New Mexico Rapid Assessment Method
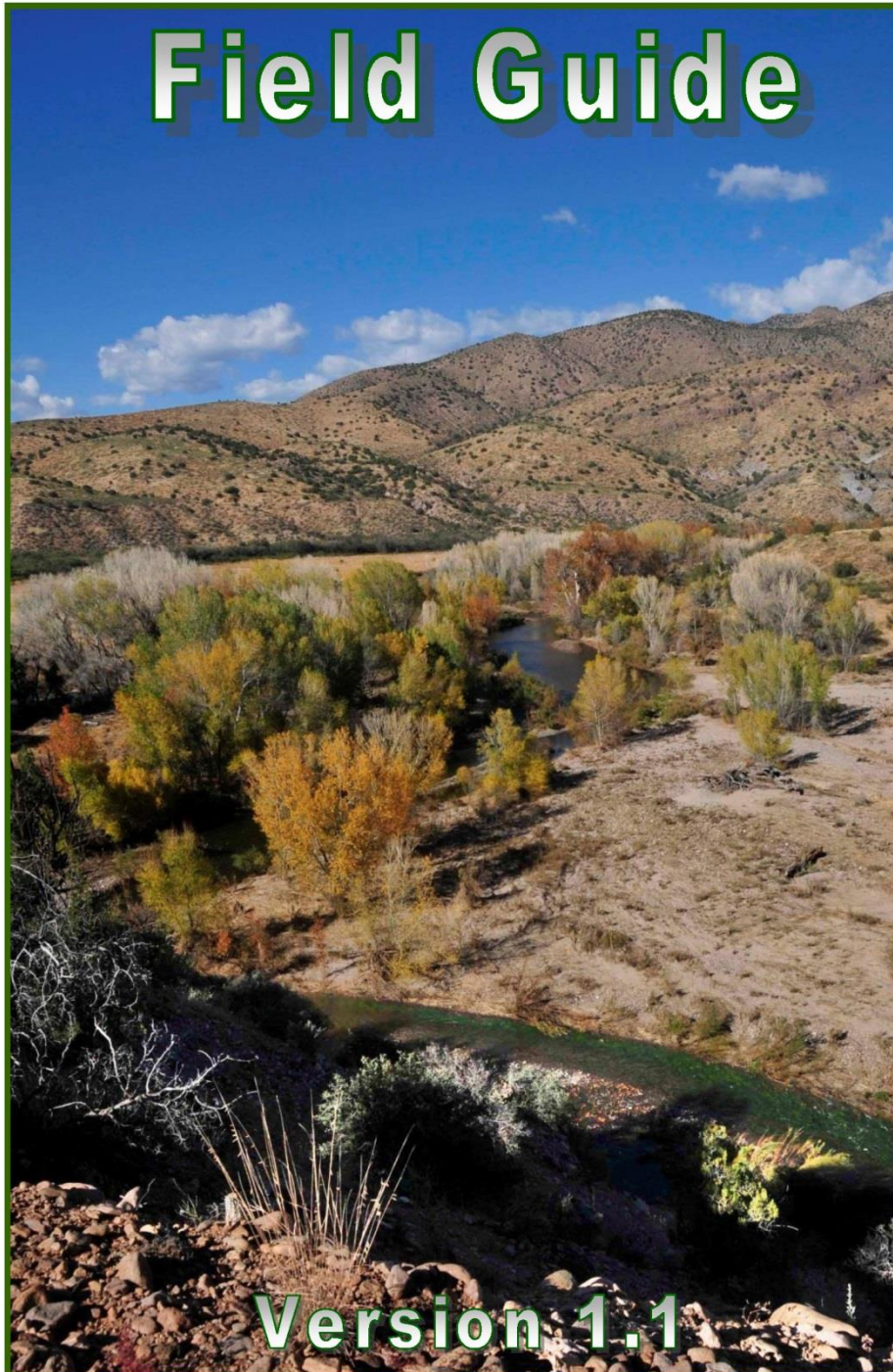
Lowland Riverine Wetlands

Field Guide

Version 1.1

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NMRAM

New Mexico Environment Department

Surface Water Quality Bureau

and

Natural Heritage New Mexico

Museum of Southwestern Biology

University of New Mexico

New Mexico Rapid Assessment Method

Lowland Riverine Wetlands Field Guide.

Version 1.1

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Abbreviations

CT	Community Type	RWSI	Relative Wetland Size Index
DBH	Diameter at Breast Height	SA	Sample Area
E	Exotic	Sc	Current Wetland Size
GIS	Geographic Information System	Sh	Historic Wetland Size
GPS	Global Positioning System	SWQB	Surface Water Quality Bureau
LUI	Land Use Index	U	Unknown
M	Mixed Native and Exotic	USA	United States of America
N	Native	USDA	United States Department of Agriculture
NMED	New Mexico Environment Department	WOI	Wetland of Interest
NMRAM	New Mexico Rapid Assessment Method		
NRCS	Natural Resources Conservation Service		
PDF	Portable Document Format		
RCC	Riparian Corridor Connectivity		
RSR	Relative Size Ratio		

I. Introduction

This New Mexico Rapid Assessment Method (NMRAM) Field Guide provides procedures and the metric measurement protocols for conducting a rapid assessment of wetlands in the Lowland Riverine wetland subclass. The assessment is a multi-step process involving a two-person team. It begins with delineating a target Wetland of Interest (WOI) and one or more Sampling Areas (SAs) within the WOI to be assessed. For each SA, 13 metrics are measured and rated (Table 1). These are grouped into three attribute categories: Landscape Context (4 metrics), Biotic (5), and Abiotic (4). Landscape Context metrics are assessed using maps and/or a geographic information system (GIS) and preferably completed before going into the field to help familiarize the team with the site. The Biotic and Abiotic attributes are evaluated in the field along with a set of field-based stressor checklists and documentary photographs. Worksheets are provided to guide the taking and recording of data (Appendix A) along with a glossary of terms (Appendix G). The worksheets together with maps and photographs make up the *NMRAM Assessment Package* that becomes the supporting record of a project.

Step-by-step protocols follow for filling out the worksheets and evaluating and rating each metric. Ratings for each metric have values from one (poor condition) to four (excellent). To arrive at an overall rating for an SA, individual metric ratings are weighted and rolled up by attribute group into a final overall numeric score. Based on the scores, categorical condition ranks are assigned as follows: A = Excellent (>3.25-4.0); B = Good (>2.5-3.25); C = Fair (>1.75-2.5), and D = Poor (1.0 -1.75). When there are multiple SAs in a WOI, the SA scores can be averaged to arrive at a final rank for entire wetland.

Table 1. List of NMRAM Lowland Riverine metrics with page references for the worksheets in Appendix A.

Metrics	Field Worksheet Page
Landscape Context	
L1. Buffer Integrity Index	3
L2. Riparian Corridor Connectivity	5
L3. Relative Wetland Size	5
L4. Surrounding Land Use [Buffer]	6
Biotic	
B1. Relative Native Plant Community Composition	10
B2. Vegetation Horizontal Patch Structure	10
B3. Vegetation Vertical Structure	11
B4. Native Riparian Tree Regeneration	12
B5. Invasive Exotic Plant Species Cover	12
Abiotic	
A1. Floodplain Hydrologic Connectivity	14
A2. Physical Patch Complexity	15
A5. Soil Surface Condition	16
A6. Channel Mobility	17

II. Pre-field Protocols

Pre-field steps include:

1. Download the worksheets for NMRAM Lowland Riverine Version 1.1 from the New Mexico Environment Department Surface Water Quality Bureau (NMED SWQB) NMRAM website or copy worksheets from Appendix A.

2. Delineate the project area, WOI(s), and provisional SA(s) boundaries on maps as described below to assess the Landscape Context suite of metrics and to guide the field survey.

3. Verify land ownership, review site background information, and obtain the necessary permissions for sampling.

4. Review recent river flow data for your site using gage data in Appendix B (this is a key element for the Floodplain Hydrological Connectivity metric).

5. Assemble field equipment, guides, worksheets, and maps.

Worksheets

Worksheets are provided in Appendix A and a digital version is available from the NMED SWQB website.[1] The downloaded worksheets are smart PDFs where data and ratings can be directly entered in the field using a laptop or other digital device, or recorded manually on printed forms and entered later into the digital file in the office. The PDF worksheets are designed to compute some metric ratings automatically when the data are entered; other metric ratings must still be evaluated directly. The worksheets also track the field process, global positioning system (GPS) locations, and photo inventory.

Maps

The NMRAM requires field maps to conduct the assessment. Two different map formats are required to support field mapping and the field survey:

1) <u>Landscape Map.</u> A map at approximately 1:6,000-10,000 scale that shows the SA(s) in a landscape context. Any modifications to the SA location that occur on site along with any features to aid the field validation of Landscape Context metrics around the SA should be sketched on the Landscape Map. Specifically, the map should delineate the maximum extent of the potential buffer and include the buffer lines used to measure the Buffer Width sub-metric of the Buffer Integrity Index (see Landscape Context metrics below).

