San Cristobal Drainage Project 15-21

Pre-treatment Monitoring Report

2015

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conserving natural resources *for our future*

Santa Fe-Pojoaque SWCD

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 by the Santa Fe-Pojoaque Soil and Water Conservation District (SWCD) 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.

LIDAR was not available for this site, and NAIP imagery could not be classified by our GIS specialist because of the vegetation density along the river.

Personnel Involved

2015 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

- Kathryn R Mahan, Ecological Monitoring Specialist

2015 New Mexico Forest and Watershed Restoration Institute GIS Team:

- Adrienne Miller, GIS Specialist
- Patti Dappen, GIS Specialist

Other persons contacted:

- Fred Rossbach, Field Coordinator, Greater Rio Grande Watershed Alliance

San Cristobal Drainage Project

Project 15-21 is located on the San Cristobal Ranch near the community of Lamy, NM.

Lamy receives an average of 15.6 inches of rain annually. Temperatures range from an average high of 86 in July, average low of 19 in January (City Stats, 2015). According to the NRCS Web Soil Survey, the project is 85% Jaralosa-Chupe-Riverwash Complex and 11% Zia-Gullied Land complex. The ecological sites present on this site are predominantly Sandy R035XA113NM, followed by Loamy R035XA112NM, Salt Flats R035XA126NM, and Gravelly R035XG114NM (USDA NRCS, 2013).

The Sandy ecological site typically supports plant communities composed of fourwing saltbush, winterfat, and sagebrush at the shrub layer, and at the herbaceous layer, Rocky Mountain beeplant, blue grama, western wheatgrass, threeawns, galleta, dropseed, Indian ricegrass, needle-and-thread, squirreltail, and New Mexico feathergrass. This may also support a shrub-dominated state (dominanted by sagebrush, rabbitbrush with a blue-grama/threeawn/dropseed/muhly understory), as well as a juniper-dominated state (with a patchy grass understory of blue grama, dropseeds, galleta, Indian ricegrass and threeawn) (USDA NRCS).

The Loamy ecological site typically is in a grassland state dominanted by blue grama, Western wheatgrass, galleta, ring muhly, dropseed and/or threeawn, but can also be found in piñon-juniper invaded state (piñon, juniper, and blue grama), grass/succulent-mix state (blue grama, cholla-prickly pear), shrub-dominated state (rabbitbrush/horsebrush and blue grama), and bare state (bare/sparse grass) (USDA NRCS, n.d.).

Monitoring was conducted at this 35.8 –acre project site on November 19, 2015 as part of a restoration project targeting non-native phreatophytes scheduled for 2015-2016. The project is located on the San Cristobal Ranch off NM Hwy 41 near Lamy and Galisteo, NM in Santa Fe County (see Figure 1 below). The project was sponsored by the Santa Fe- Pojoaque SWCD. Planned treatment includes removal of varying density salt cedar as well as Russian olive and Siberian elm along the San Cristobal perennial drainage. Restoration goals are to increase wildlife and livestock forage and increase hydrologic function including an increase in overland flow (presence of water near springs) and a reduction in erosion and channelization) leading to an overall increase in ecosystem health and function.

Figure 1. Project 15-21 in geographic context.

This site is part of the working San Cristobal Ranch, which is managed by Singleton Ranches. The predominant land use on the property is as pasture for both horses and cattle. This is the second GRGWA project to be done in the San Cristobal Drainage (in 2014, project 14-15 was outlined near this area). The site is at approximately 6200 feet.

San Cristobal Drainage, referred to in most literature NMFWRI encountered as the San Cristóbal Arroyo, drains from Glorieta and Rowe Mesa, which becomes the east fork of the Galisteo River. According to the Galisteo Basin Archaeological Sites Protection Act, the San Cristóbal Arroyo is a permanent (perennial) water source (New Mexico Department of Cultural Affair Office of Archaeological Studies, 2014). There is limited stream data available beginning in 1955 collected by the USGS from stream site "08317600 San Cristobal Arroyo NR Galisteo, NM" (USGS, 2015).

There are some access concerns to site due to the soil type, which, in the project area, is predominantly Jaralosa-Chupe-Riverwash complex and is not passable when wet. At the time of the site visit, within the project area, there was plentiful tamarisk, as well as some Russian olive and Russian thistle. There was also an abundance of native species including cottonwood, coyote willow, juniper, marestail, chamisa, snakeweed, sagewort, helianthus, 4-wing saltbush, cocklebur, sedges, blue grama, ring muhly, saltgrass, and other native grasses.

Metric 15-21 November 19, 2015	**Score**
Relative Native Plant Community Composition	2
Vegetation Horizontal Patch Structure	4
Vegetation Vertical Structure	2
Native Riparian Tree Regeneration	3
Exotic Invasive Plant Species Cover	1
Project Biotic Score (based on above ratings)	2.3
Project Biotic Rating	C/Fair
Soil Surface Condition	2
Surface Fuels	0.5

The lowest scores for this project came from the high percentage of invasive plants. The project scored best in the horizontal structure metric, because there were multiple plant communities distributed across the landscape of the project area. This is reflected in the vegetation polygon map, below. This site scored a 2.3 out of 4 overall, which is a "C" or "Fair" biotic rating.

