Riparian Conservation Opportunity Areas

A Portfolio of Priority Riparian and Wetland Areas for Conservation and Restoration in New Mexico

USER GUIDE

Version 3.0

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A Portfolio of Priority Riparian and Wetland Areas for Conservation and Restoration in New Mexico

Version 3.0

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Museum of Southwestern Biology, University of New Mexico

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Introduction and framework

This portfolio of Riparian Conservation Opportunity Areas (RCOAs) was developed as a spatial toolkit to support planning for conservation and restoration of New Mexico's riparian and wetland resources with the goal of enhancing habitat quality, improving wildlife connectivity, and sustaining other ecosystem services (https://nhnm.unm.edu/rcoas). RCOAs are discrete sites in river corridors that have been built in a GIS framework based on vegetation composition, landscape features, and ownership. They have been further prioritized based on habitat value and conservation opportunity to provide operational targets for local conservation and restoration actions and collectively for planning at a basin-wide scales.

The portfolio was initially developed for the Upper Rio Grande as part of the "Ribbons of Life Upper Rio Grande Riparian Connectivity" project under the auspices of the National Wildlife Federation. It was expanded state wide to encompass all basins across the state with the support of New Mexico Department of Game and Fish (NMDGF) as part of the 2025 revision of the New Mexico State Wildlife Action Plan (SWAP) (Figure 1). The RCOA portfolio is intended to be dynamic such that the geo-spatial platform offers an opportunity to track and measure success of conservation and restoration projects in New Mexico.

RCOAs are structured around four ecological components (Table 1). At their core they are anchored by "Riparian Strongholds" (RS)—large blocks of high-quality habitat that is hydrologically connected, and contains functional natural riparian vegetation, e.g., cottonwood riparian forest (Figure 2). The strongholds are bounded by "Other Native Riparian Areas" (ORAs) of lower ecological value such as drier shrublands, grasslands and "Potential Restoration Areas" (PRAs) often dominated by non-native species such as Russian olive or tamarisk which may be restorable to enhance overall habitat quality. In addition, there can be "Small Primary Riparian Areas" (SRAs)—small patches of high-quality riparian vegetation interspersed among the other three components which contribute to connectivity in the riparian mosaic which makes up an RCOA. With this framework, RCOAs and their components provide

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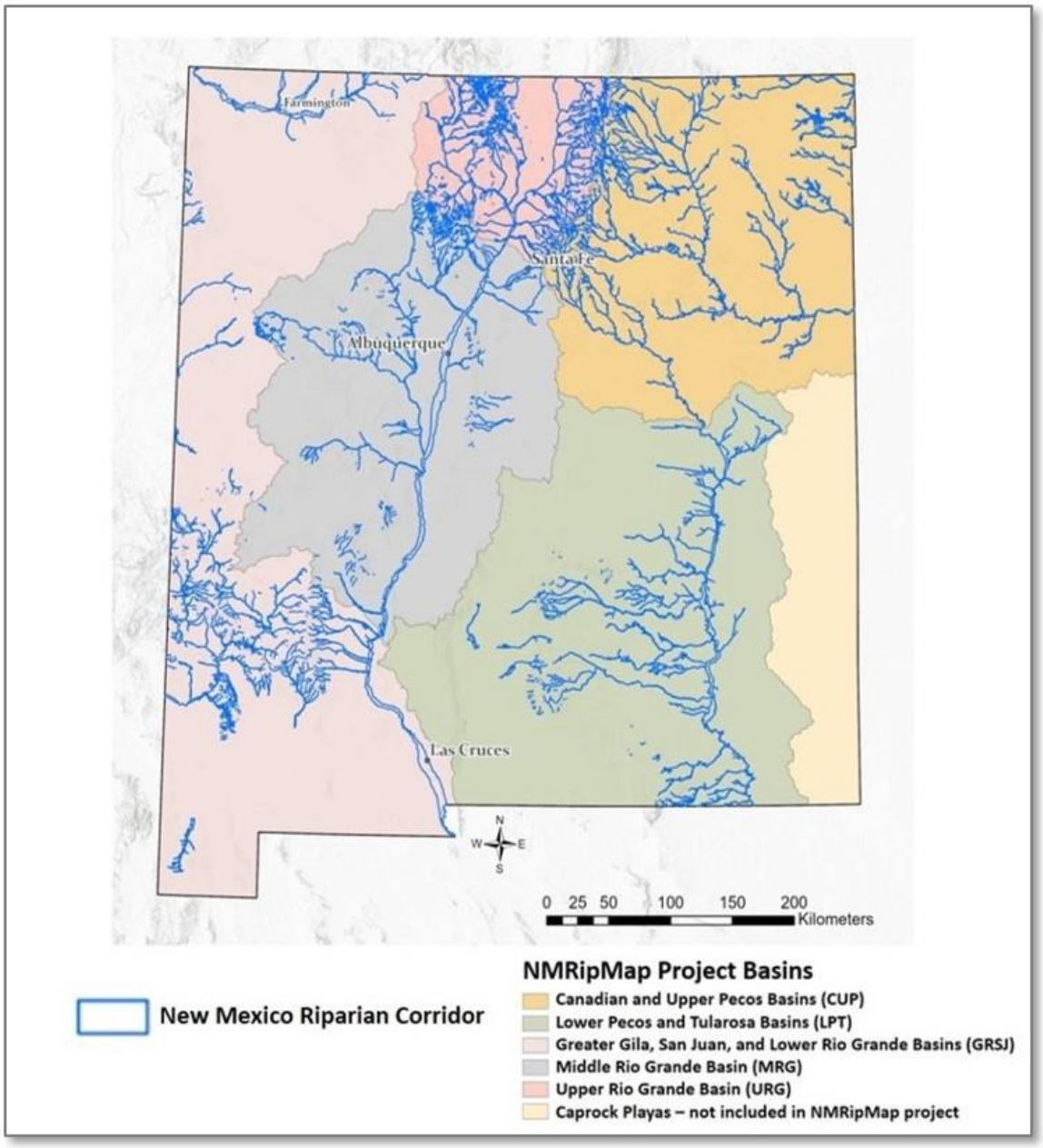

Figure 1. The New Mexico Riparian Corridor and the New Mexico Riparian Habitat Map (NMRipMap) Project Basins referenced in the building of the statewide Riparian Conservation Opportunity Areas Version 3.0.

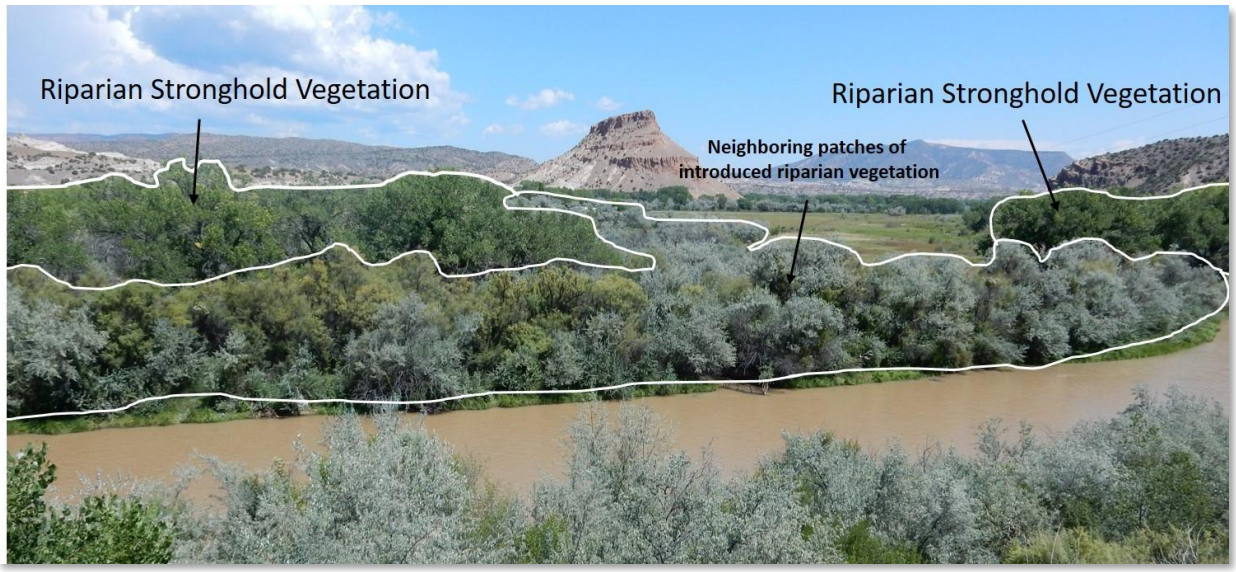

Figure 2. Example of an RCOA on the Rio Chama made up of a Riparian Stronghold of mature native cottonwood riparian forest (bosque) plus a neighboring Potential Restoration Area dominated by introduced riparian vegetation (Russian olive) which if restored would add to the stronghold and increase connectivity.

