Santa Fe-Pojoaque SWCD Thomas Project (11.05)

10-year Monitoring Report

2022

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for the
Greater Rio Grande Watershed Alliance

Santa Fe-Pojoaque SWCD

Table of 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 on the Santa Fe River near 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 II). Finally, plant species observed within the 1/10 area around the plot were recorded, as were other comments documenting conditions at the plot.

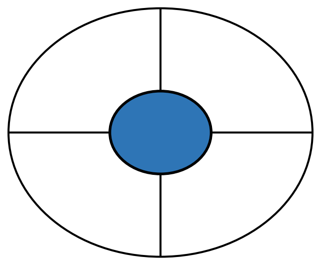


Figure 1. example of plot layout. The outer circle represents the 1/10 acre plot and the blue circle is the 1/100 plot

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 VI).

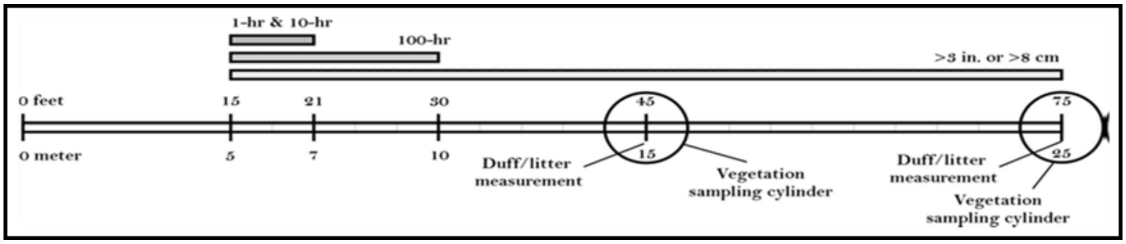


Figure 2. Example of fuels transect

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)
- Daniel Hernandez, Ecological Monitoring Technician

2022 New Mexico Forest and Watershed Restoration Institute 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

11.05 Thomas Project

The SFP 4&5 Thomas project is a fenced riparian area approximately 2100 feet by 300 feet. It crosses Paseo Real/NM56/Airport Road and the western edge of the limits of the City of Santa Fe.

The 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 70% Cuyamungue-Riverwash complex, 0 to 2 percent slopes, flooded; 16% Riovista gravelly loamy sand, 0 to 1 percent slopes; 9% Riverwash, flooded; 3% Pits, 2% Zepol silt loam, 0 to 2 percent slopes, flooded; and <1% Delvalle-Urban land complex, 0 to 2 percent slopes. 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 targeting 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, followed with cut-stump herbicide and the removal of approximately 10 cottonwood snags. Slash was to be chopped and spread as chips to a depth of under 2 inches, outside of the high water area; larger woody material (over 3 inches) was to be removed from high water areas to outside the fence along the road to allow for public removal. 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 inspection reports and documents, some portion of this project was re-treated in 2013 and 3 acres were re-treated using a foliar herbicide in October 2014. 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.

10-year revisit monitoring occurred in October of 2022

Figure 2. SFP4_5 in geographic context.

Thomas Project (11.05) Site Summary

2011 11.05 Site observations: The project area has a near contiguous canopy along the channel of Cottonwood, Coyote Willow, Goodding's Black Willow, Russian Olive, and Siberian Elm, with some One-seed Juniper interspersed. A few open, sandy areas exist, characterized by clumps of Chamisa and grasses and scattered Cottonwood. Ducks were observed in the area and there was evidence of historic beaver activity. These plots were assessed to fall in Hink & Ohmart Structure Classes 2 and 3.

2016 11.05 Site observations: The project has a dense canopy, especially immediately adjacent to the Santa Fe River, with a cottonwood overstory and coyote willow understory. Further from the channel, rubber rabbitbrush becomes dominant and more xeric grassy/open areas are present. Russian olive and Siberian elm are found throughout the project, especially on the north and south ends. A variety of nonnative herbaceous weedy species, such as Russian thistle, are also present, especially on the northern end of the project. Heavy mastication material is present in some areas. The plots were assessed to fall in Hink and Ohmart Structure Classes 1, 5 and 6.

2022 11.05 Site Observations: The project area has a dense canopy of cottonwoods, Gooding's black willow, and coyote willow. The understory consists mostly of bare soil and abundant litter, while more open areas are grassy and contain a diversity of forbs, though a somewhat different assemblage than six years previous. This site was more diverse than other sites done later in the growing season since plants had not yet senesced and could be identified.

