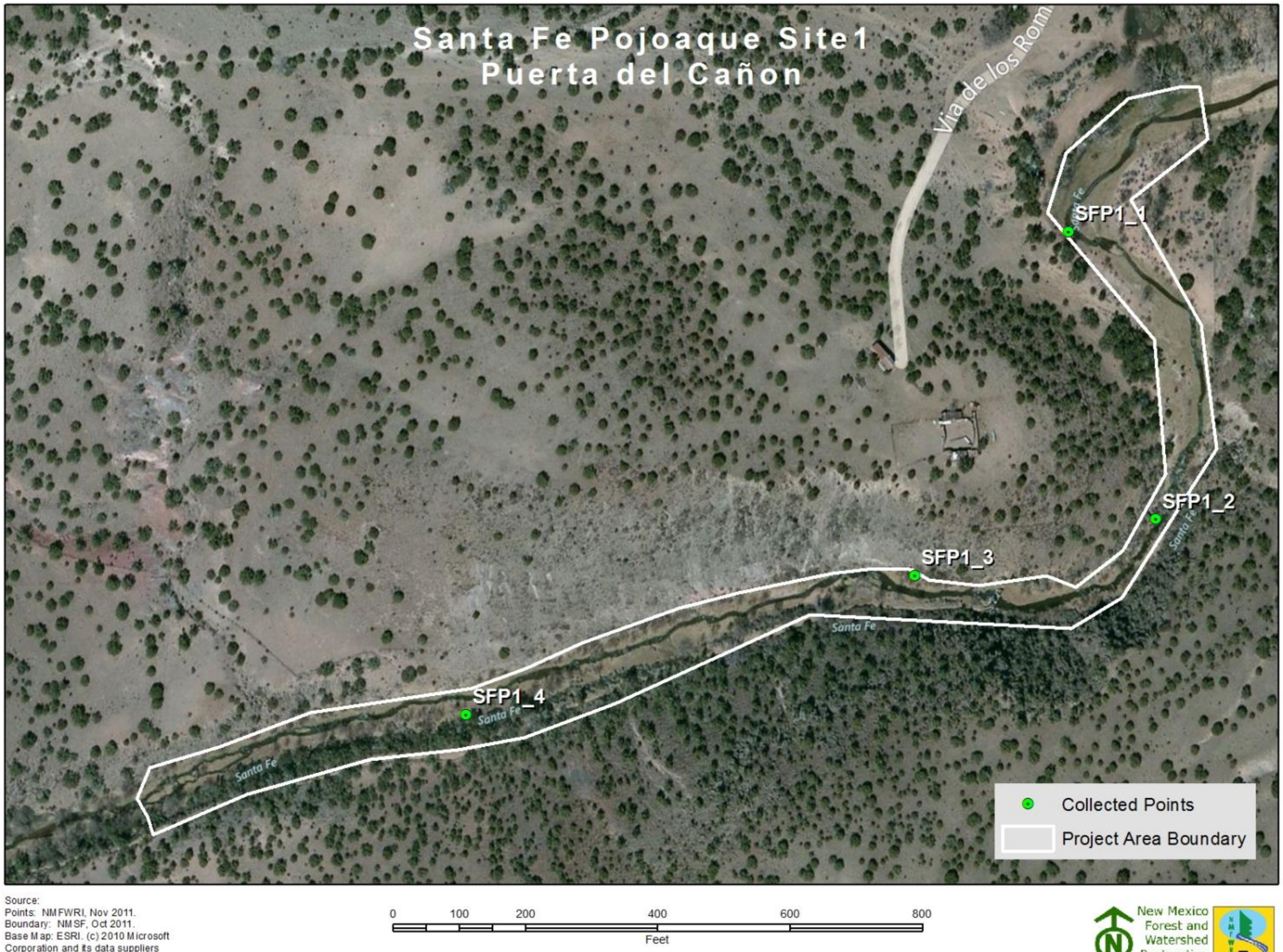


Figure 6. 11.15 plots.

