Pino Fire Restoration Project 14.16

5-Year Post-Treatment Monitoring Report

2021

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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
MRCGD	Middle Rio Grande Conservancy District
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
VSWCD	Valencia Soil and Water Conservation District
WQCC	Water Quality Control Commission
WSS	Web Soil Survey, a soils database of the NRCS

Purpose of Report

This report covers the low-intensity pre-treatment vegetation monitoring assessment performed on a non-native phreatophyte removal project submitted to the Greater Rio Grande Watershed Alliance. Following an explanation of monitoring methods, we will discuss 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 non-native 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 2.0, 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. Waypoints were marked with a Garmin GPS unit and named sequentially by site. Photos were taken in the direction that most effectively captured the diverse vegetation community. Where appropriate, one waypoint was used for photos taken in multiple directions.

While vegetation polygon maps are typically a product of NMRAM assessments, they are not available in this case due to contractor error. Instead, NMFWRI's GIS Specialist used LIDAR to classify vegetation structure.

Estimating Vegetation Cover using LIDAR and eCognition Software

Remote Sensing methods were used to try to assess the post-treatment characteristics of the riparian site using LiDAR (Light Detection and Ranging) and Aerial Imagery.

Using LiDAR, one is able to develop a very accurate elevation model as well as estimating surface feature heights and characteristics by using a multiple return, high density, LiDAR data set. Airborne laser sensors provide information to analyze forests in a 3-D format over large areas. Current LiDAR systems provide georeferenced information of the vertical structure of land cover features. Laser pulses from a sensor carried aboard an aircraft are directed toward the ground to collect ranging data to the top of the canopy, and in some instances, to sub canopy layers of vegetation and to the ground. (Popescu, 2002)

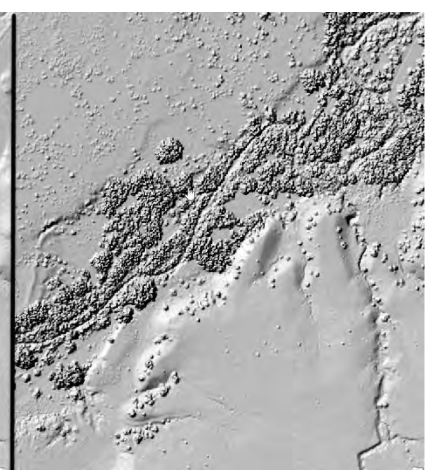
To develop a vegetation height classification, LiDAR and NAIP imagery were analyzed using eCognition software. An object-oriented classification systems was used so that spectral characteristics as well as height above ground values of the vegetation could be incorporated into a robust classification system. LiDAR was also used to develop Vegetation Height Profiles for areas around the photo point locations.

LiDAR Processing

2018 LiDAR for the Pino Fire site was downloaded from The USGS 3DEP LiDAR Explorer (https://prd-tnm.s3.amazonaws.com/LidarExplorer/index.html#/) in LAS file format. Using the 2018 LiDAR, A Digital Terrain Model (DTM) was created by filtering only the point clouds classified as ground and then only those ground point clouds were converted to a raster DTM. Next, LiDAR first returns were filtered and selected to represent surface features. Only those first returns were converted to a raster Digital Surface Model (DSM). Bird and other noise that were not surface features were removed before creating the raster DSM. In order to get true heights above ground the Digital Surface Model was subtracted from the Digital Terrain model creating a Normalize Digital Surface Model (nDSM). The values of the nDSM were heights above ground in meters. Below are examples of how these products look.

2020 NAIP

LiDAR Derived Digital Terrain Model



LiDAR Derived Digital Surface Model

Personnel Involved

2021 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

- Kathryn R Mahan, Ecological Monitoring Program Manager
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2021 New Mexico Forest and Watershed Restoration Institute GIS Team:

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Other persons contacted:

- Fred Rossbach, Field Coordinator, Greater Rio Grande Watershed Alliance
- Andrew Hautzinger, Valencia Soil and Watershed Conservation District
- Johnny Chavez, Valencia Soil and Watershed Conservation District

Pino Fire Restoration Project

Project Description & Goals

Project 14.16 is located on Valencia SWCD and MRGCD property near the communities of Belen and Rio Communities, NM.

Belen receives an average of 7.6 inches of rain annually. Temperatures range from an average high of 95 in July, average low of 19 in January (City-Stats, 2015). According to the USDA NRCS Web Soil Survey, the project is nearly 90% Typic Ustifluvents and 10% Mixed Alluvial land. The Typic Ustifluvents map unit correlates to ecological site R042XB018NM Bottomland, and Mixed Alluvial land is ecological site R042XA055NM Salty Bottomland.