11.05 2011-2022 - Observed plant species

11.05 Thomas						
Vegetation Type/Year	***2011***		***2016***		***2022***	
Graminoids			*Bromus tectorum*	*Cheatgrass*	*Bromus tectorum*	*Cheatgrass*
			Elymus canadensis	*Canada Wild Rye*	*Elymus canadensis*	*Canada Wild Rye*
			Achnatherum robustum	*Sleepygrass*	*Festuca arundinacea*	*Tall Fescue*
			Dactylis glomerata	*Orchard grass*	*Sporobulus airoides*	*Alkali Sacaton*
			Elymus elymoides	*Squirreltail*		
			Elymus smithii	*Western Wheatgrass*		
Forbs	*Bassia prostrata*	*Forage Kochia*	*Bassia prostrata*	*Forage Kochia*	*Bassia scoparia*	*Kochia*
	Verbascum thapsus	*Mullein*	*Verbascum thapsus*	*Mullein*	*Verbascum thapsus*	*Mullein*
			Ambrosia acanthicarpa	*Bursage*	*Ambrosia artemisifolia*	*Ragweed*
			Anemopsis californica	*Yerba mansa*	*Euphorbia davidii*	*Toothed Spurge*
			Chenopodium album	*Lambsquarter*	*Marubium vulgare*	*Horehound*
			Cirsium vulgare	*Bull thistle*	*Sphaeralcea spp*	*Globemallow*
			Convolvulus arvensis	*Field Bindweed*	*Lepidium spp*	*Peppergrasses*
			Conyza canadensis	*Marestail*	*Tanacetum vulgare*	*Tansy*
			Cucurbita foetidissima	*Buffalo Gourd*	*Bidens spp*	*Beggarticks*
			Descurainia pinnata	*Tansymustard*	*Rumex crispus*	*Curly Dock*
			Gaura parviflora	*Velvet gaura*	*Oenothera curtiflora*	*Velvet Gaura*
			Lactuca serriola	*Prickly Lettuce*	*Heterotheca villosa*	*Hairy Goldenaster*
			Lappula occidentalis	*Western Sticktight*	*Sonchus asper*	*Sowthistle*
			Machaeranthera canescens	*Purple Aster*	*Xanthium strumarium*	*Rough Cocklebur*
			Melilotus albus	*White Sweetclover*	*Amaranthus retroflexus*	*Redroot Pigweed*
			Salsola tragus	*Russian Thistle*	*Verbesina encelioides*	*Cowpen Daisy*
			Senecio vulgaris	*Groudsel*	*Melilotus alba*	*White Sweetclover*
			Solanum elaeagnifolium	*Silverleaf Nightshade*	*Echinochloa crus-galli*	*Barnyardgrass*
			Thlaspi arvense	*Field Pennycress*	*Malva neglecta*	*Common Mallow*
			Xanthium strumarium	*Rough Cocklebur*		
				Unknown forb		
				Unknown Thistle		
Cactus						
Shrubs	*Ericameria nauseosa*	*Rubber rabbitbrush*	*Ericameria nauseosa*	*Rubber rabbitbrush*	*Ericameria nauseosa*	*Rubber Rabbitbrush*
	Salix exigua	*Coyote willow*	*Salix exigua*	*Coyote willow*	*Salix exigua*	*Coyote Willow*
			Cylindropuntia spp.	*Cholla*		
			Gutierrezia sarothrae	*Broom snakeweed*		
Trees	*Salex gooddingii*	*Gooding's Willow*	*Salex gooddingii*	*Gooding's Willow*	*Salex goodingii*	*Gooding's Willow*
	Elaeagnus angustifolia	*Russian Olive*	*Elaeagnus angustifolia*	*Russian Olive*	*Fraxinus spp*	*Ash*
	Juniperus monosperma	*One-Seed Juniper*	*Juniperus monosperma*	*One-Seed Juniper*	*Acer negundo*	*Boxelder Maple*
	Populus deltoides	*Rio Grande Cottonwood*	*Populus deltoides*	*Rio Grande Cottonwood*	*Populus deltoides*	*Rio Grande Cottonwood*
	Ulmus pumila	*Siberian Elm*	*Ulmus pumila*	*Siberian Elm*	*Ulmus pumila*	*Siberian Elm*

The “new” species recorded in 2016 were a thorough mix of native and exotic species, including welcome additions such as yerba mansa, and unwelcome ones such as Russian thistle and cheatgrass. The target species found pre-treatment in 2011, Russian olive, Siberian elm, and one-seed juniper, were still present post-treatment in 2016, though some were resprouts. In both years, identification of forb, grasses and some shrub species was impacted by both the plant identification skills of the monitoring team and by the season.

Tree Component

The tree component consists of data collected on the 1/10 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 by calculating Trees Per Acre (TPA) and basal density by calculating Basal Area Per Acre (BA/AC).

