Valencia SWCD Belen 1, 2, 3, 4 Sites

10-year Monitoring Report

2023

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Greater Rio Grande Watershed Alliance

NMFWRI

VALENCIA
SOIL & WATER CONSERVATION DISTRICT

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 and 10-year-post-treatment vegetation monitoring assessments performed on non-native phreatophyte removal projects near Belen, NM submitted by the Valencia 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 each 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 (2012) protocols

Due to the short timeframe between project selection and implementation in 2011/2012, 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 was 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 2012 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 document conditions at the plot.

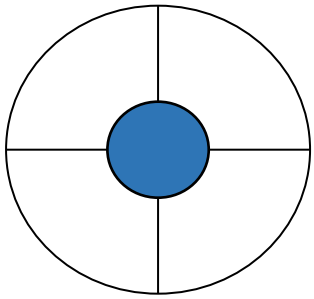


Figure 2. example of plot layout. The outer circle represents the 1/10 acre plot and the blue circle is the 1/100 plot

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_with cheatsheets_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 X). 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 X).

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).

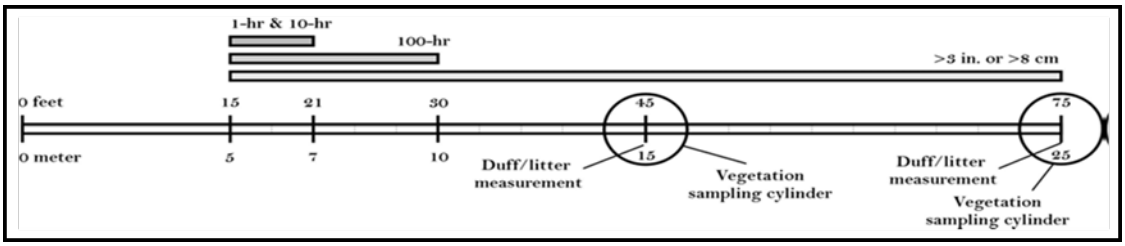


Figure 3. Example of fuels transect

Personnel Involved

2012 Monitoring Team:

- Joe Zebrowski, New Mexico Forest and Watershed Restoration Institute
- Jill Wick, New Mexico Department of Game and Fish (Sites B1 and B2)
- Dave Lightfoot, SWCA Environmental Consultants (Sites B3 and B4)
- Cody Stropki, SWCA Environmental Consultants (Sites B3 and B4)

2016 Monitoring Team:

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

2023 Monitoring Team.

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

Other persons contacted 2012:

- Charlie Lujan, Valencia Soil and Water Conservation District
- Madeline Miller, Valencia Soil and Water Conservation District

Other persons contacted 2016:

- Madeline Miller, Valencia Soil and Water Conservation District

Other Persons Contacted 2023:

- Yasmeen Najmi, Middle Rio Grande Nature Conservancy

Bosque Ecological Monitoring Program Sites

Two Bosque Ecological Monitoring Program (BEMP) monitoring sites were located at the northern end of project area Belen 1 and the southern portion of project area Belen 2. These sites were likely disturbed during the treatment activity. GRGWA monitoring now strives to integrate BEMP monitoring into the overall project monitoring scheme.

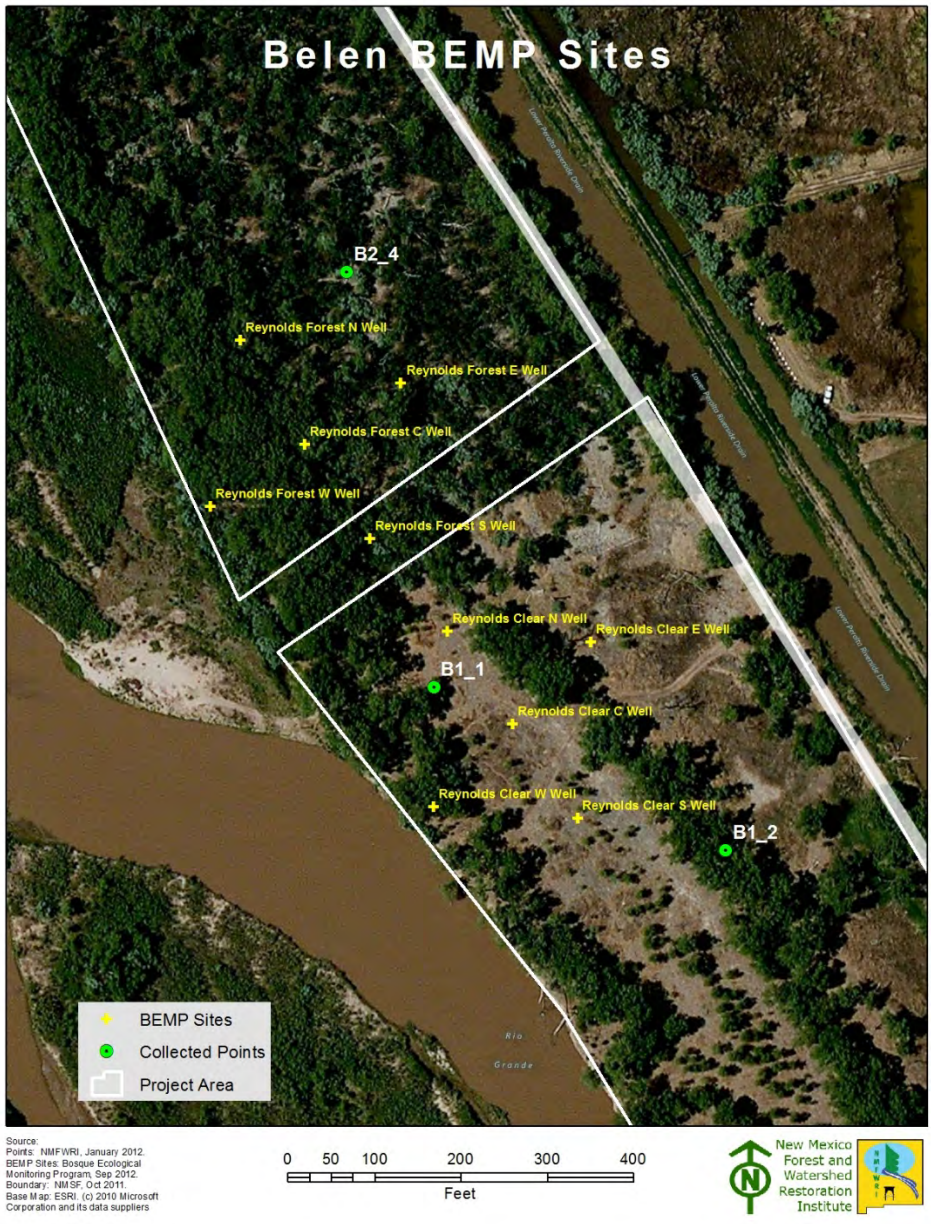


Figure 4. BEMP sites present on Belen

Belen Projects

Belen projects 1, 2, 3 and 4 are located on state/Middle Rio Grande Conservancy District (MRCGD) property between the Rio Grande and the Lower Peralta Riverside Drain east of Belen in Valencia County, NM.

The nearby city of Los Lunas receives an average of 9.75 inches of precipitation annually. The average high temperature is 94 degrees in July, and the average low is 18 in December and January (U.S. Climate Data, 2017). According to the NRCS Web Soil Survey, the four project areas are comprised of <1% Riverwash (in Belen 1 and Belen 2) and the remainder Mixed alluvial land. Ecological sites within this project include R042XA055NM Salty Bottomland (USDA NRCS, 2016).

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

Pre-treatment monitoring was conducted at these sites on January 12, 2012 and February 7, 2012 as part of a restoration project non-native phreatophytes scheduled for 2011-2012. Post-treatment monitoring was conducted November 18, 2016, December 8, 2016, and December 16, 2016. All sites are located east of the Rio Grande and west of the Lower Peralta Riverside Drain. Sites 1, 2 and 3 are adjacent to one another; site 4 is approximately 0.4 miles north. The project was sponsored by the VSWCD. Restoration goals include enhancing wildlife and removing nonnative woody invasives. A fifth 2011 site, Belen 5, is approximately 0.5 north of Belen 4; this site was not monitored, as treatment began on the site before pre-treatment monitoring had been conducted.

Bosque Fires

In 2019 the Iron Works fire occurred in the town of Belen, burning 138-acres of the bosque and adjacent land. The fire started on private land via the dumping of hot ash and quickly spread due to spring winds. In 2022 The Big Hole fire ignited in the footprint of the Iron Works fire and burned 892-acres along the bosque. 41% of our project boundaries were burned in the Big Hole Fire and the damage is evident in Appendix V.