Bottomland typically supports bottomland grassland plant communities, for example, those dominated by burrograss, alkali sacaton, giant sacaton, dropseeds, galleta, vinemesquite, and/or tobosa (USDA NRCS). Salty Bottomland can support a range of plant communities which typically include cottonwood, tamarisk, mixed exotics (dominated by Russian olive/ Russian knapweed/ etc), saltgrass and saltgrass-sacaton, and bottomland grassland (possibly dominated by saltgrass, giant sacaton, dropseed, muhly, and/or any of the other grasses listed for Bottomland) (USDA NRCS)

The project is located south of the Jarrales bridge, and had not been treated prior to the Pino Wildfire. Restoration activities planned included removal by a variety of methods of Siberian elm, Russian olive, salt cedar, mulberry and tree-of-heaven as well as burnt black willow poles. Restoration goals were to rehabilitate the impacts of the Pino wildfire as well as fire hazard reduction (i.e. improve ecosystem function through removal of nonnative invasive phreatophytes and down woody debris, promote native species, and improve wildlife habitat). Jetty jacks are present on-site, as is a powerline. Section boundaries include the river, a fuelbreak, a dozer line, and levee and canal roads.

The Pino Wildfire

The Pino Fire had a substantial impact on this site. This was a wildfire that burned over 50 acres in and around the bosque during March of 2014.

According to the Valencia SWCD's 2015 Annual Report, the fire was caused by the actions of a private landowner burning slash piles on the east side of the river. The response was a collaboration between New Mexico State Forestry (including inmate crews), the Bureau of Land Management, US Forest Service, and volunteers from Valencia and Socorro Counties and required over 15 engines, 3 tenders, a helicopter, a bulldozer, two hand crews (for a total of over 50 people) working at one time. The fire jumped the river due to high winds. Five to six residences and "several" hay barns were threatened during the course of the fire; ultimately, no structures were burned (NM State Forestry Fire Information Office, 2014).

Local news reported the fire's primary fuel source was the dense salt cedar stands along the river (Chelo Rivera, KRQE News 13, 2014). GRGWA's 2014 RFP noted the presence of dead sapling- and pole-sized salt cedar and Russian olives in the project area but suggested that much of the damaged vegetation was beginning to re-sprout, with heights at 2 to 4 feet by August 2014, just 5 months post-fire (Claunch-Pinto Soil and Water Conservation District on behalf of The Greater Rio Grande Watershed Alliance, 2014). Our contractor's photographs and notes from February 2016 (11 months post-fire; see Appendix II) suggest a patchy burn pattern where some areas experienced significant mortality in all canopy strata.

By contrast, VSWCD's 2015 report noted that the MRGCD's Fuels Reduction research site to the Northwest of the project, with a patchy mosaic of native vegetation, had a "great recovery" in shrub and groundcover species, as well as good survival of overstory trees. (Valencia SWCD)

We suggest VSWCD and the MRCGD consider further exploring the differences in fire severity and vegetation response in these two nearby areas given that they had such different pre-fire native/exotic composition ratios and vegetation densities.