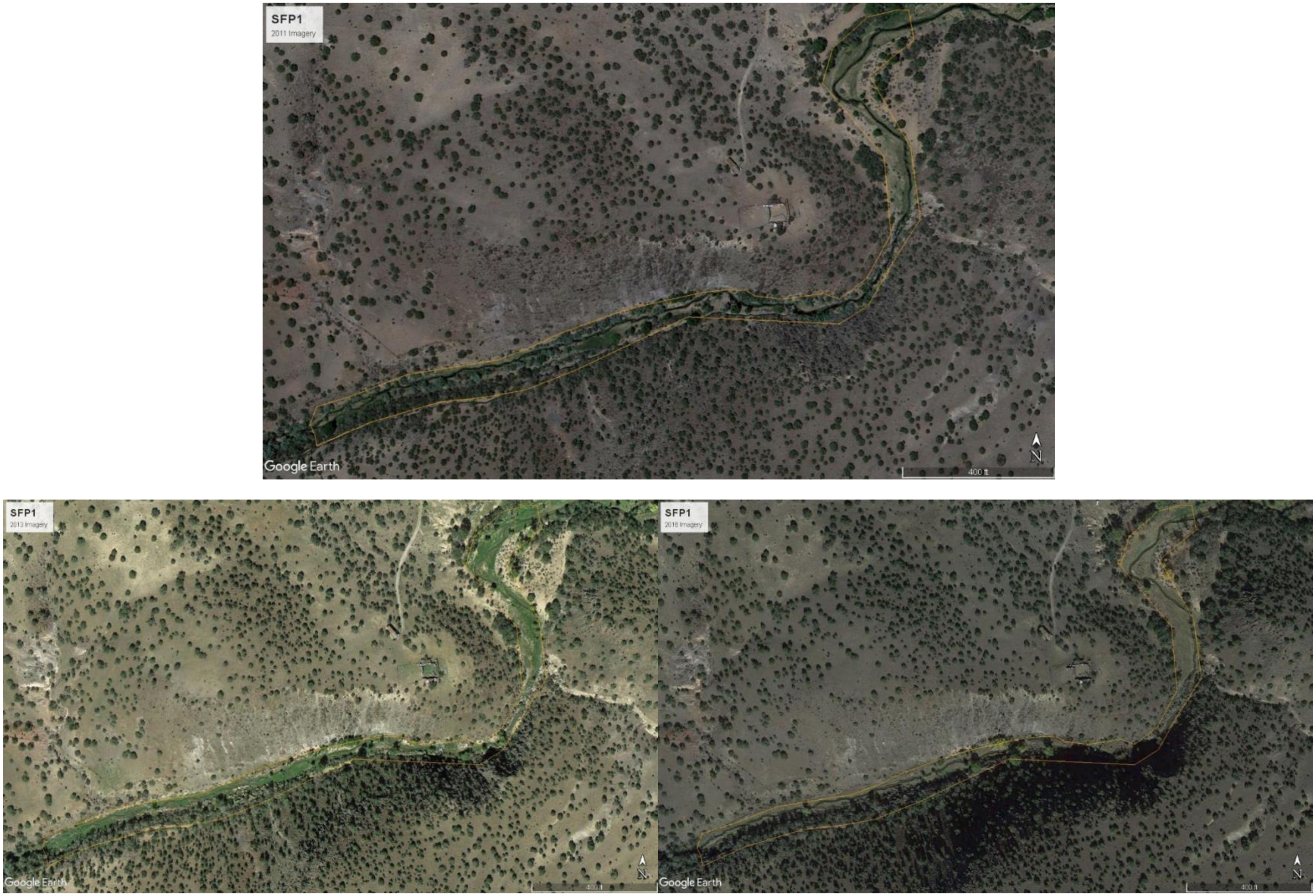


Figure 7. Google Earth imagery for 11.15 pre- and post-treatment.
2011 pre-treatment imagery is top; 2013 and 2016 post-treatment imagery on bottom.

Tree Component

The tree component consists of data collected on the 1/10 and 1/100 acre plot. Individual Tree data is collected on the 1/10 acre plot and Seedling and Sapling counts are collected on the 1/100 acre plot. Measurements of tree's diameter at breast height (DBH), height, live crown base height, condition (live, sick or dead), and any significant mistletoe damage. We analyze tree density using Trees Per Acre (TPA) and basal density Basal Area Per Acre (BA/AC). In most areas *J. monosperma* was the dominant tree species. The site receives moisture from the Santa Fe river year round and this could attribute to the diversity in seedlings seen in Figure 7. Species such as *F. paradoxa* and *E. nauseosa* were prevalent in the canyon area of the project while *E. angustifolia* was more represented in the more open areas of the project.

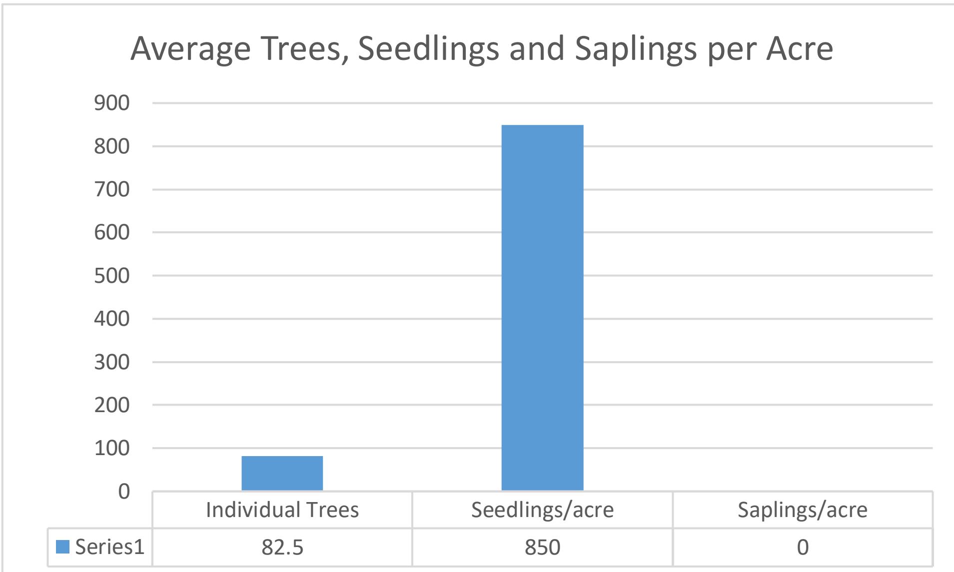


Figure 8. Displays the average trees, seedlings and saplings per acre for the entire project.

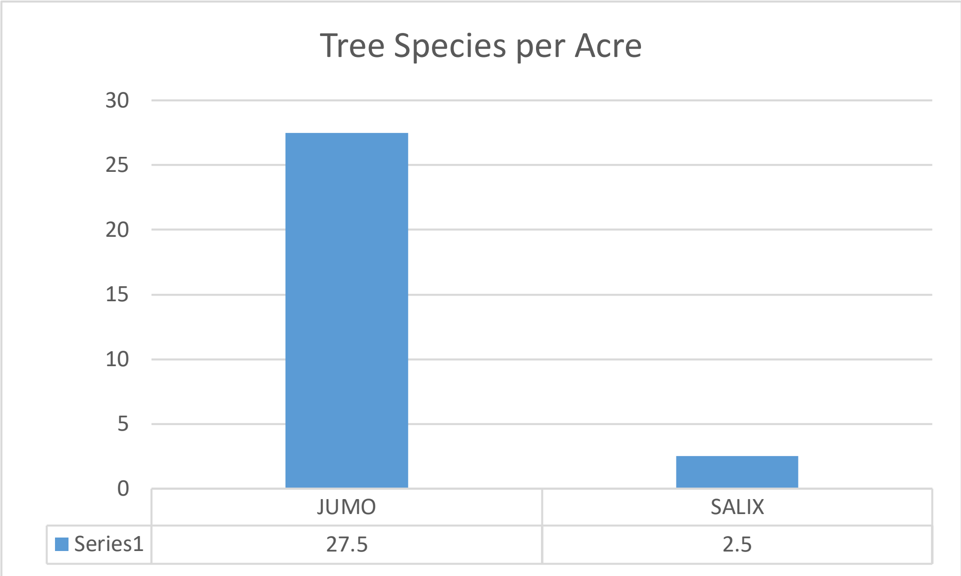


Figure 9. Displays average tree species per acre for the entire project.

