Esquibel Riparian 16.17

Post-treatment Monitoring Report

2021

Prepared by
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Contents

Acronyms and Abbreviations

Acronym, Abbreviation, or Term	Explanation or Definition as used by NMFWRI
AGL	above ground level; GIS term
BBIRD plots	Breeding Biology Research and Monitoring Database, larger circular plot types
BEMP plots	Bosque Ecosystem Monitoring Program, small rectangular plot types
FEAT	Fire Ecology Assessment Tool
FFI	FEAT/ FIREMON Integrated
FIREMON	Fire Effects Monitoring and Inventory System
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
NAIP	National Agriculture Imagery Program (aerial imagery)
NDVI	Normalized Difference Vegetation Index; GIS term for a band ratio of the visible red and the near infrared spectral bands and is calculated using the following formula: (NIR – Red)/(NIR+Red)
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 2.0
NRCS	Natural Resource Conservation Service
PC	Plot center
RGIS	Resource Geographic Information System
SWCD	Soil and Water Conservation District
TIFF	Tagged image file format
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 the low-intensity post-treatment vegetation monitoring assessment performed on a non-native phreatophyte removal project submitted for the Espinosa Canyon Drainage near Abo to the Greater Rio Grande Watershed Alliance in 2021. 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 the field methods explained below as well as LIDAR analysis where appropriate and available.

Monitoring and Field Methods

Low intensity Field Methods

Low intensity pre-treatment vegetation monitoring was done using an adapted version of the biotic portion of the New Mexico Rapid Assessment Method (NMRAM), v 2.1, updating recommendations made in the Field Manual for Greater Rio Grande Watershed Alliance (GRGWA) Riparian Restoration Effectiveness Monitoring and the GRGWA Monitoring Plan, developed by Lightfoot & Stropki of SWCA Environmental Consultants in 2012. (For a brief overview of both low and high intensity monitoring methods used by the NMFWRI on GRGWA projects, please see Appendix III.)

For those not familiar, NMRAM was developed by the New Mexico Environment Department Surface Water Quality Bureau Wetlands Program and Natural Heritage New Mexico as a "cost effective, yet consistent and meaningful tool" (Muldavin, 2011) for wetland ecological condition assessment in terms of anthropogenic disturbance as negatively correlated with quality and functionality. The portions of NMRAM we utilized are Level 2 "semi-quantitative" field measurements taken at less detail than plot level (Muldavin, 2011).

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

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

Photopoints were established to capture images where vegetation shifts were observed and/or at representative locations throughout the site. Waypoints were marked with a Garmin GPS unit and named sequentially by site. Photos were taken facing north, east, south and west at each point.

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

Personnel Involved

2021 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

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

2021 New Mexico Forest and Watershed Restoration Institute GIS Team:

- Patti Dappen, GIS Program Manager

Other persons contacted:

- Fred Rossbach, Field Coordinator, Greater Rio Grande Watershed Alliance
- Vernon Kohler, Field Technician, Claunch-Pinto Soil and Water Conservation District
- Robert Esquibel, landowner