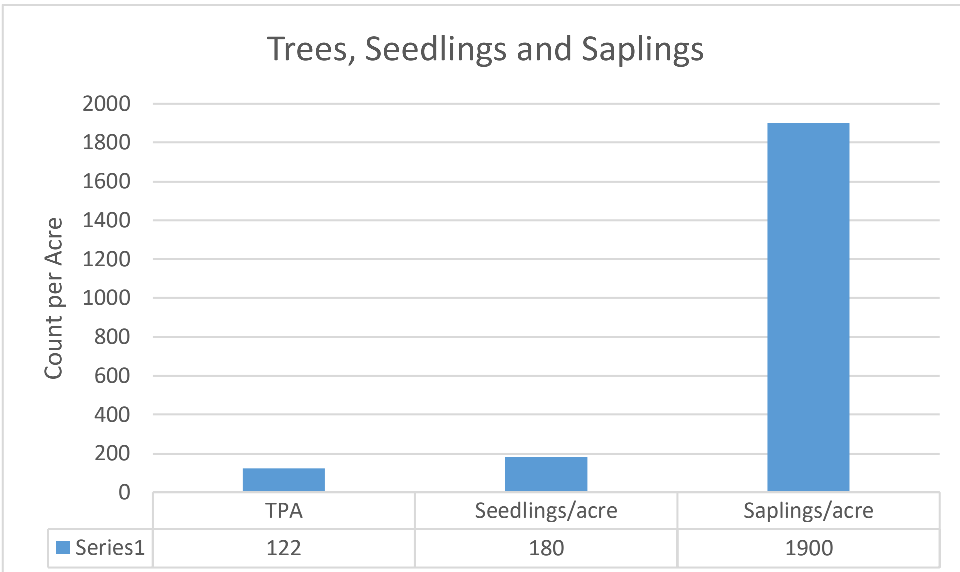


Figure 3. Displays Trees, Seedlings and Saplings per acre

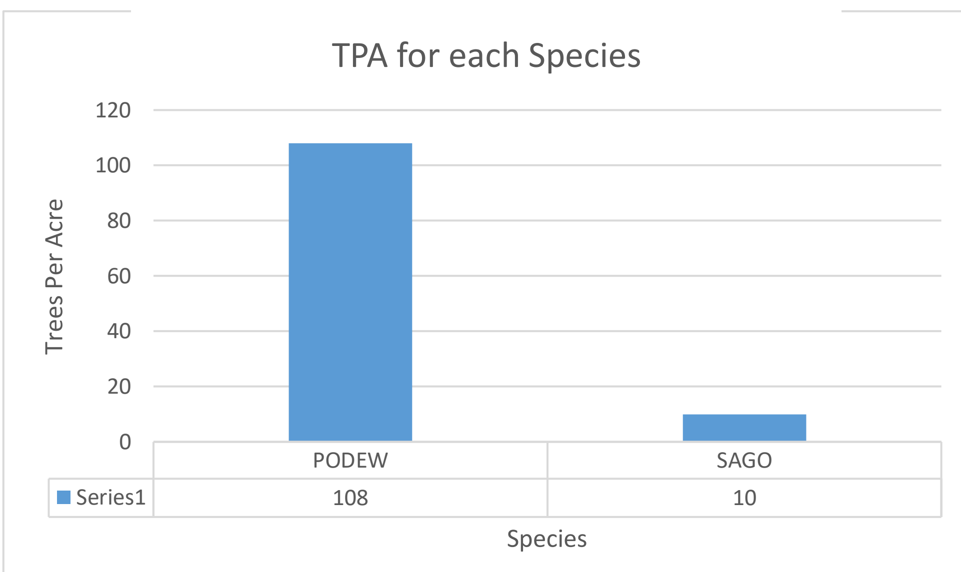


Figure 4. Displays trees per acre for individual tree species

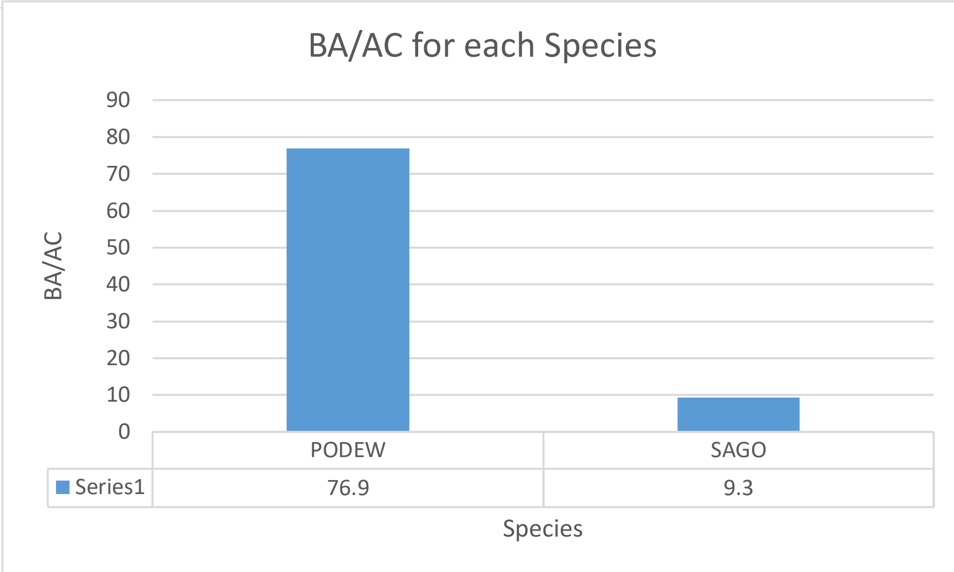


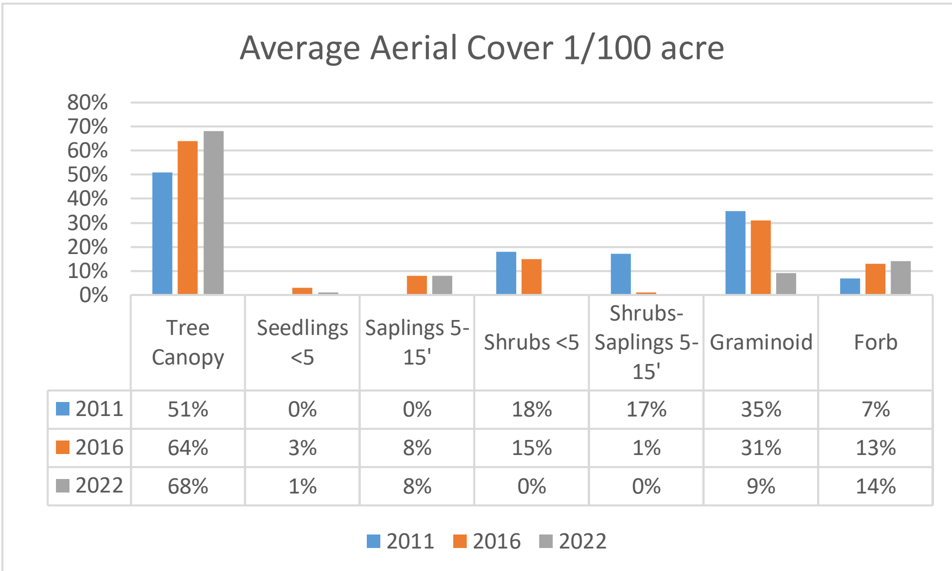
Figure 5. Displays basal area per acre for each species

Thomas 11.05			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
11.05_1	1	1	10	26.16
11.05_2	25	25	250	195.88
11.05_3	7	7	70	67.81
11.05_4	0	0	0	0.00
11.05_5	33	28	280	142.98
Total	**Total number of sample trees on plot**	**Number of growing stock sample trees on plot**	**Average for all Plots**	
			TPA	**BA/AC**
	66.00	**61.00**	**122.00**	**86.57**