Table 1. Riparian Conservation Opportunity Areas (RCOA) components. See Table 2 for definitions of PNRV, DMRV, and IRV.

Component	Acronym	Definition
Riparian Stronghold	RS	Stands of primary native riparian vegetation (PNRV) >= 12 ac (5 ha) that are the building blocks of an RCOA.
Other Native Riparian Area	ORA	These areas feature Dry-Mesic Riparian Vegetation (DMRV) types often on older terraces with deeper water tables or cobbly, low-water-holding soils, and are found adjacent to or within RSs.
Potential Restoration Area	PRA	These areas consist of mainly Introduced Riparian Vegetation (IRV) that are adjacent to RSs, and they can also serve as connectors between other RSs or smaller patches of PNRV.
Small Primary Riparian Areas	SRA	Patches of PNRV that did not meet the size threshold for an RS but that are adjacent to a PRA or an ORA. They provide supplemental, high-quality habitat within an RCOA.

Building RCOAs

RCOAs and their components are based on the New Mexico Riparian Habitat Map (NMRipMap Ver. 2.0 Plus, hereafter NMRipMap, a fine-scale map of riparian and wetland vegetation communities within the river corridors of New Mexico (Figure 3). NMRipMap Level 3 map units are aggregated into three generalized vegetation types which are the elements that define the four components of an RCOA (Table 2).

RCOAs are built in a GIS[2] using a consistent rule set that first identifies at least one RS in a reach, then by adding other adjacent components (ORAs and PRAs) if they are present, and finally adjacent SRAs to complete the RCOA (Figure 4). ORAs and PRAs must touch at least one RS and they can link RSs, but they cannot link to each other to avoid a chaining effect up or downstream away from RSs. Once built, these RCOAs are quality controlled for significant spatial errors that may have been a function of the underlying vegetation map or river corridor delineation. The minimum size of RCOAs was set at ~12 acres (5 ha), a size that was considered generally economically viable with respect to the investment for added conservation or restoration values.

Table 2. Generalized riparian vegetation types based on NMRipMap (Ver. 2.0 Plus) and defined RCOA components in Table 1 (see Table 3 for specific NMRipMap units that make up the elements). Wetland species designations that define the elements are based on the National Wetland Plant List (Lichvar et al. 2016).

RCOA Element Name	Acronym	Definition
Primary Native Riparian Vegetation	PNRV	High-quality native riparian vegetation, typically occurring where the water table is sufficiently high to support obligate or facultative wetland species.
Dry-Mesic Riparian Vegetation	DMRV	Native riparian vegetation that occurs on drier sites in the riparian zone where the water table may be lower or soils coarser. It is typically native, dominated by facultative and facultative upland wetland species that can tolerate the drier conditions.
Introduced Riparian Vegetation	IRV	Introduced, non-native woody riparian vegetation that can also be mixed with native riparian vegetation, e.g., Russian olive and tamarisk shrublands and woodlands, or Russian olive and tamarisk shrublands and woodlands mixed with cottonwood forests or willow shrublands.

[2] The RCOAs were built using ArcMap 10.8.1, ESRI, and ArcGIS Pro, Version 3.2, ESRI 2023.

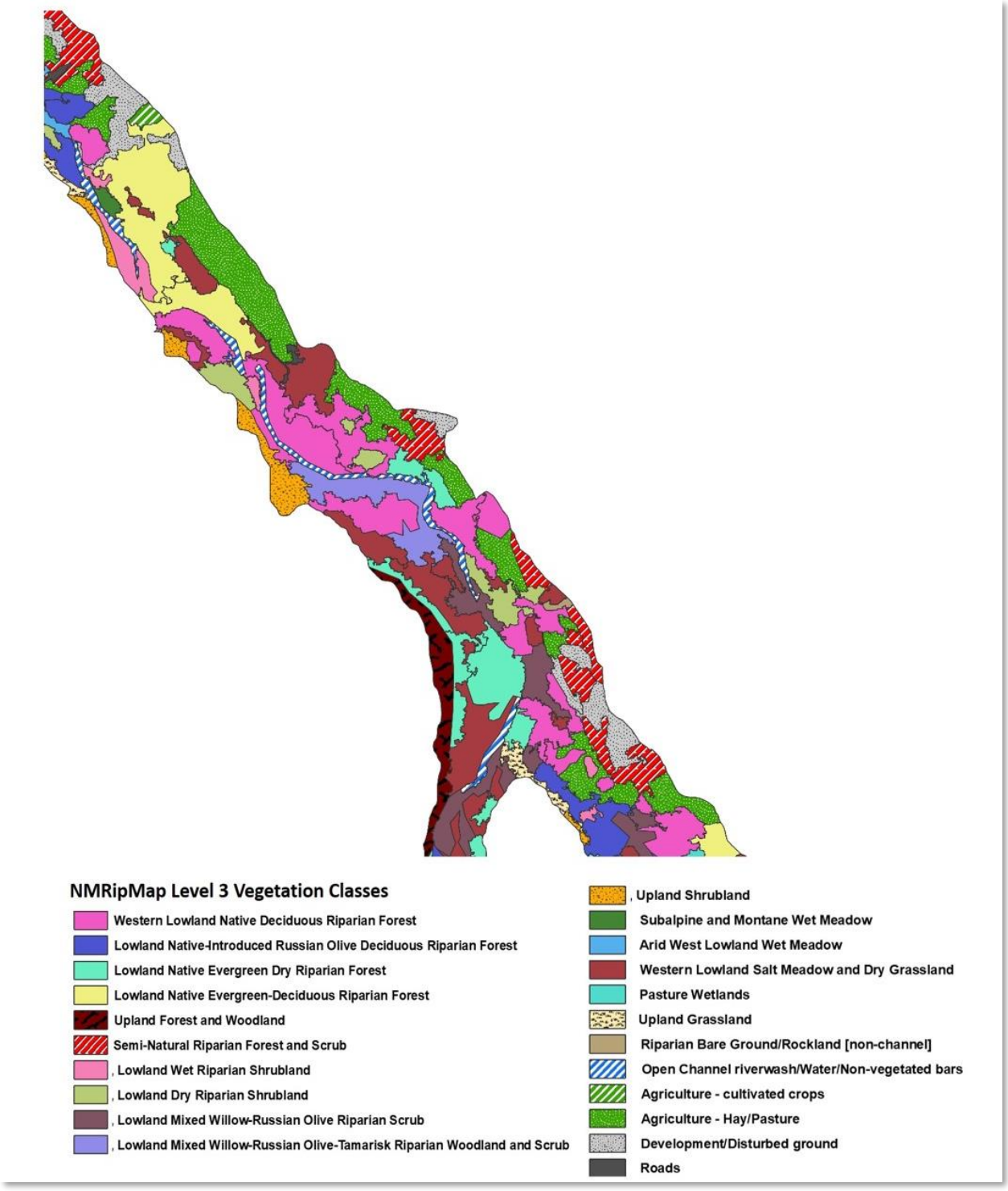

Figure 3. Example of New Mexico Riparian Habitat Map (NMRipMap) Level 3 fine-scale vegetation pattern in riparian corridor.