Esquibel Riparian Project

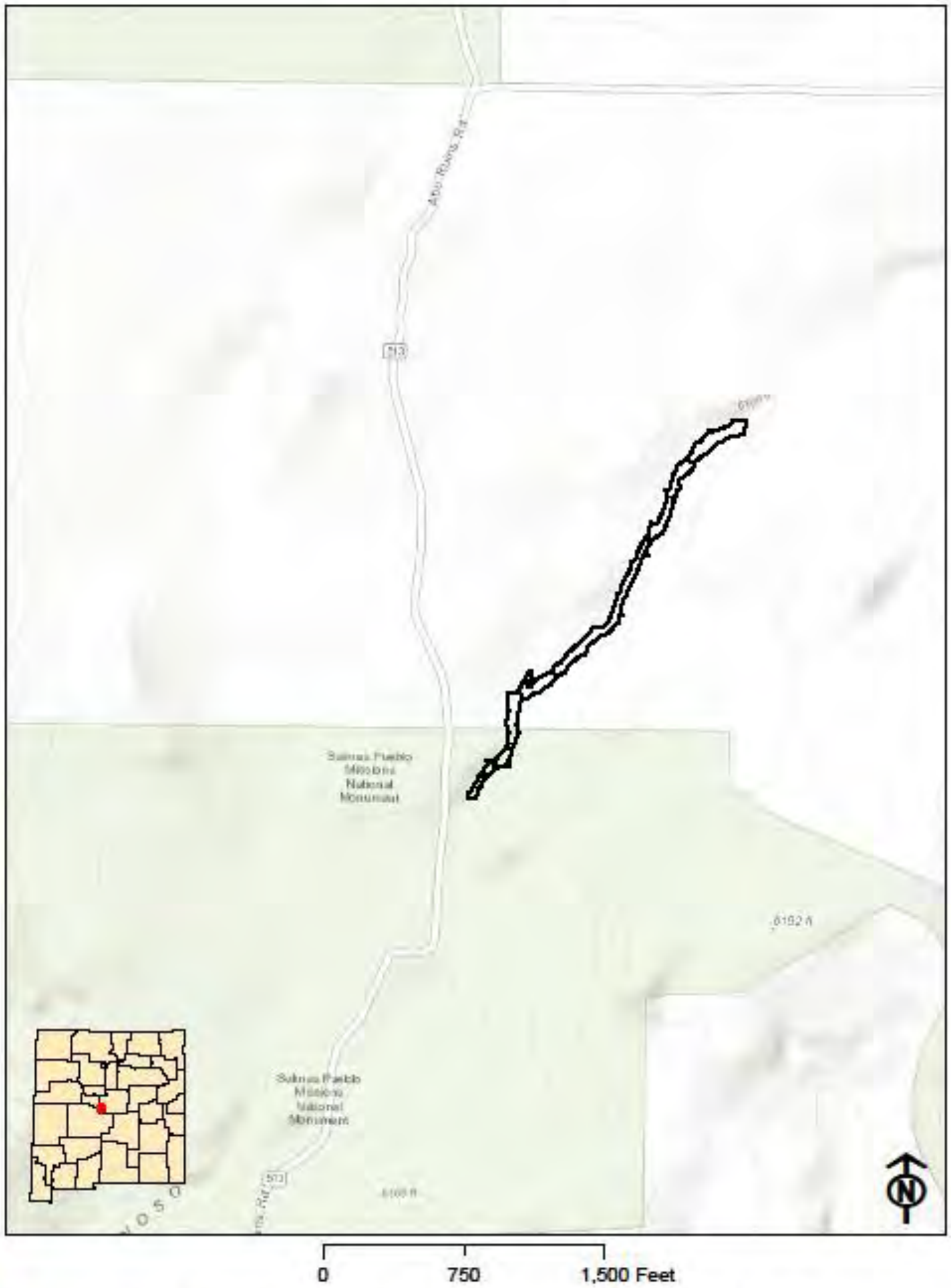
Project 16.17 is a privately-owned ranch located in the Espinosa Canyon Drainage in Torrance County, near Abo, N.M.

Mountainair, the nearest community, has an average annual precipitation of 15 inches. The average high temperature is 87° F in July and the average low is 21° F in December & January (U.S. Climate Data, 2017). According to the NRCS Web Soil Survey, the project area is comprised of 100% Alicia loam, 1 to 6 percent slopes. Ecological sites within this project include R070CY109NM Loamy (USDA NRCS, 2016).

The Loamy ecological site typical plant community is a mixed grassland of warm and cool season, mid- and short perennial grasses. Woody species occupy a minor portion of this community, as do forbs. During periods of abundant spring and fall moisture, a large variety of forbs can be found. Piñon and oneseed juniper can occur in some portions of this site (USDA NRCS n.d., n.d.)

Monitoring was conducted at this 3.1-acre site on November 28, 2016 as part of a restoration project targeting non-native phreatophytes scheduled for 2016-2017 in an intermittent stream riparian zone. Post-treatment monitoring was conducted on December 11th, 2021. The project is located on a private ranch in Torrance County, in the Espinosa Canyon Drainage near Abo, NM; access is by county and private ranch roads off US Hwy 60. The Abo Ruins National Monument is located to the south of the project boundary. The Claunch-Pinto Soil and Water Conservation District (CPSWCD) sponsored the project. This is an initial treatment to remove mature and pole sized Russian olive and salt cedar, as well as oneseed juniper and 50% of the mid-story coyote willow, by extraction and mastication. Restoration goals include reducing non-native phreatophytes, promoting natural hydraulic processes including increasing overland water flow and increasing overall ecosystem function and health.