Table 1. Displays stand table plot summaries for each plot within the project

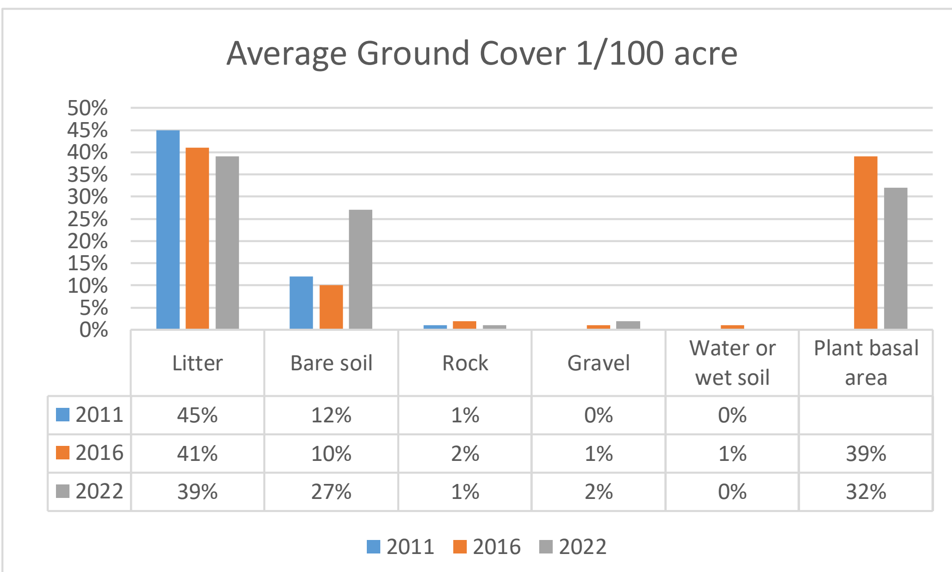
Understory and Bosque Floor Components

As described above, percent ground and aerial cover was estimated at each plot within the 1/100th acre subplot. Tree canopy cover was collected using a spherical densionmeter, while all other cover was collected using visual estimations. Cover was collected during all three monitoring visits and below are graphs displaying all three years of data. In 2016 there was a drop in Shrubs-Saplings 5-15ft and none observed in 2022. Also, of note is the drop in Graminoid cover between 2016 and 2022. Ground cover remained fairly similar throughout the years except for bare soil, which saw an increase in 2022.



	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2011	51%	0%	0%	18%	17%	35%	7%
2016	64%	3%	8%	15%	1%	31%	13%
2022	68%	1%	8%	0%	0%	9%	14%

Figure 6. Displays average aerial cover for 1/100-acre plot over 3 monitoring periods



	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2011	45%	12%	1%	0%	0%	
2016	41%	10%	2%	1%	1%	39%
2022	39%	27%	1%	2%	0%	32%

Figure 7. Displays average ground cover for 1/100-acre plot over 3 monitoring periods