2) <u>SA Map.</u> A map that encompasses a single SA at between 1:1,500-3,000 scale for mapping vegetation communities, abiotic features, and transect locations (see Biotic and Abiotic metrics below). The vegetation communities in an SA can be provisionally mapped on the SA Biotic Map prior to field reconnaissance and then validated and modified during the survey. Modifications that occur in the field to the SA boundary should be recorded on the SA Abiotic Map.

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[1] https://www.env.nm.gov/swqb/

Two copies of the field maps are required, one for each person or team that is measuring biotic and abiotic metrics, respectively. Each map should have a 100- or 200-m UTM grid overlay to help navigation in the field along with a north arrow and scale bar (Figure 1). A third optional map at 1:24,000 or coarser is often useful for locating a site relative to highways and towns.
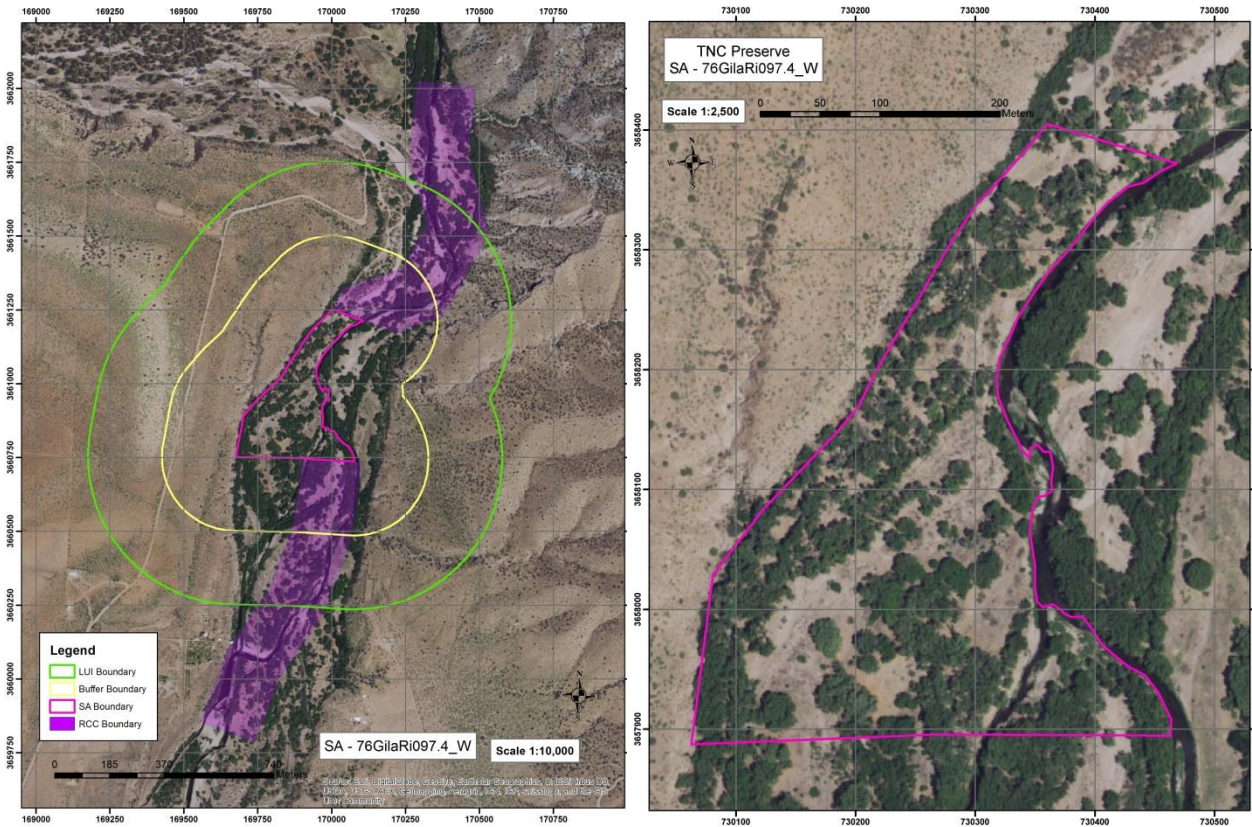
Figure 1. Examples of Landscape and SA field maps. On the left, a landscape-scale map with boundaries for measuring the landscape metrics. On the right, a fine-scale SA map for field vegetation and abiotic features mapping.

Delineating the Wetland of Interest (WOI)

Delineating a WOI is necessary for determining the number and placement of SAs and for some metric measurements. A WOI is delineated using a GIS or paper maps and may or may not coincide with the project area. When it does not, wetland vegetation maps can help inform the boundaries of a WOI in concert with aerial imagery interpretation (e.g., National Wetland Inventory maps[2]). In addition, boundaries should:

- follow the natural feature patterns of the wetland and be relatively homogeneous;
- belong to the target wetland subclass;
- avoid major discontinuities caused by land use (i.e., avoid inclusions of agricultural lands, urban development, and other non-wetland elements).

An example where the WOI boundary follows these natural-features guidelines is shown in Figure 2. This approach is designed to meet the immediate needs of a rapid assessment when other procedures are not required or desired (e.g., jurisdictional wetland delineation). As necessary, the boundary may be modified based on the field reconnaissance or other requirements at a project level.
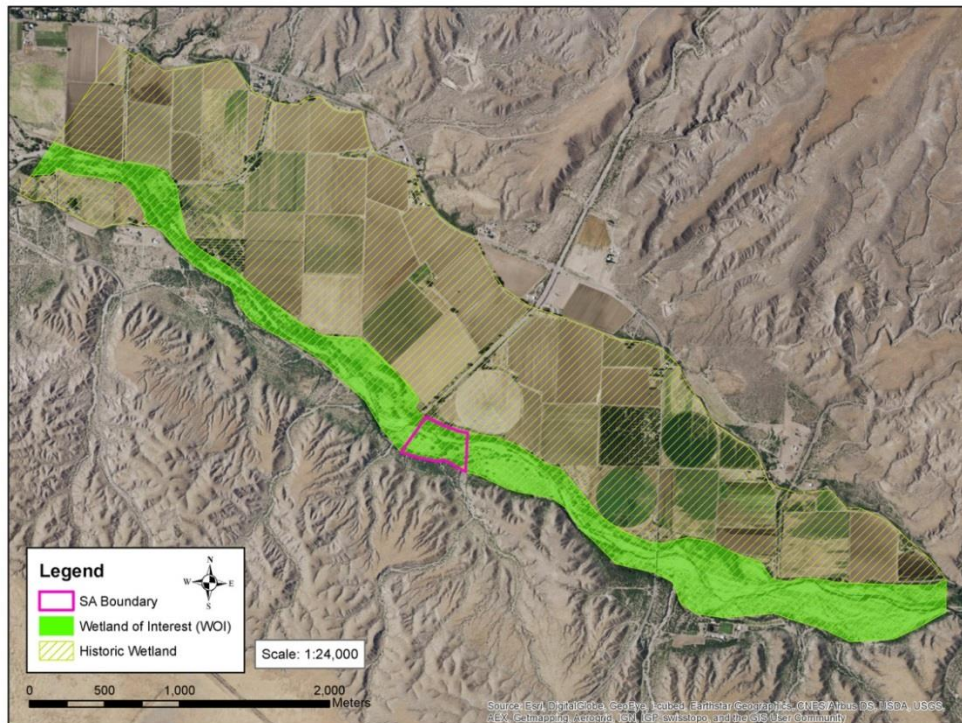
Figure 2. Example of a WOI delineation (green), the historic wetland extent (cross-hatch yellow), and the placement of an SA (pink outline) that is representative of the WOI.

Delineating the Sampling Area (SA) and the SA Cover Worksheet

Use the *SA Cover Worksheet* (Worksheet Page 1) to track the basic information about a given SA within a WOI/project area.

- Assign a unique SA Code and SA Name, which are user-defined per project needs. For tracking purposes, an SA Code and SA Name cannot duplicate other SAs.
- Enter the project and/or WOI name this SA references or any other relevant site designation that can help track the assessment.
- For the NMRAM Wetlands Assessment database, enter the AU (Assessment Unit) Code and AU Name if available from the NMED SWQB website.
- Describe the general local location and SA boundary rationale.
- Enter the ownership and note any restrictions on data sharing, if applicable and directions to the site.
- Enter the surveyor names and initials by their roles in the assessment.
- Enter the central location in UTM coordinates and include the zone and datum.
- Enter the date, and start and end times of the field survey.
- In the SA Description, provide narratives of conditions by major attribute category and comments on the condition rank of the sampling area (preferably before leaving the site).
- Before the team leaves the site they should give the SA a provisional field Rating and Rank.
- Final Rating and Rank are completed in the office after all data has been entered and finalized.

SA size and placement

While an SA can be placed randomly, given the limitations of time and personnel resources that often exist, it should be placed to best represent the vegetation pattern and conditions within the WOI. At a minimum, there is one SA per WOI/project area, but for large WOIs, two or more SAs may be required to capture the range of variation (particularly if randomization is used). In addition, an SA may be constrained by logistical considerations such as ownership and access (keeping in mind that this may affect metric scores).

