Coronado SWCD Alfredo Baca Project 15.07

Post-treatment Monitoring Report

2022

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Coronado Soil and Water Conservation District

NMFWRI

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 pre-treatment vegetation monitoring assessment performed on a non-native phreatophyte removal project submitted on behalf of Alfredo Baca to the Greater Rio Grande Watershed Alliance. Following an explanation of monitoring methods, we will discuss 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 2.0, 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 (polygon) 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(ies). Where appropriate, one waypoint was used for photos taken in multiple directions.

Prior to entering the field, our GIS specialist created a map with the project boundaries as provided by GRGWA. She 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 specialist.

Due to the COVID-19 Pandemic, traditional post-treatment monitoring and photo points were not collected as travel restrictions and safety issues limited our traditional field season. 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)

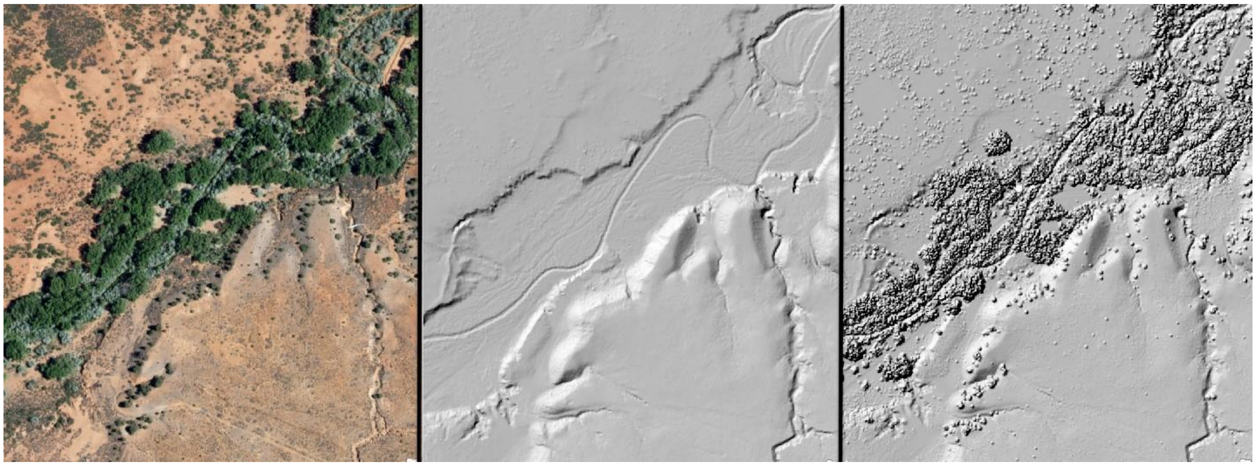
To develop a vegetation height classification, LiDAR and NAIP imagery were analyzed using eCognition software. An object oriented classification systems was used so that spectral characteristics as well as height above ground values of the vegetation could be incorporated into a robust classification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

LiDAR (Light Detection and Ranging) point clouds for this county were collected in 2018 and 4-Band 2020 NAIP Aerial Imagery with the Near Infra-Red band was incorporated to develop a classification stratifying vegetation within height classes. LiDAR was also used to develop Vegetation Height Profiles for areas around the photo point locations.