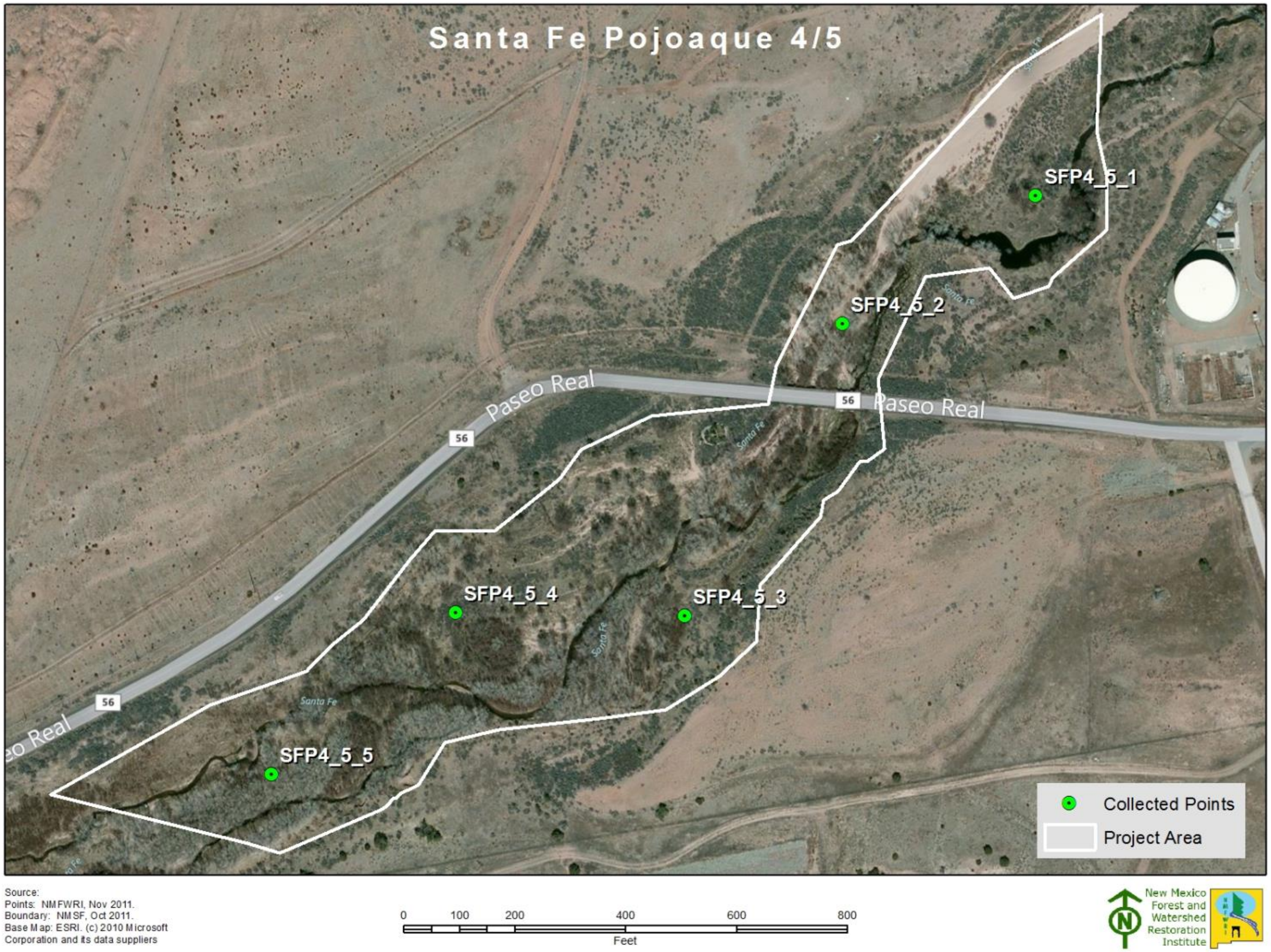


Figure 3. 11.05 plots.

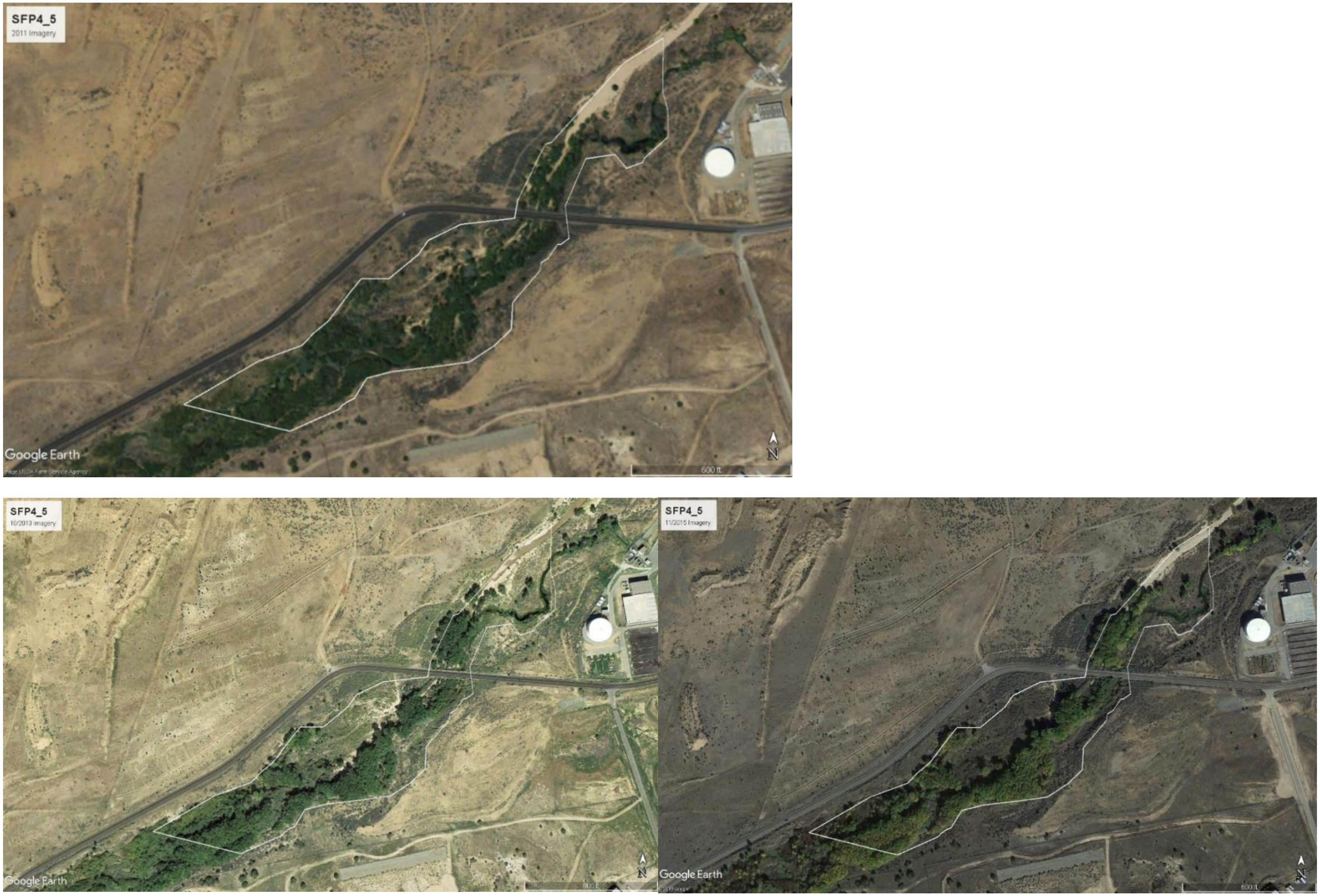


Figure 4. Google Earth imagery for 11.05 pre- and post-treatment.
2011 pre-treatment imagery is top; 2013 and 2015 post-treatment imagery on bottom.