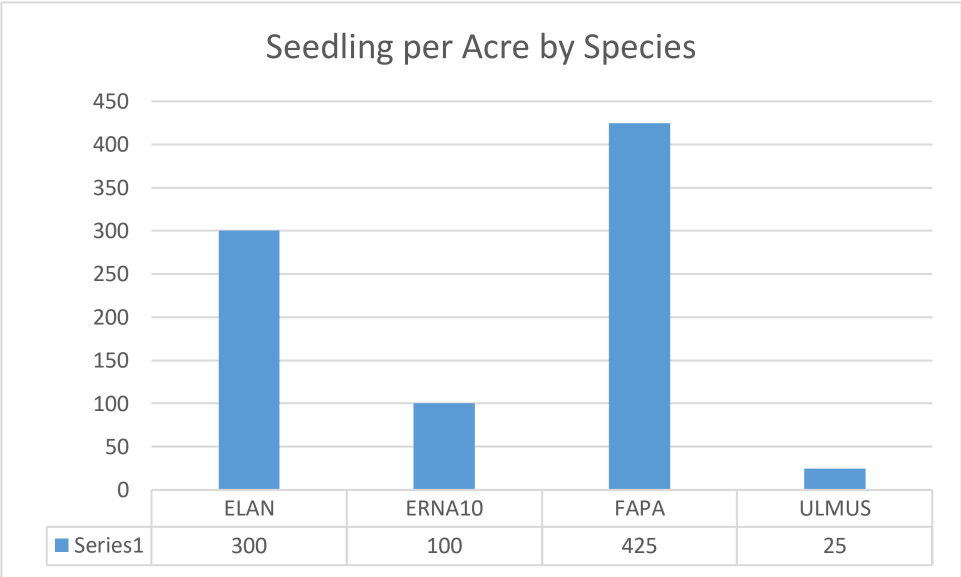


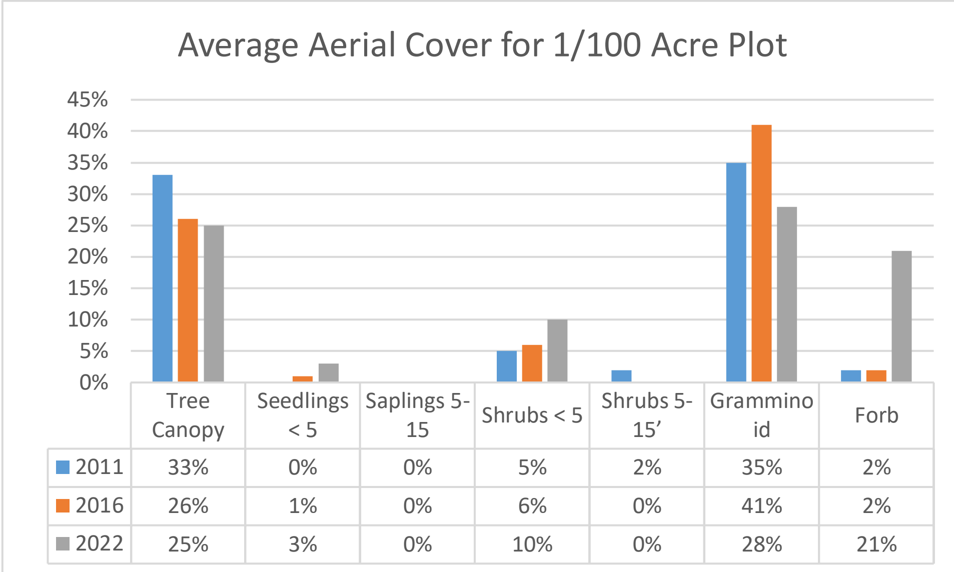
Figure 10. Displays Seedlings species per acre for the entire project.

11.15 Puerte del Canon		October 2022		
Individual Plot Summary Table				
Macro Plot Name	Total number of sample trees on plot	Growing Stock		
		Number of growing stock sample trees on plot	Trees per Acre	Basal Area per Acre
11.15_1	12	12	120	27.70
11.15_2	6	6	60	3.34
11.15_3	1	1	10	3.58
11.15_4	14	14	140	14.71
Total	**Total number of sample trees on plot**	**Number of growing stock sample trees on plot**	**Average for all Plots**	
			TPA	**BA/AC**
	33.00	**33.00**	**82.50**	**12.33**

Table 1. Plot summary from the Stand Tables (used to organize individual tree data in a forester friendly format) which shows the basal area, trees per ace and number of trees measured for each plot as well as the averages for the project

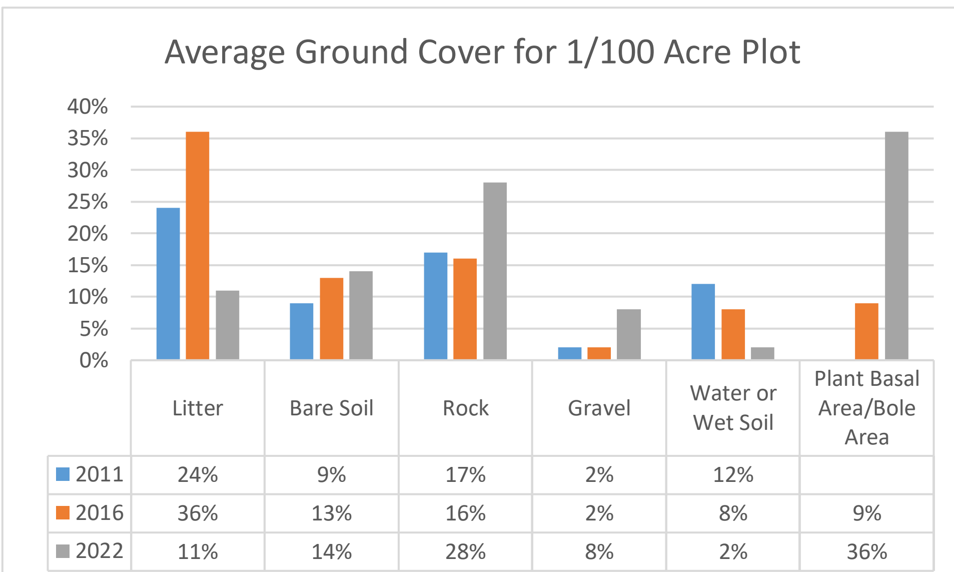
Understory and Bosque Floor Components

As described above, percent ground cover was estimated at each plot within the 1/100th acre subplot. Total aerial cover may exceed 100% due to vegetation stacking on top of each other. Of note is the decrease in canopy cover and graminoid cover while forb cover increased. Looking at the ground cover there is an increase in plant basal and bole area between 2016 and 2022 which could be a result of the lower canopy cover.