SAs are provisionally mapped prior to the field visit, then modified as needed based on field indicators and constraints. The delineation of SAs should be done with care. Decision rules used to delineate the SA should be documented on the SA Cover Worksheet to provide context for evaluating the assessment outcome. This is particularly important where project goals may affect the delineation (e.g., mitigation assessments). Overall, the goal is to delineate relatively homogeneous SAs with respect to hydrology and wetland type. That is, an SA is a sampling area along a channel that best reflects the hydrological processes of the local reach (e.g., flooding, sediment deposition, scour, and groundwater recharge) and is characterized by wetland vegetation communities that are representative of the wetland subclass (non-riparian or non-wetland types may occur internally but they should be relatively minor elements).

Several metrics are scale dependent where, as the SA size goes up, the assessment scores go up.

- To maintain consistency across sites, Lowland Riverine SAs should not exceed approximately 16 ha (40 acres) in overall size while not extending beyond 500 m of river corridor length.

Conversely, as SA size goes down from the maximum, scores are likely to decline, but this is considered a measure of lowered ecological integrity and is intrinsic to the assessment scoring. SA size should only be smaller than the specifications when the wetland itself has been reduced in size (per the WOI boundaries). There is no minimum size, but once the SA drops below 200m in length and 100m in width Ranks on most metrics will be very low.

If an SA is on only one bank, it should extend to the outside edge of the floodplain that is not hydrologically connected (for example a high terrace). The break can be either natural or anthropogenic. If the SA is on both sides of a channel then the width may be split between them, however, on at least one side it should extend to the edge of the active floodplain. For very large floodplains this may not be practical, in which case, obtaining a representative sample of the WOI is the primary driver of SA placement, and should be foremost in determining how the SA is apportioned across the floodplain.

SA homogeneity. SAs should be relatively homogeneous with respect to hydrological factors and other site conditions; there should not be any major hydrologic breaks or significantly different site alterations within an SA. If there are, then two or more SAs should be placed to assess the range of conditions within the WOI.

Examples of features that should be used to delineate SA boundaries include:
- Acequias and other diversion structures and ditches;
- Ends of large-pipe discharges;
- Grade control or water-elevation control structures;
- Weirs, culverts, dams, levees, and other flow-control structures;
- Major changes in riverine confinement, entrenchment, degradation, aggradation, slope, or bed form;
- Major tributary or channel confluences that significantly alter the shape and structure of the floodplain (including ephemeral channel confluences with significant sediment input);
- Waterfalls;
- Reaches with beaver ponds versus ones without;
- Adjacent springs or seeps that significantly modify the floodplain and/or local groundwater conditions;
- Transitions between wetland subclasses (e.g., unconfined to confined);
- Railroads and other "non-buffer" elements listed in Worksheet 1a that cross the floodplain and active channel.

Land Ownership and Sampling Permissions

In general, sampling permissions on public lands will not be an issue unless the SA is considered sensitive for management reasons. Land management agencies should be contacted to confirm that the site is unrestricted with respect to access.

When sampling on private lands, permission for access should be sought as soon as the SA has been identified and delineated. If the ownership is unknown, records can be checked at county courthouses for contact information. Owners should be contacted directly by phone or visit, and written permission for access obtained. While delineation of the SA should be based on biological and physical attributes, lack of owner permission may require adjusting the SA location and boundaries prior to field reconnaissance.

Field Equipment, Guides, and Worksheets

Suggested equipment includes:

- ☐ Two paper copies of the field maps (Landscape and SA maps), one for each field member to be used not only as a guide to the SA but to spatially annotate biotic and abiotic features to support the assessment. A third optional map at 1:24,000 is often useful for locating a site relative to highways and towns.

- ☐ Worksheet sets for each field member covering the metrics they will measure.

- ☐ Clipboards, preferably those with storage compartments to protect datasheets.

- ☐ Laptop or tablet if using active PDF worksheets.

- ☐ Pencils.

- ☐ Water-resistant markers for labeling maps or other sheets or items which may come in contact with water.

- ☐ GPS unit and directions to site (with GPS coordinates).

- ☐ Camera and photo board.

- ☐ Binoculars for viewing riverbank conditions.

- ☐ Compass, for accurately orienting field maps and conducting mapping exercises.

- ☐ Pin flags to mark features for photographs.

- ☐ Plant press for collecting unknown plants.

- ☐ Bleach and bucket: it is mandatory that all field technicians sterilize boots with a bleach and water mixture before and after entering waterways to prevent the spread of didymo (*Didymosphenia geminata*), a microscopic algae that is considered a nuisance species, as well as whirling disease and other potential pathogens.

- ☐ Waders for crossing and working within channels as the site conditions require. Waders, wading shoes, or other footwear *without* felted soles is recommended; felted soles are known to transport pathogens.

III.   Metric Measurement and SA Condition Ranking Overview

There are two levels of investigation: 1) GIS-based assessment of the Landscape Context metrics (Level 1), and 2) field-based semi-quantitative Biotic and Abiotic metrics (Level 2), each with its own set of data worksheets, which are provided in Appendix A. The protocols that follow provide the guidelines for measuring the metrics and completing the worksheets, and assigning assessment ratings to each metric.

Assessing Landscape Context Metrics (Level 1)

For the Landscape Context attribute, metrics are measured in the context of the SA boundary. These are non-field metrics that are evaluated manually or in a GIS framework using maps and aerial photographs and then verified in the field where possible. Copies of the Landscape Maps should be included with the final NMRAM Assessment Package that becomes the supporting record of a project, and can be either hand edited field maps, or pdf maps exported from a GIS showing delineated features for each metric. The basic GIS layers needed are:

- Recent ortho-rectified aerial photography or satellite imagery with a minimum resolution of 1 m (3 feet);

- Roads and trails;

- Ownership; and

- Topographic maps or digital elevation models.

Sources for geospatial data include New Mexico Resource Geographic Information System (http://rgis.unm.edu/browsedata), BING, and Google Earth, among others.

See the Protocols section for specific instructions on metric measurements.

Assessing Field Biotic and Abiotic Metrics (Level 2)

There are five Biotic and four Abiotic metrics that are measured as part of the field survey of the SA (Table 1). The survey requires a field team composed of two members: one who evaluates the biotic metrics and verifies the landscape context metrics, while the other evaluates the abiotic metrics. The team member responsible for the biotic reconnaissance should have a basic understanding of the local flora (particularly common dominant trees and shrubs), and whether they are native or introduced (exotic) (see Appendix C for a list of common species). In addition, the technician should be familiar with state-listed noxious weeds that may occur in the area (Appendix D). The team member responsible for the abiotic metrics should have basic training in measuring hydrological conditions and recognizing floodplain geomorphological characteristics (Rosgen Applied Fluvial Geomorphology training is beneficial). As they work through the SA, both team members should watch for stressors and conditions along the SA edges relevant to the landscape context metrics. Upon completion of the field survey, the team works together to verify the landscape context metrics, complete the stressor checklists, write the SA narrative summaries, and assign a provisional Wetland Condition Rank.

Field assessment steps:

1. Preliminaries. Together, team members fill in basic survey information (date, time, location, etc.) on the SA Cover Worksheet. Then a quick joint reconnaissance of the site is helpful to help set up the survey and make SA boundary changes based on local conditions.

2. Biotic survey. The biotic team member traverses the SA and maps the major vegetation communities detailing attributes that are important to the metric scoring. This map becomes the basis for filling out the worksheets and rating the biotic metrics.

3. Abiotic survey. The abiotic team member sets up three lateral traverses from the main channel to floodplain edge to search for indicators of abiotic conditions and annotating the map with supporting information. During each traverse, indicators are checked off metric-specific lists on the worksheets that provide the foundation for rating each metric.

4. Landscape Context review. The Landscape Context metrics have been measured prior to the field survey and now can be reviewed based on field evidence during the survey. Each team member is likely to survey different areas in the SA and each should note landscape context condition issues that may affect the ratings, particularly in areas adjacent to the SA boundary. These are reported on the SA Cover Worksheet and can be used to modify metric ranks (with a narrative justification).

5. After completion of the surveys, team members collaboratively complete the narrative summaries on the SA Cover Worksheet; complete all stressor checklists, review and complete the in-field ranking of all metrics and provide a provisional SA Score and Rank and Assessment Summary (signed off with team member initials).

6. The Team should verify valley bottom boundaries for Relative Wetland Size (RWSI) metric during travel to and from the SA.

The intent is that a team should be able to complete the field survey in four to six hours, depending on the complexity and size of the site, and personnel resources.

SA Boundary adjustments in the field

While the SA boundary is initially mapped in the office prior to heading out to the field, it is not always possible to identify hydrologic breaks such as irrigation diversion structures, irrigation returns, or landownership changes, all of which may affect the SA configuration. Therefore, it is good practice to first check if the SA size meets the specifications outlined above, as well as any lateral constraints not detected in the imagery. The SA can be shifted or the configuration changed in the field as necessary to accommodate the specifications (e.g., representative vegetation patches) or constraints (e.g., unforeseen ownership restrictions). All changes to the SA configuration or location are recorded on the field maps and noted on the SA Cover Worksheet.