***Project**: SFP SWCD* ***Project Unit**: 11.05* ***Plot**: 11.05_1*

11.05_1 Aerial & Ground Cover

	Aerial cover 1/100 acre						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	21%	0%	0%	30%	20%	0%	20%
2016	15%	0%	0%	15%	2%	75%	20%
2022	50%	0%	1%	0%	0%	1%	15%

	Ground cover 1/100 acre					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	60%	20%	0%	0%	0%	n/a
2016	30%	0%	0%	0%	0%	70%
2022	30%	5%	0%	0%	0%	65%

2011 Hink & Ohmart Type: 3

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

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

2011 Comments: None.

2016 Comments: Abundant plant species included Russian thistle and Western wheatgrass.

2022 Comments: Open field of grasses and forbs (mostly kochia), with a couple of black willow trees near plot center.

***Project**: SFP SWCD* ***Project Unit**: 11.05* ***Plot**: 11.05_2*

11.05_2 Aerial & Ground Cover

	Aerial cover 1/100 acre						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	94%	0%	0%	1%	10%	1%	0%
2016	98%	0%	0%	0%	0%	5%	5%
2022	98%	0%	0%	0%	0%	3%	1%

	Ground cover 1/100 acre					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	90%	6%	3%	0%	0%	n/a
2016	65%	19%	10%	5%	1%	1%
2022	10%	74%	4%	8%	0%	4%

2011 Hink & Ohmart Type: 3

2016 Hink & Ohmart Type: 1 **2016 Modified Hink & Ohmart Type**: 1

2022 Hink & Ohmart Type: 2 **2022 Modified Hink & Ohmart Type:** 2

2011 Comments: None.

2016 Comments: This plot crosses a dry channel.

2022 Comments: Grassy open understory, sandy/rocky streambed, all under cottonwoods.

***Project**: SFP SWCD* ***Project Unit**: 11.05* ***Plot**: 11.05_3*

11.05_3 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	42%	2%	0%	10%	25%	35%	8%
2016	85%	5%	25%	20%	0%	15%	20%
2022	62%	0%	30%	0%	0%	1%	3%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	40%	15%	2%	0%	0%	n/a
2016	40%	5%	0%	1%	0%	34%
2022	85%	1%	0%	0%	0%	14%

2011 Hink & Ohmart Type: 3

2016 Hink & Ohmart Type: 1 **2016 Modified Hink & Ohmart Type**: 1

2022 Hink & Ohmart Type: 5 **2022 Modified Hink & Ohmart Type:** 5

2011 Comments: None.

2016 Comments: This plot required a river crossing. Trash and shells were found near plot center; coyote willow stands were very dense.

2022 Comments: Partially open area where the cottonwood and willow canopied floodplain transitions to a chamisa laden hillside.

***Project**: SFP SWCD* ***Project Unit**: 11.0_5* ***Plot**: 11.05_4*

11.05_4 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	2%	0%	0%	50%	10%	55%	5%
2016	25%	5%	10%	40%	5%	20%	20%
2022	28%	5%	5%	0%	0%	40%	50%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	25%	15%	0%	0%	0%	n/a
2016	40%	15%	0%	0%	0%	45%
2022	25%	5%	0%	0%	0%	70%

2011 Hink & Ohmart Type: 3

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

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

2011 Comments: None.

2016 Comments: Snails found on plot.

2022 Comments: North and west are open and contain many grasses and forbs. South and east are dense coyote willow.

***Project**: SFP SWCD* ***Project Unit**: 11.05* ***Plot**: 11.05_5*

11.05_5 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2011	94%	0%	0%	1%	20%	85%	0%
2016	95%	5%	5%	0%	0%	40%	0%
2022	100%	2%	3%	0%	0%	1%	0%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2011	10%	5%	0%	0%	1%	n/a
2016	30%	10%	0%	1%	3%	44%
2022	45%	50%	0%	0%	0%	5%

2011 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 1 **2016 Modified Hink & Ohmart Type**: 1

2022 Hink & Ohmart Type: 2 **2022 Modified Hink & Ohmart Type:** 2

2011 Comments: None.

2016 Comments: Evidence of recent flooding present on plot.

2022 Comments: Mostly under cottonwood canopy, with lots of bare soil and grasses in more open areas. Abundant litter in many places.

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
11.05_1	35.6306	-106.0902
11.05_2	35.6299	-106.0913
11.05_3	35.6285	-106.0923
11.05_4	35.6285	-106.0937
11.05_5	35.6277	-106.0948

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)

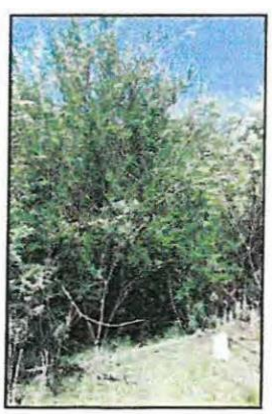
Type 1- High Structure Forest with a well-developed understory.

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.

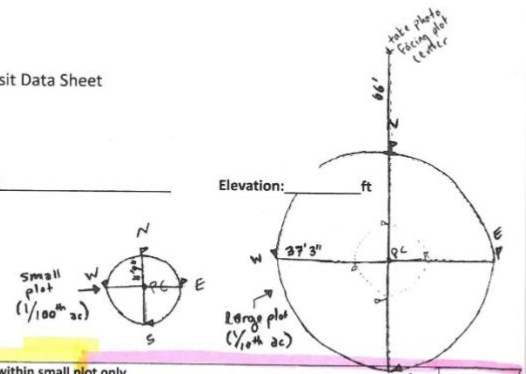
Appendix III – Sample Datasheets

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)

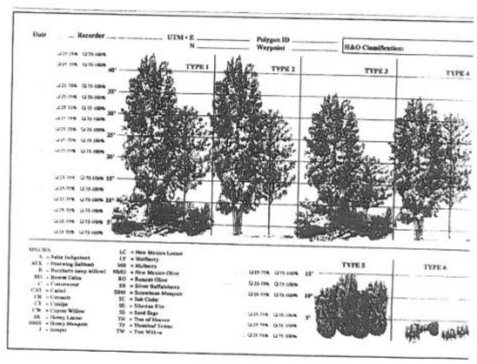
Species Observed in 1/10th ac plot (scientific name, common name, or USDA PLANTS code)

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 datasheets

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: ____________________

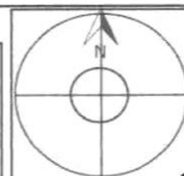
Macroplot Sizes		
Size (Acres)	1/100	1/10
Radius (Feet, Decimal Feet)	11.78	37.24
Radius (Feet, Inches)	11' 9"	37' 3"

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: ____________________

Comments/Description of Plot:

Tree Canopy Cover (%) (densiometer)

________ + ________ + ________ + ________

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"

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 damage/disease, wit• ness tree, etc.