	Tree Canopy	Seedlings < 5	Saplings 5-15	Shrubs < 5	Shrubs 5-15'	Grammino id	Forb
2011	33%	0%	0%	5%	2%	35%	2%
2016	26%	1%	0%	6%	0%	41%	2%
2022	25%	3%	0%	10%	0%	28%	21%

Figure 11. Average aerial cover for the 1/100 acre plot comparison of three different years of monitoring.



	Litter	Bare Soil	Rock	Gravel	Water or Wet Soil	Plant Basal Area/Bole Area
2011	24%	9%	17%	2%	12%	
2016	36%	13%	16%	2%	8%	9%
2022	11%	14%	28%	8%	2%	36%

Figure 12. Average ground cover for 1/100 acre plot comparison of three different years of monitoring.

***Project*: SFP SWCD** ***Project Unit*: Puerta del Canon, 11.15** ***Plot*: 11.15_1**

11.15_1 Aerial & Ground Cover

	Aerial cover (%) of the 1/100-acre plot						
Year	**Tree Canopy**	**Seedlings <5'**	**Saplings 5-15'**	**Shrubs <5'**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	3%	0%	0%	3%	8%	7%	1%
2016	15%	2%	0%	10%	0%	20%	2%
2022	40%	1%	0%	0%	0%	30%	15%

	Ground cover (%) of the 1/100-acre plot					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	1%	3%	65%	8%	15%	n/a
2016	2%	8%	55%	5%	5%	5%
2022	20%	10%	5%	0%	0%	65%

2011 Hink & Ohmart Type: 4 or 6

2016 Hink & Ohmart Type: 6 **2016 Modified Hink & Ohmart Type**: 7 (rock)

2022 Hink & Ohmart Type: 6 **2022 Modified Hink & Ohmart Type:** 6H

2011 Comments: None.

2016 Comments: Plot crosses river; cattle appear to have continuous river access. There is no stream shade and active bank undercutting on plot.

2022 Comments: Open area bisected by the stream channel, covered by grasses and forbs, with scattered junipers upslope from the floodplain.

***Project**: SFP SWCD* ***Project Unit**: Puerta del Canon, 11.15* ***Plot**: 11.15_2*

11.15_2 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5'**	**Saplings 5-15'**	**Shrubs <5'**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	3%	0%	0%	3%	8%	7%	1%
2016	15%	2%	0%	10%	0%	20%	2%
2022	41%	0%	0%	15%	0%	15%	5%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	1%	3%	65%	8%	15%	n/a
2016	2%	8%	55%	5%	5%	5%
2022	5%	30%	15%	20%	5%	25%

2011 Hink & Ohmart Type: 3

2016 Hink & Ohmart Type: 3 **2016 Modified Hink & Ohmart Type**: 2/6H

2022 Hink & Ohmart Type: 6 **2022 Modified Hink & Ohmart Type:** 6H

2011 Comments: None.

2016 Comments: This plot is especially cliffy and rocky. The river crossing includes a deep pool.

2022 Comments: Steep canyon walls slope down to the narrow grassy floodplain, with surroundings containing lots of rocky ground cover. Juniper and Apache plume scattered around.

***Project**: SFP SWCD* ***Project Unit**: Puerta del Canon, 11.15* ***Plot**: 11.15_3*

11.15_3 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5'**	**Saplings 5-15'**	**Shrubs <5'**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	97%	1%	0%	0%	0%	22%	0%
2016	50%	0%	0%	5%	0%	4%	1%
2022	17%	10%	0%	25%	0%	35%	5%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	75%	2%	1%	0%	0%	n/a
2016	75%	23%	0%	0%	0%	2%
2022	20%	15%	30%	10%	0%	25%

2011 Hink & Ohmart Type: 4

2016 Hink & Ohmart Type: 5 **2016 Modified Hink & Ohmart Type**: 5/6H

2022 Hink & Ohmart Type: 6 **2022 Modified Hink & Ohmart Type:** 6S

2011 Comments: None.

2016 Comments: This plot is downstream of the acequia diversion. It is steep, rocky with abundant slash on site. Salt is visible on the soil surface. Tires, glass and other debris were noted. Plot center stake was in tumbleweeds.

2022 Comments: Steep hillside with grasses, Apache plume, and russian olive, with the Santa Fe river to the south of plot center with surrounding narrowleaf cottonwoods.

***Project**: SFP SWCD* ***Project Unit**: Puerta del Canon, 11.15* ***Plot**: 11.15_4*

11.15_4 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5'**	**Saplings 5-15'**	**Shrubs <5'**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	18%	0%	0%	15%	0%	50%	6%
2016	24%	0%	0%	10%	0%	90%	5%
2022	0%	0%	0%	0%	0%	30%	60%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	17%	25%	2%	0%	0%	n/a
2016	60%	10%	5%	1%	0%	26%
2022	1%	1%	64%	2%	2%	30%

2011 Hink & Ohmart Type: 4

2016 Hink & Ohmart Type: 6 **2016 Modified Hink & Ohmart Type**: 6H

2022 Hink & Ohmart Type: 3 **2022 Modified Hink & Ohmart Type:** 3

2011 Comments: None.

2016 Comments: Plot center was in a brush pile.

2022 Comments: Open grassy area with more open grass to the west across the river. Juniper found on the slope to the east near irrigation ditch.

Next steps (monitoring)

Continuing forward, 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.

Having collected data on three separate occasions (2011, 2016, 2022) our next steps will be to summarize the data collected and describe the progression of the site.