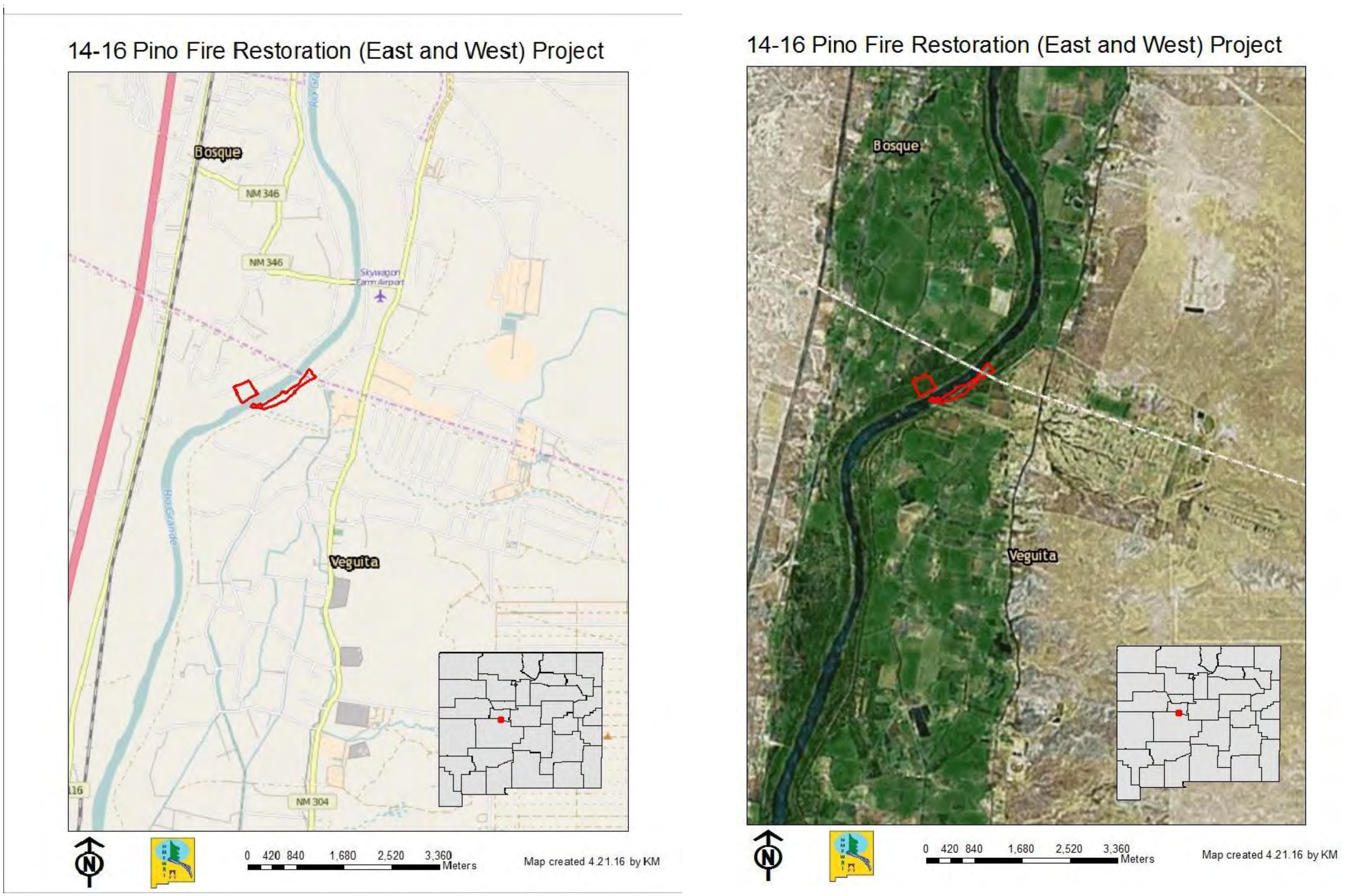


Figure 1. 14.16 Pino Fire in geographic context

Figure 2. KRQE News 13 SkyNews photos of the Pino Fire.
(Chelo Rivera, KRQE News 13, 2014)