Appendix IV – Fuels Transect Data Sheet

GRGWA Surface Fuels

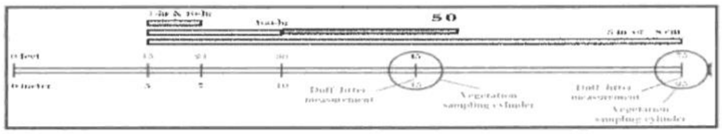
Sheet 1 of 1: Fine Woody Debris—Coarse Woody Debris

Observer	
Recorder	

Administrative Unit:	
Project Unit:	
Macroplot:	
Date (DD/MM/YYYY):	
Time:	

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

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

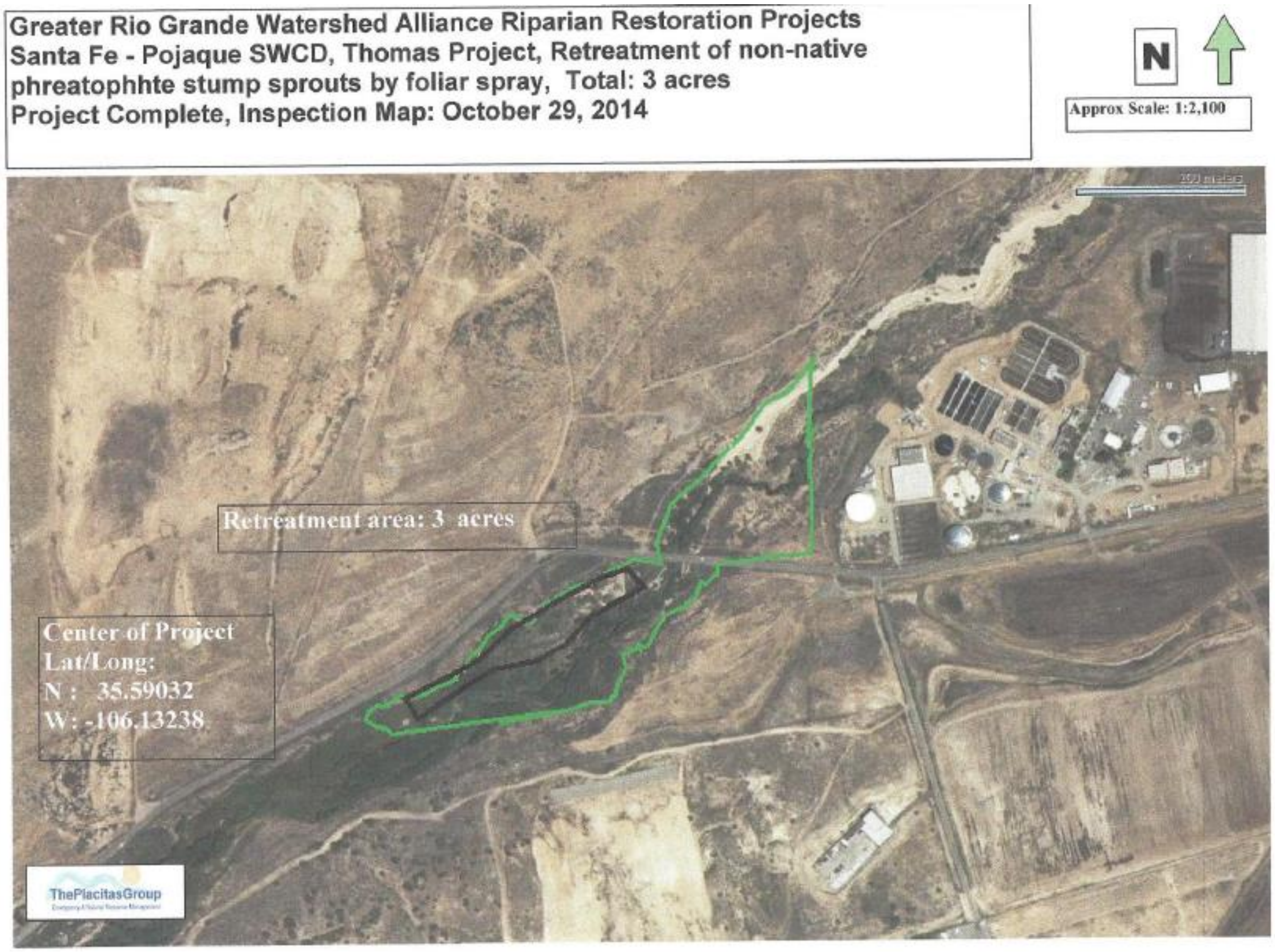
2 Some bark is missing, as are many of the smaller branches. No old needles still on branches. Hard when kicked

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 Map



Retreatment Area: Area was treated in 2013(?) and October 2014 (map from page 3 of GRGWA Inspection Report, 10/29/2014)

Appendix VI- Photos


SFP4_5_1C facing center from north at 66’ (2011)


SFP4_5_1C facing center from north at 66’ (2016)


SFP4_5_1C facing center from north at 66’ (2022)