LiDAR Processing

2018 LiDAR for the Alfredo Baca Project 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.



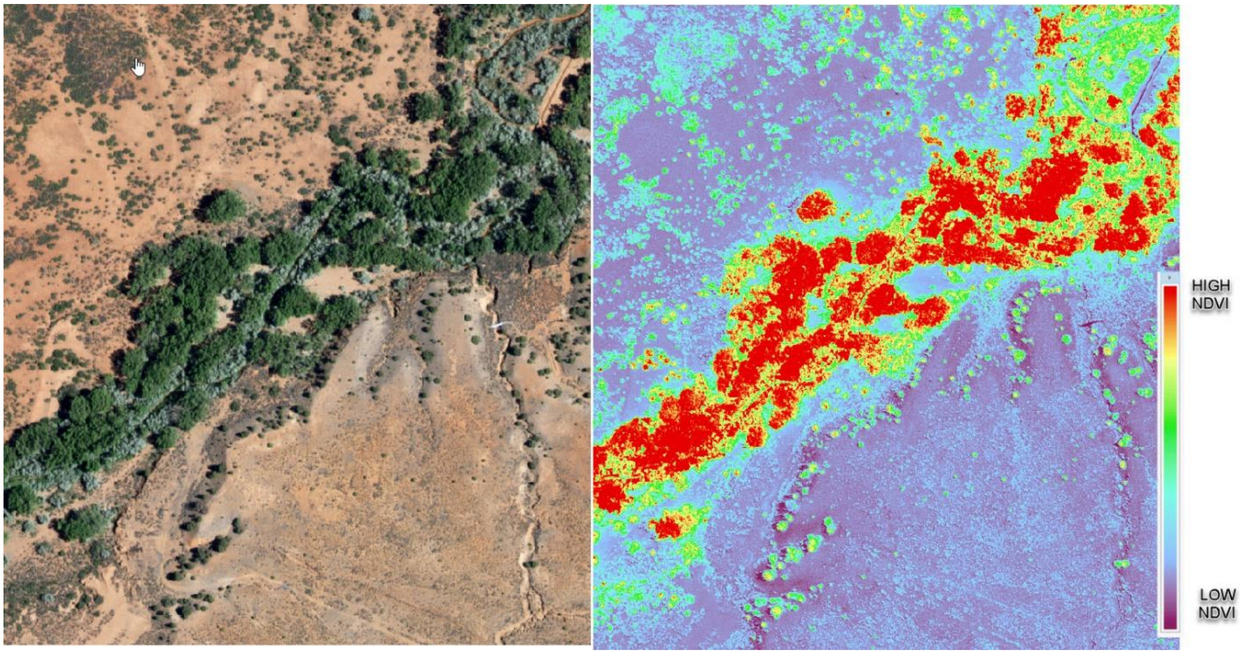
2020 NAIP *LiDAR Derived Digital Terrain Model* *LiDAR Derived Digital Surface Model*

Estimating Vegetation Cover using LIDAR and eCognition Software

eCognition software is an object based image classification system that allows for a semi-automated analysis of high resolution images. This approach divides the image into meaningful homogenous regions, known as image objects. These image objects are groups of pixels that are adjacent to each other and are spectrally similar. Once image objects are created, they provide a great deal of information from which an image classification can be developed.

Having height information with LiDAR greatly increases the accuracy of the classification. Though the use of traditional remote sensing is an effective means of mapping and monitoring land cover, the mapping of small shrubs and trees based only on spectral information is challenged by the fact that shrubs and trees often spectrally resemble grassland and thus cannot be safely distinguished and classified. With the aid of LiDAR-derived information, such as elevation, the classification of spectrally similar objects can be improved (Hellesen T, Matikainen, L. 2013)

Image segmentation within eCognition was based on elevation surface models. The 4-Band NAIP imagery was used to calculate image brightness values and NDVI values were calculated and both were used as inputs to identify vegetated and non-vegetated areas. The image was classified to identify vegetation vertical structure types representative of the modified Hink and Ohmart system. LiDAR profiles were used to identify understory vegetation to determine if forested area were Types 1 or Type 2. A digital surface model for all heights above ground was used to classify single-story Communities (Types 5, 6S, 6H, and 7). This classification incorporated height classes as well as NDVI to identify active vegetation. Once the vegetation was classified by height the resulting classification was exported from eCognition as a Raster image and acreages were calculated.



Example of Normalized Difference Vegetation Index NDVI Calculation

Personnel Involved

2021 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

- Kathryn R Mahan, Monitoring Program Manager
- Alex Makowicki, Monitoring Technician

2021 New Mexico Forest and Watershed Restoration Institute GIS Team:

- Patti Dappen, GIS Program Manager

Other persons contacted:

- Lynn D. Montgomery, Coronado SWCD
- Fred Rossbach, Field Coordinator, Greater Rio Grande Watershed Alliance

Baca Project

The project 15-07 is located on the property of Alfredo Baca near the community of Algodones, NM.

Algodones receives an average of 7.6 inches of rain annually. Temperatures range from an average high of 94 degrees Fahrenheit in July to an average low of 19 degrees in January (City Stats, 2016). According to the NRCS Web Soil Survey, the project area is 96% Peralta clay loam and 4% trail loamy sand. Similarly, the Web Soil Survey has categorized the project area as 96% R042XA055NM Salty Bottomland and 4% R042XA057NM Bottomland. (USDA NRCS, 2013)

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, burrograss, alkali sacaton, galleta, vinemesquite, and/or tobosa) (USDA NRCS).