Best Management Practices for pest control

To prevent the spread of aquatic diseases and nuisance species, it is imperative that field staff follow procedures to clean and sterilize field equipment. Outside the wetland, at the staging area before the wetland is entered and upon leaving the wetland, boots, waders, and field equipment (e.g., stadia rods, etc.) that come in contact with surface waters must be hosed or washed off. This must occur away from wetlands and surface waters. All porous material (including felt-soled shoes, which are not recommended due to concerns about didymo) must be immersed in a 2% bleach solution for five minutes or until thoroughly soaked, then rinsed or dried thoroughly. Any remaining solution must be poured away from vegetation.

SA Condition Ranking

For each SA, there is an *SA Rank Summary Worksheet* (Worksheet Page 2) where the metric ratings are compiled, weighted, and an overall weighted Condition Rank for the SA assigned. The metric and attribute weighting hierarchy is built into the summary sheet such that individual and attribute category weighted scores can be calculated easily and then rolled up into a final numeric SA Wetland Condition Score. The digital PDF version of the form *automatically* compiles the scores from the various worksheets, computes a ranking score from 1.0 (poor) to 4.0 (excellent), and assigns a letter SA Wetland Condition Rank as follows:

- A, Excellent Condition (>3.25-4.0)) – wetlands with intact functions and processes, diverse vegetative communities with almost no exotic weeds, and large relative to its historical size, with natural buffers. These wetlands are largely undisturbed and surrounded by undisturbed land (buffer) and would be considered to meet the wetland reference standard for a site.

- B, Good Condition (>2.5-3.25) – somewhat degraded in response to environmental stressors. These wetlands have various combinations of relatively minor disturbances or factors negatively affecting condition, e.g., some alteration of the hydrological regimes; evidence of on-site anthropogenic disturbances; a reduction of vegetative community and structural diversity with the presence of some exotic weeds; and moderately reduced size relative to their historical size, although the buffer may still be relatively natural. Often, these wetlands are good candidates for wetland restoration because impacts can be reversed with a high likelihood of recovery. Wetlands in good condition may be the best available.

- C, Fair Condition (>1.75-2.5) – moderately degraded in response to environmental stressors. These wetlands have one or more aspects that significantly affect condition, e.g., significantly disrupted hydrological regimes; degraded vegetative condition marked by monotypic community types often with exotic and noxious weeds; and small relative to their historical size. Buffers are typically significantly modified as well but have some natural elements remaining. These wetlands may have restoration potential depending on specific wetland conditions and on the stressors that are affecting that condition. However, restoration measures are expected to be more extensive (and maybe more costly) than B-ranked wetlands.

- D, Poor Condition (1.0 -1.75) – degraded wetlands with highly disrupted hydrological regimes, poor vegetative composition and diversity that is usually dominated by exotic and noxious weeds, and very small relative their historic size. These wetlands may also have little or no undisturbed buffer. These wetlands generally would require extensive rehabilitation measures to realize their natural potential and provide their natural functions.

While final scoring will generally be a post-field process that integrates the GIS-based landscape context metrics with the field-derived biotic and abiotic metrics, it is good practice to assign a provisional score and rank in the field in order to address any questions or gaps in the data set. Accordingly, there are boxes at the bottom of the SA Cover Worksheet for a provisional score and rank, along with narrative summaries for each attribute category and the overall assessment that should be completed in the field and refined as needed in the final ranking assignment in the office.

Reporting and the New Mexico Wetlands Assessment Database

The worksheets, maps, and photographs together make up the NMRAM Assessment Package. Any of the package components can be used individually in project-level reports, but the package is also designed for entry into the New Mexico Wetlands Assessment Database. This database is intended as a comprehensive, central clearing house for information on New Mexico's wetlands with a web interface providing various reporting tools to facilitate the analysis of single and comparison of multiple sites from around the state. See http://www.env.nm.gov/swqb/ for updates.

IV.   Metric Protocols

Landscape Context Metrics

There are four Landscape Context metrics designed to measure the conditions surrounding the SA using a GIS or paper maps:

L1. The Buffer Integrity Index is composed of two sub-metrics, Buffer Percent and Buffer Width that are measured in a buffer zone that extends out 250 m from the SA perimeter (Figure 3).

L2. Riparian Corridor Connectivity is measured in a riparian corridor zone that extends upstream and downstream 1000 m and 200 m across.

L3. Relative Wetland Size is measured across the entire floodplain, current and historic.

L4. Surrounding Land Use evaluates conditions within an area that extends out 500 m from the SA perimeter (overlapping the buffer zone).

Once all metrics have been rated, they are rolled up into a single Landscape Context Attribute score on the SA Rank Summary Worksheet.
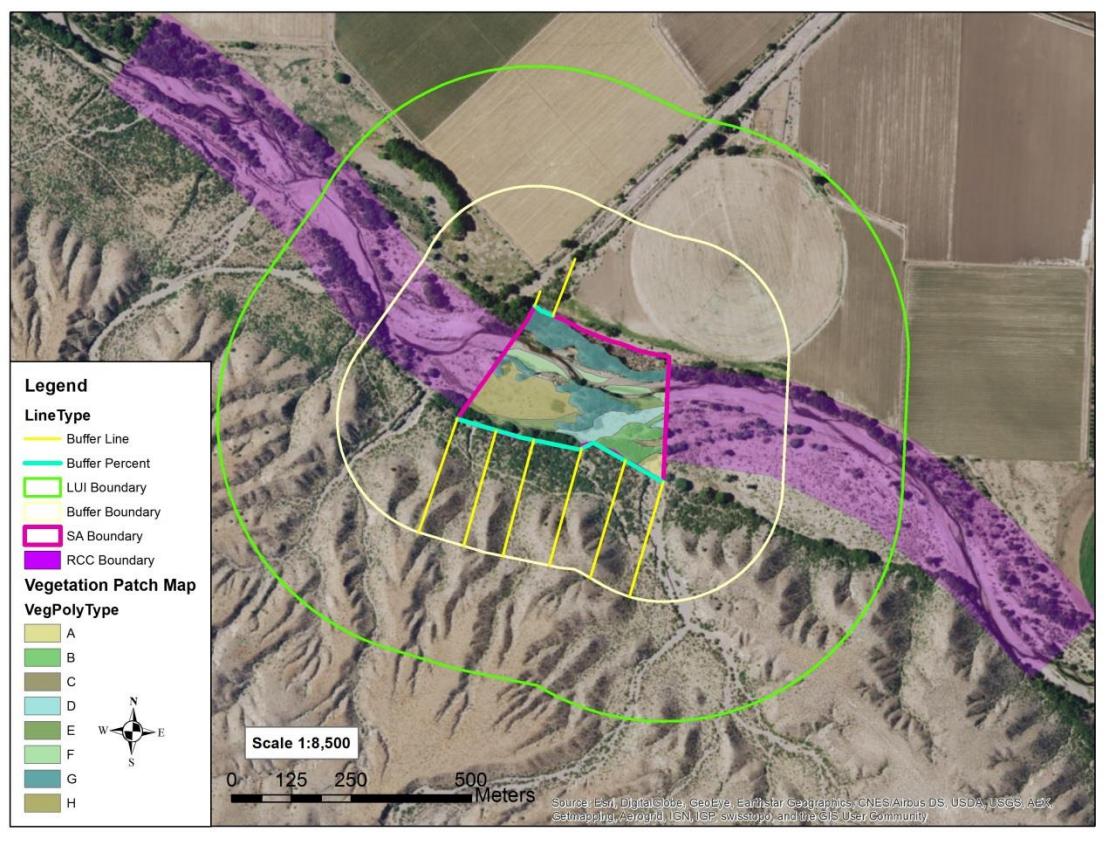
Figure 3. Lowland Riverine Landscape Context metrics are measured in three zones around an SA: Buffer 250 m around the SA (pale yellow line), Supporting Landscape 500 m (light green line), and Riparian Corridor upstream and downstream 1000 m (purple area). Buffer % is measured around the perimeter of the SA (cyan line) and Buffer Width is measured at eight points extending laterally from the SA boundary (yellow lines). Riparian Corridor Connectivity is evaluated upstream and downstream on both banks. Land Use Index (LUI) is evaluated in the Supporting Landscape. The vegetation map is shown inside the SA and is used in the Biotic metrics evaluation.

L1. Buffer Integrity Index

Definition: The Buffer Integrity Index is a measure of the amount of natural and semi-natural vegetated buffer surrounding the SA and is composed of two sub-metrics:

- *Buffer Percent*: the percentage of the lateral perimeter surrounding a wetland SA that is considered natural or semi-natural buffer;

- *Buffer Width*: the average width of the extant buffer lateral to the SA.

Seasonality: This metric generally is not sensitive to seasonality, but imagery from the growing season will likely enhance interpretations.