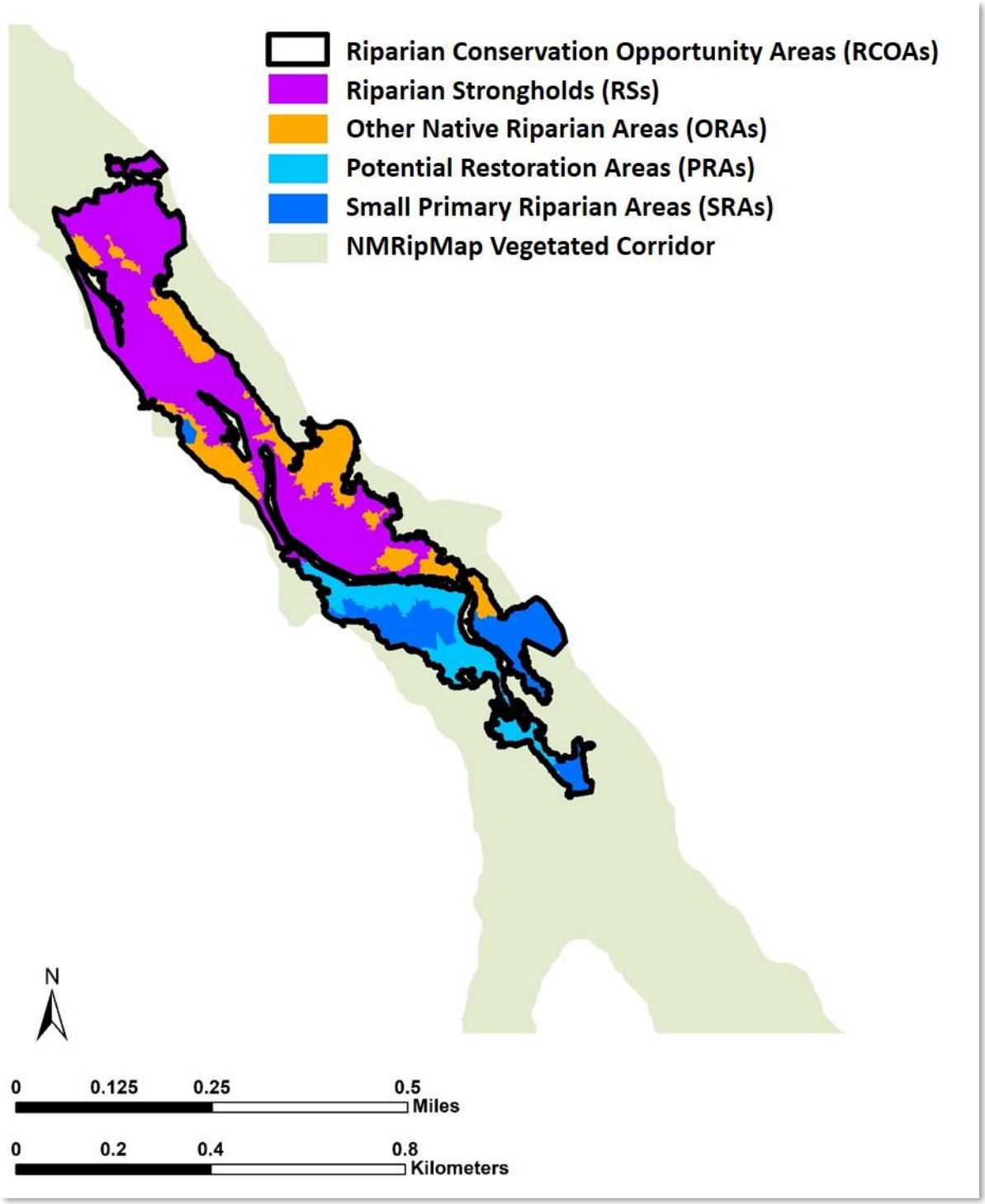

Figure 4. RCOAs have at their core Riparian Strongholds (RSs) with adjacent patches of Other Native Riparian Areas (ORAs) and non-native Potential Restoration Areas (PRAs) plus remaining adjacent Small Primary Riparian Areas (SRAs) that increase connectivity in the RCOA. These components are derived from the NMRipMap (see Figure 3; Tables 1 and 2).

RCOA Component Descriptions

Below are summary descriptions for the four components that make up RCOAs; each corresponds to a spatial layer in the RCOA Toolkit available for viewing and downloading at https://nhnm.unm.edu/rcoas. Each spatial layer comes with a suite of specific additional attributes that include size, vegetation composition and structure, and condition ratings, among others(see "Attribute Tables" document on RCOA webpage for details).

Riparian Strongholds (RS)

RSs are large areas of PNRV that are at least 5 hectares (~12 acres) in size and form the building blocks for RCOAs. PNRV is typically found adjacent to river channels where the water table is sufficiently high enough to support wet native riparian vegetation, which is often composed of obligate or facultative wetland species, e.g., marshes, wet meadows, willow shrublands, and cottonwood forests (Figure 5a; Table 3a). Each RCOA must have at least one RS, but there can be multiple RSs linked by ORAs and PRAs.

Other Native Riparian Areas (ORAs)

These are areas with DMRV vegetation types that are typically native and commonly found adjacent to or embedded in RSs (Figure 5b; Table 3b). They commonly occur on older terraces where the water table is deeper or where the soils are cobbly and lack water-holding capacity. These sites support riparian vegetation dominated by facultative wetland or facultative species. For example, in lowland areas this would include salt meadows and dry riparian grasslands, dry-mesic riparian shrublands, or woodlands in the riparian zone dominated by conifers. In montane areas the meadows dominated by facultative wetlands or upland or facultative grasses and dry-mesic shrublands. By rule, ORAs cannot link PRAs to RSs to avoid chaining together all of the riparian habitat in the corridor. While ORAs are drier than RSs, they are a natural part of the riparian system, and, in some cases, they can also offer possible restoration opportunities to create PNRV (e.g., actions that will reestablish ORA links to local ground water, including beaver dam-analog construction or bank lowering).

Potential Restoration Areas (PRAs)

These are riparian areas comprised of IRV types dominated or co-dominated by introduced species, such as salt cedar (*Tamarix* spp.) or Russian olive (*Elaeagnus angustifolia*), often in association with native trees and shrubs (Figure 5c; Table 3c). We have further grouped the IRV NMRipMap units into three operational subgroups of PRAs: Mixed Native-Introduced Shrubland; Mixed Native-Introduced Forest; and Introduced Woodland. Among the three, we consider Mixed Native-Introduced Shrubland (I-1) the most mesic and hydrologically connected to ground water (i.e., similar to RS shrublands) with greater potential for restoration. Mixed Native-Introduced Forest (I-2) is likely less hydrologically connected but still co-dominated by natives, making vegetation patches in this sub-category still reasonable targets for restoration. Introduced Woodland (I-3) sites are completely dominated by introduced species and may commonly be disconnected from ground water. Vegetation patches in this subgroup may represent the most expensive targets for restoration but are also the most in need of restoration. PRAs are found adjacent to RSs and can link RSs to each other or to SRAs.

Small Primary Riparian Areas (SRAs)

These are patches of PNRV that did not meet the size threshold for RSs but lie adjacent to a PRA or ORA and provide supplemental, high-quality habitat within an RCOA.