16-17 Esquibel



16-17 Esquibel is located on a private ranch inTorrance County, in the Espinosa Canyon Drainage near Abo, NM; access is by county and private ranch roads off US Hwy 60. The Abo Ruins National Monument is located to the south of the project boundary.This is an initial treatment to remove mature and pole sized Russian olive and salt cedar, as well as oneseed juniper and 50% of the mid-story coyote willow,

Figure 1. Project 16.17 in geographic context.

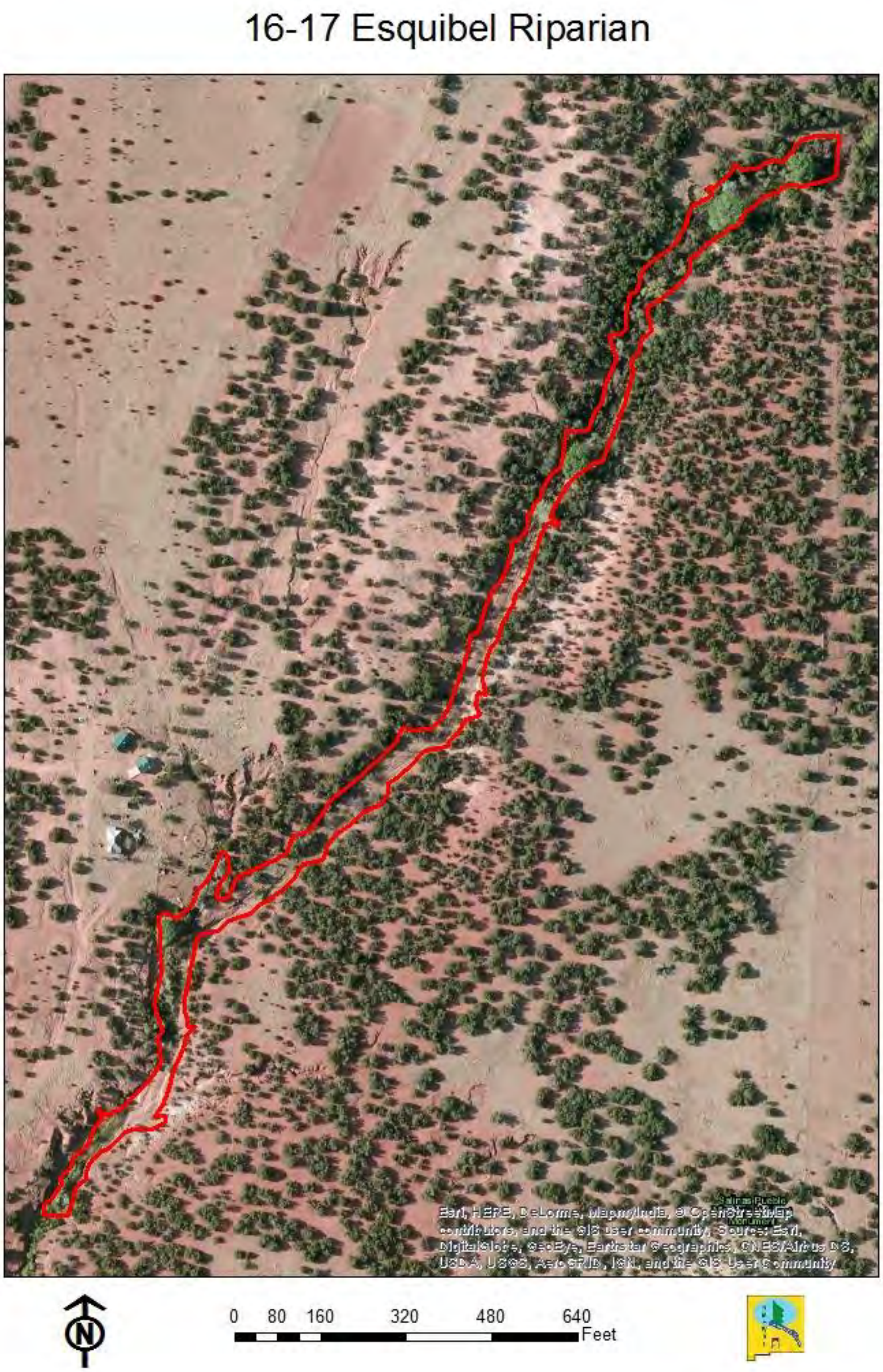


Figure 2. 16.17 Esquibel Riparian project outline.