Monitoring was conducted at this 24.4 -acre project site on August 24, 2015 as part of a restoration project targeting non-native phreatophytes scheduled for 2015-2016. Post-treatment monitoring occurred remotely in April of 2022 due to time constraints keeping the crew from visiting the site. Remote monitoring included the use of LiDAR and NAIP imagery along with eCognition software to classify vegetation. The project is located east of the Rio Grande in the Angostura Grant near the community of Algodones in Sandoval County, NM (see Figure 1 below). The project was sponsored by the Coronado SWCD. Planned treatment includes removal of Siberian elms, Russian olives and salt cedar of various sizes. Restoration goals are to reduce the fire hazard, continue landowner nonnative phreatophyte removal efforts, promote and preserving existing native vegetation and restore the riparian area to a more natural condition.

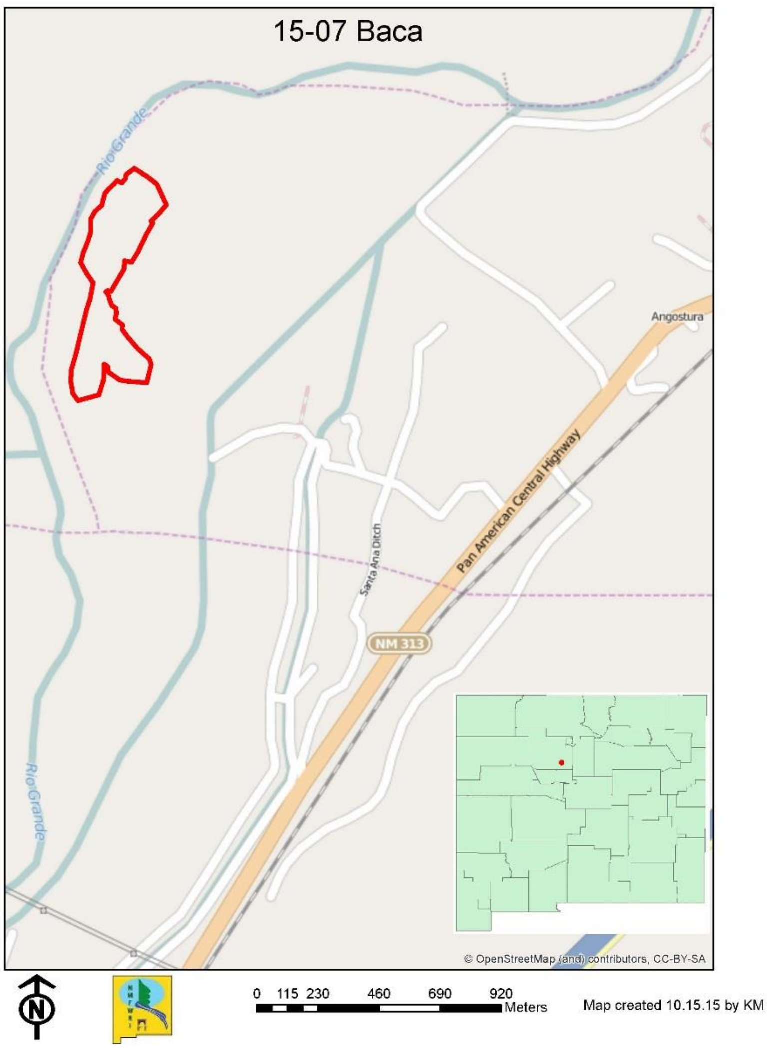


Figure 1. Project 15.07 in geographic context.

This site is part of Mr. Baca's family land. The predominant land use on the property is as pasture for both horses and cattle; there are some visible impacts of the grazing on the landscape, including sparse presence of pasture grass. The landowner's stewardship has resulted in over 100 acres of nonnative phreatophyte removal and control efforts, and at this time the landowner is working with the NRCS to develop a Conservation Management Plan for his approximately 250 acres.

The landowner's extensive work on the property has resulted in an open, park-like feel in some areas, but the area outlined for treatment as project 15-07 is relatively dense. Within the project area, there are several Russian olives resprouts as well as tamarisk and the herbaceous invasive Russian thistle. There was also a native cottonwood overstory, and at the time of the site visit, abundant ragweed and lambsquarters.