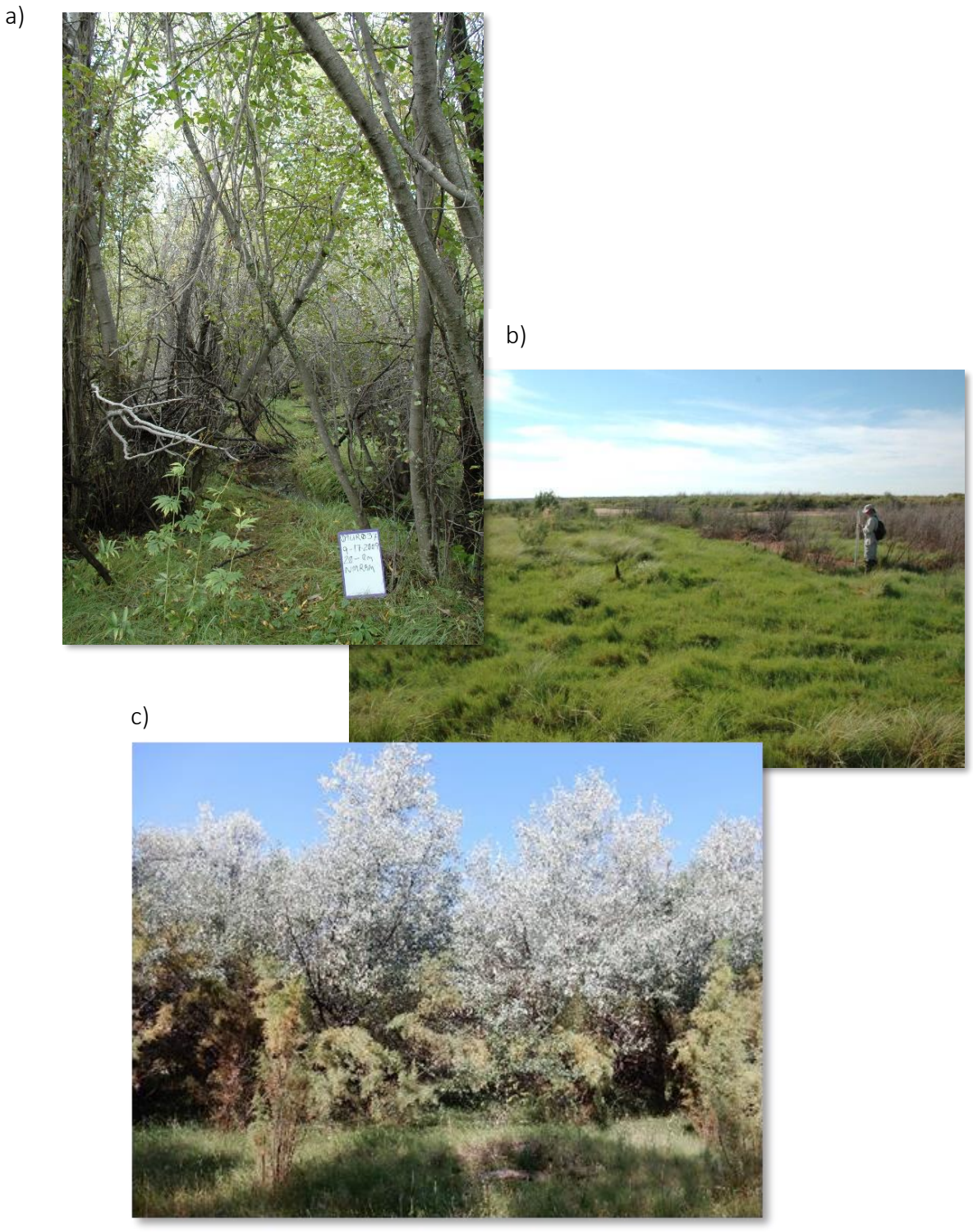

Figure 5. a) A Riparian Stronghold (RS) along Cabresto Creek made up of Primary Native Riparian Vegetation (PNRV), e.g., dominated by narrowleaf cottonwood; b) an Other Native Riparian Area (ORA) composed of Dry-Mesic Riparian Vegetation (DMRV) e.g., inland salt grass and alkali sacaton; and c) a Potential Restoration Area (PRA), e.g., dominated by non-native Introduced Riparian Vegetation (IRV) made up of tamarisk and Russian olive.

Table 3. NMRipMap vegetation map units and the basins they are associated with used for RCOA component construction.

3a) Primary Native Riparian Vegetation (PNRV) NMRipMap Vegetation Map Units (RSs and SRAs)	
Forest and Woodlands	**NMRipMap Basin**
Montane Native Evergreen Riparian Forest	*URG, MRG, CUP, GRSJ, LP*
Montane Native Evergreen-Deciduous Riparian Forest	*URG, MRG, CUP, GRSJ, LP*
Montane Native Deciduous Riparian Forest	*URG, MRG, CUP, GRSJ, LP*
Western Lowland Native Deciduous Riparian Forest	*URG, MG, GRSJ, LP*
Great Plains Lowland Native Deciduous Riparian Forest	*CUP*
Lowland Native Evergreen-Deciduous Riparian Forest	*URG, MRG, CUP, GRSJ, LP*
Southwest Desert Native Deciduous Riparian Forest	*GRSJ*
Southwest Desert Native Dry Deciduous Riparian Woodland	*GRSJ*
Shrublands	
Subalpine-Montane Riparian Shrubland	*URG, MRG, CUP, GRSJ, LP*
Lowland Wet Riparian Shrubland	*URG, MRG, CUP, GRSJ, LP*
Herbaceous Vegetation	
Subalpine and Montane Wetland	*URG, MRG, CUP, GRSJ, LP*
Western Lowland Marsh	*URG, MRG, GRSJ, LP*
Arid West Lowland Wet Meadow	*URG, MRG, GRSJ, LP*
Great Plains Lowland Marsh	*CUP*
Great Plains Lowland Wet Meadow	*CUP*

3b) Dry Mesic Riparian Vegetation (DMRV) NMRipMap Vegetation Map Units (ORAs)	
Forest and Woodlands	**NMRipMap Basin**
Lowland Native Evergreen Dry Riparian Forest	*URG, MRG,CUP, GRSJ, LP*
Shrublands	
Montane Dry Riparian Shrubland	*URG, MRG, CUP, GRSJ, LP*
Lowland Dry Riparian Shrubland	*URG, MRG, CUP, GRSJ, LP*
Desert Alkaline-Saline Wet Shrubland	*MRG, GRSJ, LP*
Herbaceous Vegetation	
Subalpine and Montane Wet Meadow	*URG, MRG, CUP, GRSJ, LP*
Montane Dry Riparian Meadow and Grassland	*URG, MRG, CUP, GRSJ, LP*
Western Lowland Salt Meadow and Dry Grassland	*URG, MRG,GRSJ, LP*
Great Plains Lowland Salt Meadow and Grassland	*CUP*

3c) Introduced Riparian Vegetation (IRV) NMRipMap Vegetation Map Units (PRAs)		
Forest and Woodlands	**Operational Sub-group**	**NMRipMap Basin**
Lowland Native-Introduced Russian Olive Deciduous Riparian Forest	*I-2*	*URG, MRG, CUP, GRSJ, LP*
Lowland Native-Introduced Tamarisk Deciduous Riparian Forest	*I-2*	*URG, MRG, CUP, GRSJ, LP*
Lowland Native-Introduced Russian Olive - Tamarisk Deciduous Riparian Forest	*I-2*	*URG, MRG, CUP, GRSJ, LP*
Shrublands		
Russian Olive Introduced Riparian Woodland and Scrub	*I-3*	*URG, MRG, CUP, GRSJ, LP*
Tamarisk Introduced Riparian Woodland and Scrub	*I-3*	*URG, MRG, CUP, GRSJ, LP*
Russian Olive-Tamarisk Introduced Riparian Woodland and Scrub	*I-3*	*URG, MRG, CUP, GRSJ, LP*
Mixed Introduced Forest and Scrub	*I-3*	*URG, MRG, CUP, GRSJ, LP*
Lowland Native-Introduced Russian Olive Riparian Scrub	*I-1*	*URG, MRG, CUP, GRSJ, LP*
Lowland Native-Introduced Tamarisk Riparian Scrub	*I-1*	*URG, MRG, CUP, GRSJ, LP*
Lowland Native-Introduced Russian Olive-Tamarisk Riparian Woodland and Scrub	*I-1*	*URG, MRG, CUP, GRSJ, LP*