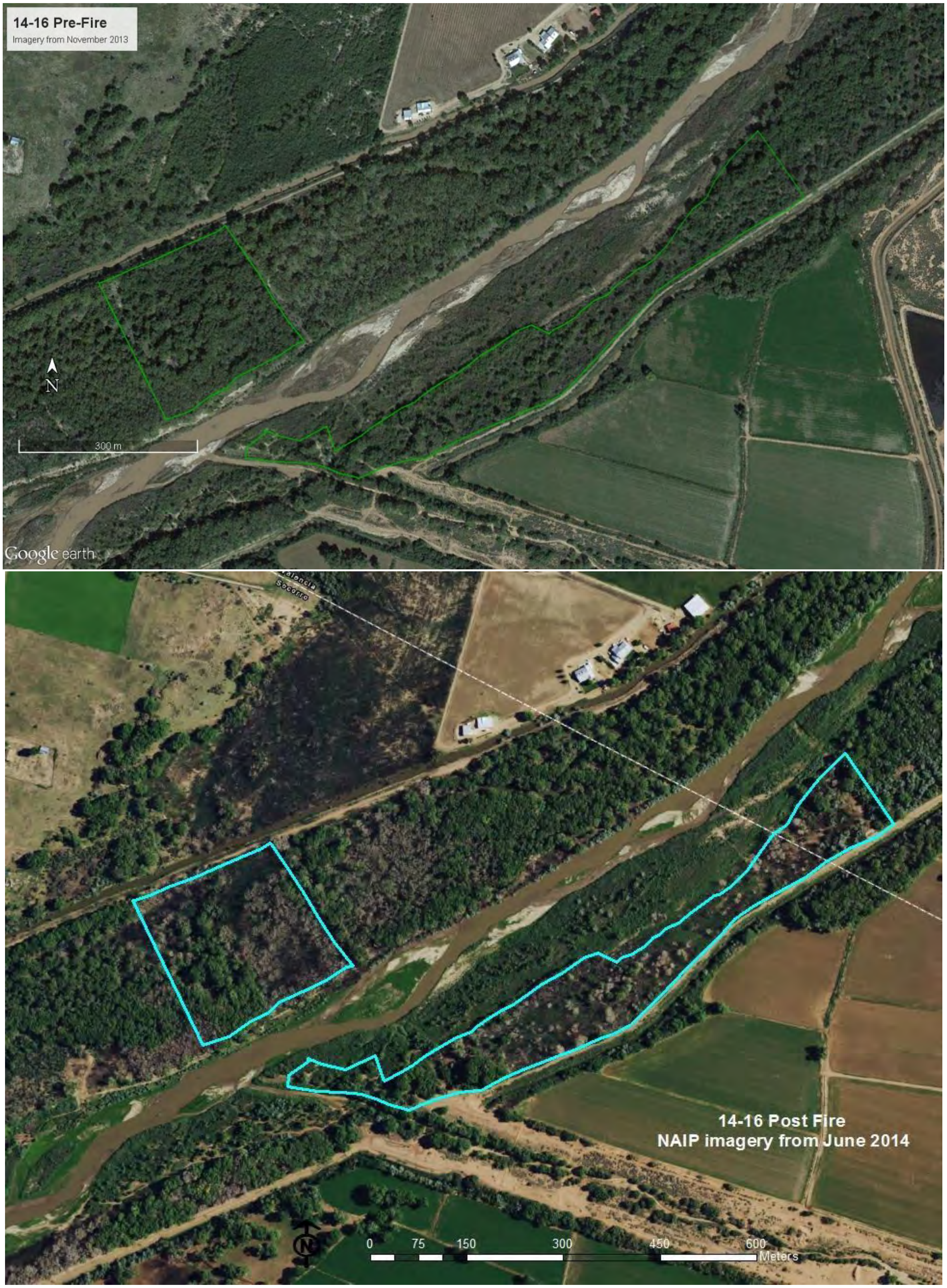


Figure 3. 14.16 Pre- and post-fire imagery (Google and NAIP).

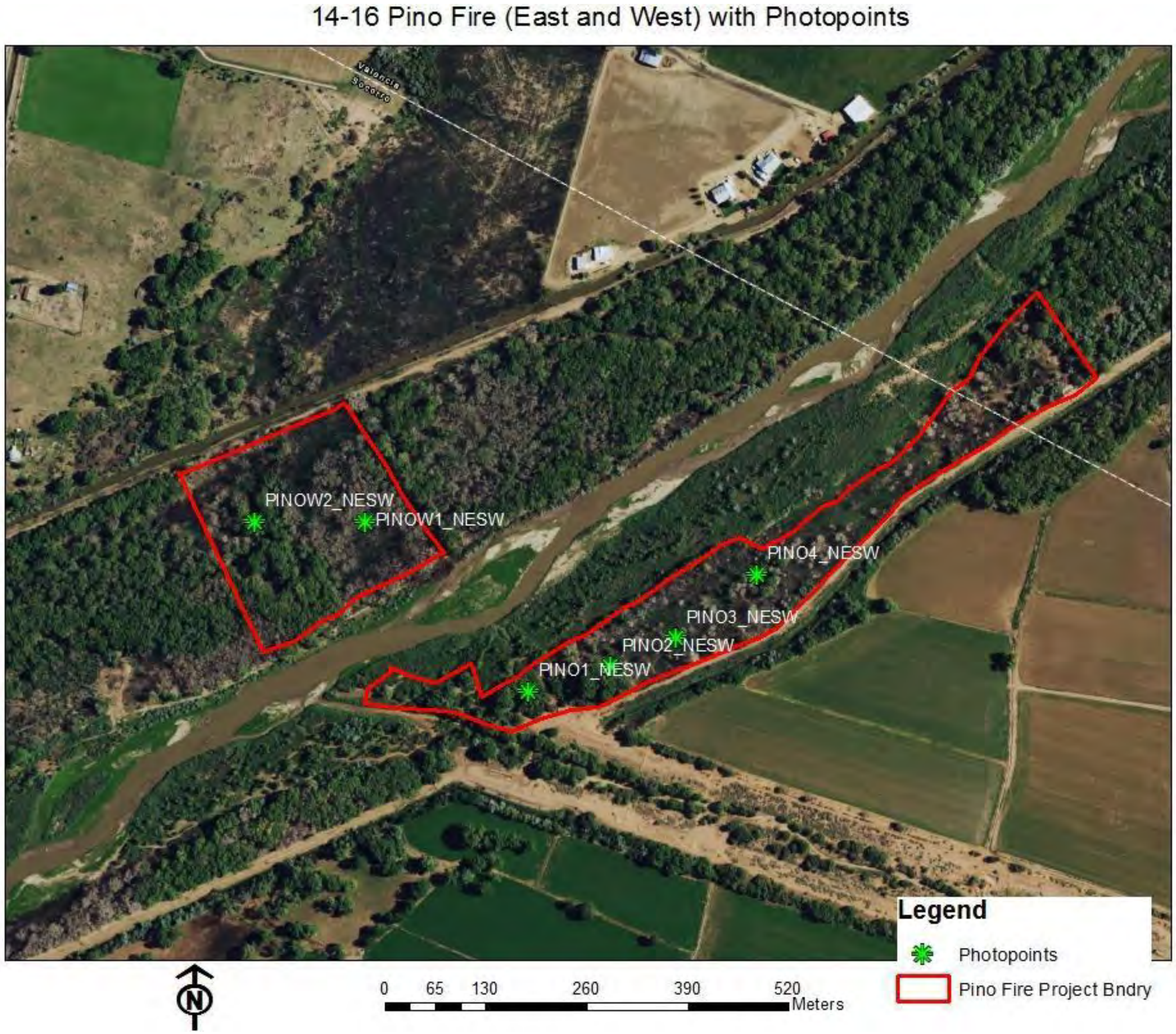


Figure 4. 14.16 Pino Fire monitoring photopoints

Monitoring Results

Initial monitoring was conducted at a 35.8 –acre project site on February 3, 2015 as part of a restoration project targeting non-native phreatophytes scheduled for 2014-2015. In 2021 in-person monitoring was not possible so LiDAR was used to evaluate the project for vegetation cover and classification.