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Appendix I – Plot Coordinates Table

Name	Latitude	Longitude
SFP1_1	35.5929	-106.1300
SFP1_2	35.5917	-106.1300
SFP1_3	35.5914	-106.1310
SFP1_4	35.5908	-106.1330

Appendix II - Modified Hink and Ohmart categories, from NMRAM

The following is pages 39-41 in Muldavin et al.'s 2014 NMRAM for Montane Riverine Wetlands v 2.0 Manual (draft, not yet published)

Vegetation Vertical Structure Type Definitions for NMRAM

Multiple-Story Communities (Woodlands/Forests)

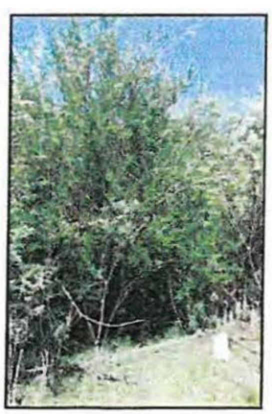
Type 1 - High Structure Forest with a well-developed understory.

Tall mature to intermediate-aged trees (>5 m [>15 feet]) with canopy covering >25% of the area of the community (polygon)and understory layer (0-5 m [0-15 feet]) covering >25% of the area of the community (polygon). Substantial foliage is in all height layers. (This type incorporates Hink and Ohmart structure types 1 and 3.) Photograph on Gila River by Y. Chauvin, 2012.

Type 2 - Low Structure Forest with little or no understory.

Tall mature to intermediate-aged trees (>5 m [>15 feet]) with canopy covering >25% of the area of the community (polygon) and understory layer (1-5 m [3-15 feet]) covering <25% of the area of the community (polygon). Majority of foliage is over 5 m (15 feet) above the ground. (This type incorporates Hink and Ohmart structure types 2 and 4.) Photograph on Diamond Creek by Y. Chauvin, 2012.

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



Type 5 - Tall Shrub Stands.

Young tree and shrub layer only (15-5 m [4.5-15 feet]) 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. Photograph on San Francisco River by Y. Chauvin, 2012.

Type 6S-Short Shrub Stands.

Short stature shrubs or very young shrubs and trees (up to 1.5 m [up to 4.5 feet]) covering >10% of the area of the community (polygon). Stands dominated by short woody vegetation, may include herbaceous vegetation underneath the woody vegetation. Photograph on Lower Pecos River by E. Lindahl, 2008.

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 <10% cover. Photograph of *Carex nebrascensis* meadow on upper Rio Santa Barbara by Y. Chauvin, 2009.

Type 6H-Herbaceous.

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 <10% cover. Photograph on Diamond Creek by Y. Chauvin, 2012.

Type 7–Sparse Vegetation/Bare Ground.

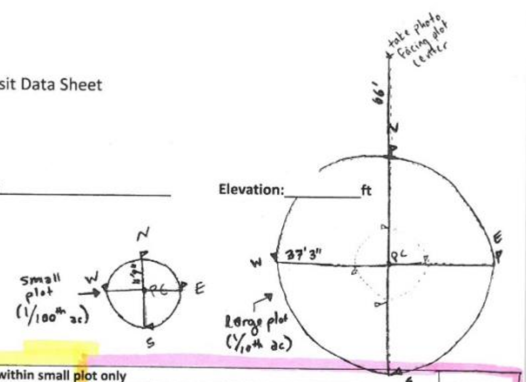
Bare ground, may include sparse woody or herbaceous vegetation, but total vegetation cover <10%. May be natural in origin (cobble bars) or anthropogenic in origin (graded or plowed earth) Photograph on Lower Gila River by Y. Chauvin, 2012.

Appendix III – Sample Datasheet

2011 Datasheet with original Hink & Ohmart

GRGWA 2011 Revisit Data Sheet

Project:
Project Unit:
Plot Number:
Lat (dd.dddd):__________________ **Long (ddd.dddd):**__________________ **Elevation:**________ft



Date:	
Time:	
Plot size:	1/100th ac for understory ("small plot") 1/10th ac for overstory

aerial cover

Cover % - Taken from/within small plot only												
Tree canopy (use densiometer facing out at 11'9" flags)	**Seedlings <5'** (estimate aerial cover)	**Saplings 5-15'** (estimate aerial cover)	**Shrubs <5'** (estimate aerial cover)	**Shrubs 5-15'** (estimate aerial cover)	**Graminoid** (estimate aerial cover)	**Forb** (estimate aerial cover)	**Litter** (estimate ground cover)	**Bare soil** (estimate ground cover)	**Rock** (estimate ground cover)	**Gravel** (estimate ground cover)	**Water or wet soil** (estimate ground cover)	Plant Basal / Bole (est. ground cover)

Hink & Ohmart structural class for entire 1/10th ac plot (unmodified, see back):

Hink & Ohmart modified structural class for entire 1/10th acre plot (see NMRAM)

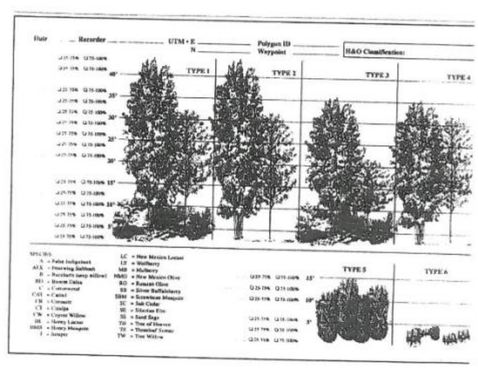
Species Observed in 1/10th ac plot (scientific name, common name, or USDA PLANTS code)

Grasses	Forbs	Shrubs	Trees

Photopoints needed (with whiteboard):

- PC showing whiteboard with name clearly legible
- North facing Center – 66'
- PC north to 11'9"
- PC east to 11'9"
- PC south to 11'9"
- PC west to 11'9"

Comments/Observations:



Unmodified Hink & Ohmart → (courtesy of SWCA)

2022 Sample datasheet

GRGWA Plot Description (1 of 2)