Wetland Subclasses

To support effective conservation planning, we categorized RCOAs into three wetland subclasses[3] (Figure 6). These have distinctive habitat and vegetation characteristics that present different conservation opportunities and challenges:

1) Headwater Complexes —high montane/alpine wetlands, and wet meadows that typically occur at the tops of watersheds on gentle to moderate slopes above first-order streams;

2) Confined—confined river canyons with little floodplain that commonly support conifer forests along the streams with limited shrub and herbaceous wetlands, or low-elevation canyons with limited riparian vegetation along the streams and rivers (e.g., the Rio Grande Gorge);

3) Unconfined—unconfined river valleys with broad floodplains dominated by a mosaic of riparian forests, shrublands and herbaceous wetlands (e.g., cottonwood, willow, and introduced species such as Russian olive and tamarisk).

[3] Wetland subclasses are based on the New Mexico Rapid Assessment Methodology (NMRAM). See https://www.env.nm.gov/surface-water-quality/wp-content/uploads/sites/18/2022/03/NMRAM-Manual_v2_0_Final-for-Website.pdf

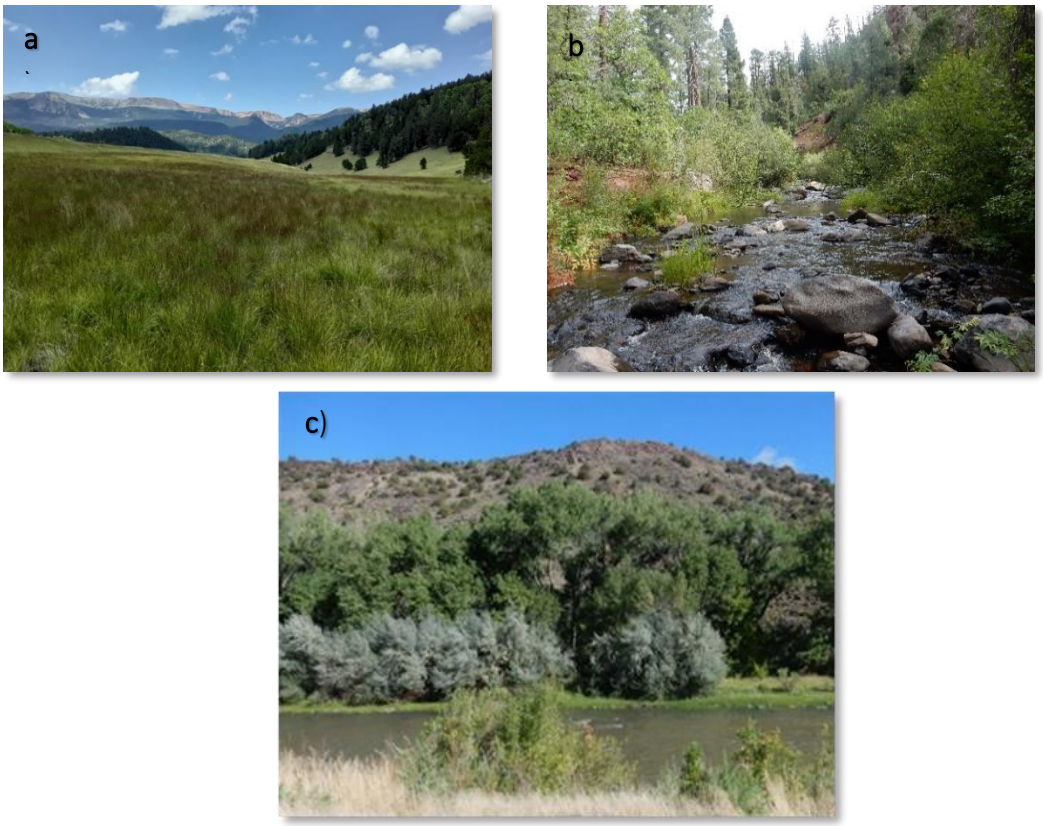

Figure 6. Examples of the wetland subclasses: a) "Headwater Complex" in Valle Vidal in the northern Sangre de Cristo Mountains; b) a "Confined" canyon reach along the Rio San Antonio; and c) a lowland "Unconfined" reach of the Rio Grande north of Velarde, NM.

RCOA Conservation Ratings

To help prioritize the RCOAs for conservation action, each was rated from A to D, decreasing in conservation and restoration value with respect to size, component composition, and ecological diversity (Table 4). For size, once the total area of an RCOA exceeds 160 acres or 0.25 sq. miles it is considered very large, in contrast to relatively small at between 5 and 40 acres. But size should also be considered in the context of wetland class. For example, confined canyon RCOAs are often naturally unfragmented by development and therefore relatively large compared to those in unconfined valleys which are commonly significantly modified by agriculture and urban development with only remnant, yet very important, riparian strongholds for connectivity.

The relative amounts of RS, ORA, and PRA components is also important—the less ORA and PRA relative to RS the higher the rating for the RCOA (reflected in ratings for ORA and PRA). That is, the greater the amount of riparian strongholds relative to other components, the higher the priority of the RCOA is for conservation. Accordingly, the less percentage ORA and PRA the higher the RCOA score. Yet, it must be remembered that *all* RCOAs have RSs and an intrinsic higher value relative to their surrounding landscape.

To add a measure of overall biodiversity value, a Vegetation Type Diversity Index (VTDI) was computed based on Pérez et al. (2008) and the classical Shannon Diversity Index for species (Shannon 1948). Using the underlying NMRipMap PNRV types that inform RSs and SRAs, the VTDI accounts for both the

number of PNRV types and their relative abundance. Higher values represent greater vegetation diversity for an RCOA, which can be considered a coarse filter, reflecting overall riparian biodiversity.

The scores on each of the above elements are averaged and given a rating of A to D based on unweighted even breaks among the average scores.

Table 4. RCOA conservation ratings are based on the average component rating scores of overall size of an RCOA, the percentage of ORA and PRA vegetation types, and vegetation type diversity. The database attribute field names are provided along with a short description of what they are based on and the ratings scale for each.

RCOA Scoring Field Names	**Description**		
RCOA_Rating	RCOA rating based on RCOA RCOA_Average_Score	Rating A B C D	RCOA Average Score >= 3.25 > 2.5 and < 3.25 > 1.75 and <= 2.5 <= 1.75
RCOA_Average_Score	Numerical average of ratings for the following: • RCOA_Size_Score • RCOA_ORA_pct_Score • RCOA_PRA_pct_Score • RCOA_VegTypeDiversity_Score		
RCOA_Size_Score	Rating based on the area of the RCOA in acres (RCOA Attribute Table: RCOA_Area_ac).	Score 4 3 2 1	Acres >= 160 >= 80 and < 160 >= 40 and <80 <40
RCOA_ORA_pct_Score	Rating based on percent ORA in the RCOA (RCOA Attribute Table: RCOA_ORA_pct).	Score 4 3 2 1	Percent < = 1 > 1 and <= 10% > 10 and <=25% > 25%
RCOA_PRA_pct_Score	RCOA rating based on percent PRA in the RCOA (RCOA Attribute Table: RCOA_PRA_pct).	Score 4 3 2 1	Percent 0 > 0 and <= 10% >10 and <= 25 >25
RCOA_VegTypeDiversity_Score	Rating based on the Vegetation Type Diversity Index (VTDI) based on the number of Primary Native Riparian Vegetation types and their sizes patches within an RCOA (RCOA Attribute Table: RCOA_VegTypeDiversityIndex).	Score 4 3 2 1	VTDI ≥ 1.25 ≥ 1 to <1.25 ≥ 0.6 to <1 <0.6

Supplemental Conservation Planning Layers

As part of the RCOA Toolkit, there is a set of supplemental layers to aid in conservation planning which focus on the context outside the RCOAs and connectivity in the riparian corridor as a whole: Inter-connectivity Zones (IZs); Supplemental Habitat Zones (SHZs) with two tiers; and Potential Connectivity Breaks brought on by development (Figure 7). Each of these layers also comes with a set specific attributes detailed in the "Attribute Tables" document available for downloading at https://nhnm.unm.edu/rcoas.