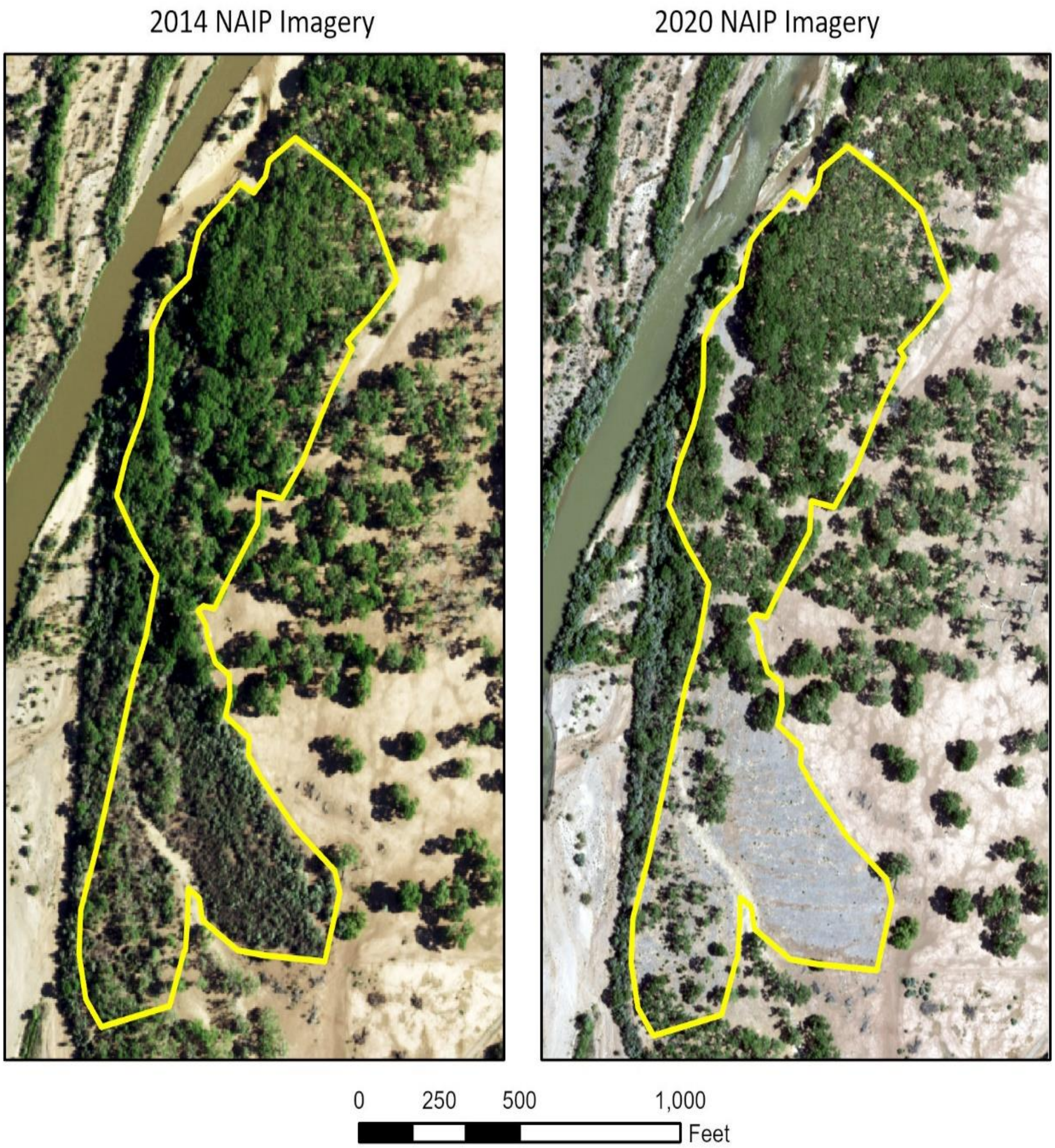


Figure 2. 2014 and 2020 NAIP imagery of 15.07 project boundary

2020 Vegetation Classification Results

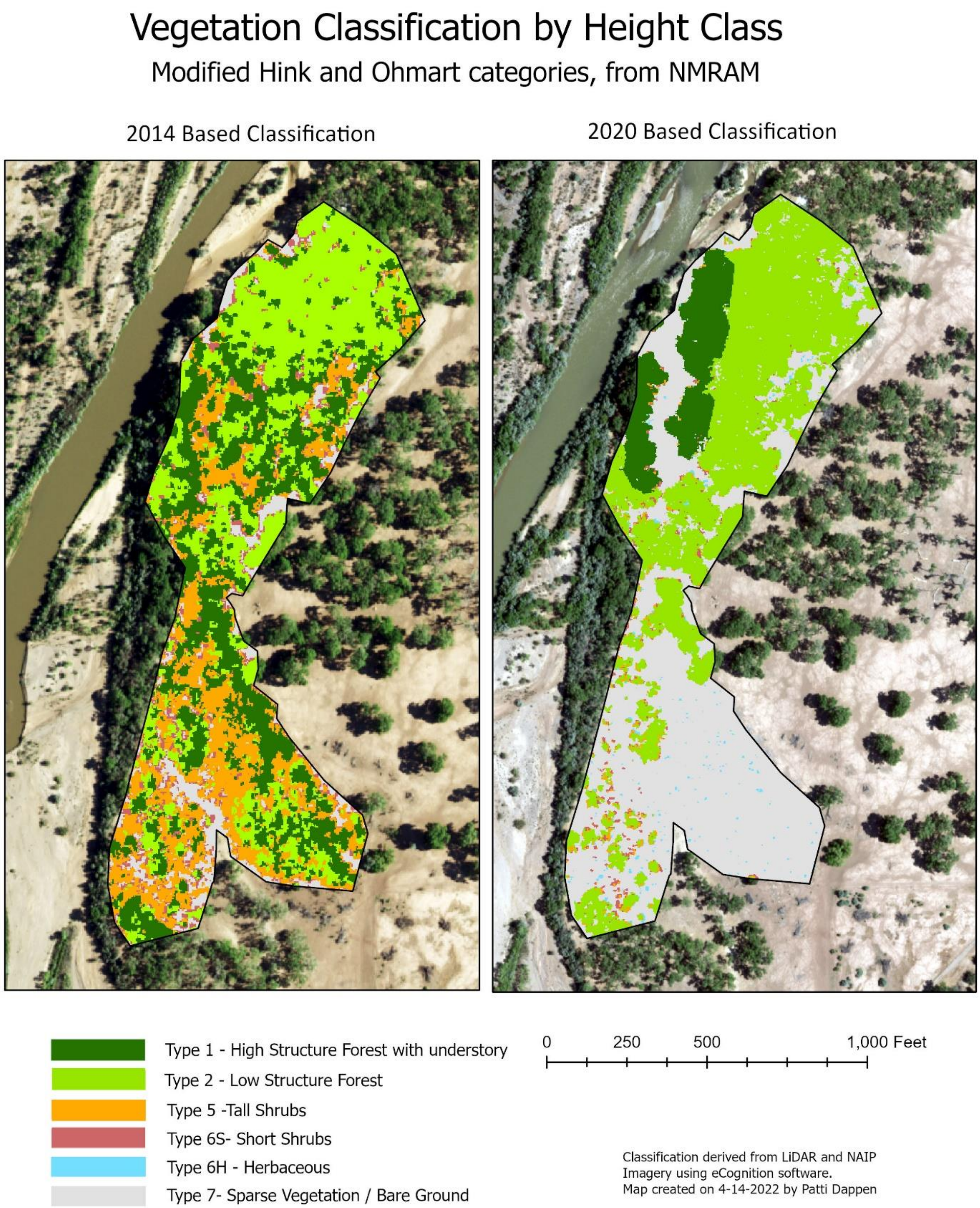


Figure 3. 2014 and 2020 Hink and Ohmart Vegetation Structure type using eCognition software.

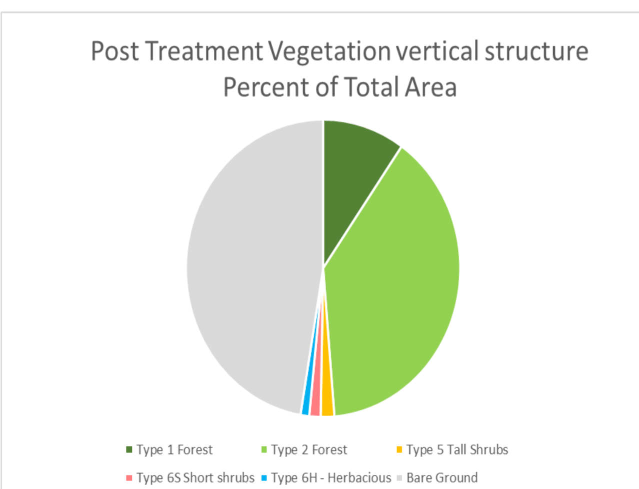
Summary

Figure 3 shows the results of the LIDAR and NAIP analysis as described above. Some differences exist between Figures 2 and 3, due to the year of imagery, appearance of "live" vegetation in imagery, time of site visit, etc. The most notable differences can be seen in the southeast corner of the project area which was previously dominated by tall shrubs and high structure forest. In the 2020 imagery this area of the project was observed to be sparse vegetation or bare ground. The loss of tall shrubs and high structure forest can be attributed to the removal of phreatophyte species such Siberian Elm and Russian Olive which were targeted during treatment. Without an onsite revisit it is hard to gain an idea of which plants are filling in the open spaces and what species are now dominant.