Observer: ____________________

Recorder: ____________________

Latitude (dd.dddddd): ____________________

Longitude (ddd.ddddd): ____________________

Elevation (ft): ____________________

Administrative Unit: ____________________

Project Unit: ____________________

Macroplot: ____________________

Date (DD/MM/YYYY): ____________________

Time: ____________________

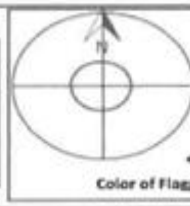
Macroplot Sizes		
Size (Acres)	1/100	1/10
Radius (Feet, Decimal Feet)	11.78	37.24
Radius (Feet, Inches)	11' 9"	37' 3"

Hill Slope (where steepest): ________ %

Aspect (circle one): N E S W

Aspect azimuth: ________ °

Mag Declination: ________ °



Describe Witness Tree(s):
USE NATIVE TREES ONLY

Draw location of tree on plot

Color of Flagging Used: ____________

Photo Azimuths: (1) of whiteboard at PC. (1) from 75 feet N looking south to PC (4) from PC in all four cardinal directions; (1) from each Brown's transect looking toward PC.

ORDER TAKEN: ____________________

Tree Canopy Cover (%) (densiometer)

________ + ________ + ________ + ________

Comments/Description of Plot:

Hink & Ohmart Dominant Structural Class

Original:

Modified:

Soil Texture (4 locations)

North: ____________________

East: ____________________

South: ____________________

West: ____________________

SMALL PLOT INCLUDES ALL SEEDLINGS OR SAPLINGS <5 INCHES DBH/DRC.

Species	Condition (Live, Dead, Sick)	Small Plot (1/100th Acre only) - Tree Regen, Shrubs & Cacti				
		Height classes—Seedlings (feet)				
		> 0 - 0.5'	> 0.5—1.5'	> 1.5' - 2.5'	>2.5' - 3.5'	>3.5' - 4.5'

Species	Condition (Live, Dead, Sick)	Small Plot (1/100th Acre only) - Tree Regen, Shrubs & Cacti				
		Diameter classes—Saplings (inches)				
		> 0 - 1"	>1-2"	>2-3"	>3-4"	>4-5"

New Mexico Forest and Watershed Restoration Institute

Plot Description Version: 4/3/2018, km

Precisions:
Slope: ±5 percent
Vegetation cover : ±1 class estimation or ±10%

GRGWA Plot Description (2 of 2)

List by Species	Status (L, D, S)	Nativity: N, E, I, Unk?	AERIAL COVER (%) (ENTIRE 1/10th acre plot)				
			Estimate Aerial Cover % for Species by Lifeform				
			Tree	Shrub	Forb/herb	Gramanoid	Cactus
TOTALS							

GROUND COVER (%) (ENTIRE 1/10th acre plot) (must total 100 %)							
Plant basal	Bole	Litter	Bare soil	Rock (>2.5in)	Gravel (< 2.5 in)	Water, Wet Soil	Total (%)

Comments on Species Composition and/or Ground Cover:

GRGWA Trees

Observer/Recorder:__ Project/Site/Plot.__ Date

	1/lOth acre plot (37' 3" radius)								
Tree#	Species	Tree cond.	OBH	ORC	No. stems	Total Tree Ht	UCrBHt	Mistletoe (%)	Comments dam-age/disease, wit• ness tree, etc.

Appendix IV – Fuels Transect Data Sheet

GRGWA Surface Fuels

Sheet 1 of 1: Fine Woody Debris—Coarse Woody Debris

Observer ______________________

Recorder ______________________

1-hour Transect Length - 6'	10-hour Transect Length - 6'
100-hour Transect Length - 35'	1000-hour Transect Length - 60'

Administrative Unit: ______________

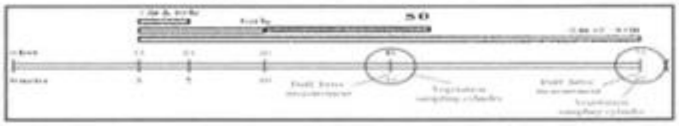
Project Unit: ______________

Macroplot: ______________

Date (DD/MM/YYYY): ______________

Time: ______________

Class		Diameter (in)
FWD	1-hr 10-hr 100-hr	0 to 0.25 0.25 to 1.0 1.0 to 3.0
CWD	1000-hr and greater	3.0 and greater



Fine Woody Debris (1, 10, 100 hr fuels)	Transect	Azimuth	Slope	1 - Hr Count	10 - Hr Count	100 - Hr Count	Comment
	1						
	2						

Coarse Woody Debris (1000 hr fuels)	Transect	Slope	Log No.	Log Diameter	Decay Class	Comment

Litter & Duff	Transect 1	45'	75'	Transect 2	45'	75'
	Litter Depth (in)			Litter Depth (in)		
	Duff Depth (in)			Duff Depth (in)		
	Comments?			Comments?		