In 2016, exotic species observed in abundance included salt cedar, Russian olive, and horehound. Native species included cottonwood, black willow, coyote willow, oneseed juniper, broom snakeweed, sideoats grama, blue grama, and other grasses. Field crew notes included comments on massive cottonwood trees, large salt cedars, and burn spots from landowner restoration efforts. The landowner also mentioned that water used to run in the drainage and has dammed up a spring in one area.

Table 1. NMRAM Scores for 16.17.

Metrics for 16.17 (December 11, 2021)	**2021 Score**	**2016 Score**
Relative Native Plant Community Composition	3	2
Vegetation Horizontal Patch Structure	1	4
Vegetation Vertical Structure	1	4
Native Riparian Tree Regeneration	1	2
Exotic Invasive Plant Species Cover	2	1
Project Biotic Score (based on above ratings)	1.8	2.6
Project Biotic Rating	C/Fair	C/Fair
Soil Surface Condition	4	3
Surface Fuels	0.1	0.2

The lowest scores for the site came in Vegetation Horizontal Patch Structure and Vegetation Vertical Structure metrics. These low scores can be attributed to the loss of vegetation diversity. In 2016 High Structure Forest was the dominant vegetation vertical structure, representing approximately one third of the site, followed by Tall Shrubs representing a little less than a quarter of the site. In 2021 Short Shrub Stands became the dominant vegetation vertical structure, occupying 90% of the site while the other 10% was bare ground. The loss of High Structure Forest might be attributed to the removal of exotic woody plants such as Tamarisk, Russian Olive and Siberian Elm. This could explain the drop in exotic species cover from 25% in 2016 to 10% in 2021. Open spaces created after removal of these larger species provide prime habitat for coyote willow, which was observed as being abundant and fits into the parameters for Short Shrub Stands vegetation structure type. Overall, the site scored a “C” or “Fair”, a 1.8 out of 4.