Inter-Connectivity Zones (IZs)

Given a suite of RCOAs, the riparian zones between them can still offer conservation opportunities, particularly for enhancing connectivity between RCOAs and providing smaller scale options for restoration and protection. To this end, we developed Inter-Connectivity Zones (IZs). IZs focus the remaining patches of PNRV, DMRV, and IRV general vegetation types that either separately or in combination are associated with one or more RCOAs (see Table 1). To prioritize IZs for conservation planning, the emphasis was put on wildlife movement, particularly of small mammals and herptiles identified as Species of Greatest Conservation Need in the State Wildlife Action Plan[4], which inhabit riparian ecosystems. Accordingly, using the known home ranges of 13 SGCN, we assigned one-third mile (545 m) as the maximum distance from an RCOA that an IZ can occur.

We then sequentially applied the following steps to further filter IZs for conservation planning purposes:

1. Areas with at least 0.25 acres (0.1 ha) of PNRV, DMRV, and/or IRV;
2. Areas that had >= 50% primary native riparian vegetation (PNRV);
3. Areas that intersected an SGCN based on the Species of Concern 1 and 2 categories in the Crucial Habitat Assessment Tool (CHAT[5]);
4. Areas within 100 m of perennial or artificial waters defined by the National Hydrography Dataset (NHD).

This IZ identification process typically creates a small-patch mosaic of a diversity of riparian types, including native and introduced, and wet and dry, which can still be important to ecosystem function and can provide additional opportunities for wildlife movement if conserved or restored.

Supplemental Habitat Zones (SHZs)

Supplemental habitat zones include vegetation along irrigation ditches (acequias), pastures, and pastures with wetlands that provide additional, although sometimes marginal, habitat for wildlife forage and movement. We have tiered these zones by their potential to provide habitat for wildlife (S-1 and S-2). Tier S-1 includes semi-natural riparian vegetation, such as hedgerows and vegetation along ditches, and pastures with wetlands that are maintained primarily for livestock but may have a modicum of wetlands available for wildlife use. Tier S-2 includes vegetation types with lesser conservation value, such as active cultivated agriculture, and hay pasture that is likely drier and mowed. Overall, SHZs can be important targets for preservation, particularly in the context of urban development where these areas

[4] from the 2017 SWAP

[5] based on the 2024 update of the CHAT

may be critical to maintain wildlife movement. SHZs are attributed with total area, tier, and the NMRipMap level 3 map unit name.

Potential Connectivity Breaks

Potential Connectivity Breaks are roads or urban/developed zones that may pose greater restrictions on wildlife movement by blocking passage or offering little habitat. Despite these challenges, there are still potential solutions such as culverts, wildlife corridor bridges, and urban wildlife/restoration projects that may mitigate these breaks and enhance connectivity. Potential Connectivity Breaks are attributed with total area and the NMRipMap level 3 map unit name.

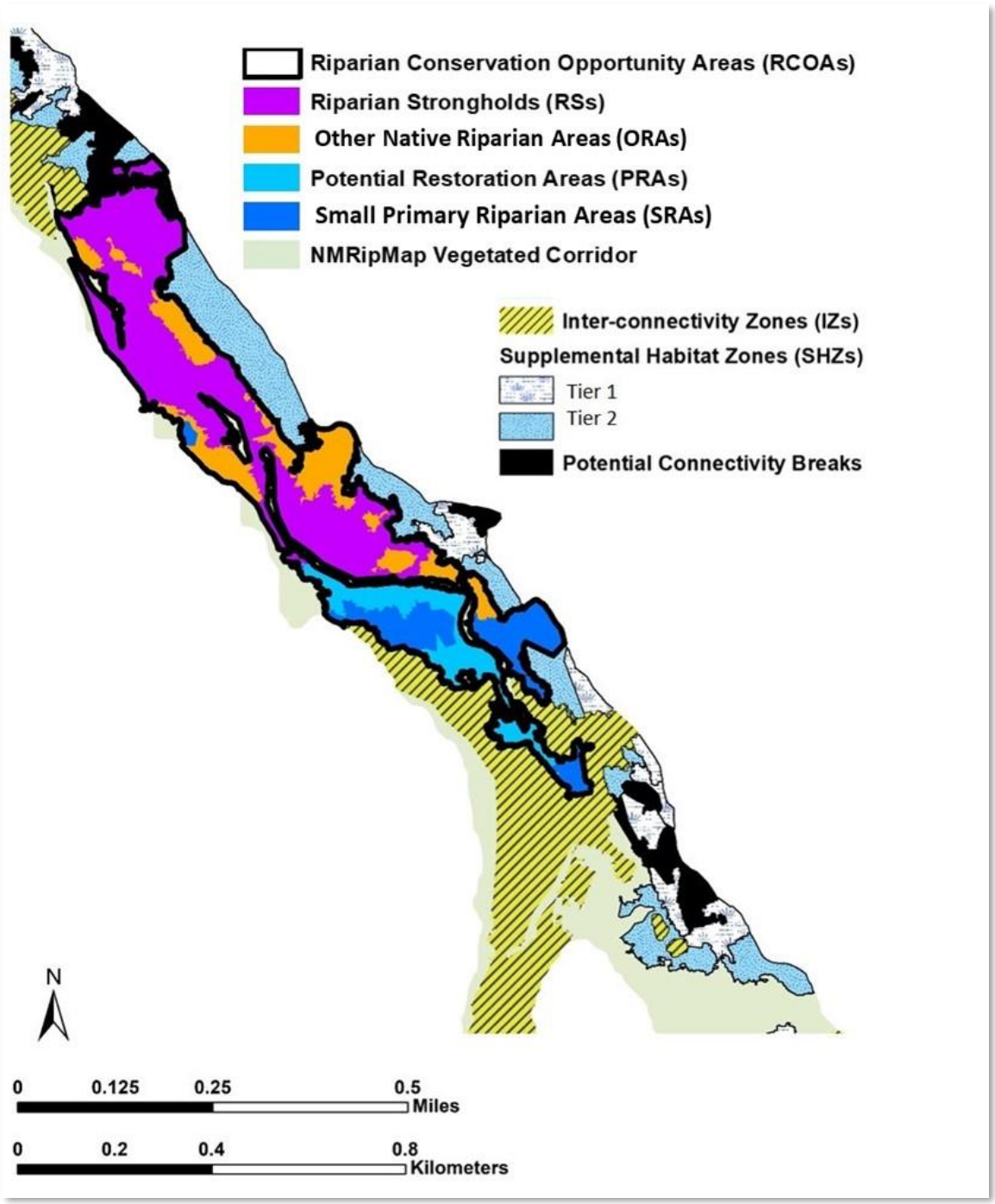

Figure 7. Inter-connectivity Zones and Supplemental Habitat Zones that are supplemental conservation planning layers adjacent to and potentially link RCOAs. Potential Connectivity Breaks may pose significant barriers to connectivity.