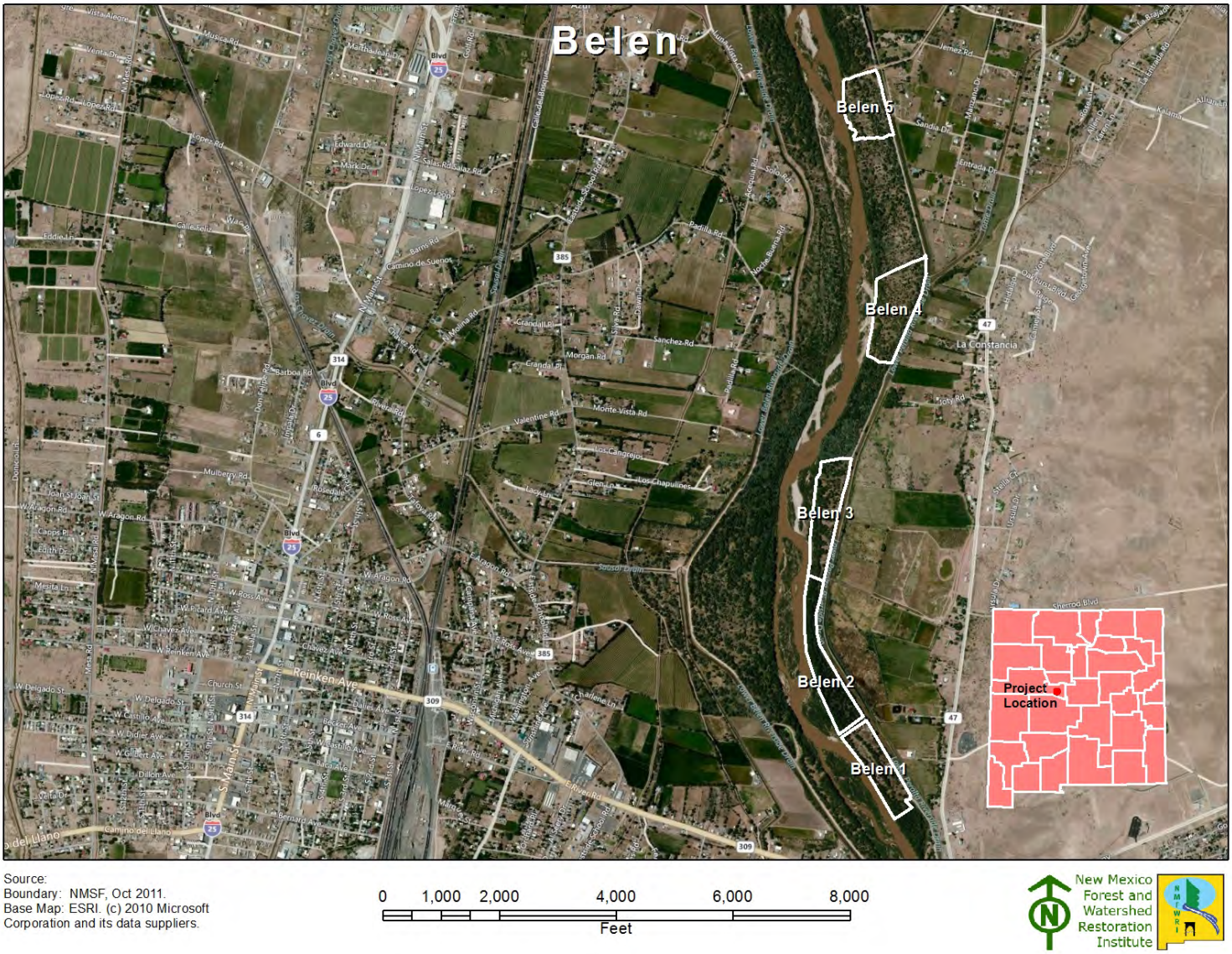


Figure 5. Belen projects in geographic

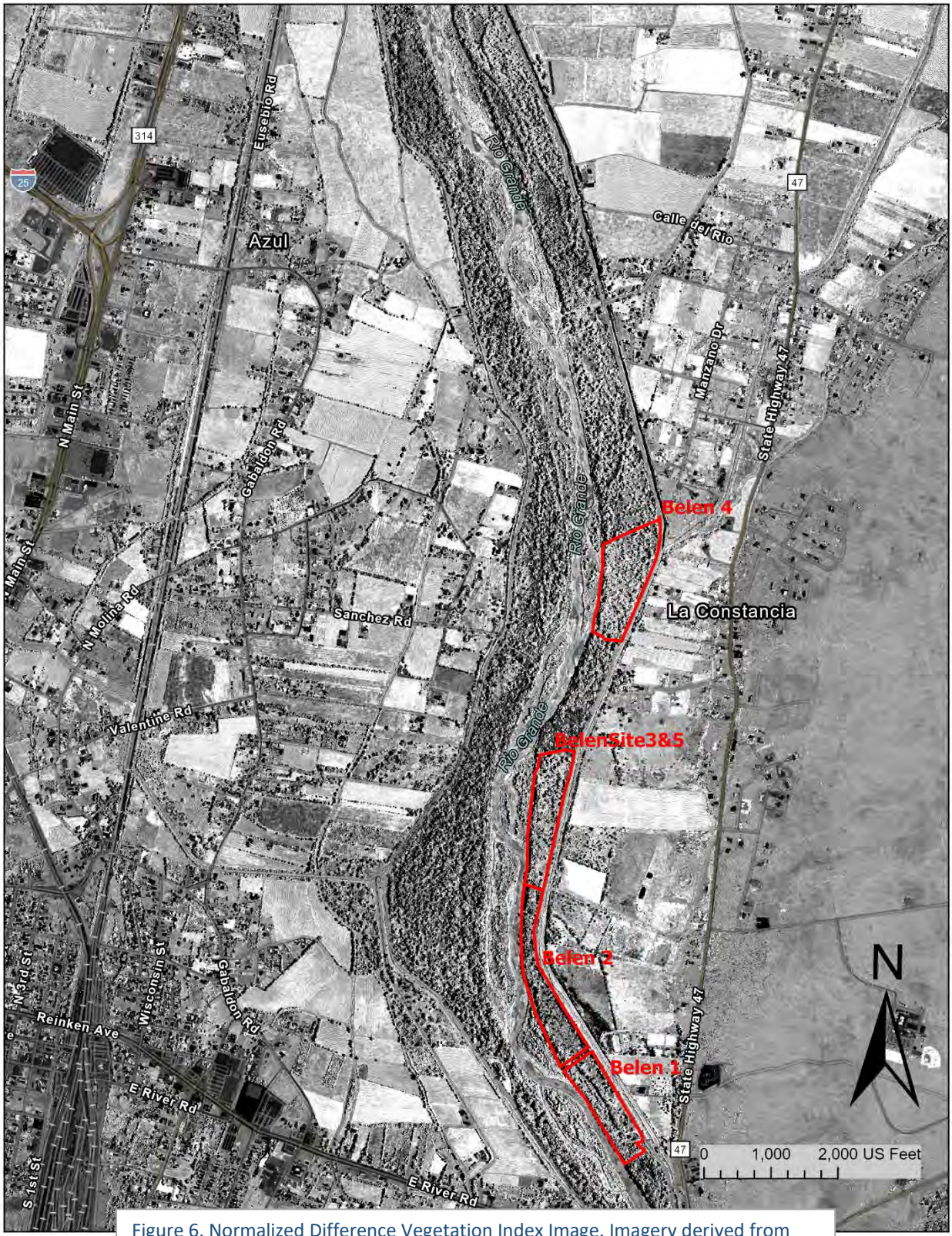


Figure 6. Normalized Difference Vegetation Index Image. Imagery derived from 2018 NAIP imagery. Belen project boundaries marked in red. Lighter whites represent more vegetation. Darker areas are areas absorbing light, such as water.

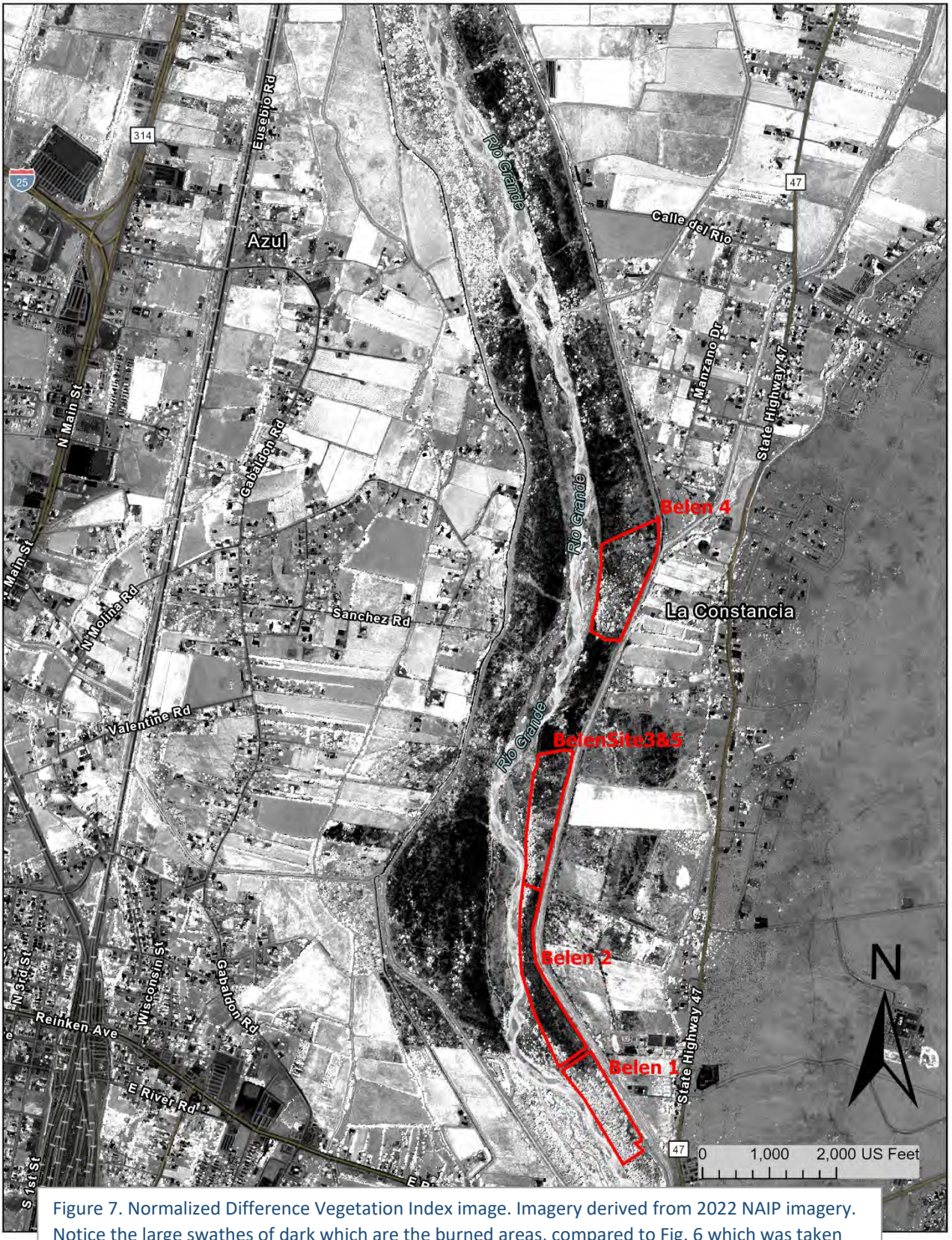


Figure 7. Normalized Difference Vegetation Index image. Imagery derived from 2022 NAIP imagery. Notice the large swathes of dark which are the burned areas, compared to Fig. 6 which was taken prior to the major fires.

Belen 1

Site Summary

2012 Belen 1 Site observations: The project area is moderately to heavily wooded, with a light to moderately dense, multi-tiered understory. It had been treated in the mid-2000s. Much of the area consists of grassy openings. Since monitoring was done so late in the fall, sparse forb and grasses cover may be attributed to seasonal dormancy. The plots were assessed to fall in Hink & Ohmart Structure Classes 1, 2, and 6.

2016 Belen 1 Site observations: This project had several open areas supporting yerba mansa communities. The southern boundary was clearly marked by a solid wall of salt cedar. Resprouts of target species (salt cedar, Russian olive, Siberian elm) were observed on plots 2, 5 and 6. The plots were assessed to fall in Hink and Ohmart Structure classes 3 and 4.

2023 Belen 1 Site Observations: The project site was not involved in the recent fire and was thick with understory vegetation. This site recorded the highest tree species diversity, which included the native *F. neomexicana*.

Belen_1 2012 & 2023

Observed plant species

11.11 Belen 1						
Vegetation Type/Yea	2011		2016		2022	
Graminoids	*Sporobolus wrightii*	*Giant Sacaton*	*Sporobolus wrightii* *Sporobolus airoides* *Muhlenbergia asperifolia*	*Giant Sacaton* *Alkali Sacaton* *Scratchgrass*	*Sporobolus wrightii* *Sporobolus airoides* *Echinochloa spp* *Elymus elymoides* *Distichlis spicata*	*Giant Sacaton* *Alkali Sacaton* *Cockspur* *Squirreltail* *Saltgrass*
Forbs	*Anemopsis californica* *Salsola spp*	*Yerba Mansa* *Russian Thistle*	*Anemopsis californica* *Salsola spp* *Bassia prostrata* *Helianthus annuus L.* *Chenopodium album L.* *Conyza canadensis* *Aster sp.*	*Yerba Mansa* *Russian Thistle* *Kochia* *Annual sunflower* *Lambsquarters* *Marestail* *Aster*	*Anemopsis californica* *Salsola spp* *Bassia prostrata* *Helianthus annuus L.*	*Yerba Mansa* *Russian Thistle* *Kochia* *Annual sunflower*
Cactus						
Shrubs					*Salix exigua* *Baccharis salicina* *X*	*Coyote Willow* *Seepwillow* *Unknown 1*
Trees	*Forestiera neomexicana* *Populus deltoides wiz.* *Tamarix ramosissima* *Elaeagnus angustifolia* *Salix gooddingii*	*New Mexico Olive* *Rio Grande Cottonwood* *Salt Cedar* *Russian Olive* *Goodding's Willow*	*Forestiera neomexicana* *Populus deltoides wiz.* *Tamarix ramosissima* *Elaeagnus angustifolia* *Salix gooddingii* *Ulmus pumila*	*New Mexico Olive* *Rio Grande Cottonwood* *Tamarisk* *Russian Olive* *Goodding's Willow* *Siberian Elm*	*Forestiera neomexicana* *Populus deltoides wiz.* *Tamarix ramosissima* *Ulmus pumila* *Forestiera pubescens*	*New Mexico Olive* *Rio Grande Cottonwood* *Tamarisk* *Siberian Elm* *Desert Olive*

The majority of the “new” plants observed in 2016 were native species, although kochia and Siberian elm also joined the mix. The target species found in 2012, Russian olive and salt cedar, were still present in 2016, as 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.

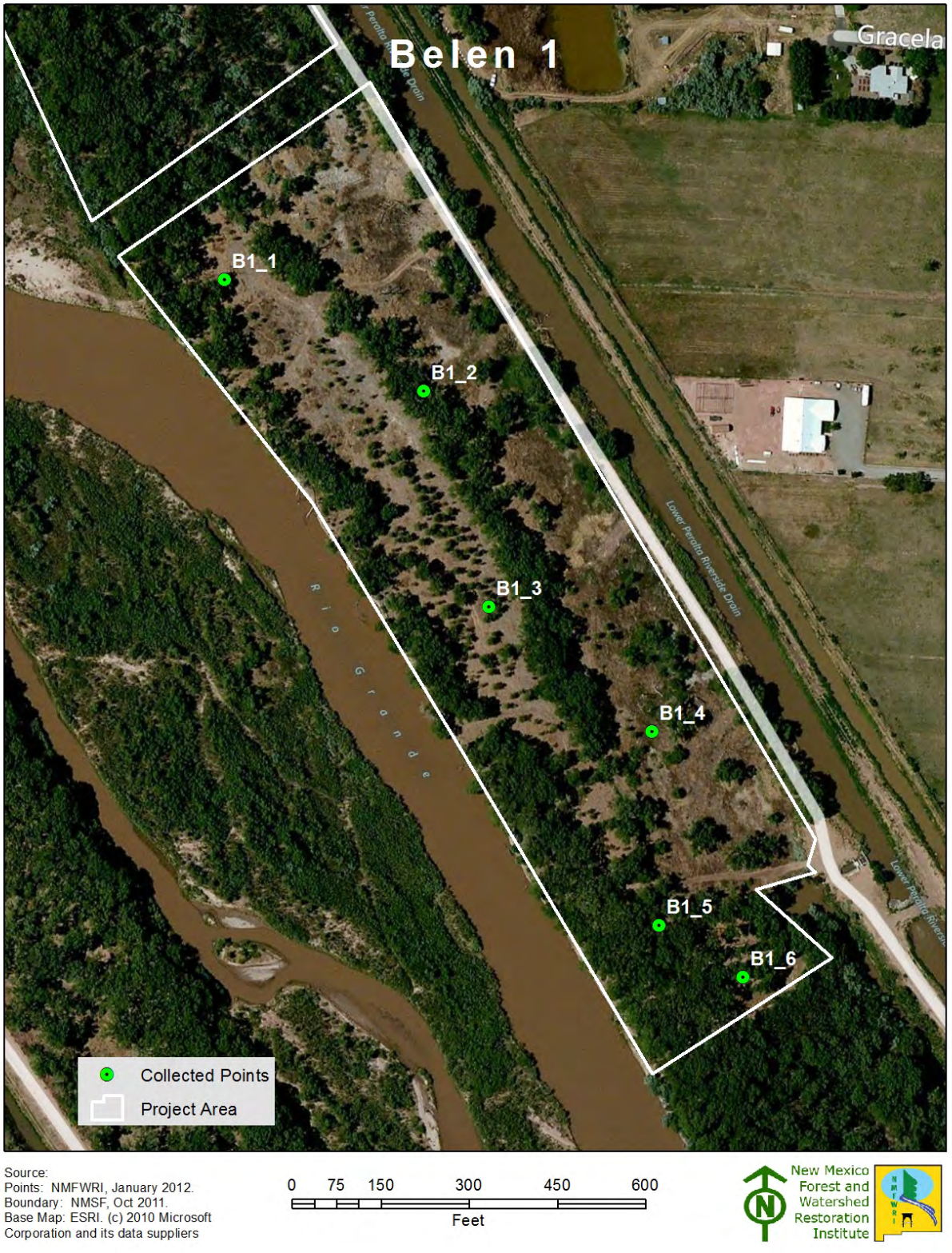


Figure 8. Belen 1 plots.