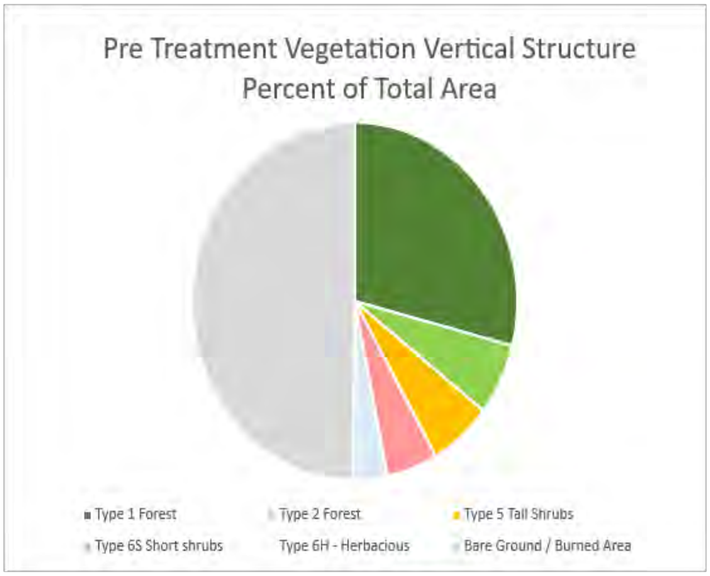


Figure 5. Pre-treatment vegetation cover by vertical vegetation class 2015

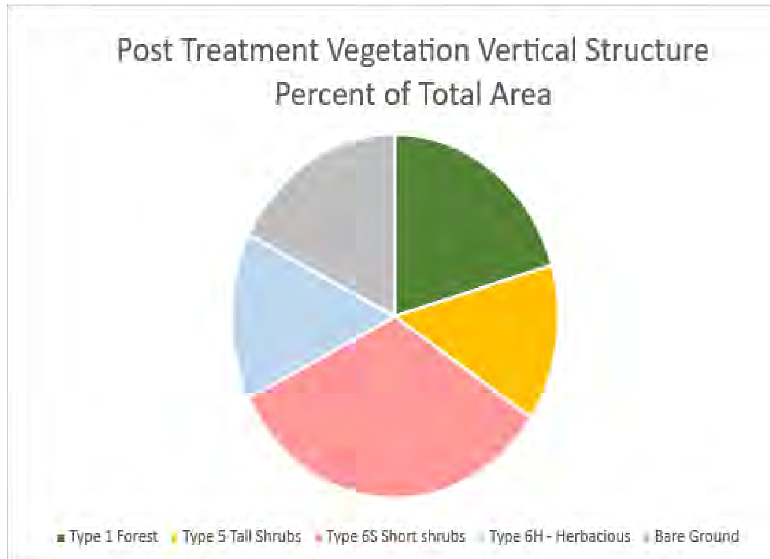


Figure 6. Post-treatment vegetation cover by vertical vegetation class, 2021

Vegetation Structure Type	Pre-Tx Acres	Post-Tx Acres	Pre-Tx Percent of Total Area	Post-Tx Percent of Total Area
Type 1 Forest	10.30	7.10	29.01%	20.46%
Type 2 Forest	2.30		6.48%	
Type 5 Tall Shrubs	2.20	4.83	6.20%	13.92%
Type 6S Short shrubs	1.80	11.54	5.07%	33.24%
Type 6H - Herbaceous	1.20	5.15	3.38%	14.83%
Bare Ground / Burned Area	17.70	6.10	49.86%	17.56%