Vegetation Structure Type	Pre-Tx Acres	Post-Tx Acres	Pre-Tx Percent of Project Area	Post-Tx Percent of Project Are
Type 1 Forest	7.60	2.37	19.93%	9.72%
Type 2 Forest	8.20	9.50	29.95%	38.97%
Type 5 Tall Shrubs	5.30	0.39	15.75%	1.60%
Type 6S Short shrubs	1.40	0.33	7.58%	1.34%
Type 6H		0.25		1.02%
Bare Ground	1.80	11.55	26.84%	47.35%

Table 1. Post-treatment land cover categorized by Hink and Ohmart vegetation structure classification.

Vegetation Structure Type	Acres	Percent of Total Area
Type 1 Forest	7.60	19.93%
Type 2 Forest	8.20	29.95%
Type 5 Tall Shrubs	5.30	15.75%
Type 6S Short shrubs	1.40	7.58%
Bare Ground	1.80	26.84%



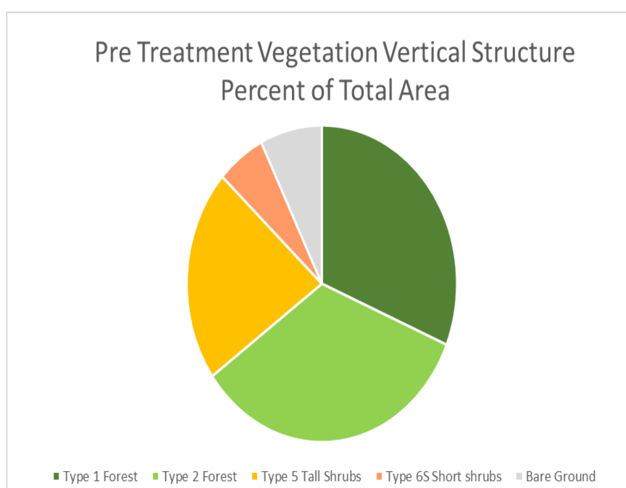


Figure 4. Percent total of project site by vertical vegetation structure.

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 2.0. 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. 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 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

Project Name	Point number in NMFWRI Garmin	Direction facing (azimuth)	Description	Coordinates
15.07 pre	BACA1	184	polygon 6	35.377428, -106.51274
	BACA2	176	polygon 5	35.37453, -106.513179
	BACA3	265	polygon 1	35.37256, -106.512627
	BACA3	45	2nd from same pt, polygon 2	35.37256, -106.512627
	BACA4	160	polygon 4	35.375089, -106.512885
	BACA5	322	polygon 5	35.375553, -106.512771

Appendix II - Photos

BACA1, view of polygon 6 – cottonwoods, Russian olives and salt cedars. Taken facing 184 degrees.

BACA2, view of polygon 5 - cottonwoods, Russian olives and salt cedars. Taken facing 176 degrees.

BACA3, view of polygon 1. Taken facing 265 degrees.

BACA3, view of polygon 2.
Taken facing 160 degrees.

BACA4, view of polygon 4.
Taken facing 160 degrees.

BACA5, view of polygon 5.
Taken facing 322 degrees.

Appendix III – 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 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.

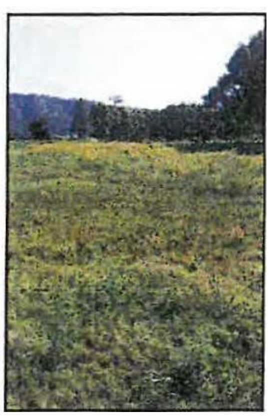
Young tree and shrub layer only (15-5 m [4.5-15 feet]) covering >25% of the area of the community (polygon). Stands dominated by tall shrubs and young trees, may include herbaceous vegetation underneath the woody vegetation. Photograph on San Francisco River by Y. Chauvin, 201
2.

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.