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 using Trees Per Acre (TPA) and basal density Basal Area Per Acre (BA/AC). Of note is the high density of native *F. neomexicana.*

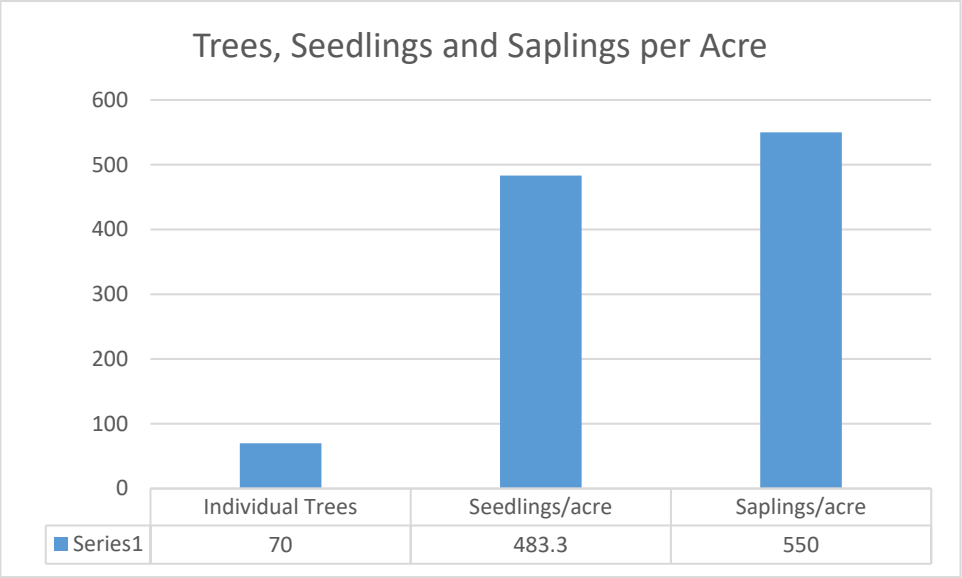


Figure 9. Displays average individual trees, seedlings and saplings, for the entire project.

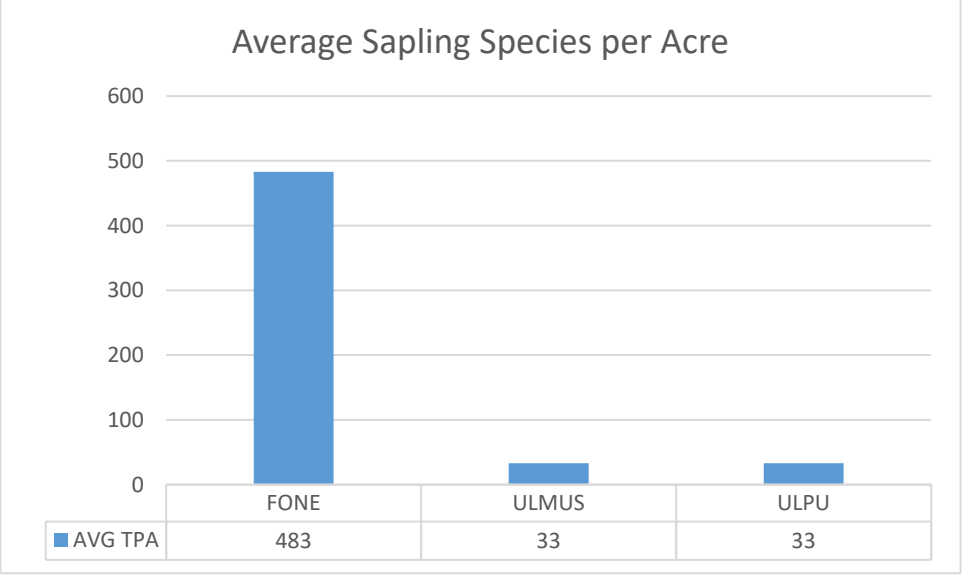


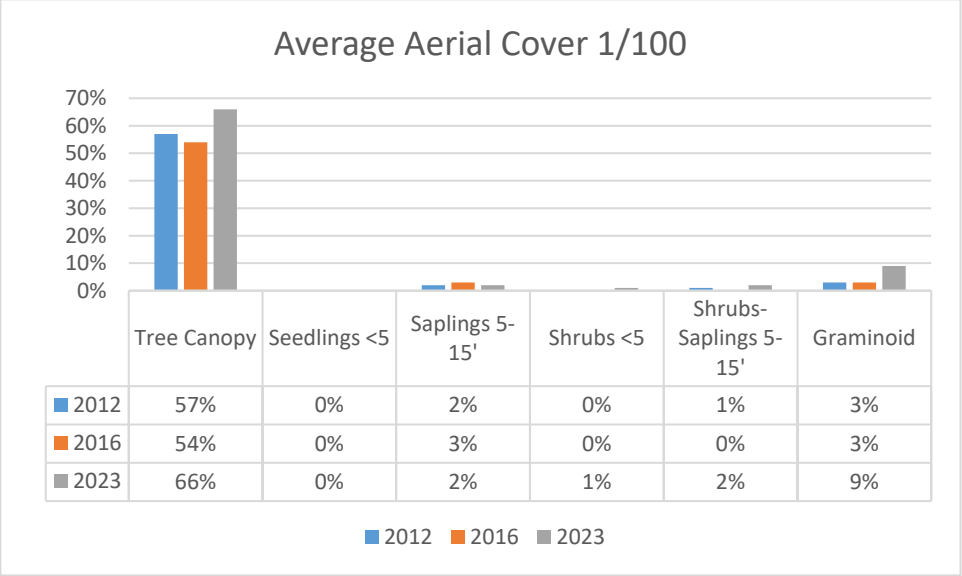
Figure 10. Displays average saplings per acre for the entire project separated by species.

Belen 1 11.15			**December 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
11.11_1	6	6		60	52.90
11.11_2	7	7		70	166.40
11.11_3	10	10		100	39.38
11.11_4	1	1		10	3.67
11.11_5	16	16		160	214.00
11.11_6	3	2		20	48.17
Total	**Total number of sample trees on plot**	**Number of growing stock sample trees on plot**	**Average for all Plots**		
			TPA	**BA/AC**	
	43.00	**42.00**	**70.00**	**87.42**	

Table 1. Displays the Stand Table summaries for each plot within the project. Stand tables are used by foresters to interpret tree data in an understandable format.

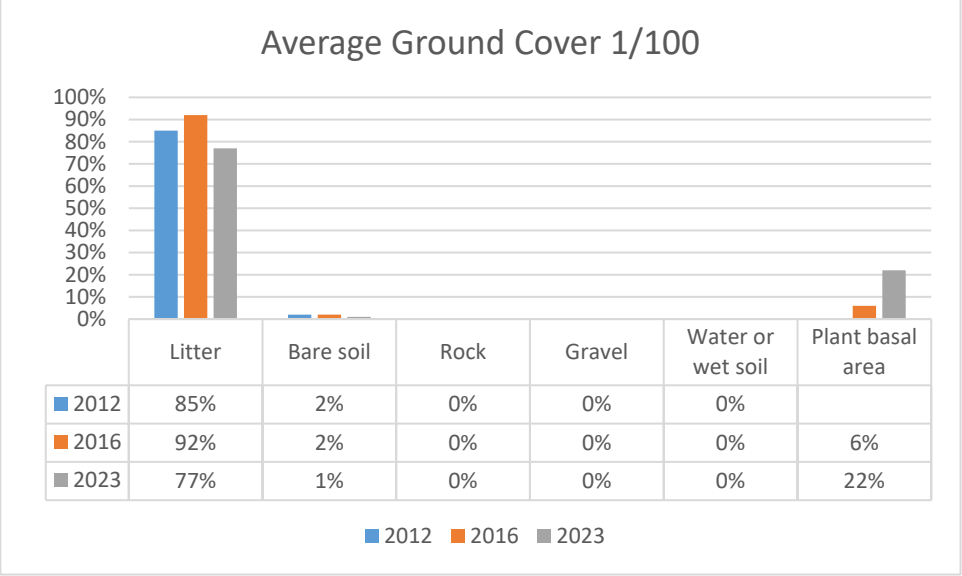
Understory and Bosque Floor Components

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 increase in tree canopy and graminoid cover and reduction in litter cover.



	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid
2012	57%	0%	2%	0%	1%	3%
2016	54%	0%	3%	0%	0%	3%
2023	66%	0%	2%	1%	2%	9%

Figure 11. Displays the average aerial cover for the entire project.



	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	85%	2%	0%	0%	0%	
2016	92%	2%	0%	0%	0%	6%
2023	77%	1%	0%	0%	0%	22%

Figure 12. Displays the average aerial cover for the entire

Project: Valencia SWCD **Project Unit**: Belen 1 **Plot**: 11.11_1

11.11_1 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	48%	1%	0%	0%	2%	0%	3%
2016	38%	0%	0%	0%	0%	5%	15%
2023	59%	0%	0%	7%	0%	40%	3%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	95%	2%	0%	0%	0%	
2016	95%	4%	0%	0%	0%	1%
2023	90%	1%	0%	0%	0%	9%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 4 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: None.

2016 Comments: BEMP plots visible on-site.

2023 Comments: Open grassy area with scattered charred cottonwood snags, cottonwoods to the east, dense sunflowers to the north, and a thick layer of litter all around.

Project: Valencia SWCD **Project Unit**: Belen 1 **Plot**: 11.11_2

11.11_2 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	79%	0%	0%	0%	0%	0%	10%
2016	76%	0%	10%	0%	0%	5%	5%
2023	86%	1%	0%	0%	15%	0%	0%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	89%	1%	0%	0%	0%	n/a
2016	90%	0%	0%	0%	0%	10%
2023	80%	0%	0%	0%	0%	20%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 3 **2016 Modified Hink & Ohmart Type**: 1

2023 Hink & Ohmart Type: 3 **2023 Modified Hink & Ohmart Type:** 5

2012 Comments: None.

2016 Comments: None.

2023 Comments: In the north a canal runs in the background with NM olive and cottonwoods dominating vegetation. Cottonwoods and NM olive also dominate the rest of the area, with some russian olive in the west.

Project: Valencia SWCD **Project Unit**: Belen 1 **Plot**: 11.11_*3*

11.11_3 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2012	59%	0%	5%	0%	0%	0%	2%
2016	56%	0%	0%	0%	0%	0%	5%
2023	76%	0%	10%	0%	0%	0%	0%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2012	96%	2%	0%	0%	0%	n/a
2016	95%	0%	0%	0%	0%	5%
2023	95%	0%	0%	0%	0%	5%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 3 **2023 Modified Hink & Ohmart Type:** 5

2012 Comments: large down woody debris; masticated & mulched material present

2016 Comments: open plot, near road

2023 Comments: Open cottonwood canopy with an understory of kochia, sunflowers, and thick leaf litter.

Project: Valencia SWCD **Project Unit**: Belen 1 **Plot**: 11.11_4

11.11_4 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2012	26%	0%	0%	0%	0%	0%	95%
2016	12%	0%	5%	0%	0%	0%	75%
2023	31%	0%	0%	0%	0%	15%	10%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2012	5%	0%	0%	0%	0%	n/a
2016	90%	0%	0%	0%	0%	10%
2023	5%	0%	0%	0%	0%	95%

2012 Hink & Ohmart Type: 2/6

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 6 **2023 Modified Hink & Ohmart Type:** 6H

2012 Comments: None.

2016 Comments: Abundant circles of yerba mansa.

2023 Comments: Dense yerba mansa and grass, with a dirt pile covered in kochia with road in background to the west, elms to the south.

Project: Valencia SWCD **Project Unit**: Belen 1 **Plot**: B1_5

11.11_5 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2012	85%	0%	0%	2%	8%	5%	3%
2016	78%	0%	5%	0%	0%	0%	0%
2023	95%	0%	5%	0%	0%	0%	0%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2012	91%	1%	0%	0%	0%	n/a
2016	95%	0%	0%	0%	0%	5%
2023	92%	3%	0%	0%	0%	5%

2012 Hink & Ohmart Type: 1

2016 Hink & Ohmart Type: 3 **2016 Modified Hink & Ohmart Type**: 1

2023 Hink & Ohmart Type: 3 **2023 Modified Hink & Ohmart Type:** 1

2012 Comments: None.

2016 Comments: BEMP pipes on plots; lots of leaf litter.

2023 Comments: PC moved one chain on an azimuth of 260.

Project: Valencia SWCD **Project Unit**: Belen 1 **Plot**: 11.11_6

11.11_6 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	63%	0%	0%	0%	0%	8%	3%
2016	62%	0%	0%	0%	0%	10%	10%
2023	48%	0%	0%	0%	0%	2%	3%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	89%	0%	0%	0%	0%	n/a
2016	85%	10%	0%	0%	0%	5%
2023	99%	0%	0%	0%	0%	1%

2012 Hink & Ohmart Type: 1/2

2016 Hink & Ohmart Type: 3 **2016 Modified Hink & Ohmart Type**: 6

2023 Hink & Ohmart Type: 2 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: None.

2016 Comments: Old road present but not used recently, except perhaps by ORV for recreation. Wall of tall untreated salt cedar to the southwest of the plot.

2023 Comments: Bunchgrasses and fallen woody debris dominate the understory, with a Russian olive thicket to the west and tamarisk to the north, with mature cottonwoods creating an open canopy. A road runs west of the plot.