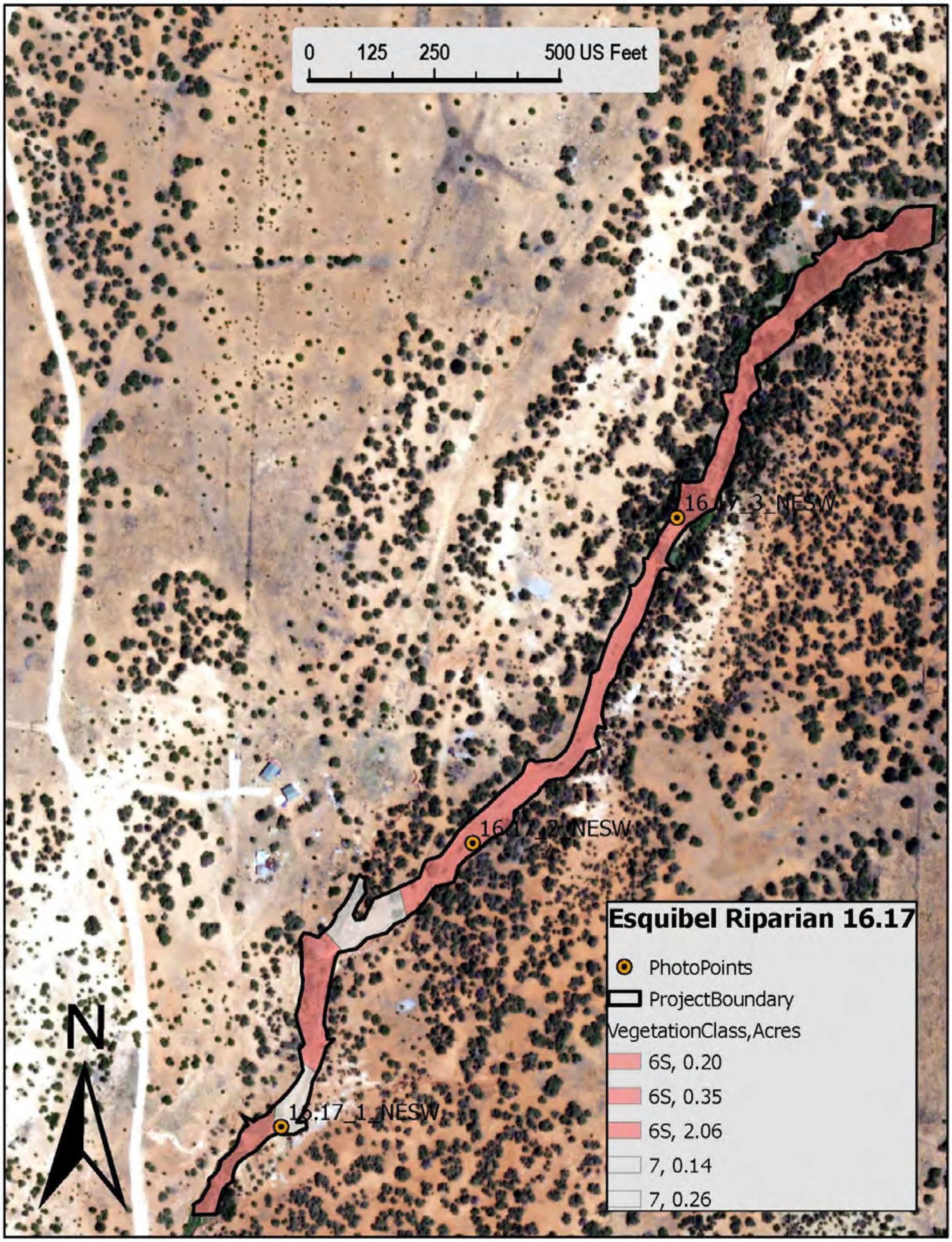


Figure 3. 16.17 Esquibel Riparian project vegetation polygons.

Discussion

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

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

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

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

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Appendix I - Photopoint Table

Name	Latitude	Longitude
16.17_1_NESW	34.4532	-106.3730
16.17_2_NESW	34.4548	-106.3720
16.17_3_NESW	34.4566	-106.3700

		100-0339			N	Bedrock @37' @360°	JUMO @102' @358°				Bedrock, arroyo
		100-0340			E	Alkali grass @11' @90°	PIED @42' @98°				Uphill, JUMO, PIED, gravely
		100-0342			S	JUMO @11' @164°	PIED @46' @206°				Bedrock, hill to the right of arroyo
16.17_1_NESW	11/1/2021 12:00pm	100-0343	34.45320978	-106.3728068	W	Arroyo @17' @270°	Coyote willow @24' @270°				Arroyo, bunch grass, cattail, willow patch
		100-0348			N	Alkali sacaton @11' @360°	Bank of arroyo @47' @360°				Grassy bank of stream. JUMO
		100-0349			E	Alkali sacaton @11' @90°	PIED @69' @90°				Grassy, JUMO, low bank stream
		100-0350			S	Fourwing salt bush @17' @196°	JUMO @46' @180°				Grassy, shrubby/JUMO, low bank stream
16.17_2_NESW	11/1/2021 1:44pm	100-0351	34.45475303	-106.3715818	W	Salt cedar @14' @288°	JUMO @67' @240°	37' 3"			Grassy, salt cedar, high bank side, JUMO
		100-0352			N	Tamarisk @25' @16°	JUMO @71' @0°/360°				Scattered tamarisk, two cottonwoods, woody debris.
16.17_3_NESW	11/1/2021 2:57pm	100-0353	34.45655332	-106.3702465	E	Stream bank @36' @90°	JUMO @51' @90°	-	Olympus red	AM, CB	Stream bank, JUMO

		100-0354			S	Coyote willow @36' @204°	Cottonwood @79' @210°				Coyote willow, Cottonwood with woody debris piled on trunk
		100-0355			W	Coyote willow @5' @270°	JUMO @37' @270°				JUMO, PIED, Coyote willow

Appendix II – Photos

2016: 16.17_1_N. View facing north, taken inside of polygon 2.