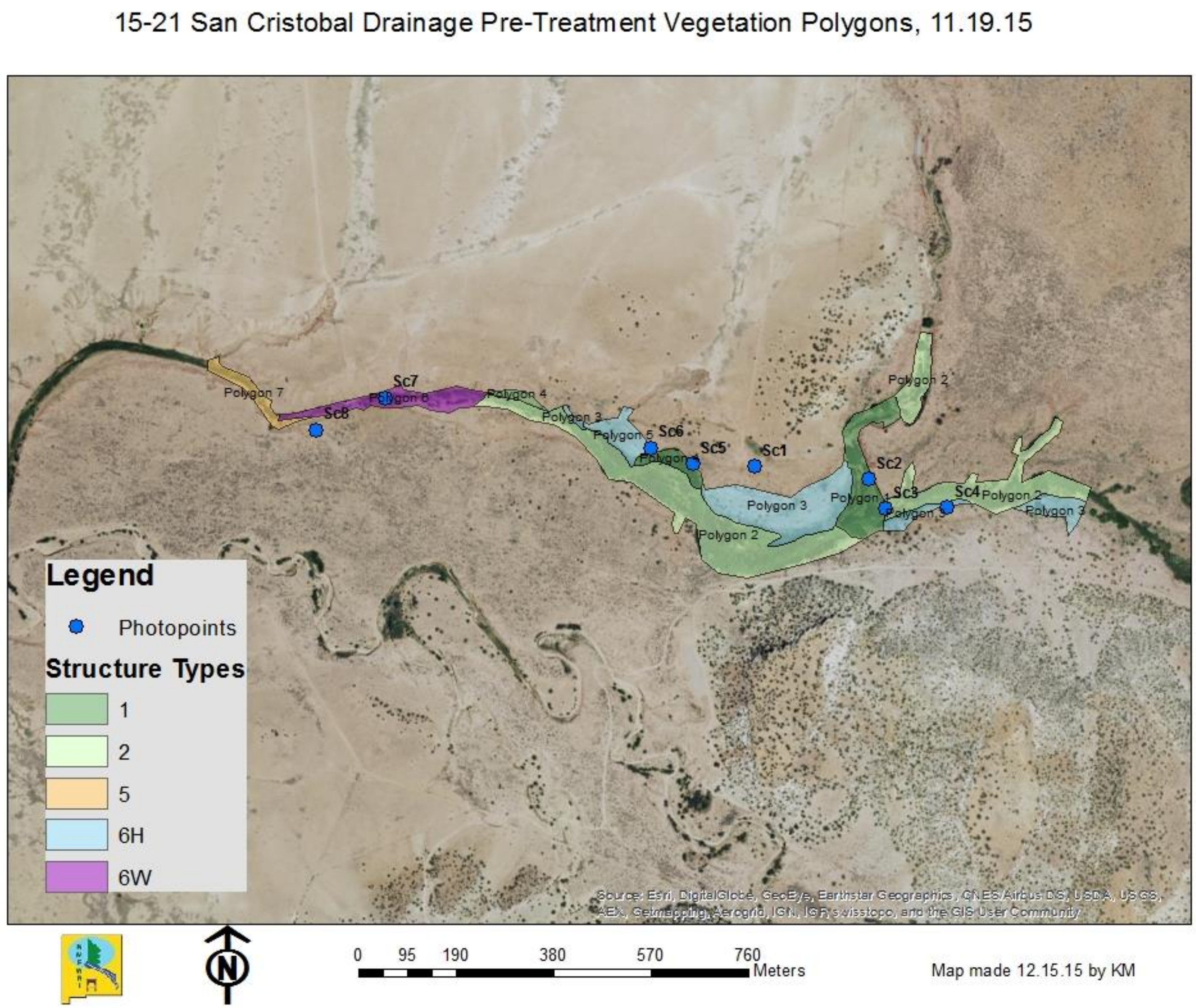

Figure 2. Project 15-21 vegetation polygons and photopoints.

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. 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 – Photopoints

Project Name	Point number in NMFWRI Garmin	Direction facing (azimuth)	Description	X coord	Y coord
15.21 pre	SC1	184	view of drainage	35.38719675	-105.880288
	SC2	320	view up arm	35.38699793	-105.8778486
	SC2	148	view toward main project body	35.38699793	-105.8778486
	SC3	140	view of drainage bottom	35.3864775	-105.8774877
	SC4	80	view of fork	35.38650759	-105.8761508
	SC5	285	bend with taller trees (olive, cottonwood) & erosion	35.38724368	-105.8816127
	SC6	285	grass ledge/ taken standing on eroding hill	35.3875104	-105.8825401
	SC7	270	floodplain, erosion...very wet	35.38834901	-105.8882329
	SC8	292	west end of project	35.38777	-105.8897222

Appendix II - Photos

SC1, view of drainage. Taken facing 184 degrees.

SC2, view up “arm” of project. Taken facing 320 degrees.

SC2, view toward main body of project. Taken facing 148 degrees.

SC3, view of drainage bottom. Taken facing 140 degrees.

SC4, view of fork. Taken facing 80 degrees.

SC5, view of San Cristobal drainage bend – cottonwood, Russian olive, and erosion. Taken facing 285 degrees.

SC6, view of grassy terrace. Taken standing on eroding hill, facing 285 degrees.

SC7, view of floodplain and erosion; wet area. Taken facing 270 degrees.

SC8, west end of project. Taken facing 292 degrees.

Appendix III – Monitoring Methods currently 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.

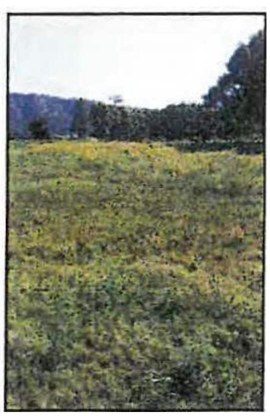
Young tree and shrub layer only (1.5-5 m [4.5-15 feet]) covering >25% of the area of the community (polygon). Stands dominated by tall shrubs and young trees, may include herbaceous vegetation underneath the woody vegetation. Photograph on San Francisco River by Y. Chauvin, 201
2.

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.