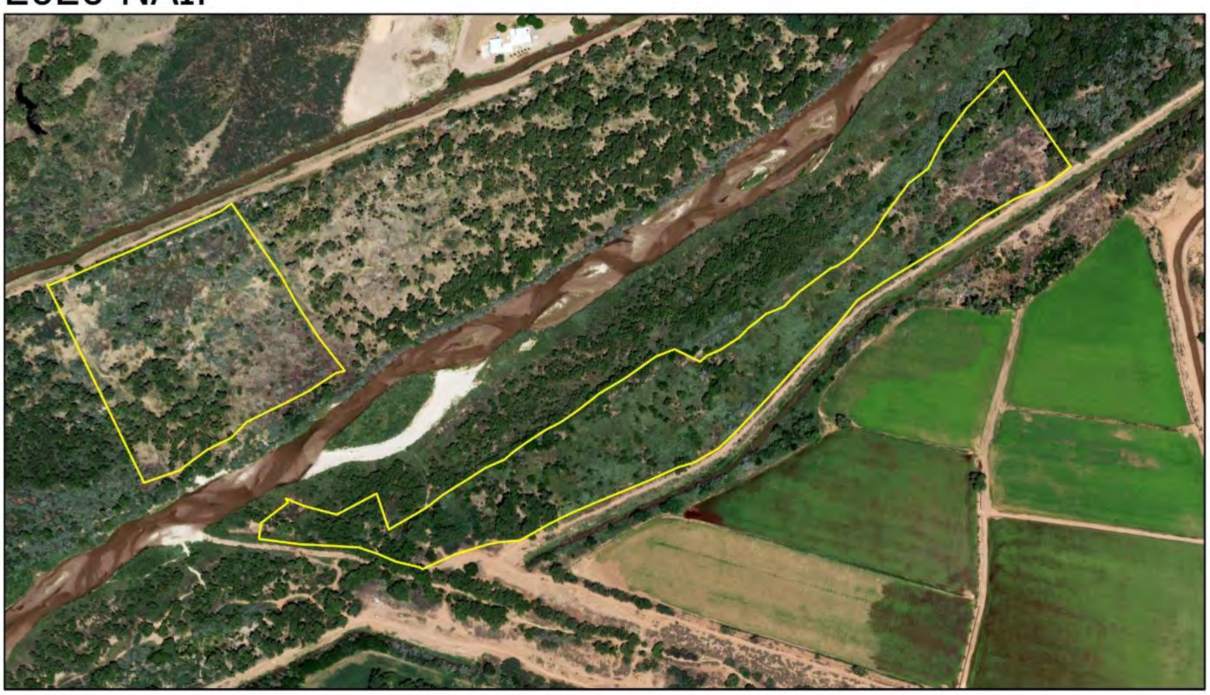
Table 1. Comparing the change in vertical vegetation classification from pre and post-treatment