Protocol: Buffer Percent and Buffer Width are evaluated using aerial photography imagery in a GIS or on paper maps (Figures 1 and 3). It is based on "allowed buffer" land-cover elements that provide protective services such as reducing pollutant contamination within 250 m of the SA boundary versus "excluded non-buffer" land-cover elements that do not (Worksheet 1a).

Buffer Percent

Steps:

1. Using aerial photography in a GIS or on the Landscape map, enter the source of the imagery and date, if available. Check off buffer land-cover elements that occur along the perimeter of the SA in the Buffer column on Worksheet 1a. Do not include any areas less than 5 m (16 feet) wide as buffer. Any portion of the SA perimeter not bounded by at least 5 m of an allowed buffer element is considered unbuffered.

2. Using only the lateral SA perimeter, and ignoring upstream and downstream SA perimeters which cross the channel, enter the estimated percentage of the SA perimeter that is flanked by allowed buffer land cover elements and use the percentage to rate the sub-metric using Table L1a.

Buffer Width

Buffer Width is measured as the average distance along eight sample lines perpendicular to the lateral perimeter of the SA, extended to the first non-buffer element encountered or to a maximum of 250 m (Figure 3).

Steps:

1. Where there is buffer along the perimeter of the SA, draw a series of eight lines perpendicular to the lateral perimeter of the SA at even intervals extending out to the first non-buffer element as defined in Worksheet 1a or to the buffer boundary at 250 m. No line should be placed such that it records zero length. Divide the lines equally between the two lateral boundaries of the SA (four on each side; if there is only buffer on one side of the SA place all eight lines on that side). Label the lines A through H. No lines should extend upstream, downstream, or parallel to the river channel.

2. Measure the length of each line in meters and enter the values on Worksheet 1b.

3. Calculate the average buffer width from the measured lines.

4. Use the average to rate Buffer Width in Table L1b.

5. Enter that rating on the SA Rank Summary Worksheet.

Buffer Integrity Index Calculation and Rating

Steps:

1. Enter the sub-metric ratings (Buffer Percent and Buffer Width) in Worksheet 1c. Calculate the Buffer Integrity Index as the average of the two sub-metric ratings.
2. Rate using Table L1c.
3. Enter the Buffer Integrity Index rating on the SA Rank Summary Worksheet.

L2. Riparian Corridor Connectivity (RCC)

Definition: Riparian Corridor Connectivity (RCC) measures the disruption of natural land connectivity upstream and downstream of the SA with an emphasis on detecting intervening obstructions that might inhibit wildlife movement and impact plant populations.

Seasonality: This metric generally is not sensitive to seasonality, but imagery from the growing season will likely enhance interpretations.

Protocols: Riparian Corridor Connectivity rating is based on the total segment lengths of Riparian Corridor non-connectivity land cover elements (Worksheet 1a) in the riverine corridor 1000 m upstream and downstream of the SA and 200 m across.

Steps:

1. Using the most recent imagery available in GIS or on the Landscape Map delineate the Riparian Corridor Connectivity zone 1000 m upstream and 1000 m downstream from the SA boundaries along the main channel, and 200 m in width. The Riparian Corridor Connectivity zone should be centered within the river available floodplain, and must include both banks of the river, but does not need to be centered on the active channel. The river available floodplain is the floodplain that is not disconnected by anthropogenic features such as levees.
2. For each bankside on the upstream and downstream segment, measure the total length of all non-connectivity land-cover patches from Worksheet 1a that interrupt the corridor for at least 10 m (33 feet) and enter the values in Worksheet 2. Assign at least the minimum length for any special class, non-connectivity elements that cross the riparian corridor as provided in Table L2a below.
3. Check off non-connectivity elements in the RCC column on Worksheet 1a.
4. Sum the length of disruptions for each segment (upstream and downstream individually) and calculate the percentage disruption per segment ((meters of disruption/2000)*100).
5. Sum the total length of disruptions for all segments (upstream and downstream combined) and calculate the percentage total disruption for the SA riparian corridor ((meters of disruption/4000)*100).
6. Rate Riparian Corridor Connectivity using the narratives in Table L2b and the data from Worksheet 2. Work from the top of the table down; both segment and total length criteria must be met for a given rating.
7. Enter the rating on the SA Rank Summary Worksheet.

Table 2. Minimum assessed length for special class, non-connectivity land cover elements bisecting the riparian corridor.

Special Class Non-Connectivity Land Cover Element	Minimum Assigned Impairment
Unpaved graded and/or maintained roads	10 m
Single-lane paved road	20 m
Two-lane paved road/highway	50 m
Four-lane paved road/highway	100 m
Railroad	50 m
Concrete diversion or retention dams	25 m
Small non-concrete (wood, earth) diversion dams	10 m

L3. Relative Wetland Size

Definition: An index of reduction of the current wetland size relative to its estimated historical extent.

Seasonality: This metric can be evaluated during any season. However, the use of growing-season imagery with adequate "green-up" can improve accuracy.

Protocol: Relative Wetland Size is based on the ratio of the WOI size to its historical size. The key is determining the lateral extent of the historical floodplain based on photo interpreted features, field verification and historic evidence where possible (Figure 4). The assumption is that the valley bottom represents the historic floodplain.

Steps:

1. From the upper and lower limits of the SA, extend lines perpendicular from the boundary of the WOI in both directions to the edge of the floodplain where it hits upland slopes or ancient terraces (i.e., several hundred years old or more) that appear to support upland vegetation (Figure 4). The assumption is that this should represent the historic floodplain of bars, channels, and alluvial terraces that were active within the relatively recent past.

2. Connect the lateral lines along the upland on both sides of the channel to create a single polygon representing the historic WOI.

3. Calculate or estimate the areas of both the current WOI and historic WOI, enter the values on Worksheet 3a, and calculate the Relative Size Ratio (RSR) between the two:

   RSR= (S_c / S_h).

   Where: S_c = current size and S_h = historical size.

4. Using Worksheet 3b, calculate Relative Wetland Size Index (RWSI) as the percentage reduction from historical size:

   RWSI(%) = (1-RSR)*100

5. Rate using Table L3 and enter the rating on the *SA Rank Summary Worksheet.*

Figure 4. Relative Wetland Size for the riverine subclasses is the ratio of the current WOI (representing the current size – green cross-hatch) to the historical size (yellow area) estimated across the floodplain based on photo interpretation (the historical area includes the SA). Subsequent field checking as part of the reconnaissance survey is advised (e.g., the north fields in this image were excluded from the historical area because they were considered upland during the field visit).

L.4 Surrounding Land Use

Definition: The amount and intensity of human land use in the designated zone surrounding the SA.

Protocol: Surrounding Land Use is based on calculating a Land Use Index (LUI) that reflects the relative extent of a suite of land use elements in an area extending 500 m out from the SA boundary. Each land use element is weighted for its potential impact on the SA (from 0.0 indicating high impact to 1.0 no impact; Worksheet 4).

Steps:

1. Using current aerial photography in a GIS platform or from the Landscape Map, estimate the percentage of each land use element in the buffer and land use zones combined and enter the whole number value in Worksheet 4. Total cover cannot exceed 100%.

2. For each element, multiply the percentage area times the weighting coefficient and record that score in the LUI Score column. Sum the scores in the LUI Score column.

3. Rate using the Table L4.

4. Enter rating on the SA Rank Summary Worksheet.

For example, if 30% of the adjacent area is composed of old fields (0.5 * 30 = 15), 10% of unpaved roads (0.1 * 10 = 1), and 60% of natural area (1.0 * 60 = 60), the total land use score would equal 76 as the sum of 15 + 1 + 60. The rating from Table L4 would be a 2.

Biotic Metrics

There are five Biotic metrics that are designed to measure key biological attributes within a wetland that reflect ecosystem integrity:

B1. Relative Native Plant Community Composition is an index of the abundance of native-versus exotic-dominated vegetation communities.

B2. Vegetation Horizontal Patch Structure is an assessment of general vegetation patch diversity and complexity of the patch pattern.

B3. Vegetation Vertical Structure is an assessment of the overall vertical structural complexity of the vegetation canopy layers.

B4. Native Riparian Tree Regeneration assesses the abundance and spatial distribution of riparian tree reproduction.

B5. Invasive Exotic Plant Species Cover is a measure of the total percent cover of invasive plant species based on the New Mexico list of noxious weeds.

Biotic metric measurements are based on the mapping of vegetation community patches (stands) on the SA Map with its aerial imagery base (Figure 5). A draft of the vegetation community map patches may be prepared via GIS prior to the field survey and then field-verified. Alternatively, the vegetation patches can be directly drawn in the field on the SA Map for biotic metrics as part of the survey walkthrough.