Belen 2

Site Summary

2012 Belen 2 Site observations: The project area is densely wooded, with an abundance of fallen trees and tree limbs. No shrubs or herbaceous plants were observed in the understory. The site does not show evidence of having been treated. Jetty jacks, joined by cables, also traverse the site in the vicinity of plot B2_1. Since monitoring was done so late in the fall, lack of forb and grasses cover may be attributed to seasonal dormancy. The dense overstory canopy and large amount of coarse woody debris may also contribute to the sparse understory. The plots were assessed to fall in Hink & Ohmart Structure Class 2.

2016 Belen 2 Site observations: This project area was fairly open, with some cottonwood overstory and very little woody understory. Plots 1 and 2 had lots of down wood debris and cottonwood leaves; plots 3 and 4 had lots of kochia which made travel difficult and/or unpleasant. Jetty jacks are present throughout this project, some mostly buried and others full of limbs and debris. A lack of grass may be related to the seasonality, but more likely has to do with the heavy ground cover by other materials. The plots were assessed to fall in Hink and Ohmart classes 2, 4 and 6.

2022 Belen 2 Site observation: The project site was heavily burned from a recent fire. There was little litter coverage and many of the cottonwoods were resprouting. The site had levee jacks in place and was near to the Rio Grande.

Belen_2 2012-2022

Observed plant species

At least two of the "new" plants observed in 2016 were native species; two or three were exotics including kochia and Siberian elm (the nativity status of reed grass is not clear). The target species found in 2012, Russian olive and salt cedar, were still present in 2016, as resprouts. In both years, identification of forb, grasses and some shrub species were impacted by both the plant identification skills of the monitoring team and by the season.

11.12 Belen 2						
Vegetation Type/Yea	2011		2016		2022	
Graminoids			*Calamagrostis*	*Reedgrass*	*Sporobolus airoides*	*Alkali Sacaton*
					Sporobolus spp	*Sacaton*
					Carex spp	*Sedges*
					Distichlis spicata	*Saltgrass*
Forbs			*Bassia prostrata*	*Kochia*	*Bassia prostrata*	*Kochia*
			Solanum elaeagnifolium	*Silverleaf nightshade*	*Solanum elaeagnifolium*	*Silverleaf nightshade*
					Salsola spp	*Russian Thistle*
Cactus						
Shrubs			*Baccharis salicina*	*Seepwillow*	*Salix exigua*	*Coyote Willow*
					X	*Unknown 1*
Trees	*Elaeagnus angustifolia*	*Russian olive*	*Elaeagnus angustifolia*	*Russian olive*	*Elaeagnus angustifolia*	*Russian olive*
	Populus deltoides	*Rio Grande cottonwood*	*Populus deltoides*	*Rio Grande cottonwood*	*Populus deltoides*	*Rio Grande cottonwood*
	Tamarix ramosissima	*Salt cedar*	*Tamarix ramosissima*	*Salt cedar*	*Tamarix ramosissima*	*Salt cedar*
			Ulmus pumila	*Siberian Elm*	*Salix gooddingii*	*Goodding's Willow*

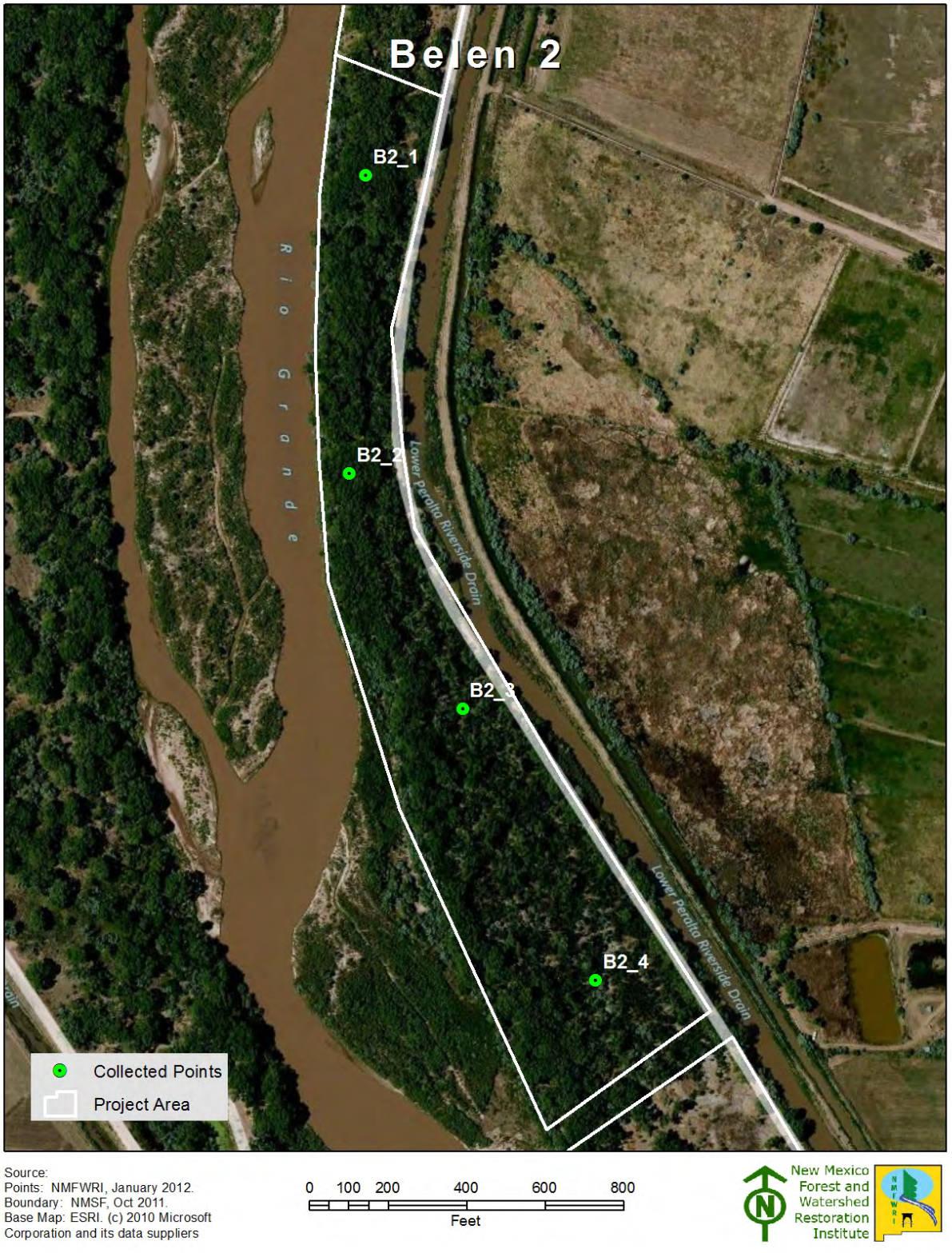


Figure 9. Belen 2 plots.

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 using Trees Per Acre (TPA) and basal density Basal Area Per Acre (BA/AC).

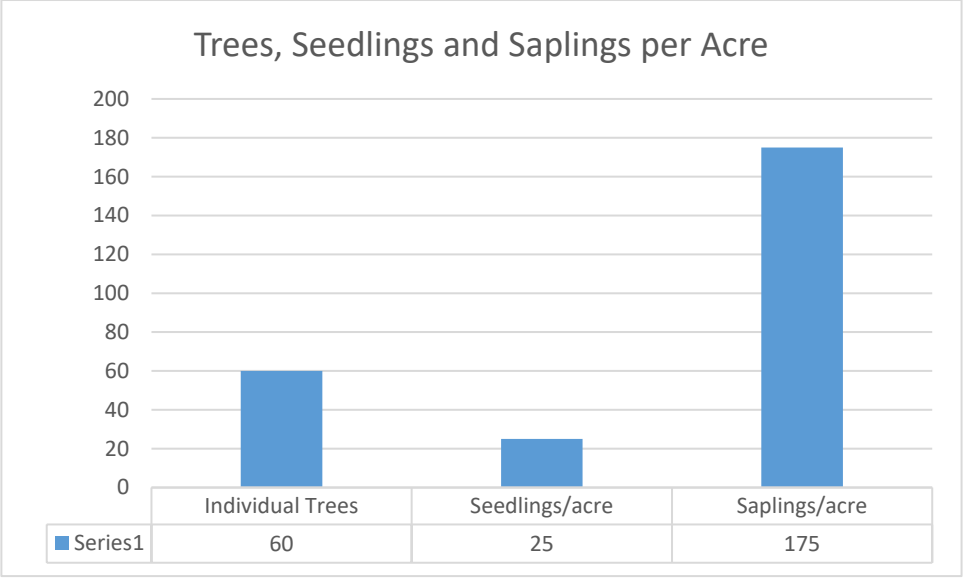


Figure 10. Displays the average trees, seedlings and saplings per acre for the entire project.

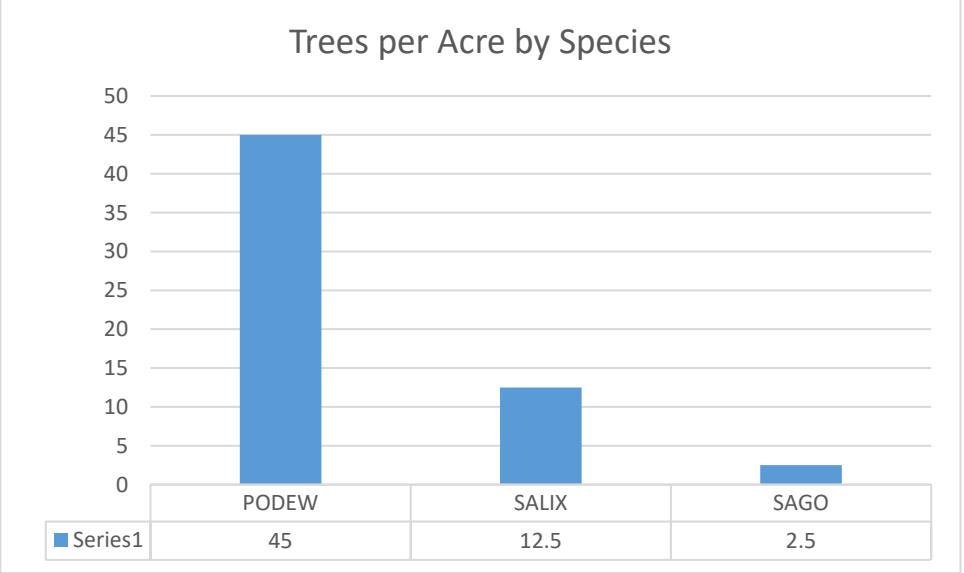


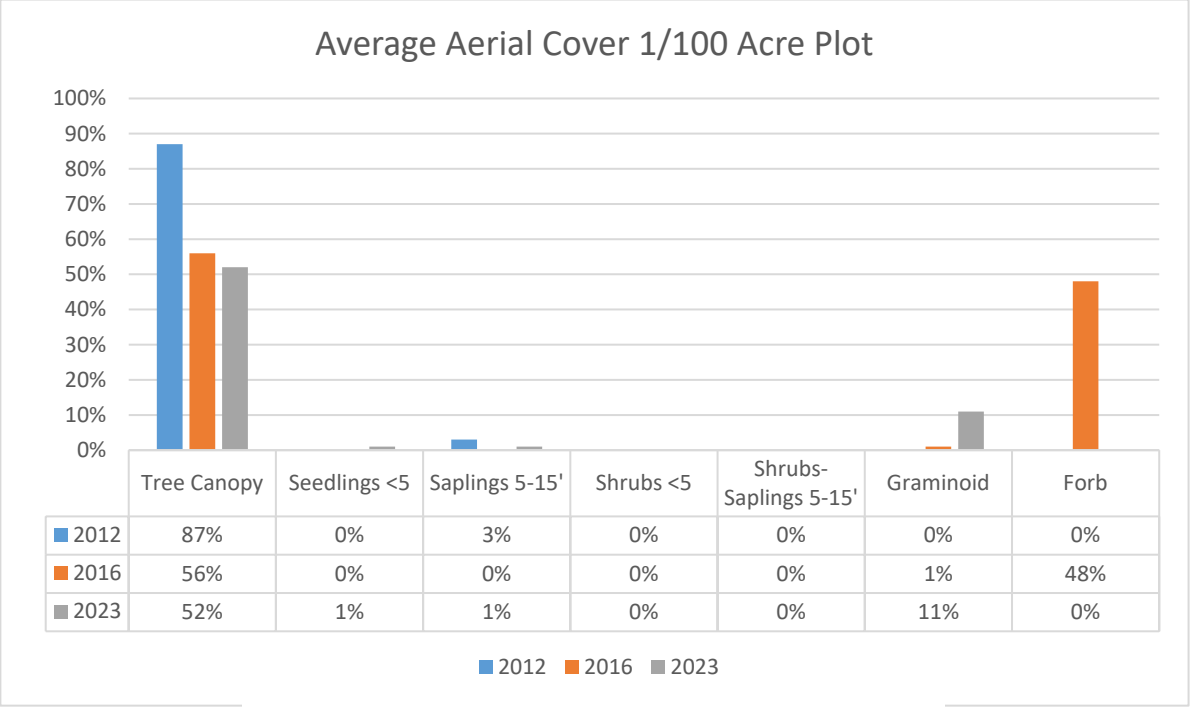
Figure 11. Displays the average trees per acre by species.