14.16 Pino Fire Imagery Comparisons

2014 NAIP

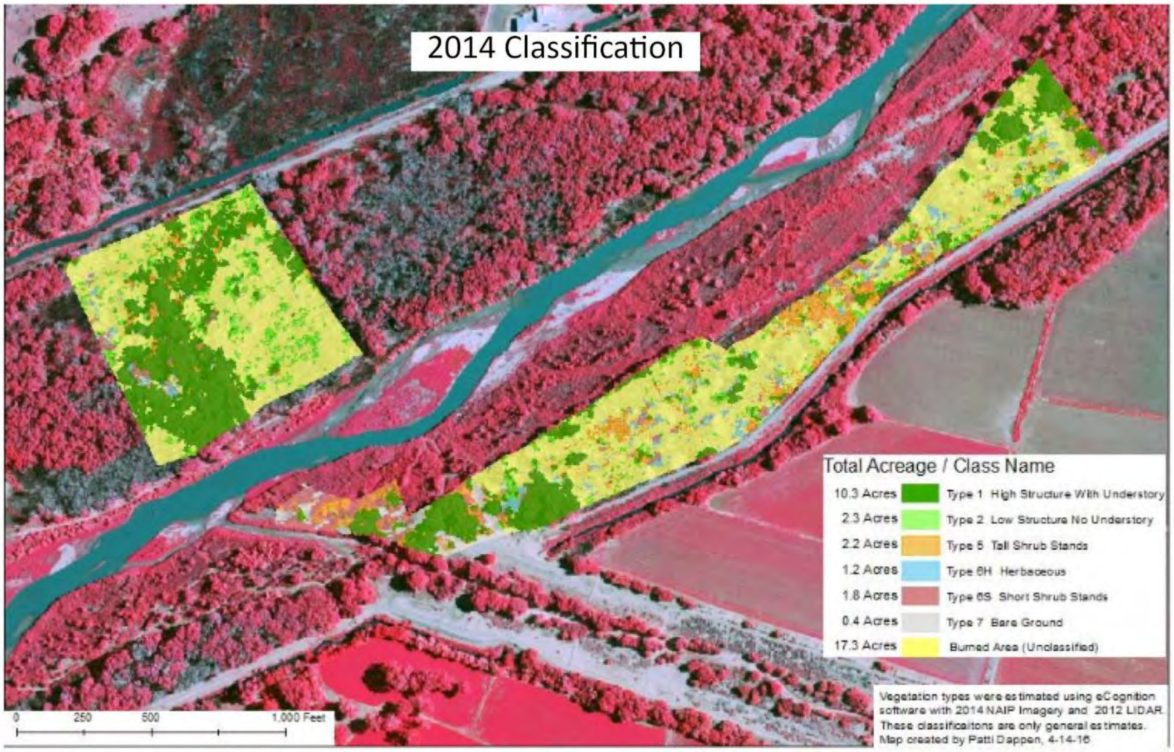
0 250 500 1,000 1,500 Feet

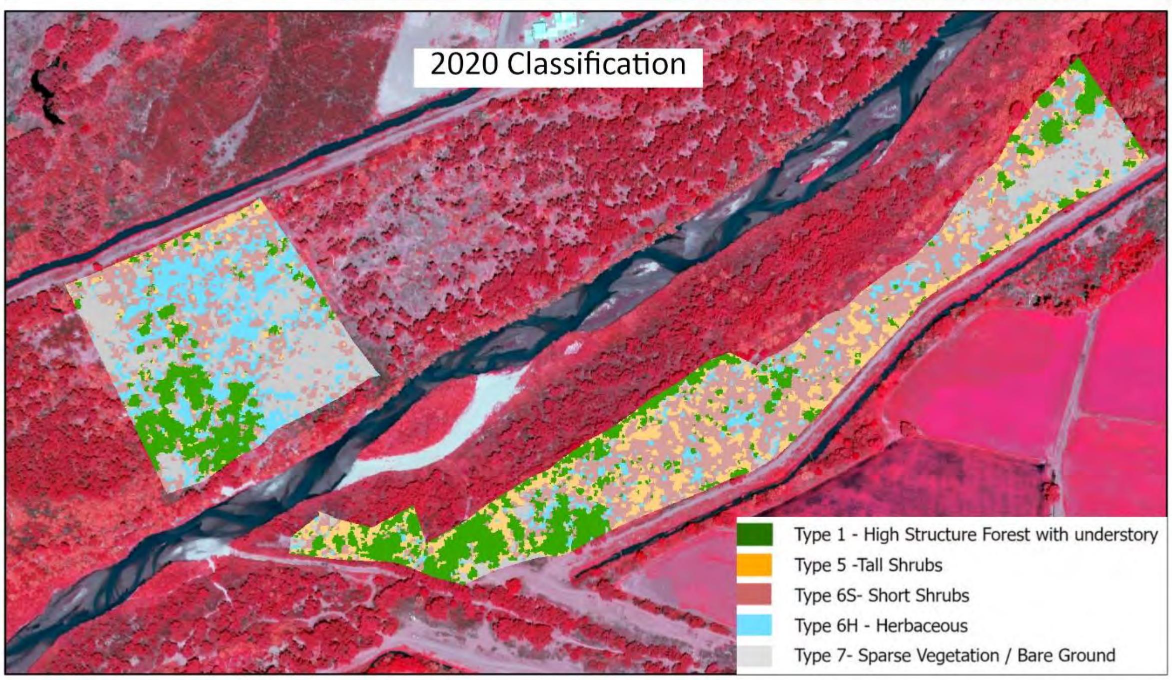
2020 NAIP



Vegetation Classification by Height Class

Modified Hink and Ohmart categories, from NMRAM





Summary

After the Pino fire, a more diverse habitat occupied the bosque area within the project boundaries. During pre-treatment monitoring, a mature forest with large and medium sized trees were recorded and could have contributed to the significance of the fire by creating multiple vertical levels of fuel. The fire acted as a reset for the project site and evened out the vertical vegetation layers. During our remote post-treatment monitoring, we observed a decrease in bare-ground and an increase in tall shrubs, short shrubs, and the herbaceous layer. This increase in ground level and short mid-story vegetation could be attributed to a less crowded mid-story. This shows that the fire cleared out the understory (i.e. a lack of type 2 forest) to a point that allowed regrowth that might not have had room to grow two years later. A less crowded mid-story reduces competition for species on the ground level and provides more opportunity for plant regeneration. Further monitoring in the future should be done to observe if any vegetation vertical classes become dominant.

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 version 2.0 For more information, contact Maryann McGraw of the NMED or NMFWRI.

While we provide a biotic site score and rating, 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 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).

The goal of 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 – Photopoints

Project Name	Point number in NMFWRI Garmin/ Name on Maps	Direction facing	Coordinates
14.16 pre	PINO1	N	34.529082729, -106.778150378
		E	
		S	
		W	
	PINO2	N	34.5293885, -106.777001387
		E	
		S	
		W	
	PINO3	N	34.529735008, -106.776095806
		E	
		S	
		W	
	PINO4	N	34.530490218, -106.774974726
		E	
		S	
		W	
	PINOW1	N	34.531010482, -106.78049312
		E	
		S	
		W	
	PINOW2	N	34.530996904, -106.782040922
		E	
		S	
		W	

Appendix II – Photos

PINO1, taken facing north.

PINO1, taken facing east.

PINO1, taken facing south.

PINO1, taken facing west.

PINO2, taken facing north.

PINO2, taken facing east.

PINO2, taken facing south.

PINO2, taken facing west.

PINO3, taken facing north.

PINO3, taken facing east.

PINO3, taken facing south.

PINO3, taken facing west.

PINO4, taken facing north.

PINO4, taken facing east.

PINO4, taken facing south.

PINO4, taken facing west.

PINOW1, taken facing north.

PINOW1, taken facing east.

PINOW1, taken facing south.

PINOW1, taken facing west.