- *When mapping, only polygons of individual patches of homogeneous vegetation greater than 0.25 ha [0.62 acre] are delineated (i.e.,* the minimum mapping unit polygon size*). Patches smaller than 0.25 ha are considered inclusions in the surrounding patch.*

Each polygon is labeled with a number that corresponds to a Polygon Number on Worksheet 5 and then evaluated with respect to Vegetation Vertical Structure (B3), Native Riparian Tree Regeneration (B4), and Invasive Exotic Plant Species Cover (B5) (see specific metric protocols below). Each polygon is also assigned to a running list of community types (CTs) on Worksheet 6, which is used to evaluate Relative Native Plant Community Composition (B1). To help with later interpretations and scoring, documentary photographs representative of each CT are recommended and logged using the Photo Point Log (Worksheet 15). When the species identification of a stratum dominant is uncertain:

- Collect and press a voucher specimen for later confirmation;
- Label each collection with the date, collector, field species code from the CT on Worksheet 6, polygon number, SA code; and
- Circle the corresponding species code on Worksheet 6 for reference.
- Note: Photographs of the entire plant, as well as close-ups of leaves, flowers and fruits can also aid in identification (Record these photographs on the Photo Point Log, Worksheet 15).

Lastly, before leaving the site, a Vegetation Stressor Checklist is completed to aid in interpretation of conditions. The attribute narratives on the SA Cover Worksheet that describe SA conditions and impacts should also be completed at this time.

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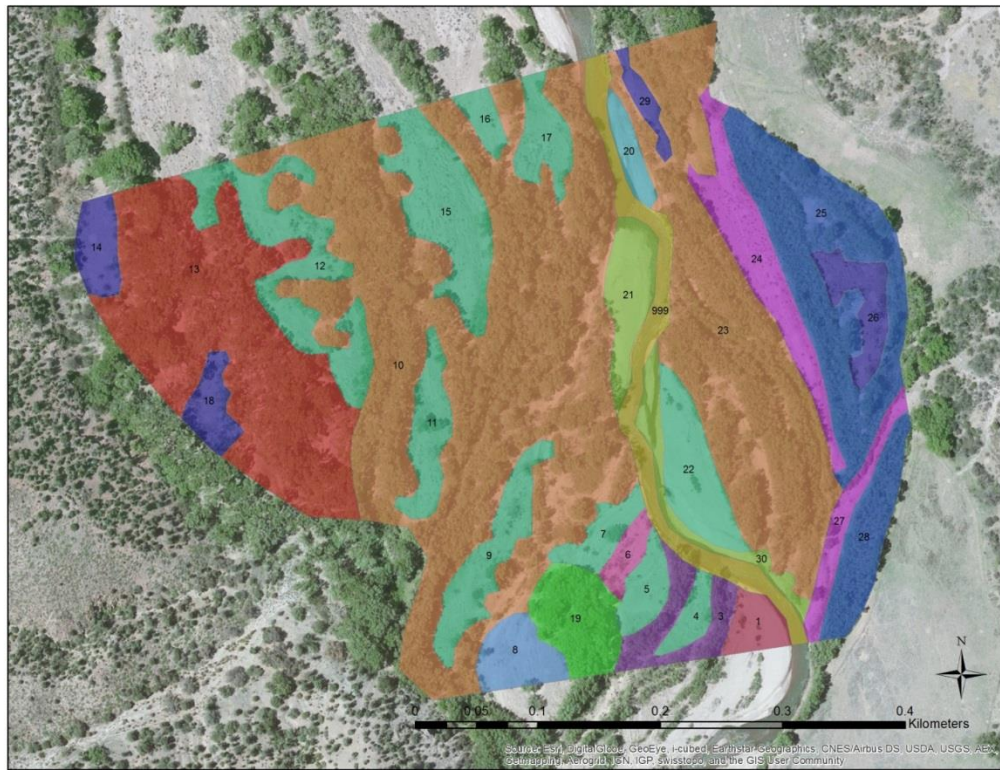
Figure 5. An example of a plant community type vegetation map on the Gila River that underpins the NMRAM biotic metrics. The polygons are labeled with the Polygon Numbers from Worksheet 5. The different colors reflect the community types (CT) listed on Worksheet 6.

B1. Relative Native Plant Community Composition

Definition: An index of the abundance of native- versus exotic-dominated vegetation communities.

Seasonality: Best assessed during the growing season when dominant species are most easily identified.

Protocols: This metric is based on the SA vegetation community map and field reconnaissance data in Worksheets 5 and 6. Each polygon listed on Worksheet 5 is assigned to (CTs) during the reconnaissance and, in turn, the CTs are evaluated with respect to native species composition and their relative abundance.

Polygon assignment to CTs is an iterative process whereby the first polygon visited is described with respect to the top two dominant species by height strata using Worksheet 6. There are three strata: a Tall Woody Strata composed of trees and shrubs greater than 5 m tall (15 feet); a Short Woody Strata of trees and shrubs under 5 m (15 feet); and an

Herbaceous Strata made up of graminoids (grasses and grass-like plants) and forbs. For each of the tall and short woody strata, total strata vegetative canopy cover must exceed 25% before a species is recorded; for the herbaceous strata, total cover must be greater than 10%. The species are recorded in the order of their relative abundance by strata, and a species can appear only once within a CT designation (if a species occurs in two strata, it is assigned to the strata in which it is most abundant). The next polygon visited is either assigned to the same CT on Worksheet 6 if it has the same composition and structure or, if not, a new CT is described and the polygon assigned to it. This process is continued for all polygons mapped in the SA. Based on these basic species data a Weighted CT Native Composition Score for the SA is computed, and this, in turn, is used to rate Relative Native Plant Community Composition.

Steps:

1. Beginning with the first polygon visited, assign up to two dominant species by strata (Tall Woody, Short Woody, Herbaceous) within the polygon to the "CT A" on Worksheet 6. Use USDA Plants Database Codes[3] for species whenever possible. A list of the most common dominant riparian species in the subclass is provided in Appendix C.
   - Ignore a woody stratum if it represents less than 25% of the total vegetative cover.
   - Ignore the herbaceous element in a stratum if it represents less than 10% of the total vegetative cover.
   - If a stratum is a mix of exotic and native dominants, make sure to record one native and one exotic dominant species for that stratum.
   - Each species can only be recorded once per CT, even if it occurs in multiple strata, pick the strata in which it is most prevalent.
   - Indicate if the species is exotic (E) or native (N).

2. Repeat Step #1 for all map polygons recorded during the field reconnaissance on Worksheet 5. If the CT composition of a polygon matches one previously recorded, simply add the polygon number to that CT. If it is different from any previously recorded, add a new CT with an associated list of dominants.
3. Once all polygons have been assigned to the CT list, estimate the relative mapped amount of each CT as a percentage of the entire SA and enter the value as a decimal number in the "% SA" box (this can be done in the GIS or simply visually estimated from the SA vegetation community map).
4. Using Table 3 below, assign a Raw CT Score for each CT based on native versus exotic composition of the dominants in each stratum per the designations in the E/N column. Compute the area-weighted score for each CT by multiplying the % SA value times the Raw score and enter the result in the "Wt Score" box.
5. Sum the Weighted Scores and enter into the CT Final Weighted Score box.

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[3] USDA, NRCS. 2014. The PLANTS Database (http://plants.usda.gov, 25 August 2014). National Plant Data Team, Greensboro, NC 27401-4901 USA.

6. Use the Final Weighted CT Score to rate Relative Native Plant Community Composition for the SA using Table B1.
7. Enter rating on the SA Rank Summary Worksheet.

Biotic Metrics 77GilaRi103.0   9-22-12

Worksheet 5. Biotic Metrics B3, B4 and B5. Refer to Table B3a on the next page for vertical structure type definitions.

Polygon No	B3 Structure Type	B4 Tree Regeneration % Cover	B5 Invasive Species % Cover	Wetland Species (yes/no)	Invasive Species Obs (List Codes)	Wetlands Species Obs (List Codes)	Comments
1	6H	Ø	Ø	☐			goosefoot monotypic – no signs of flooding
2	6H	Ø	Ø	☐			goosefoot/tumbleweed – no signs of flooding
3	6H	Ø	Ø	☐			spike dropseed/goosefoot – no signs of flooding
4	6S	1-2	1	☒	AIAL	LEOR	rabbitbrush, open terrace/cobble surface, patches young willow & cotton wood
5	5	1	Ø	☒		LEOR	cobble bar w/dense herbaceous scattered cottonwood,
6	1	<1	Ø	☐			med age cottonwood/seedlings willow w/ coyote willow + seep willow
7	6S	Ø	Ø	☐			Terrace with Rabbitbush and cobble surface
8	1	<1	Ø	☐			side channel (dry) w/ mature sycamore and young cottonwood
9	2	<1	0.5	☐	ULPU		dry side channel/cottonwood on N side 6-12" DBH
10	5	5	Ø	☒		LEOR	young regen cottonwood, sycamore and seedlings willow, dense patches of coyote willow
11	5	Ø	Ø	☐			mixed Terrace drainage, cobble scattered shrubs.
12	5	<1	Ø	☐			cobble bar with dense grass & forbs scattered patches of willow
13				☐			
14				☐			
15							

9-22-12

Worksheet 6. B1 - Relative Native Plant Community (CT) Composition. Enter the species codes and indicate if the species is Exotic (E) or native (N) in origin. A species code can only occur once per CT.