11.12 Belen 2				2022/2023
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**
11.12_1	**7**	**7**	**70**	**150.67**
11.12_2	**14**	**14**	**140**	**224.27**
11.12_3	**2**	**2**	**20**	**40.22**
11.12_4	**1**	**1**	**10**	**29.36**
Total	**Total number of sample trees on plot**	**Number of growing stock sample trees on plot**	**Average for all Plots**	
			TPA	**BA/AC**
	24.00	**24.00**	**60.00**	**111.13**

Table 2. Displays the Stand Table summaries for each plot within the project. Stand tables are used by foresters to interpret tree data in an understandable format.

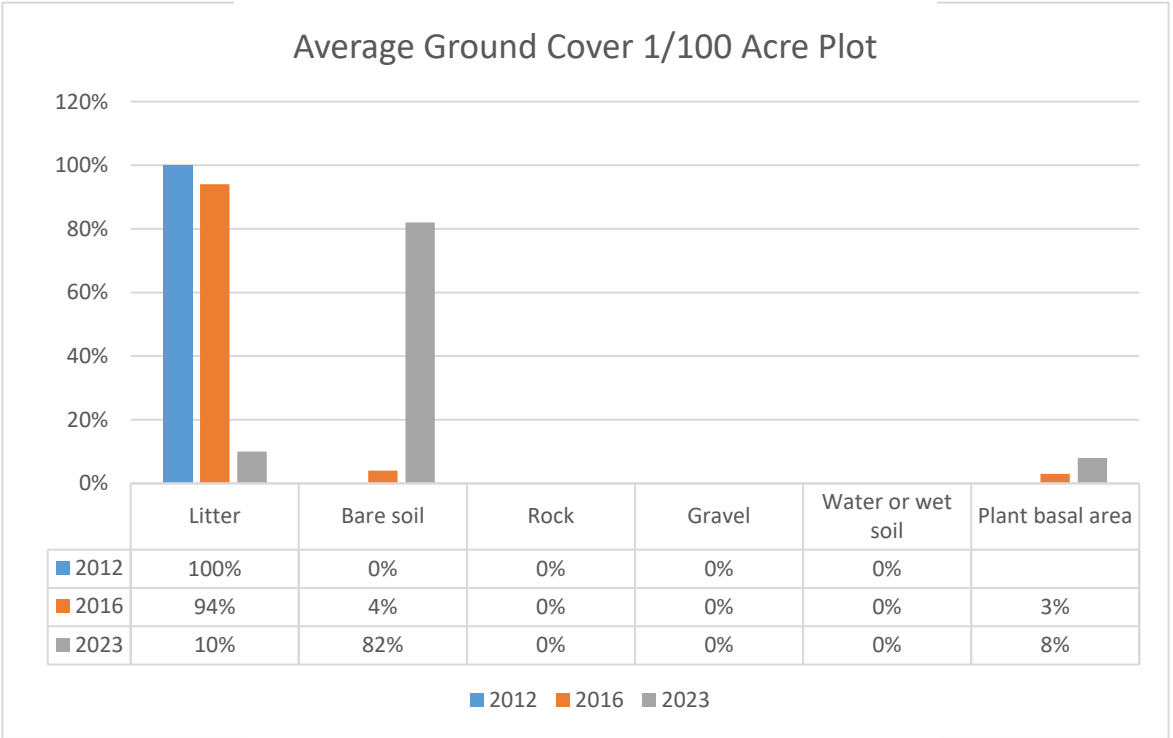
Understory and Bosque Floor Components

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. A big drop in canopy cover was seen between 2012 and 2023. Of note is the appearance and disappearance of forbs. Within the ground cover measurements, litter coverage reduced by a large amount and bare soil increased from 4 to 82% seen in figure 7.



	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	87%	0%	3%	0%	0%	0%	0%
2016	56%	0%	0%	0%	0%	1%	48%
2023	52%	1%	1%	0%	0%	11%	0%

Figure 12. Displays average aerial cover for the entire



	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	100%	0%	0%	0%	0%	
2016	94%	4%	0%	0%	0%	3%
2023	10%	82%	0%	0%	0%	8%

Figure 13. Displays average aerial cover for the entire

Project: Valencia SWCD **Project Unit**: Belen 2 **Plot**: 11.12_1

11.12_1 Aerial & Ground Cover

	Aerial Cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	96%	0%	0%	0%	0%	0%	0%
2016	92%	0%	0%	0%	0%	0%	0%
2023	79%	0%	5%	0%	0%	1%	2%

	Ground Cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	100%	0%	0%	0%	0%	n/a
2016	100%	0%	0%	0%	0%	0%
2023	20%	78%	0%	0%	0%	2%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 2 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 2 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: Heavy down woody debris; jetty jacks present.

2016 Comments: Heavy litter cover with very little vegetation; jetty jacks present, full of branches and wrack.

2023 Comments: Levy jacks and an open understory characterize this site. Cottonwoods and russian olive dominate the canopy and understory of the western side.

***Project**: Valencia SWCD* ***Project Unit**: Belen 2* ***Plot**: 11.12_2*

11.12_2 Aerial & Ground Cover

	Aerial Cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	96%	0%	0%	0%	0%	0%	0%
2016	92%	0%	0%	0%	0%	3%	0%
2023	95%	0%	0%	0%	0%	0%	0%

	Ground Cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	100	0	0	0	0	n/a
2016	95%	5%	0%	0%	0%	1%
2023	15%	85%	0%	0%	0%	0%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 2 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: Heavy down woody debris; jetty jacks present. Densiometer was lost so canopy cover was estimated.

2016 Comments: There appears to be an old trail through the plot; jetty jacks are present but mostly buried. Plot is near the river; there is very little vegetation and lots of cover by woody debris and leaves.

2023 Comments: North, east and south are characterized by charred open terrain with cottonwood, russian olive, and tamarisk resprouts. Very open canopy. To the west is the Rio Grande. The sandhill cranes are wonderful this time of year.

Project: Valencia SWCD **Project Unit**: Belen 2 **Plot**:11.12_3

11.12_3 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	96%	0%	6%	0%	0%	0%	0%
2016	34%	0%	0%	0%	0%	0%	100%
2023	28%	0%	0%	0%	0%	45%	0%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	100%	0%	0%	0%	0%	n/a
2016	95%	0%	0%	0%	0%	5%
2023	1%	69%	0%	0%	0%	30%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 5 **2023 Modified Hink & Ohmart Type:** 5

2012 Comments: Heavy down woody debris; jetty jacks present. Densiometer was lost so canopy cover was estimated. Old hummingbird nest found on-site.

2016 Comments: This plot was covered in 6-foot-tall kochia and heavy down woody debris (cottonwoods). Finding flags for plot, and even walking through the plot, was difficult.

2023 Comments: Open cottonwood canopy with many burned cottonwoods and willow. Silverleaf nightshade and saltgrass grow in dense patches.

Project: Valencia SWCD **Project Unit**: Belen 2 **Plot**: 11.12_4

11.12_4 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	60%	0%	6%	0%	0%	0%	0%
2016	6%	0%	0%	0%	0%	0%	90%
2023	8%	5%	0%	0%	0%	0%	0%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	99%	1%	0%	0%	0%	n/a
2016	85%	10%	0%	0%	0%	5%
2023	3%	96%	0%	0%	0%	1%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4/6

2016 Modified Hink & Ohmart Type: 6H

2023 Hink & Ohmart Type: 6

2023 Modified Hink & Ohmart Type: 6H

2012 Comments: Heavy down woody debris; jetty jacks present. Densiometer was lost so canopy cover was estimated. Cottonwood snags present.

2016 Comments: Russian olive slash present on-site; one crew member got Russian olive thorns in his foot through the sole of his boot. The plot was covered in kochia plants 2-4 feet tall; difficult walking.

2023 Comments: Open bare ground with many young cottonwood trees resprouting. Burned russian olive and tamarisk trees in the east and west respectively.

Belen 3

Site Summary

2012 Belen 3 Site Observations: The project area is moderately wooded, with a light multi-tiered to mostly open, understory. Wetland areas exist in the northern portion of the project area. It had been treated in the mid-2000s. Much of the area consists of grassy openings. Since monitoring was done so late in the fall, sparse forb and grasses cover may be attributed to seasonal dormancy. The plots were assessed to fall in Hink & Ohmart Structure Classes 1, 2, and 3.

2016 Belen 3 Site Observations: This project has a relatively open cottonwood overstory, with many small to midsized Russian olives, as well as a variety of grasses, in the understory. Yerba mansa is also present in the vicinity of plot 3. The plots were assessed to fall into Hink and Ohmart class 4.

2023 Belen 3 Site Observations: The site was very burned from a recent fire and many of the cottonwoods had resprouts around their bases but many are not expected to live long. The site was otherwise open. Without foliage it was difficult to tell whether the cottonwood's canopy's were charred in the fire.

Belen_3 2012-2023

Observed plant species

11.10 Belen 3						
Vegetation Type/Yea	2011		2016		2022	
Graminoids	Juncus spp	Rushes	Juncus spp	Rushes	Sporobolus airoides	Alkali sacaton
	Sporobolus wrightii	Giant Sacaton	Sporobolus airoides	Alkali sacaton	Distichlis spicata	Saltgrass
	Carex spp	Sedges	Elymus elymoides	Squirreltail		
			Elymus canadensis L.	Canada wild rye		
			Muhlenbergia asperifoli	Scratchgrass		
			Panicum obtusum	Vine mesquite		
Forbs	Anemopsis californica	Yerba Mansa	Anemopsis californica	Yerba Mansa	Anemopsis californic	Yerba Mansa
	Opuntia spp	Prickly Pear	Opuntia spp	Prickly Pear	Bassia prostrata	Kochia
	Melilotus sp.	Yellow sweetclover	Chenopodium album L.	Lambsquarters	X	Unknown
			Conyza canadensis	Marestail		
			Equisetum sp.	Horsetail		
			Gaura parviflora	Velvetweed		
			Lappula occidentalis	Western Sticktight		
			Solanum elaeagnifolium	Silverleaf nightshade		
			Aster sp.	Aster		
			X	Unknown thistle		
			X	Unknown		
Cactus						
Shrubs	Salix exigua	Coyote Willow	Ribes spp	Gooseberry	Salix exigua	Coyote Willow
	Baccharis salicifolia	Seepwillow			Lycium spp	Wolfberry
Trees	Elaeagnus angustifolia	Russian olive	Elaeagnus angustifolia	Russian olive	Elaeagnus angustifol	Russian olive
	Populus deltoides	Rio Grande cottonwood	Populus deltoides	Rio Grande cottonwood	Populus deltoides	Rio Grande cottonwood
	Tamarix ramosissima	Salt cedar			Populus angustifolia	Rio Grande cottonwood

All 13 of the “new” plants identified in 2016 were additional native species; two species were found, including a thistle, which could not be identified. The 2012 target species found on plot, Russian olive and salt cedar, saw mixed results: salt cedar was not observed in 2016, but Russian olive resprouts were. 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. In 2023 identification was limited due to the time of year. Less forbs were observed on the project possibly due to a recent fire.

Figure 14. Belen 3 plots.

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 using Trees Per Acre (TPA) and basal density Basal Area Per Acre (BA/AC). Many of the trees were charred or completely burned.

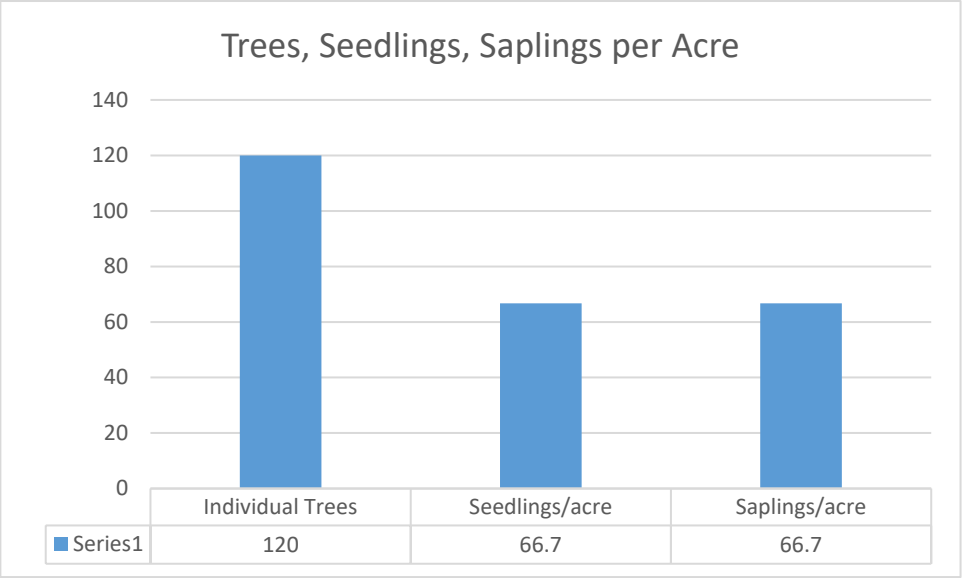


Figure 15. Displays the averages for Individual tree, seedling and saplings for the entire project

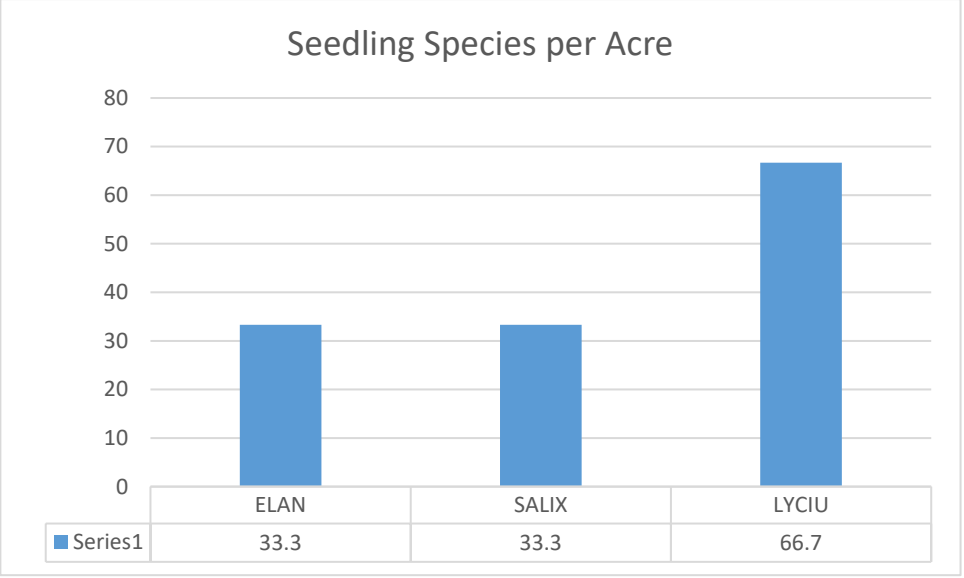


Figure 16. Displays the average seeding density for the entire project, by species.