The RCOA portfolio

Based on the above framework, a portfolio of 2,399 RCOAs has been built for the State of New Mexico that provide the toolkit's foundation layer for planning and tracking conservation and restoration actions (Figure 7). The RCOA layer is available for download on the Riparian Conservation Opportunity Areas web page at https://nhnm.unm.edu/rcoas as part of the New Mexico Conservation Information System (NM-CIS). Additionally, RCOA components and supplemental conservation planning layers are available as separate spatial files, each attributed with specific data relevant to their purpose and designed to support in-depth analysis of individual RCOAs or groups of RCOAs. These RCOA portfolio products are available as downloadable geodatabases, KMZs, or web feature services (links provided on the webpage). The layers are also viewable through an ArcGIS Online RCOA Map Viewer along with a set of resource layers to further aid interpretation of RCOAs. These include land ownership, land status from the USGS Protected Areas Database (PAD-US), NMRipMap Version 2.0 Plus, among other potentially informative layers that may aid in the planning process for a given RCOA.

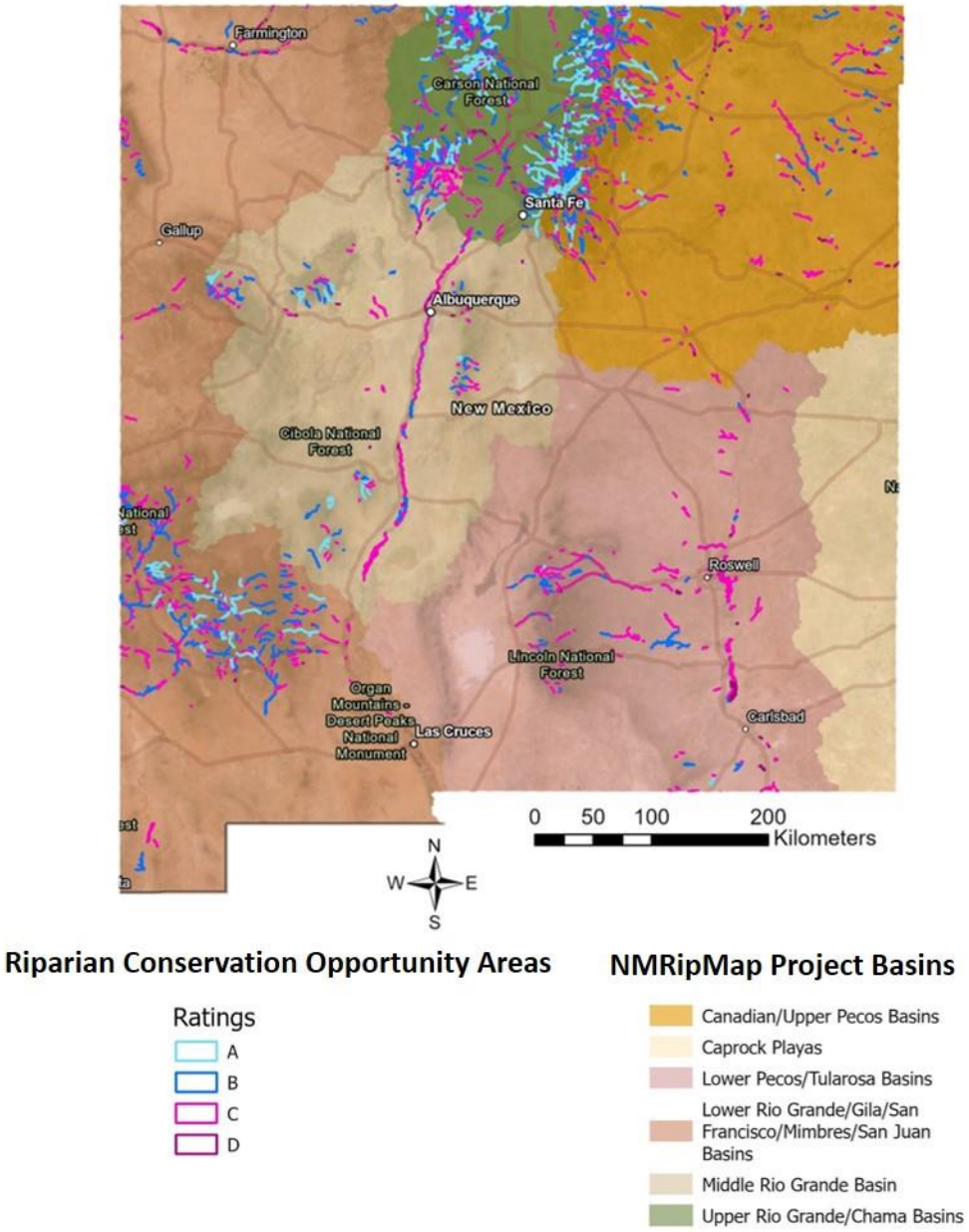

Figure 8. Distribution of the 2,339 RCOAs by conservation ratings in New Mexico overlaid on NMRipMap Project Basins. *Caprock Playas were not a part of the NMRipMap project.

RCOA Distribution

The majority of the RCOAs are found in lowland and mid-montane unconfined reaches (1,238), followed by the high-elevation headwater complexes (418), and then confined canyons (683) (see Figures 8 and 9). With respect to ownership, on average, RCOAs in the confined wetland subclass had the highest proportion of public land (primarily USFS and BLM), while those in unconfined reaches were predominantly on private lands, consistent with these areas having the most urban and agricultural development.

Headwater complex RCOAs showed a mix of public and private ownership, reflecting a combination of private ranching and recreational parcels alongside public lands. It should also be noted that RCOAs may span multiple ownerships, particularly in the unconfined reaches—an important consideration for conservation and management planning.

With respect to conservation rating, of the 2,339 RCOAs across New Mexico, 264 are rated A, 708 as B, 1,245 as C and 122 as D, but distribution is variable with respect to subclass (Figures 10, 11, and 12). Those in the confined wetland subclass had fewer mid-level C scores and more A- and B-rated sites. This likely reflects the impact of less development, although their overall ecosystem diversity was lower. In contrast, the lowland unconfined RCOAs tended to have lower scores because of fragmentation, but relatively high diversity scores. In addition, a D rating would not be considered a ”poor,” low-quality site but rather that it may have less conservation value relative to others in the RCOA portfolio. Accordingly, when using the toolkit in conservation planning, local context should always be taken into consideration.