77GilaRi103.0

CT	Polygon Nos.	Tall Woody Stratum [1]				Short Woody Stratum [2]				Herbaceous/Sparse Stratum				CT Score [3]		
		Species 1	E/N	Species 2	E/N	Species 3	E/N	Species 4	E/N	Species 5	E/N	Species 6	E/N	Raw	% SA	Wt Score
A	1									CHPR5	N			4	10	0.4
B	2									CHPR5	N	SATR12	E	2	14	0.28
C	3									SPCO4	N	CHPR5	N	4	4	0.16
D	4					ERNAN3	N	SAEX	N	LEOR	N			4	8	0.32
E	5 11					SAEX	N	BACCH	N	ECCR	I	LEOR	N	3.5	6	0.21
F	6 12	POFR2	N	SAGO	N	SAEX	N	BACCH	N					4	10	0.4
G	7					ERNAN3	N							4	5	0.2
H	8	PLWR2	N	POFR2	N	SAEX	N	CELAR	N	BRFE2	N			4	25	1.0
I	9	POFR2	N							ARTE3	N			4	13	0.52
J	10					POFR2	N	SAEX	N	LEOR	N	ECCR	I	3.5	5	0.175
K																
L																
M																
N																
O																

Final Weighted Score / 100 3.67

1. Trees and shrubs > 5 m (15 feet) and > 25% total stratum cover; 2. Trees and shrubs <5m (15 feet) and >25% total stratum cover; 3. Herbaceous (graminoids and forbs)>10% total Stratum cover. 4. Raw Score is from Table B1a; % SA Is the percentage of the SA area as a decimal number; Wt. Score is the product of the Raw Score X % SA. The final score is the sum of the weighted scores.

Comments and additional CTs:

Figure 6 Examples of Worksheets 5 and 6 filled in for the Biotic metrics field survey.

Table 3. Community Type Scoring. E = exotic-dominated CT strata; M = mixed exotic/native CT strata; N = native-dominated CT strata; A = absent; U = unknown.

CT Score	Trees (>25% Cover)	Shrubs (>25% Cover)	Herbs (>10% Cover)
Forested Wetland			
0.00	E	E or A	E or A
0.25	E	E or A	M or U
0.50	E	E or A	N
0.75	E	M or U	E or A
1.00	E	M or U	M or U
1.15	E	M or U	N
1.30	E	N	E or A
1.40	E	N	M or U
1.50	E	N	N
1.60	M or U	E	E
1.70	M or U	E	M or A or U
1.80	M or U	E	N
1.90	M or U	M or U or A	E
2.00	M or U	M or U or A	M or U or A
2.10	M or U	M or U or A	N
2.20	M or U	N	E
2.30	M or U	N	M or A or U
2.40	M or U	N	N
2.50	N	E	E
2.60	N	E	M or U
2.70	N	E	N or A
2.85	N	M or U	E
3.00	N	M or U	M or U
3.25	N	M or U	N or A
3.50	N	N or A	E
3.75	N	N or A	M or U
4.00	N	N or A	N or A
Shrub Wetland			
0.00		E	E or A
0.50		E	M or U
1.00		E	N
1.50		M or U	E
2.00		M or U	M or U or A
2.50		M or U	N
3.00		N	E
3.50		N	M or U
4.00		N	N or A
Herbaceous Wetland			
0.00			E
2.00			M or U
4.00			N
Sparsely Vegetated			
0.00			E = Human-disturbed ground (e.g., roads, cleared areas)
2.00			M = Mixed natural/human-disturbed ground
4.00			N = Natural disturbed ground (e.g., sand bars, side channels)

B2. Vegetation Horizontal Patch Structure

Definition: The Vegetation Horizontal Patch Structure metric is an assessment of general vegetation patch diversity and complexity of the patch pattern (interspersion among vegetation patch types) within an SA.

Seasonality: The SA vegetation community map from which this metric is assessed should be completed during the growing season, and the rating is best assigned in the field, but the analysis can happen as a post-field task if necessary.

Protocols: Vegetation Horizontal Patch Structure is assessed using the field reconnaissance SA vegetation patch map.

Steps:
1. Using the SA vegetation community map developed as part of the reconnaissance survey, determine the vegetation patch pattern that best matches the schematic diagrams of idealized riverine vegetation patterns (Worksheet 7). Each vegetation community must comprise at least 5% of the SA.
    - The "Horizontal Patch Structure Diagram Details" table provides a numerical description of the schematics with respect to the number of unique CTs and their aerial extent that are represented based on the SA vegetation community map.
2. Using Table B2, assign a rating based on the schematic diagrams in combination with the rating descriptions.
3. Enter rating on the SA Rank Summary Worksheet.

B3. Vegetation Vertical Structure

Definition: An assessment of the overall vertical structural complexity of the vegetation canopy layers across the SA, including presence of multiple strata and age/size classes.

Seasonality: This metric is best assessed in late spring to early fall when vegetation foliage is present.

Protocols: Vegetation Vertical Structure is evaluated during the reconnaissance and mapping. Each mapped polygon patch is assigned one of the seven vertical structure types as defined in Figure 7 below. Use the descriptions and pictorial aid to guide the assignments. The percentage of each Vertical Structure Type is estimated across the SA (Worksheet 8). The ratings are based on the various combinations of dominant and co- or sub-dominant vertical structure types (Table B3).

Steps:
1. For each vegetation map polygon, assign the dominant structure type and enter values on Worksheet 5.
2. After completing the SA survey, estimate the total percentage of the SA occupied by each of the seven structural classes using Worksheet 8.
3. Using the data from Worksheet 8, rate the SA based on criteria in Table B3.
    - Work from the top of the ratings table down, row by row.
    - Pick the first row that best fits the distribution of vertical structure types in the SA.
    - All types listed in a row must meet the minimum-cover threshold for that column to receive that rating.
4. Enter rating on the SA Rank Summary Worksheet.

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. Incorporates Hink and Ohmart structure types 1 and 3.


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. Incorporates Hink and Ohmart structure types 2 and 4.

Single-story Communities (shrublands, herbaceous, and bare ground)
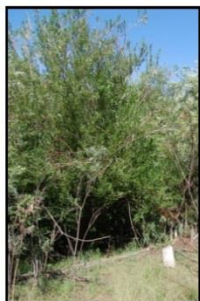
Type 5 – Tall Shrubland.
Young tree and shrub layer only (1.5–5 m [4.5–15 feet]) covering >25% of the area of the community (polygon). Stands dominated by tall shrubs and young trees, may include herbaceous vegetation underneath the woody vegetation.

Type 6S – Short Shrubland.

Short stature shrubs or very young shrubs and trees (up to 1.5 m [up to 4.5 feet]) covering >25% of the area of the community (polygon). Stands dominated by short woody vegetation, may include herbaceous vegetation underneath the woody vegetation.

Type 6W – Herbaceous Wetland.

Herbaceous wetland vegetation covering >10% of the area of the community (polygon). Stands dominated by obligate and facultative wetland herbaceous species. Woody species absent, or <25% cover.

Type 6H – Herbaceous vegetation.

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 <25% cover.

Type 7 – Sparse Vegetation, Bare Ground.
Bare ground, may include sparse woody or herbaceous vegetation, but total vegetation cover <10%. May be natural disturbance in origin (e.g., cobble bars) or anthropogenic (e.g., roads).

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Figure 7. Guide to vertical structure types.

B4. Native Riparian Tree Regeneration

Definition: This metric assesses the abundance and spatial distribution of riparian tree reproduction (seedling recruitment and clonal) across the SA (established tree seedling (>1 year), saplings, and poles under 12.7 cm (5 inches) diameter at breast height (DBH).

Seasonality: This metric can be measured year-round.

Protocol: Steps:

1. During the reconnaissance survey, estimate total percent cover of native tree seedlings, saplings and poles in each polygon in Worksheet 5.

   - Team members are not expected to distinguish between seed regeneration and clones.
   - Tree species for which this metric is applicable are narrowleaf cottonwood (*Populus angustifolia*), Plains/Rio Grande cottonwood (*Populus deltoides*), Freemont cottonwood (*Populus fremontii*), lanceleaf cottonwood (*Populus acuminata*), Arizona sycamore (*Platanus wrightii*), peachleaf willow (*Salix amygdaloides*), and Goodding's willow (*Salix gooddingii*).

2. Rate the SA based on polygon percent covers and patch density as presented in Table B4.

3. Enter rating on the SA Rank Summary Worksheet.

B5. Invasive Exotic Plant Species Cover

Definition: The Invasive Exotic Plant Species Cover is a measure of the total percent cover of invasive plant species that are Class A through Class C on the New Mexico list of noxious weeds (NRCS 2009). Species of specific concern for a given project or those that are not yet on the New Mexico list of noxious weeds can be included on a project-specific basis.

Seasonality: Exotic plant species cover is best assessed from summer to early fall.

Protocols: Invasive Exotic Plant Species Cover ratings are based on estimated percent cover across the SA. Using the New Mexico Noxious Weed list provided in Appendix D as a guide, during the reconnaissance survey:

1. List the invasive exotic species found in the SA by polygon on Worksheet 5. Estimate the total cover of invasive species within each mapped polygon in the Invasive Species % Cover column on Worksheet 5.