11.10 Belen 3			January 2023	
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**
11.10_1	0	0	0	0.00
11.10_2	20	20	200	230.79
11.10_3	16	16	160	291.36
Total	**Total number of sample trees on plot**	**Number of growing stock sample trees on plot**	**Average for all Plots**	
			TPA	**BA/AC**
	36.00	36.00	120.00	174.05

Table 3. Displays the Stand Table summaries for each plot

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 litter cover and increase in bare soil, this is probably due to the recent burn that took place, eliminating much of the litter.

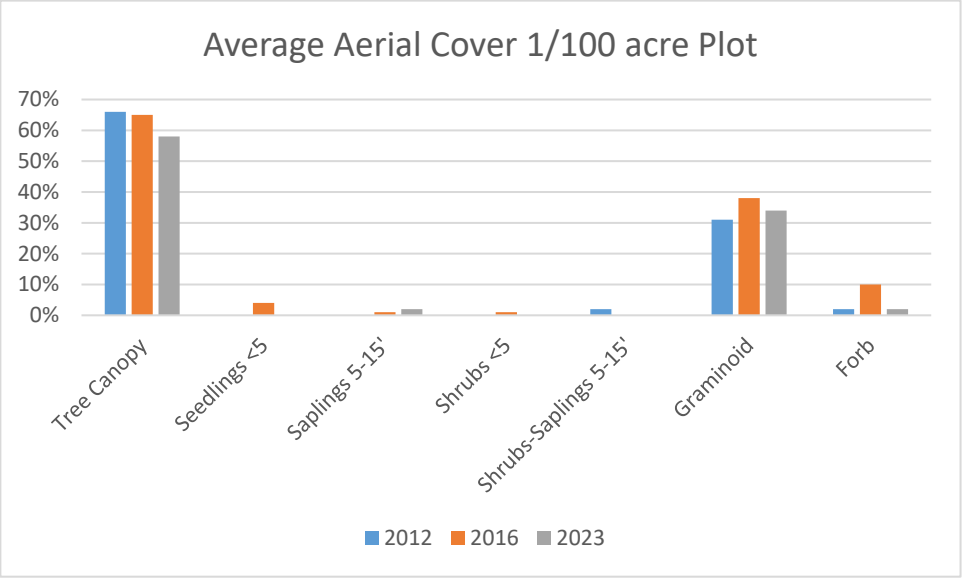


Figure 17. Displays the average aerial cover for the entire project

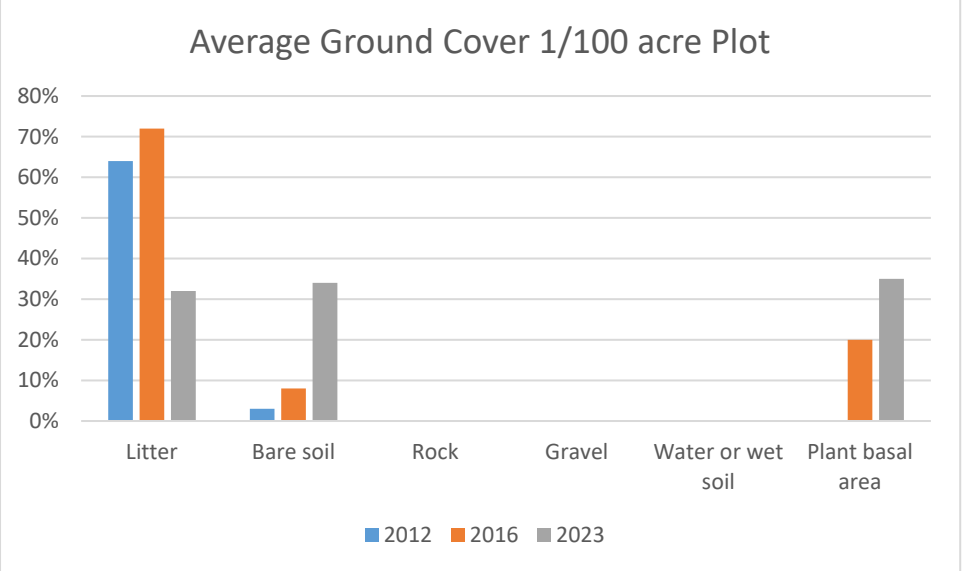


Figure 18. Displays the average ground cover for the entire project

Project: Valencia SWCD **Project Unit**: Belen 3 **Plot**: 11.10_1

11.10_1 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	10%	0%	0%	0%	5%	87%	5%
2016	56%	2%	3%	3%	0%	80%	10%
2023	8%	1%	0%	1%	0%	95%	5%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	8%	0%	0%	0%	0%	n/a
2016	75%	0%	0%	0%	0%	25%
2023	2%	0%	0%	0%	0%	98%

2012 Hink & Ohmart Type: 2/3

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2/6W

2023 Hink & Ohmart Type: 6 **2023 Modified Hink & Ohmart Type:** 6H

2012 Comments: Transition area between Hink & Ohmart types 2 and 3; wetland area; gophers present.

2016 Comments: None.

2023 Comments: The north and east side have dense russian olive with open grassy areas between thickets. Otherwise, the site is open and grassy with cottonwoods and russian olive scattered. Alkali sacaton resides in the empty open spaces between trees.

Project: Valencia SWCD **Project Unit**: Belen 3 **Plot**: 11.10_2

11.10_2 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2012	95%	0%	0%	0%	0%	1%	1%
2016	68%	10%	0%	0%	0%	15%	15%
2023	85%	0%	5%	0%	0%	3%	0%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2012	91%	7%	0%	0%	0%	n/a
2016	60%	10%	0%	0%	0%	30%
2023	25%	72%	0%	0%	0%	3%

2012 Hink & Ohmart Type: 1

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 3 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: Porcupine sign; old beaver sign.

2016 Comments: Old beaver sign (large stumps) on plot; lots of down woody debris.

2023 Comments: Open canopy with russian olive sitting underneath cottonwoods, with sporobolus in the understory. To the west is an open grassy embankment, and the Rio Grande beyond.

***Project**: Valencia SWCD* ***Project Unit**: Belen 3* ***Plot**: 11.10_3*

11.10_3 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	93%	0%	0%	0%	0%	4%	0%
2016	72%	0%	0%	1%	0%	20%	5%
2023	80%	0%	0%	0%	0%	3%	1%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	94%	2%	0%	0%	0%	n/a
2016	80%	15%	0%	0%	0%	5%
2023	70%	30%	0%	0%	0%	3%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 2 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: Very open understory.

2016 Comments: This is the nearest plot to the river; also near the road. This site has lots of bare ground and trash.

2023 Comments: Open terrain, with a forked cottonwood to the north and a patch of russian thistle to the east. There is a dirt mound to the south and the Rio Grande to the west?

Belen 4

Site Summary

2012 Belen 4 Site Observations: The project area is moderately to lightly wooded, with a light multi-tiered to mostly open, understory. Wetland areas exist in the northern portion of the project area. It had been treated in the mid-2000s. Much of the area consists of grassy openings and scattered trees and shrubs. The soil is moist in some areas. Portions of the area are sandy with hummocks and salt on the surface. There is evidence of possible historic stream channels. Since monitoring was done so late in the fall, sparse forb and grasses cover may be attributed to seasonal dormancy. The plots were assessed to fall in Hink & Ohmart Structure Classes 2, 5, and 6.

2016 Belen 4 Site Observations: This project has a tall cottonwood overstory with a more open understory, although tall grasses have become a noticeable part of the community. Jetty jacks were found on plots 1 and 3. Otherwise bare areas are covered in cottonwood duff. Plots were assessed to fall into Hink and Ohmart class 4.

2023 Belen 4 Site Observations: The project area was open and grassy between scattered cottonwoods and levee jacks. Wolfberry and phragmites were in the understory in plot 1. Living and burned cottonwoods and tamarisk were scattered across the plot making the canopy open, with kochia and bunchgrasses constituting the understory in plot 2. Open grassy terrain with charred logs and trees in Plot 3. There were also tamarisk re-sprouts on the east side of the plot. Levee jacks were present on the south side and a stand of cottonwoods with a grassy understory in the west.

Belen_4 2012-2023
Observed plant species

11.13 Belen 4						
Vegetation Type/Yec	2011		2016		2022	
Graminoids	*Muhlenbergia repens*	*Creeping muhly*	*Muhlenbergia repens*	*Creeping muhly*	*Phragmites australis*	*Common reed*
	Panicum obtusum	*Vine mesquite*	*Panicum obtusum*	*Vine mesquite*	*Sporobolus airoides*	*Alkali sacaton*
	Sporobolus flexuosus	*Mesa dropseed*			*Distichlis spicata*	*Saltgrass*
	Sporobolus giganteus	*Giant dropseed*				
Forbs	*Artemisia ludoviciana*	*White sagebrush*	*Bassia prostrata*	*Kochia*	*Bassia prostrata*	*Kochia*
	Helianthus annuus L.	*Annual sunflower*	*Ambrosia artemisiifolia*	*Ragweed*	*Apocynum*	*Dogsbane*
			Anemopsis californica	*Yerba mansa*	*X*	*Unknown 1*
			Conyza canadensis	*Marestail*		
			Yucca sp.	*Yucca*		
				Unknown fabaceae		
Cactus						
Shrubs	*Lycium spp*	*Wolfberry*	*Lycium spp*	*Wolfberry*	*Lycium spp*	*Wolfberry*
	Forestiera neomexicana	*New Mexico Olive*	*Baccharis spp*	*Seepwillow*		
	Prosopis pubescens	*Screwbean Mesquite*				
Trees	*Elaeagnus angustifolia*	*Russian olive*	*Elaeagnus angustifolia*	*Russian olive*	*Elaeagnus angustifolia*	*Russian olive*
	Populus deltoides	*Rio Grande cottonwood*	*Populus deltoides*	*Rio Grande cottonwood*	*Populus deltoides*	*Rio Grande cottonwood*
	Tamarix ramosissima	*Salt cedar*	*Tamarix ramosissima*	*Salt cedar*	*Tamarix ramosissima*	*Salt cedar*
			Salix gooddingii	*Black willow*		

The majority of the “new” plants identified in 2016 were additional native species; kochia and ravennagrass also joined the community as exotics, although it is likely ravennagrass was simplify misidentified in 2012. One species was not identified. The 2012 target species found on plot, Russian olive and salt cedar, were both still present post-treatment as 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. In 2023 there were less forbs and shrubs encounter, possibly due to the recent fire in the area. The persistence of exotic species such as *E. angustifolia* and *T. ramosissima* were noted and their average trees per acre calculation was 400 and 233 respectively.

Figure 19. Belen 4 plots.

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 using Trees Per Acre (TPA) and basal density Basal Area Per Acre (BA/AC). The high density of seedlings might be the result of the burn. Resprouts of *P. deltoids sbp. Wislizeni* and *Salix spp.* were observed throughout the project.