SFP4_5_1N facing north from center at 11.8’ (2011)


SFP4_5_1N facing north from center at 11.8’ (2016)


SFP4_5_1N facing north from center at 11.8’ (2022)


SFP4_5_1E facing east from center at 11.8’ (2011)


SFP4_5_1E facing east from center at 11.8’ (2016)


SFP4_5_1E facing east from center at 11.8’ (2022)


SFP4_5_1S facing south from center at 11.8’(2011)


SFP4_5_1S facing south from center at 11.8’ (2016)

SFP4_5_1S facing south from center at 11.8’ (2022)

SFP4_5_1W facing west from center at 11.8’ (2011)


SFP4_5_1W facing west from center at 11.8’ (2016)


SFP4_5_1W facing west from center at 11.8’ (2022)


SFP4_5_2C facing center from north at 11.8’ (2011)


SFP4_5_2C facing center from north at 11.8’ (2016)


SFP4_5_2C facing center from north at 11.8’ (2022)


SFP4_5_2N facing north from center at 11.8’ (2011)

SFP4_5_2N facing north from center at 11.8’ (2016)

SFP4_5_2N facing north from center at 11.8’ (2022)


SFP4_5_2E facing east from center at 11.8’ (2011)


SFP4_5_2E facing east from center at 11.8’ (2016)

SFP4_5_2E facing east from center at 11.8’ (2022)

SFP4_5_2S facing south from center at 11.8’ (2011)


SFP4_ 5_2S facing south from center at 11.8’ (2016)


SFP4_5_2S facing south from center at 11.8’ (2022)


SFP4_5_2W facing west from center at 11.8’ (2011)


SFP4_5_2W facing west from the center at 11.8’ (2016)


SFP4_5_2W facing west from the center at 11.8’ (2022)


SFP4_5_3C facing center from north at 66’ (2011)


SFP4_5_3C facing center from north at 66’ (2016)


SFP4_5_3C facing center from north at 66’ (2022)


SFP4_5_3N facing north from center at 11.8’ (2011)


SFP4_5_3N facing north from center at 11.8’ (2016)


SFP4_5_3N facing north from center at 11.8’ (2022)


SFP4_5_3E facing east from center at 11.8’ (2011)

SFP4_5_3E facing east from center at 11.8’ (2016)

SF4_5_3E facing east from center at 11.8’ (2022)


SFP4_5_3S facing south from center at 11.8’ (2011)


SFP4_5_3S facing south from center at 11.8’ (2016)


SFP4_5_3S facing south from center at 11.8’ (2022)

SFP4_5_3W facing west from center at 11.8’ (2011)


SFP4_5_3W facing west from center at 11.8’ (2016)


SFP4_5_3W facing west from center at 11.8’ (2022)


SFP4_5_4C facing center from north at 66’ (2016)


SFP4_5_4C facing center from north at 66’ (2022)

SFP4_5_4N facing north from center at 11.8’ (2011)

SFP4_5_4N facing north from center at 11.8’ (2016)


SFP4_5_4N facing north from center at 11.8’ (2022)

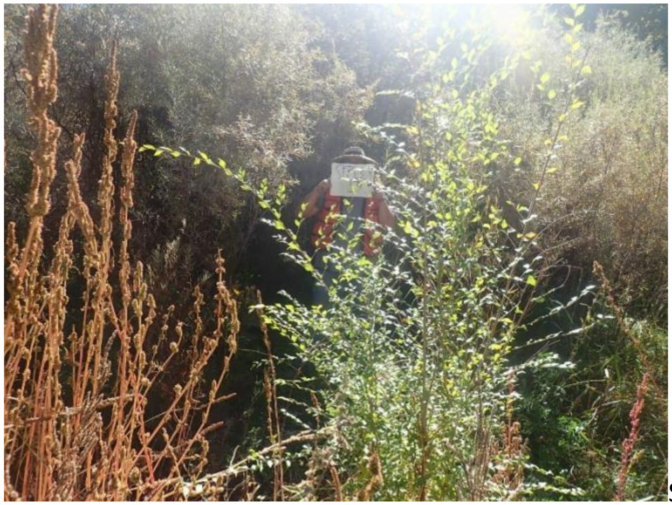

SFP4_5_4E facing east from center at 11.8’ (2011)


SFP4_5_4E facing east from center at 11.8’ (2016)


SFP4_5_4E facing east from center at 11.8’ (2022)


SFP4_5_4S facing south from center at 11.8’ (2011)


SFP4_5_4S facing south from center at 11.8’ (2016)


SFP4_5_4S facing south from center at 11.8’ (2022)


SFP4_5_4W facing west from center at 11.8’ (2011)


SFP4_5_4W facing west from center at 11.8’ (2016)


SFP4_5_4W facing west from center at 11.8’ (2022)


SFP4_5_5C facing center from north at 66’ (2011)


SFP4_5_5C facing center from north at 66’ (2016)


SFP4_5_5C facing center from north at 66’ (2022)


SFP4_5_5N facing north from center at 11.8’ (2011)


SFP_4_5_5N facing north from center at 11.8’ (2016)


SFP4_5_5N facing north from center at 11.8’ (2022)


SFP4_5_5E facing east from center at 11.8' (2011)


SFP4_5_5E facing east from center at 11.8' (2016)


SFP4_5_5E facing east from center at 11.8’ (2022)


SFP4_5_5S facing south from center at 11.8’ (2011)


SFP4_5_5S facing south from center at 11.8’ (2016)


SFP4_5_5S facing south from center at 11.8’ (2022)


SFP4_5_5W facing west from center at 11.8’ (2011)


SFP4_5_5W facing west from center at 11.8’ (2016)


SFP4_5_5W facing west from center at 11.8’ (2022)