2. Based on the polygon values and roughly noting the percentage cover by each mapped patch type, estimate the average percentage cover of invasive exotic species for the entire SA and enter the value on Worksheet 9, being particularly mindful of the percentage break points used for rating this metric (Table B5). For invasive shrubs or trees (e.g., saltcedar), it may be possible to assess this metric in GIS using fine-scaled satellite imagery or aerial photographs with ground control. However, invasive herbaceous species require an on-the-ground survey of the site.

3. Rate Invasive Exotic Plant Species Cover based on the estimated percent cover across the SA provided in Table B5.

4. Enter rating on the SA Rank Summary Worksheet.

Abiotic Metrics

There are four Abiotic metrics that reflect the physical status of a wetland:

A1. Floodplain Hydrologic Connectivity is an assessment of the ability of water to flow into or out of the wetland.

A2. Physical Patch Diversity is a measure of the physical complexity of the site that contributes to ecological diversity.

A3. Soil Surface Condition reflects anthropogenic soil disturbance impacts within the SA.

A4. Channel Mobility is an assessment of impediments to the dynamic capacity of a channel to laterally migrate or avulse.

The Channel and Floodplain Survey Overview

A channel and floodplain survey is conducted by one team member and uses a checklist and narrative approach to arrive at an assessment. The surveyor divides the stream reach into three more-or-less equal segments (upper, middle, and lower). Each of these segments is surveyed in a lateral traverse from the SA boundary to the active channel edge. Important features from the metric checklists plus any feature that is affecting the hydrologic function of the segment regardless of its inclusion on the checklist is noted. The indicator checklists are designed to guide surveyors in identifying important parameters and characteristics to apply to the ratings tables' narratives.

A sketch of major features of the floodplain on the SA abiotic map is encouraged as an aid in filling out the checklist and for later interpretation. In addition, photographs are taken in each survey segment, across the channel to the opposite bank, as well as upstream and downstream, preferably at the mid-point of the channel, if accessible. If it is not feasible to wade to the center of the channel, photos may be taken from the bank edge (see Appendix E for further guidelines). Photo-points are recorded on the Photo Point Log. Additional photographs may be taken of significant features within the floodplain and recorded on the Photo Point Log. Features that alter the size of the SA, or significantly impact floodplain connectivity, are particularly useful to photograph.

Stressor checklists are filled out as part of the SA Initial Walkthrough for hydrological modifications and soil/substrate impacts (Hydrological Modifications and Physical Structure stressor checklists) caused by human disturbance. These are used to aid interpretation of channel and floodplain conditions in the overall assessment.

A1. Floodplain Hydrologic Connectivity

Definition: Floodplain Hydrologic Connectivity is an assessment of the ability of water to flow into or out of the wetland or to inundate adjacent areas.

Protocols: Floodplain Hydrologic Connectivity is evaluated by detecting *recent* channel and floodplain inundation indicators (see Appendix F for examples). That is, evidence of the extent of flood deposits and side channel wetting that has occurred within the last five years. The assessment is also dependent on the size of a peak flow that has occurred in the last five years—large flows leave more evidence, small flows leave less. When there have only been very small flows in the preceding five years it may be very hard to rate this metric accurately. In such a case the field team must use their best professional judgement, but understand the rating may incorrect due to lack of on the ground indicators. The assessment uses a checklist/narrative approach as follows:

1. For each of the segment traverses, use Worksheet 10 to check off a score for each of the five indicators of channel and floodplain inundation. The glossary in Appendix G provides definitions of some of the elements.
2. After the traverses are completed, average the scores across traverses for each indicator.
3. Sum the indicator score averages for a Final Score.
4. Using Appendix B, estimate the return interval for the peak discharge within the last five years at the SA. This should be done prior to the field visit.
5. When using the recent peak-discharge return interval, select the appropriate rating sub-table from Table A1.
6. Using the Final Score and narrative, circle the rating that best applies to the SA. Ratings can be adjusted given other flooding evidence recorded above, but provide a justification in the Rating Adjustment Comments box.
7. Enter rating on the SA Rank Summary Worksheet.

A2. Physical Patch Complexity

Definition: This metric describes the physical structural richness of riverine wetlands and associated channels that foster habitat complexity and biotic diversity.

Seasonality: This metric can be evaluated during any season.

Protocol:

1. As part of the segment traverses, check off physical patch types in each SA segment using Worksheet 11. Definitions for the patch types are provided in the glossary.
2. Based on the narrative and using the number of patch types on Worksheet 11 as a guide, rate the metric using Table A2.
3. Enter the rating on the SA Rank Summary Worksheet.

A5. Soil Surface Condition

Definition: The Soil Surface Condition metric is a measure of anthropogenic disturbance of wetland and riparian soils that results in modification of soil characteristics.

Seasonality: This metric may be conducted in any season when the soil surface is visible or disturbance is evident.

Protocols: Soil Surface Condition is based on a visual assessment of anthropogenic soil disturbance indicators and an estimate of the percentage of soil disturbance relative to the total area of the SA. As part of the survey walkthrough, a running checklist of field indicators by SA segment is completed using Worksheet 12. The final rating requires an estimate of total percent area of the SA that has anthropogenic soil disturbance. The following are general guidelines for assessing Soil Surface Condition:

- Assume there are zones of active, naturally occurring erosion and deposition within the active floodplain of the SA. Portions of the SA may be natural sources of and sinks for sediment.

- Differentiate, to the extent possible, anthropogenic soil disturbance that could contribute to degradation of the riverine wetland.

- For systems that can be waded, assess both sides of the SA. For those that cannot, only assess the accessible side of the SA.

Steps:

1. Prior to field work using either available aerial imagery in the gis or the SA abiotic map, identify roads and other soil surface disturbances within the SA and surrounding landscape area. Mark disturbed areas on the SA abiotic map to take in the field and provisionally check them off on Worksheet 12.

2. Conduct soil surface assessment as part of the segment traverses in order to ground-truth work completed in Step 1 and to identify additional evidence of disturbance not seen at the scale of the SA abiotic map. For each segment, check off all indicators that apply on Worksheet 12. This is especially important since small amounts of disturbance can change the rating for the metric.

3. Estimate the area of soil surface disturbance as a percentage of the total area of the SA.

4. Based on the indicators and the percentage disturbance for the segments combined, rate the overall SA using the narratives in Table A5 and enter the rating on the SA Rank Summary Worksheet.

💬 Channel Mobility.

Definition: Channel Mobility is an assessment of the dynamic capacity of a channel to laterally migrate or avulse, leading to the development of a dynamic patch mosaic of fluvial landforms that support wetland and riparian communities.

Seasonality: This metric is best assessed in late spring to early fall when vegetation foliage is present.

Protocols: Channel mobility is based on the presence and extent of artificial channel stabilization features (e.g. riprap, jetty jacks) or non-native perennial woody vegetation that potentially limit the lateral channel migration at high discharge. Cover of stabilization features is estimated at the bank edge corresponding to the three floodplain traverses.

Steps:

1. At each of the three sampling points, estimate the percent absolute cover of each of the mobility elements listed in Worksheet 13 in 50-m segments on each bank (looking about 25 m upstream and 25 m downstream on the SA side and on the opposite bank side).

2. For each 50-m segment, sum the total cover of all elements.

3. Average the two bank scores to arrive at the sampling point average.

4. Average the three sampling locations and rate using Table A6.

5. Enter the rating on the SA Rank Summary Worksheet.

Stressor Checklists

Stressor checklists are designed to assess the intensity of stressors that occur within the SA and the buffer area (250 m from the SA boundary). Stressors are anthropogenic disturbances that would be expected to have a negative effect on the condition of the SA. The purpose of the stressor checklists is to provide information that furthers the understanding of the current wetland condition. They are not used in scoring or ranking the condition of the wetland.

Stressor checklists are grouped into four categories: 1) Land Use Stressors (Worksheet 14a); 2) Vegetation Stressors (Worksheet 14b); 3) Physical Structure Stressors (Worksheet 14d); and 4) Hydrologic Modifications (Worksheet 14c). Stressor checklists identify stressors that occur within the SA and the buffer.

To complete the stressor checklists,

1. For each checklist, record absent, minor (<10% of the area), moderate (mod) (10-50% of the area) and intense (>50% of the area) stressors that occur in the buffer area and the SA.

2. Summarize the SA by counting the stressors per attribute category, by location and intensity class, on Worksheet 14e. (The automated PDF will do this automatically.)

3. Enter the total number of stressors by location and intensity on the SA Rank Summary Sheet and any summary comments on the SA Cover Worksheet.

APPENDIX A. Field Sheet Packet

APPENDIX B. Discharge Return Intervals

APPENDIX C. Species List with Codes

APPENDIX D. Noxious Weed List

APPENDIX E. Photo Point Guidelines

APPENDIX F. Flooding Indicators

APPENDIX G. Glossary