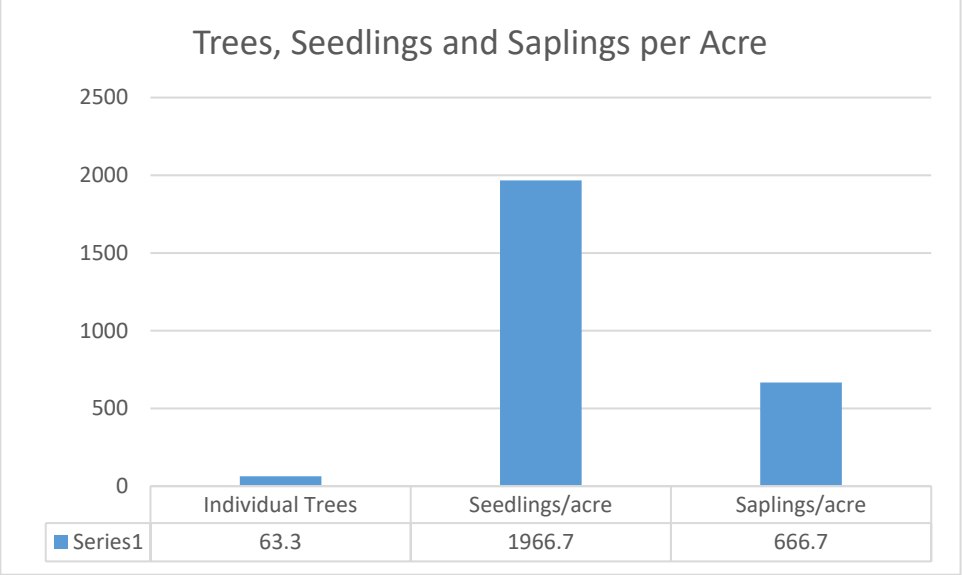


Figure 20. Displays the average trees, seedlings and saplings per acre for the entire project

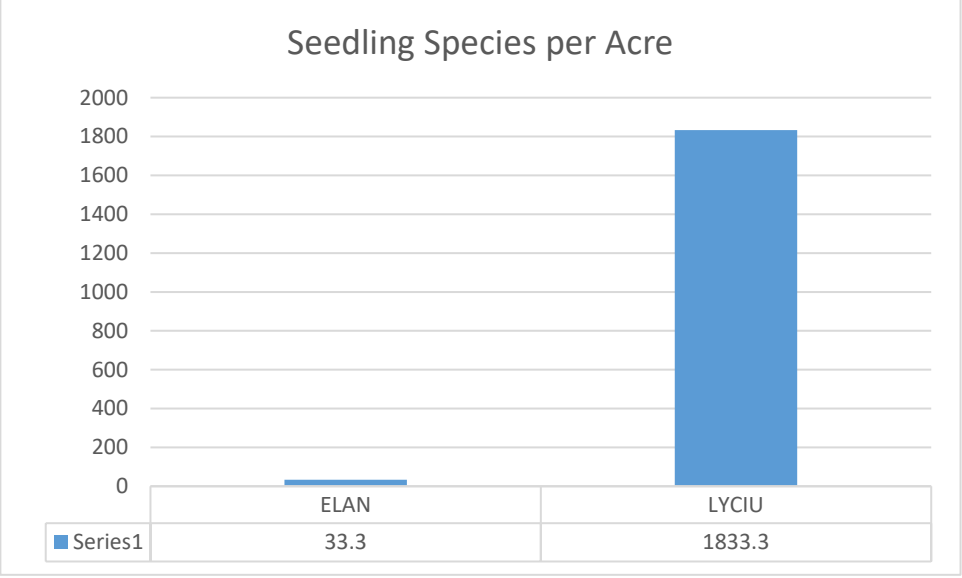


Figure 21. Displays the average seedling species per acre for the entire project.

11.13 Belen 4				**January 2023**
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
11.13_1	6	6	60	47.17
11.13_2	11	10	100	97.22
11.13_3	3	3	30	28.03
Total	**Total number of sample trees on plot**	**Number of growing stock sample trees on plot**	**Average for all Plots**	
			TPA	**BA/AC**
	20.00	**19.00**	**63.33**	**57.47**

Table 4. Displays the Stand Table summaries for each plot

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. Bare soil increase between 2016 and 2023. Recently there was a fire within the project boundaries and this could explain the increase.

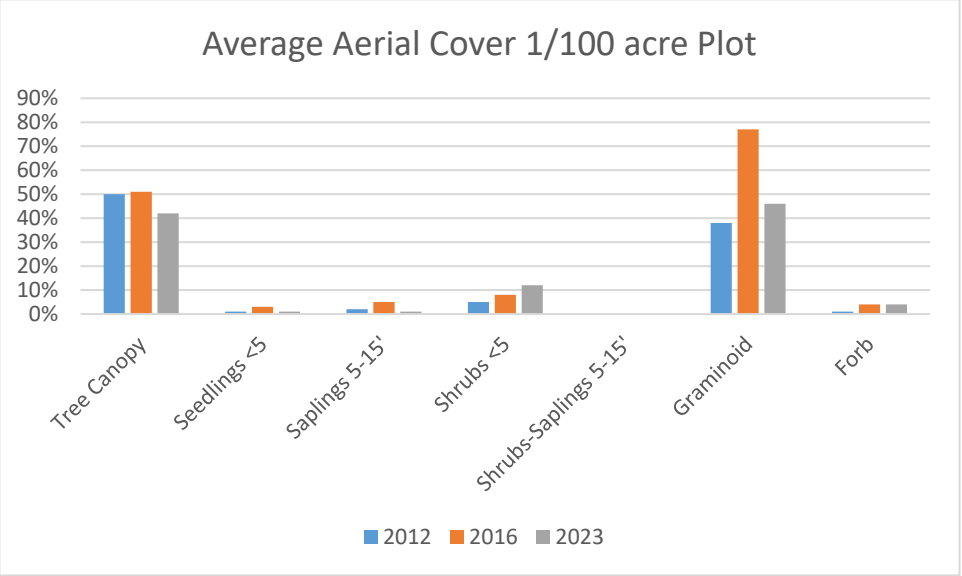


Figure 22. Displays average aerial cover for the entire project

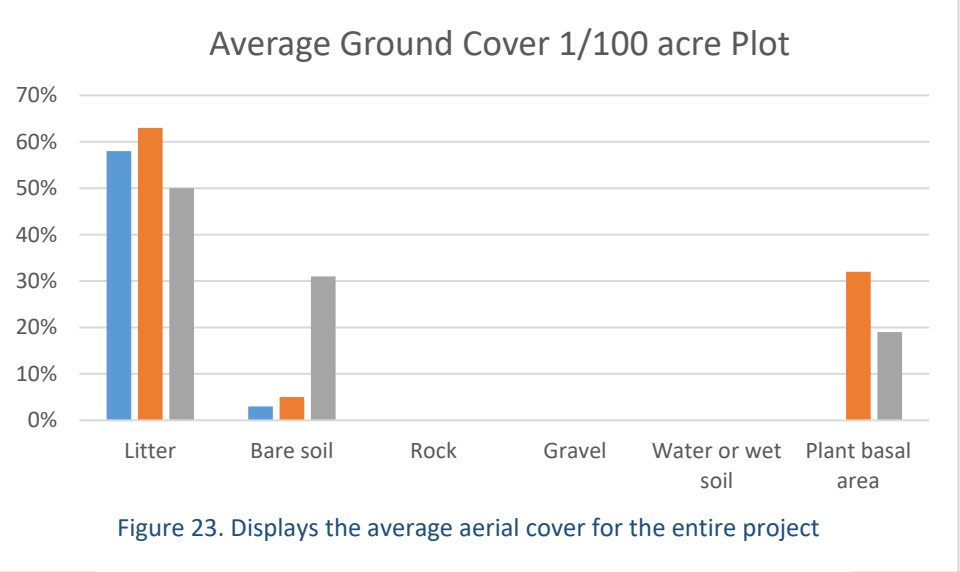


Figure 23. Displays the average aerial cover for the entire project

Project: Valencia SWCD **Project Unit**: Belen 4 **Plot**: 11.13_1

11.13_1 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	46%	0%	3%	15%	0%	20%	3%
2016	45%	5%	5%	25%	1%	75%	2%
2023	30%	1%	0%	35%	0%	3%	1%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	69%	8%	0%	0%	0%	n/a
2016	50%	5%	0%	0%	0%	45%
2023	5%	85%	0%	0%	0%	10%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 4 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: Jetty jacks present on site. Very sandy with open hummocks and patches of salt crust.

2016 Comments: This plot is near and crossed by jetty jacks.

2023 Comments: Open and grassy areas between scattered cottonwoods and levee jacks, with wolfberry and phragmites in the understory.

Project: Valencia SWCD **Project Unit**: Belen 4 **Plot**: 11.13_2

11.13_2 Aerial & Ground Cover

	Aerial cover						
Year	Tree Canopy	Seedlings <5	Saplings 5-15'	Shrubs <5	Shrubs-Saplings 5-15'	Graminoid	Forb
2012	69%	1%	2%	0%	0%	3%	0%
2016	59%	5%	10%	0%	0%	75%	5%
2023	65%	3%	2%	0%	0%	45%	10%

	Ground cover					
Year	Litter	Bare soil	Rock	Gravel	Water or wet soil	Plant basal area
2012	96%	1%	0%	0%	0%	n/a
2016	60%	5%	0%	0%	0%	35%
2023	60%	3%	0%	0%	0%	37%

2012 Hink & Ohmart Type: 2

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 4 **2023 Modified Hink & Ohmart Type:** 2

2012 Comments: Coarse woody debris; swale; possible old channel. Open understory.

2016 Comments: In photos, center photo was mislabeled on whiteboard.

2023 Comments: Living and burned cottonwoods and tamarisk are scattered across the plot forming a very open canopy, with kochia and bunchgrasses constituting the understory.

***Project**: Valencia SWCD* ***Project Unit**: Belen 4* ***Plot**: 11.13_3*

11.13_3 Aerial & Ground Cover

	Aerial cover						
Year	**Tree Canopy**	**Seedlings <5**	**Saplings 5-15'**	**Shrubs <5**	**Shrubs-Saplings 5-15'**	**Graminoid**	**Forb**
2012	36%	1%	0%	0%	0%	90%	0%
2016	48%	0%	0%	0%	0%	80%	5%
2023	32%	0%	0%	0%	0%	90%	0%

	Ground cover					
Year	**Litter**	**Bare soil**	**Rock**	**Gravel**	**Water or wet soil**	**Plant basal area**
2012	10%	0%	0%	0%	0%	n/a
2016	80%	5%	0%	0%	0%	15%
2023	85%	5%	0%	0%	0%	10%

2012 Hink & Ohmart Type: 2/5/6

2016 Hink & Ohmart Type: 4 **2016 Modified Hink & Ohmart Type**: 2

2023 Hink & Ohmart Type: 6 **2023 Modified Hink & Ohmart Type:** 6H

2012 Comments: Transition area between Hink and Ohmart classes. Swale/wetland area with possible historic channels; generally damp soil.

2016 Comments: More open than other plots.

2023 Comments: Open grassy terrain with charred logs and trees, tamarisk resprouts in the east side. Levee jacks present on the south side and a stand of cottonwoods with a grassy understory in the west.

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

Plot_Name	Latitude	Longitude
B1_1	34.6598	-106.7420
B1_2	34.6593	-106.7410
B1_3	34.6583	-106.7410
B1_4	34.6577	-106.7400
B1_5	34.6568	-106.7400
B1_6	34.6566	-106.7390
B2_1	34.6667	-106.7450
B2_2	34.6646	-106.7450
B2_3	34.6630	-106.7440
B2_4	34.6611	-106.7430
B3_1	34.6721	-106.7440
B3_2	34.6700	-106.7450
B3_3	34.6684	-106.7450
B4_1	34.6811	-106.7400
B4_2	34.6799	-106.7410
B4_3	34.6784	-106.7410

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.

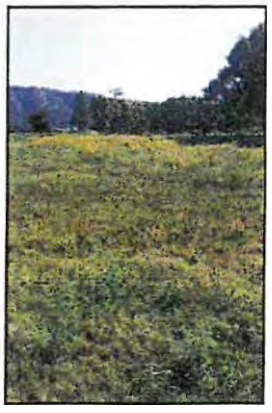
Young tree and shrub layer only (1.5-5 m [4.5-15 feet]) covering >25% of the area of the community (polygon). Stands dominated by tall shrubs and young trees, may include herbaceous vegetation underneath the woody vegetation. Photograph on San Francisco River by Y. Chauvin, 2012.

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.

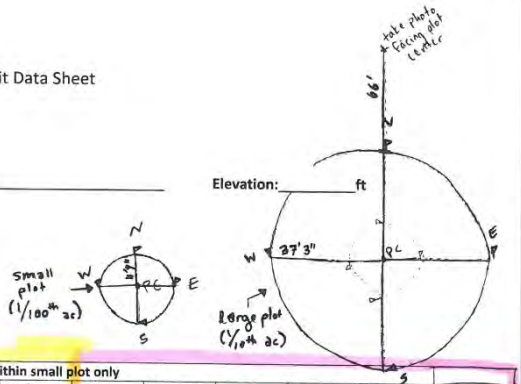
Appendix III – Sample Datasheet

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)

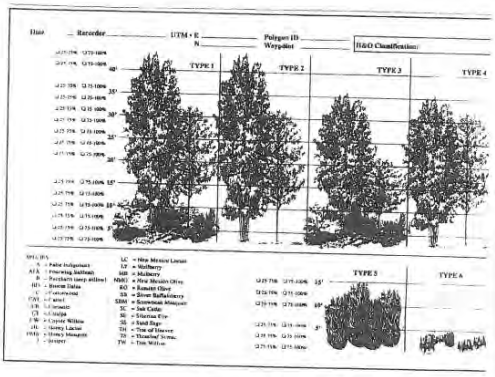
Species Observed in 1/10th ac plot (scientific name, common name, or USDA PLANTS code)

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: _____

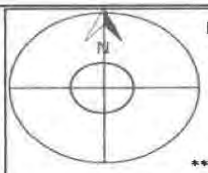
Macroplot Sizes		
Size (Acres)	1/100	1/10
Radius (Feet, Decimal Feet)	11.78	37.24
Radius (Feet, Inches)	11' 9"	37' 3"

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: _____

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"

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 damage/disease, witness tree, etc.

Appendix IV – Surface Fuels

GRGWA Surface Fuels

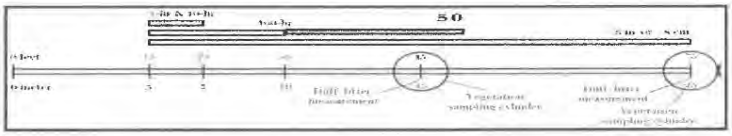
Sheet 1 of 1: Fine Woody Debris—Coarse Woody Debris

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	0 to 0.25
	10-hr	0.25 to 1.0
	100-hr	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 – Photo Pages

See the attached photo comparison pages for each site.