Precisions: Diameter: ±0.5 in ; decay class ±1 class ; Slope ±5 percent

Decay Class Description

1 All bark is intact. All but the smallest twigs are present. Old needles probably still present. Hard when kicked

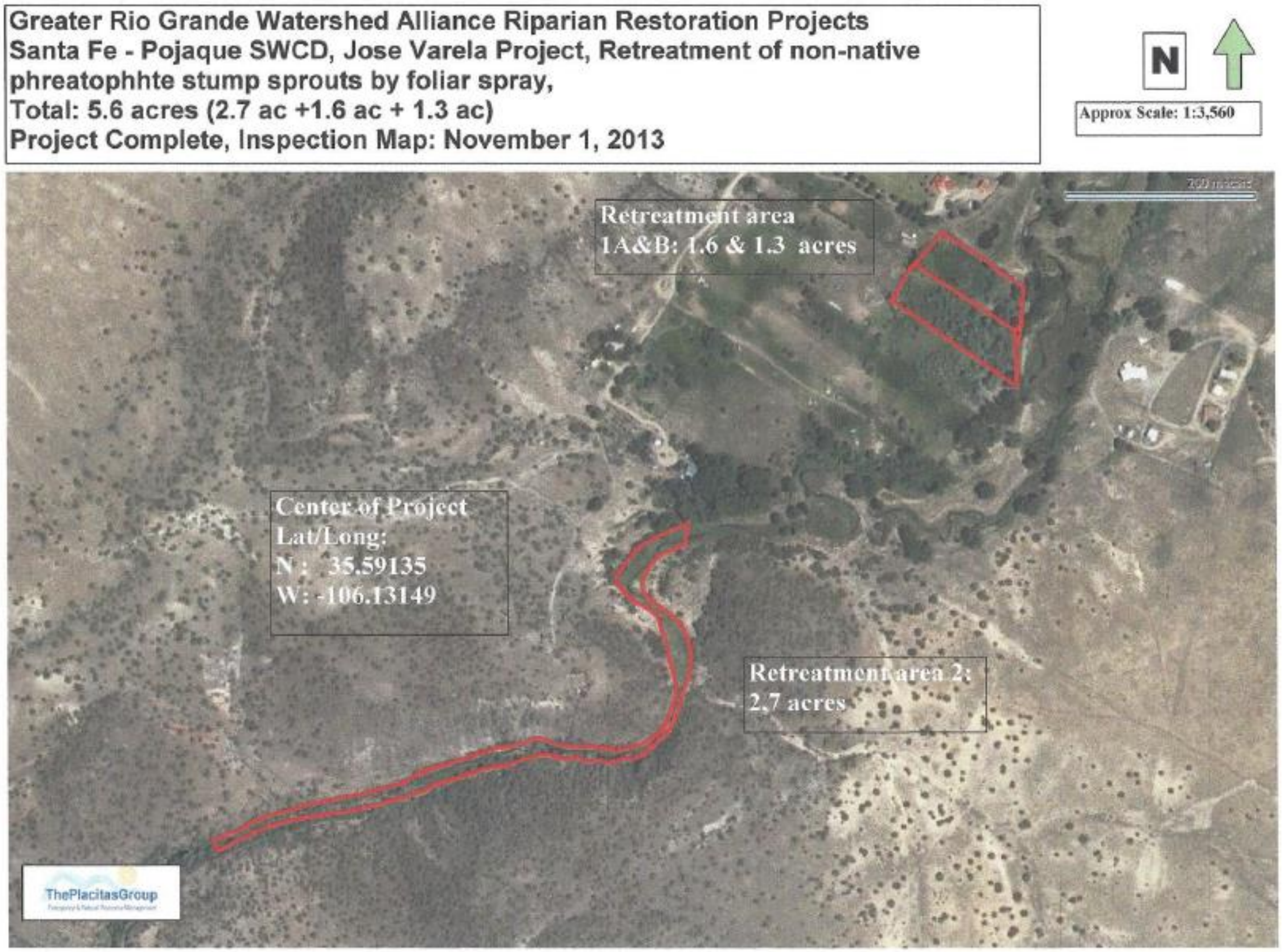
2 Some bark is missing, as are many of the smaller branches. No old needles still on branches. Hard when kicked

3 Most of the bark is missing and most of the branches less than 1 in. in diameter also missing. Still hard when kicked

4. Looks like a class 3 log but the sapwood is rotten. Sounds hollow when kicked and you can probably remove wood from the outside with your boot. Pronounced sagging if suspended for even moderate distances

5. Entire log is in contact with the ground. Easy to kick apart but most of the piece is above the general level of the adjacent ground. If the central axis of the piece lies in or below the duff layer then it should not be included in the CWD sampling as these pieces act more like duff than wood when burned.

Appendix V – Retreatment Maps

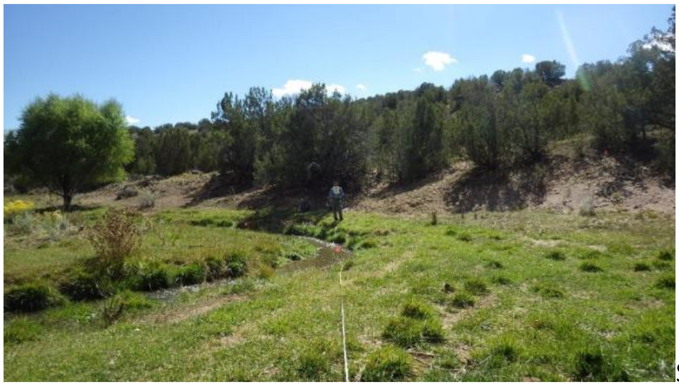


Retreatment Areas: Areas were retreated in October 2013 & October 2014 (map from page 3 of GRGA Inspection Report, 11/01/13)

Appendix VI – Photo Pages

See the attached photo comparison pages for this site.


SFP1_1C facing center from north at 66” (2011)


SFP1_1C facing center from north at 66’ (2016)


SFP1_1C facing center from north at 66’ (2022)

SFP1_1N, facing north from center at 11.8' (2011)


SFP1_1N, facing north from center at 11.8' (2016)


SFP1_1N, facing north from center at 11.8' (2022)


SFP1_1E, facing east from center at 11.8‘ (2011)

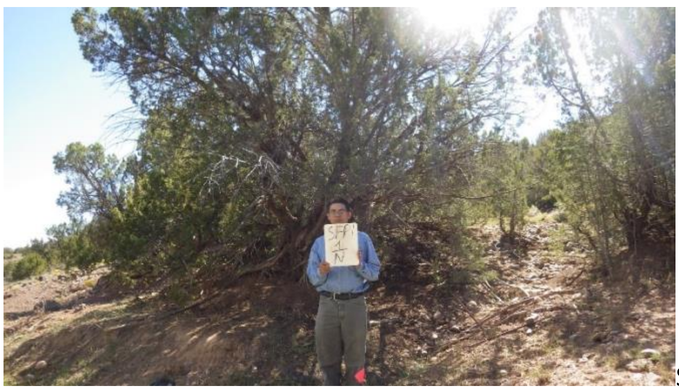
** Whiteboard is incorrectly labeled in 2016 photos for this plot.**


SFP1_1E, facing east from center at 11.8’ (2016)


SFP1_1E, facing east from center at 11.8’ (2022)


SFP1_1S, facing south from center at 11.8' (2011)

** Whiteboard is incorrectly labeled in 2016 photos for this plot.**


SFP1_1S, facing south from center at 11.8' (2016)


SFP1_1S, facing south from center at 11.8' (2022)