2021: 16.17_1_N

2016: 16.17_1_E. View facing east, taken inside of polygon 2.

2021: 16.17_1_E

2016:
16.17_1_S. View facing south, taken inside of polygon 2.

2021 Photo taken slightly left of original photo

2021: 16.17_1_S

2016:
16.17_1_W.
View facing
west, inside
of polygon 2.

2021:
16.17_1_W

2016: 16.17_2_N. View facing north inside of polygon 3.

Photos not exact match; both taken from the same point.

2021: 16.17_2_N

2016:
16.17_2_E.
View facing east inside of polygon 3.

2021:
16.17_2_E

2016: 16.17_2_SW. View facing south-west inside of polygon 3.

A matching photo could not be found

2016: 16.17_2_NW. View facing north-west taken from inside of polygon 3.

Matching photo not found

2016: 16.17_3_N. View facing north, inside of polygon 4.

2021: 16.17_3_N

2016: 16.17_3_E. View facing east from inside of polygon 4.

2021: 16.17_3_E

2016: 16.17_3_S. View facing south from inside of polygon 4.

2021: 16.17_3_S

2016: 16.17_3_W. View facing west from inside of polygon 4.

2021: 16.17_3_W

Appendix III – Current monitoring methods available

Low-intensity methods

- Where: happens on all sites with GRGWA projects
- Method name: NMRAM (New Mexico Rapid Assessment Method v 2.1)
- Time required: 3 hours – half day/ site
- Repeat: done once pre-treatment and in 4-5 year intervals post-treatment
- Basics: mapping vegetation communities (by vertical and horizontal structure), recording dominant vegetation in each strata (trees, shrubs, herbaceous), assessing fuel load, noting soil surface condition and native/exotic ratio at all vegetation levels, photo points
- Any on-site impacts or materials: none

High-intensity methods

- Where: happens on select sites, in addition to low-intensity monitoring

Submethod name 1: BBIRD or BEMP vegetation plots (depends on treatment area size)

- Time required: approx. 2 hours/site
- Repeat: both pre-treatment and in 4-5 yr intervals post-treatment
- Basics: larger plots and transects documenting vegetation, photo points
- On-site impacts or materials: rebar and cap

Submethod name 2: Brown's transects

- Time required: 1-1.5 hours/site
- Repeat: both pre-treatment and in 4-5 yr intervals post-treatment
- Basics: transects to calculate fuel loading and fire behavior, photo points
- On-site impacts or materials: rebar and cap

Submethod name 3: BEMP-adapted Groundwater Well Monitoring

- Time required:
    - Initial installation: 1-2 hours/ well (ideally 2+ wells/site)
        - Repeat: maintenance as needed, should be minimal
    - Data offloading: 10-20 minutes/well
        - Repeat: at least annually (this is when we anticipate datalogger will be full and batteries will need to be changed)
- Basics: install a well with a sensor which records groundwater level and temperature once an hour year round; this will reflect changes due to seasonal variation, vegetation growth, irrigation, etc.
- On-site impacts or materials: shallow monitoring well (consists of capped PVC pipe extending into the ground about 3 feet below the water table and above ground approx. 2 feet (can be painted earth tones); well contains a datalogger (pressure transducer) suspended on a cable into the water); well should be protected from cattle grazing (so may require rebar around pvc visible above ground)

Appendix IV - 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.

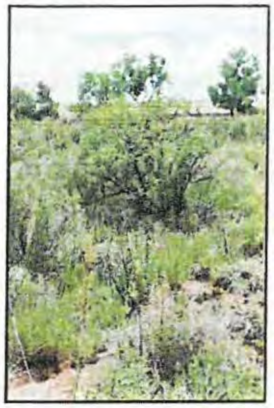
Type 2 -Low Structure Forest with little or no understory.

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.

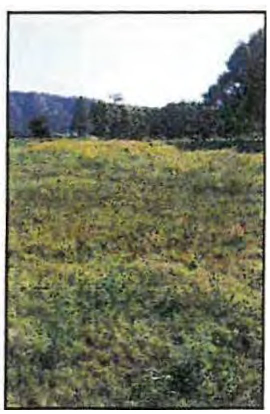


Type 6S-Short Shrub Stands.

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.