Belen 1


11.11_1C, facing center from north at 66’ (2011)


11.11_1C, facing center from north at 66’ (2016)


11.11_1C, facing center from north at 66’ (2022)


11.11_1N, facing north from center at 11.8’ (2011)


11.11_1N, facing north from center at 11.8’ (2016)


11.11_1N, facing north from center at 11.8’ (2022)


11.11_1E, facing east from center at 11.8’ (2011)


11.11_1E, facing east from center at 11.8’ (2016)


11.11_1E, facing east from center at 11.8’ (2022)


11.11_1S, facing south from center at 11.8’ (2011)


11.11_1S, facing south from center at 11.8’ (2016)


11.11_1S, facing south from center at 11.8’ (2022)


11.11_1W, facing west from center at 11.8’ (2011)


11.11_1W, facing west from center at 11.8’ (2016)


11.11_1W, facing west from center at 11.8 ’ (2022)


11.11_2C, facing center from north at 66’ (2011)


11.11_2C, facing center from north at 66’ (2016)


11.11_2C, facing center from north at 66’ (2022)

11.11_2N, facing north from center at 11.8’ (2011)


11.11_2N, facing north from center at 11.8’ (2016)


11.11_2N, facing north from center at 11.8’ (2022)

11.11_2E, facing east from center at 11.8’ (2011)


11.11_2E (2016)


11.11_2E, facing east from center at 11.8’ (2022)


11.11_2S, facing south from center at 11.8’ (2011)


11.11_2S, facing south from center at 11.8’ (2016)


11.11_2S, facing south from center at 11.8’ (2022)

11.11_2W, facing west from center at 11.8’ (2011)


11.11_2W, facing west from center at 11.8’ (2016)


11.11_2W, facing west from center at 11.8’ (2022)


11.11_3C, facing center from north at 66’ (2011)


11.11_3C, facing center from north at 66’ (2016)


11.11_3C, facing center from north at 66’ (2022)


11.11_3N, facing north from center at 11.8’ (2011)


11.11_3N, facing north from center at 11.8’ (2016)


11.11_3N, facing north from center at 11.8’ (2022)


11.11_3E, facing east from center at 11.8’ (2011)


11.11_3E, facing east from center at 11.8 (2016)


11.11_3E, facing east from center at 11.8’ (2022)


11.11_3S, facing south from center at 11.8’ (2011)


11.11_3S, facing south from center at 11.8’ (2016)


11.11_3S, facing center from south at 11.8’ (2022)


11.11_3W, facing west from center at 11.8’ (2011)


11.11_3W, facing west from center at 11.8’ (2016)


11.11_3W, facing west from center at 11.8’ (2022)


11.11_4C, facing center from north at 66’ (2011)


11.11_4C, facing center from north at 66’ (2016)


11.11_4C, facing center from north at 66’ (2022)


11.11_4N, facing north from center at 11.8’ (2011)


11.1_4N, facing north from center at 11.8’ (2016)


11.11_4N, facing north from center at 11.8’ (2022)

11.11_4E, facing east from center at 11.8’ (2011)

11.11_4E, facing east from center at 11.8’ (2016)


11.11_4E, facing east from center at 11.8’ (2022)


11.11_4S, facing south from center at 11.8’ (2011)


11.11_4S, facing south from center at 11.8’ (2016)


11.11_4S, facing south from center at 11.8’ (2022)


11.11_4W, facing west from center at 11.8’ (2011)


11.11_4W, facing west from center at 11.8’ (2016)


11.11_4W, facing west from center at 11.8’ (2022)


11.11_5C, facing center from north at 66’ (2011)


11.11_5C, facing center from north at 66’ (2016)


11.11_5N, facing north from center at 11.8’ (2011)


11.11_5N, facing north from center at 11.8’ (2016)


11.11_5E, facing east from center at 11.8’ (2011)

11.11_5E, facing east from center at 11.8’ (2016)

11.11_5S, facing south from center at 11.8’ (2011)


11.11_5S, facing south from center at 11.8’ (2016)

11.11_5W, facing west from center at 11.8’ (2011)


11.11_5W, facing west from center at 11.8’ (2016)


11.11_6C, facing center from north at 66’ (2011)


11.11_6C, facing center from north at 66’ (2016)


11.11_6C, facing center from north at 66’ (2022)


11.11_6N, facing north from center at 11.8’ (2011)


11.11_6N, facing north from center at 11.8’ (2016)


11.11_6N, facing north from center at 11.8’ (2022)


11.11_6E


11.11_6E, facing east from center at 11.8’ (2016)


11.11_6E, facing east from center at 11.8’ (2022)


11.11_6S, facing south from center at 11.8’ (2011)


11.11_6S, facing south from center at 11.8’ (2016)


11.11_6S, facing south from center at 11.8’ (2022)


11.11_6W, facing west from center at 11.8’ (2011)


11.11_6W, facing west from center at 11.8’ (2016)


11.11_6W, facing west from center at 11.8’ (2022)

Belen 2


11.12_1C, facing center from north at 66’ (2011)


11.12_1C, facing center from north at 66’ (2016)


11.12_1C, facing center from north at 66’ (2022)


11.12_1N, facing north from center at 11.8’ (2011)


11.12_1N, facing north from center at 11.8’ (2016)


11.12_1N, facing north from center at 11.8’ (2022)


11.12_1E, Facing east from center at 11.8’ (2011)


11.12_1E, facing east from center at 11.8’ (2016)


11.12_1E, Facing east from center at 11.8’ (2022)


11.12_1S, facing south from center at 11.8’ (2011)


11.12_1S, facing south from center at 11.8’ (2016)


11.12_1S, facing south from center at 11.8’ (2022)

11.12_1W, facing west from center at 11.8’ (2011)


11.12_1W, facing west from center at 11.8’ (2016)


11.12_1W, facing west from center at 11.8’ (2022)


11.12_2C, facing center from north at 66’ (2011)


11.12_2C, facing center from north at 66’ (2016)


11.12_2C, facing center from north at 66’ (2022)


11.12_2N, facing north from center at 11.8’ (2011)


11.12_2N, facing north from center at 11.8’ (2016)


11.12_2N, facing north from center at 11.8’ (2022)


11.12_2E, facing east from center at 11.8’ (2011)


11.12_2E, facing east from center at 11.8’ (2016)


11.12_2E, facing east from center at 11.8’ (2022)


11.12_2S, facing south from center at 11.8’ (2011)


11.12_2S, facing south from center at 11.8’ (2016)


11.12_2S, facing south from center at 11.8’ (2022)


11.12_2W, facing west from center at 11.8’ (2011)


11.12_2W, facing west from center at 11.8’ (2016)


11.12_2W, facing west from center at 11.8’ (2022)


11.12_3C, facing center from north at 66’ (2011)


11.12_3C, facing center from north at 66’ (2016)


11.12_3C, facing center from north at 66’ (2022)


11.12_3N, facing north from center at 11.8’ (2011)


11.12_3N, facing north from center at 11.8’ (2016)


11.12_3N, facing north from center at 11.8’ (2022)


11.12_3E, facing east from center at 11.8’ (2011)


11.12_3E, facing east from center at 11.8’ (2016)


11.12_3E, facing east from center at 11.8’ (2022)


11.12_3S, facing south from center at 11.8’ (2011)


11.12_3S, facing south from center at 11.8’ (2016)


11.12_3S, facing south from center at 11.8’ (2022)


11.12_3W, facing west from center at 11.8’ (2011)


11.12_3W, facing west from center at 11.8’ (2016)


11.12_3W, facing west from center at 11.8’ (2022)


11.12_4C, facing center from north at 66’ (2011)


11.12_4C, facing center from north at 66’ (2016)


11.12_4C, facing center from north at 66’ (2022)


11.12_4N, facing north from center at 11.8’ (2011)


11.12_4N, facing north from center at 11.8’ (2016)


11.12_4N, facing north from center at 11.8’ (2022)


11.12_4E, facing east from center at 11.8’ (2011)


11.12_4E, facing east from center at 11.8’ (2016)


11.12_4E, facing east from center at 11.8’ (2022)


11.12_4S, facing south from center at 11.8’ (2011)


11.12_4S, facing south from center at 11.8’ (2016)


11.12_4S, facing south from center at 11.8’ (2022)


11.12_4W, facing west from center at 11.8’ (2011)


11.12_4W, facing west from center at 11.8’ (2016)


11.12_4W, facing south from center at 11.8’ (2022)

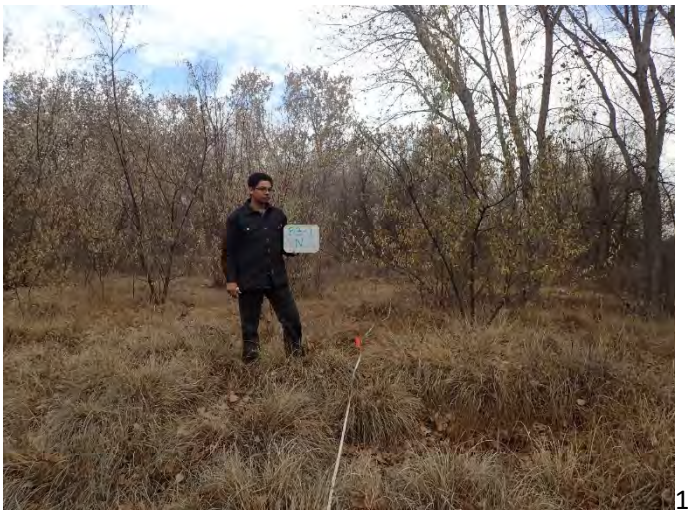
Belen 3


11.10_1C, facing center from north at 66’ (2011)


11.10_1C, facing center from north at 66’ (2016)


11.10_1C, facing center from north at 66’ (2022)


11.10_1N, facing north from center at 11.8’ (2011)


11.10_1N, facing north from center at 11.8’ (2016)


11.10_1N, facing north from center at 11.8’ (2022)


11.10_1E, facing east from center at 11.8’ (2011)


11.10_1E, facing east from center at 11.8’ (2016)


11.10_1E, facing east from center at 11.8’ (2022)


11.10_1S, facing south from center at 11.8’ (2011)


11.10_1S, facing south from center at 11.8’ (2016)


11.10_1S, facing south from center at 11.8’ (2022)


11.10_1W, facing west from center at 11.8’ (2011)

11.10_1W, facing west from center at 11.8’ (2016)


11.10_1W, facing west from center at 11.8’ (2022)


11.10_2C, facing center from north at 66’ (2011)


11.10_2C, facing center from north at 11.8’ (2016)


11.10_2C, facing center from north at 11.8’ (2022)


11.10_2N, facing north from center at 11.8’ (2011)


11.10_2N, facing north from center at 11.8’ (2016)


11.10_2N, facing north from 11.8’ (2022)


11.10_2E, facing east from center at 11.8’ (2011)


11.10_2E, facing east from center at 11.8’ (2016)


11.10_2E, facing east from center at 11.8’ (2022)


11.10_2S, facing south from center at 11.8’ (2011)


11.10_2S, facing south from center at 11.8’ (2016)


11.10_2S, facing south from center at 11.8’ (2022)


11.10_2W, facing west from center at 11.8’ (2011)


11.10_2W, facing west from center at 11.8’ (2016)


11.10_2W, facing west from center at 11.8’ (2022)


11.10_3C, facing center from north at 66’ (2011)


11.10_3C, facing center from north at 66’ (2016)


11.10_3C, facing center from north at 66‘‘ (2022)

11.10_3N, facing north from center at 11.8’ (2011)


11.10_3N, facing north from center at 11.8’ (2016)


11.10_3N, facing north from center at (2022)


11.10_3E, facing east from center at 11.8’ (2011)


11.10_3E, facing east from center at 11.8’ (2016)


11.10_3E, facing east from center at 11.8’ (2022)


11.10_3S, facing south from center at 11.8’ (2011)


11.10_3S, facing south from center at 11.8’ (2016)


11.10_3S, facing south from center at 11.8’ (2022)


11.10_3W, facing west from center at 11.8’ (2011)


11.10_3W, facing west from center at 11.8’ (2016)

11.10_3W, facing west from center at 11.8’ (2022)

Belen 4


11.13_1C, facing center from north at 66’ (2011)


11.13_1C, facing center from north at 66’ (2016)


11.13_1C, facing center from north at 11.8’ (2022)


11.13_1N, facing north from center at 11.8’ (2011)


11.13_1N, facing north from center at 11.8’ (2016)


11.13_1N, facing north from center at 11.8’ (2022)


11.13_1E, facing east from center at 11.8’ (2011)


11.13_1E, facing east from center at 11.8’ (2016)


11.13_1E, facing east from center at 11.8’ (2022)


11.13_2S, facing south from center at 11.8’ (2011)


11.13_2S, facing south at 11.8’ (2016)


11.13_2S, facing south from center at 11.8’ (2022)


11.13_2W, facing west from center at 11.8’ (2011)


11.13_2W, facing west from center at 11.8’ (2016)


11.13_2W, facing west from center at 11.8’ (2022)


11.13_3C, facing center from north at 66’ (2016)


11.13_3C, facing center from north at 66’ (2022)


11.13_3N, facing north from center at 11.8’ (2011)


11.13_3N, facing north from center at 11.8’ (2016)


11.13_3N, facing north from center at 11.8’ (2022)


11.13_3E, facing east from center at 11.8’ (2011)


11.13_3E, facing east from center at 11.8’ (2016)


11.13_3E, facing east from center at 11.8’ (2022)


11.13_3S, facing south from center at 11.8’ (2011)


11.13_3S, facing south from center at 11.8’ (2016)


11.13_3S, facing south from center at 11.8’ (2022)


11.13_3W, facing west from center at 11.8’ (2011)


11.13_3W, facing west from center at 11.8’ (2016)

 11.13_3W, facing west from center at 11.8’ (2022)