SFP1_1W, facing west from center at 11.8' (2011)

** Whiteboard is incorrectly labeled in 2016 photos for this plot.**

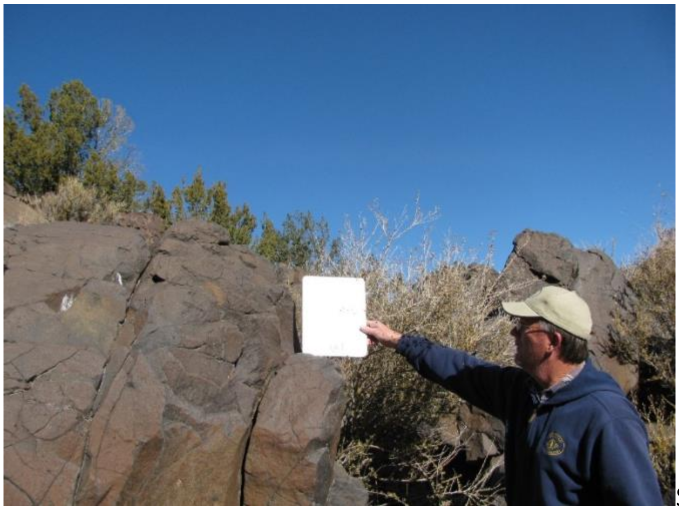
SFP1_1W, facing west from center at 11.8' (2016)


SFP1_1W, facing west from center at 11.8' (2022)


SFP1_2C, facing center from north at 66’ (2011)


SFP1_2C, facing center from north at 66’ (2016)


SFP1_2C, facing center from north at 66’ (2022)


SFP1_2N, facing north from center at 11.8' (2011)

Whiteboard is incorrectly labeled in 2011 photos for this plot.


SFP1_2N, facing north from center at 11.8' (2016)

SFP1_2N, facing north from center at 11.8' (2022)

SFP1_2E, facing east from center at 11.8’ (2011)

Whiteboard is incorrectly labeled in 2011 photos for this plot.


SFP1_2E, facing east from center at 11.8’ (2016)


SFP1_2E, facing east from center at 11.8’ (2022)

SFP1_2S, facing south from center at 11.8' (2011)

Whiteboard is incorrectly labeled in 2011 photos for this plot.


SFP1_2S, facing south from center at 11.8' (2016)


SFP1_2S, facing south from center at 11.8' (2022)


SFP1_2W, facing west from center at 11.8’ (2011)

Whiteboard is incorrectly labeled in 2011 photos for this plot.


SFP1_2W, facing west from center at 11.8’ (2016)

SFP1_2W, facing west from center at 11.8’ (2022)


SFP1_3C, facing center from north at 66’ (2011)


SFP1_3C, facing center from north at 66’ (2016)


SFP1_3C, facing center from north at 66’ (2022)


SFP1_3N, facing north from center at 11.8’ (2011)


SFP1_3N, facing north from center at 11.8’ (2016)

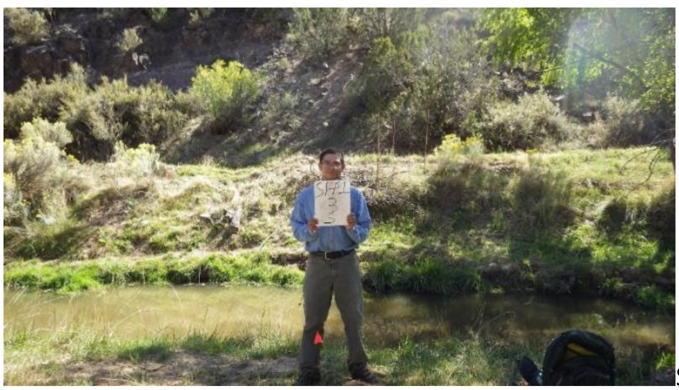

SFP1_3N, facing north from center at 11.8’ (2022)


SFP1_3E, facing east from center at 11.8’ (2011)


SFP1_3E, facing east from center at 11.8’ (2016)


SFP1_3E, facing east from center at 11.8’ (2022)


SFP1_3S, facing south from center at 11.8' (2011)


SFP1_3S, facing south from center at 11.8' (2016)


SFP1_3S, facing south from center at 11.8' (2022)


SFP1_3W, facing west from center at 11.8’ (2011)


SFP1_3W, facing west from center at 11.8’ (2016)

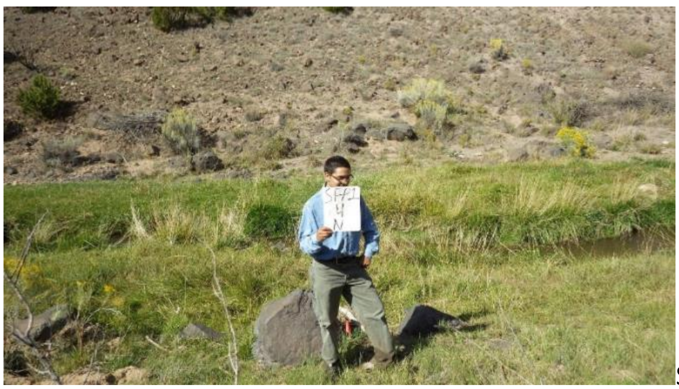

SFP1_3W, facing west from center at 11.8’ (2022)


SFP1_4C, facing center from north at 66’ (2011)


SFP1_4C, facing center from north at 66’ (2016)


SFP1_4C, facing center from north at 66’ (2022)

SFP1_4N, facing north from center at 11.8' (2011)


SFP1_4N, facing north from center at 11.8' (2016)


SFP1_4N, facing north from center at 37' (2022)

SFP1_4E, facing east from center at 11.8’ (2011)


SFP1_4E, facing east from center at 11.8’ (2016)


SFP1_4E, facing east from center at 37’ (2022)

SFP1_4S, facing south from center at 11.8’ (2011)


SFP1_4S, facing south from center at 11.8’ (2016)


SFP1_4S, facing south from center at 37’ (2022)

SFP1_4W, facing west from center at 11.8’ (2011)

SFP1_4W, facing west from center at 11.8’ (2016)

SFP1_4W, facing west from center at 37’ (2022)