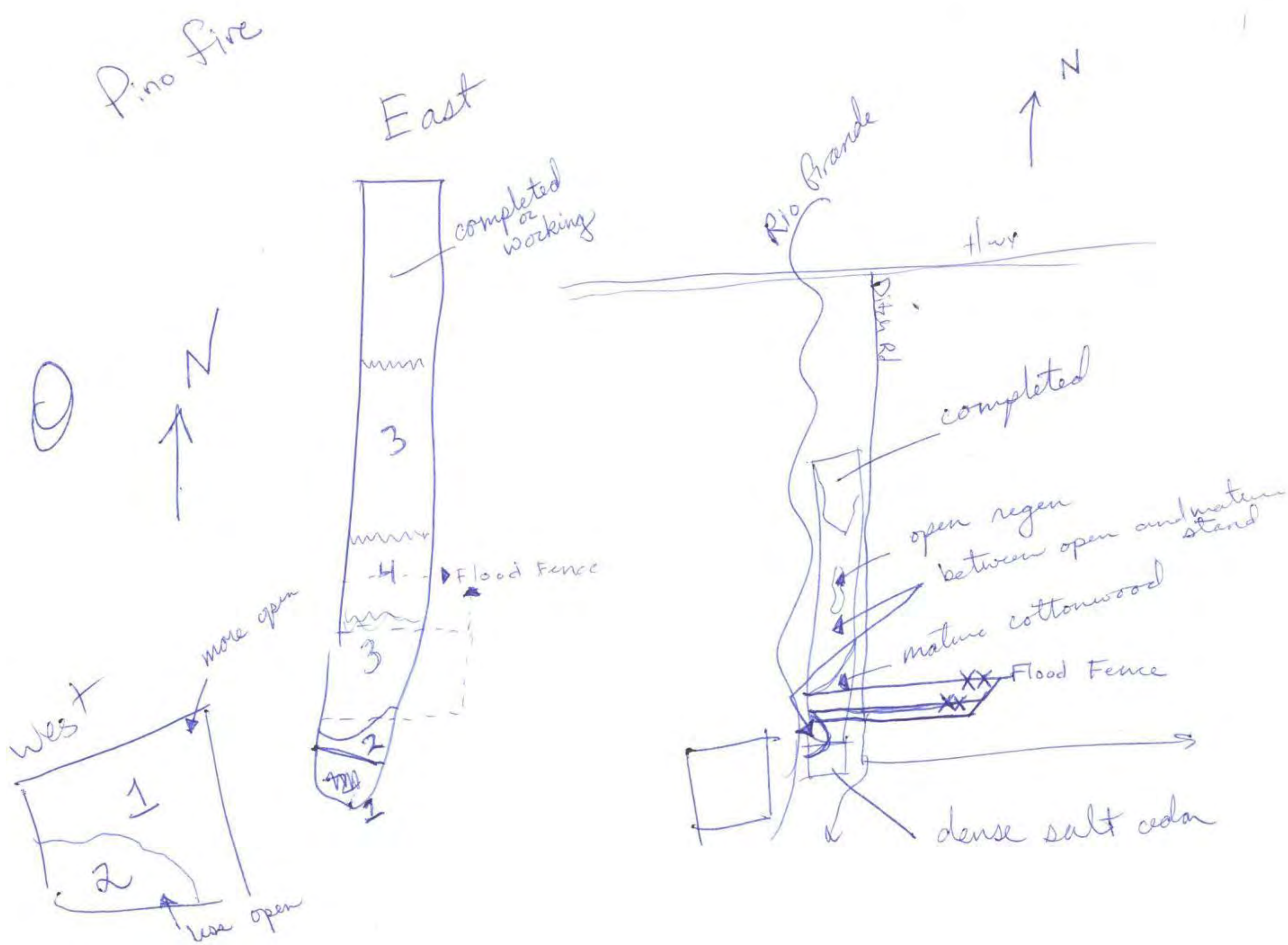
PINOW2, taken facing north.

PINOW2, taken facing east.

PINOW2, taken facing south.

PINOW2, taken facing west.

Appendix III – Contractor's Vegetation Polygon Sketch



Appendix IV – Monitoring Methods Available

Low-intensity methods

- Where: happens on all sites with GRGWA projects
- Method name: NMRAM (New Mexico Rapid Assessment Method v 2.0)
- 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 V - 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 1and 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.

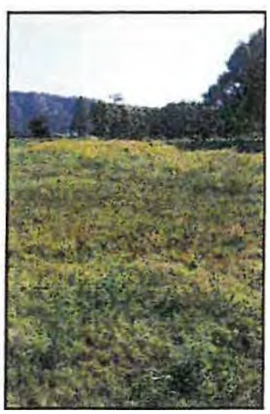
Young tree and shrub layer only (1.5-5 m [4.5-15 feet]) covering >25% of the area of the community (polygon). Stands dominated by tall shrubs and young trees, may include herbaceous vegetation underneath the woody vegetation. Photograph on San Francisco River by Y. Chauvin, 2012.

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.