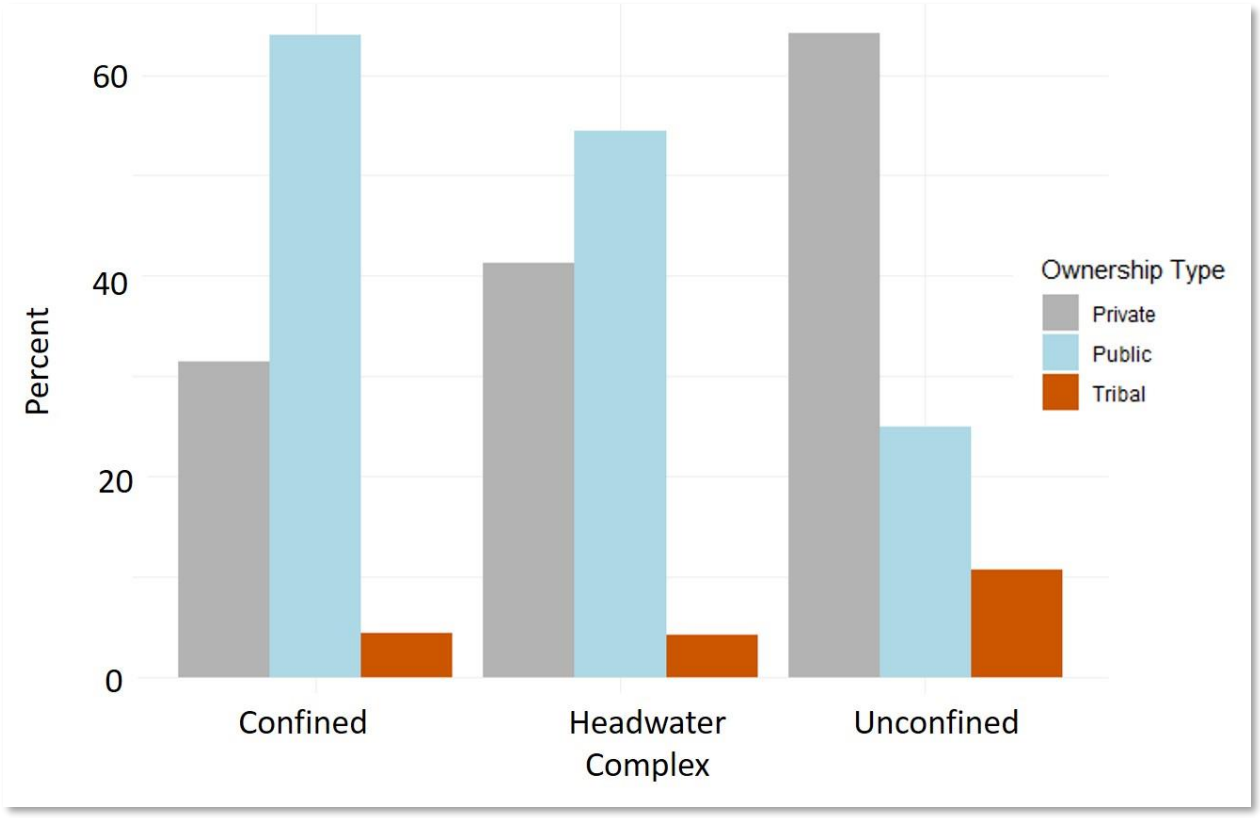

Figure 9. Distribution of RCOAs by wetland subclass and mean percent area by general land ownership

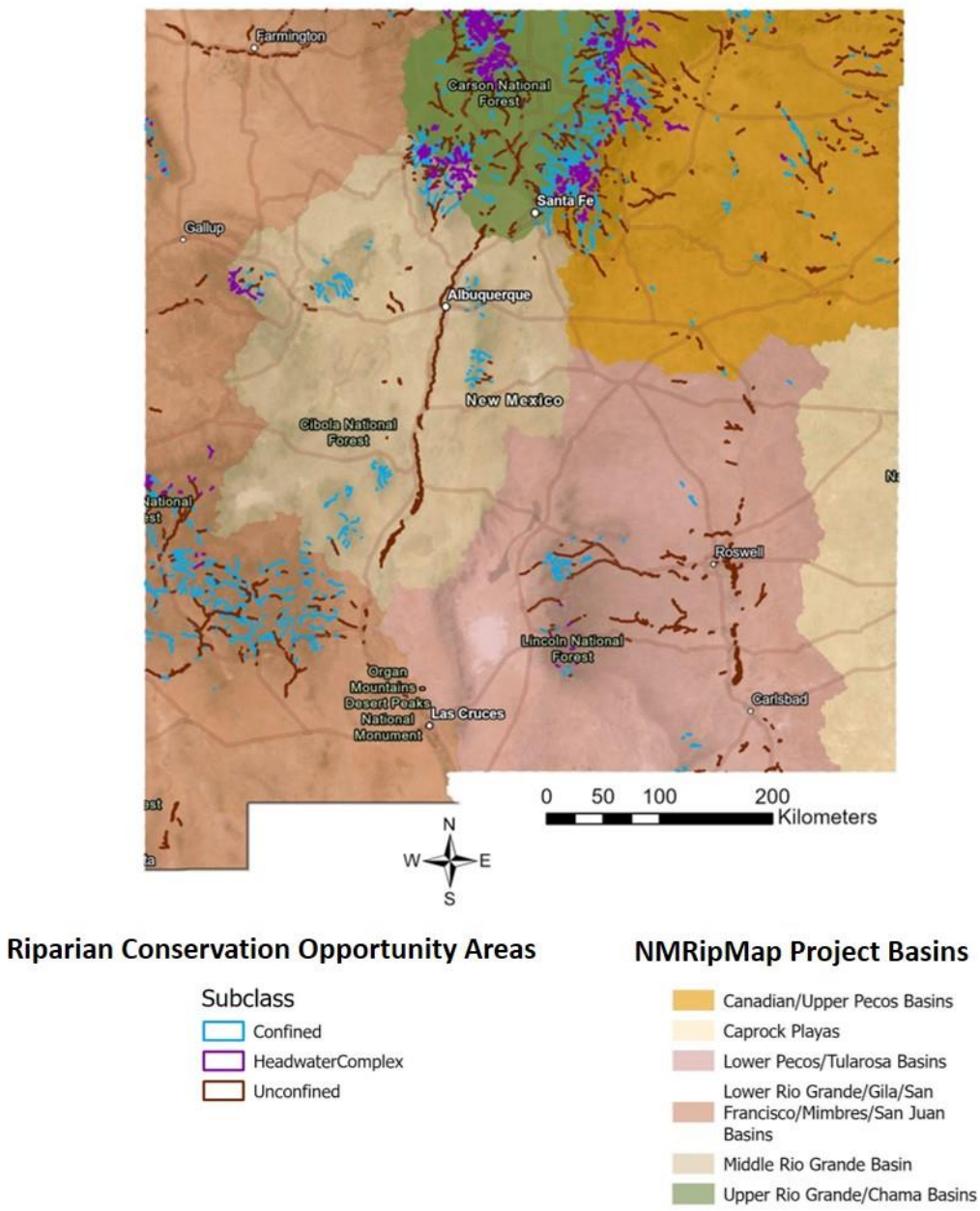

Figure 10. Distribution of 2,339 RCOAs by three wetland subclasses of Headwater Complexes at the top of watersheds, mountain Confined River Canyons, and Unconfined River Valleys typically at lower elevations. General ownerships are also color coded.

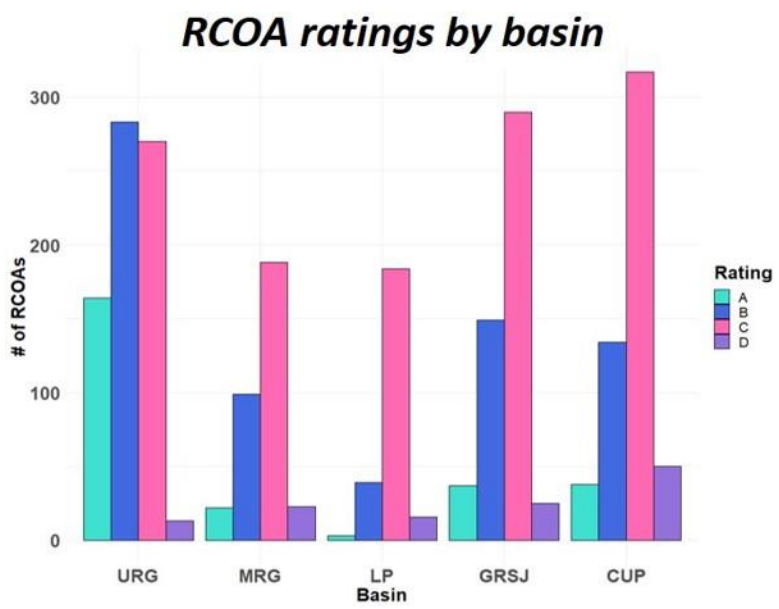

Figure 11. Distribution of RCOAs by Conservation Rating across NMRipMap Basins.

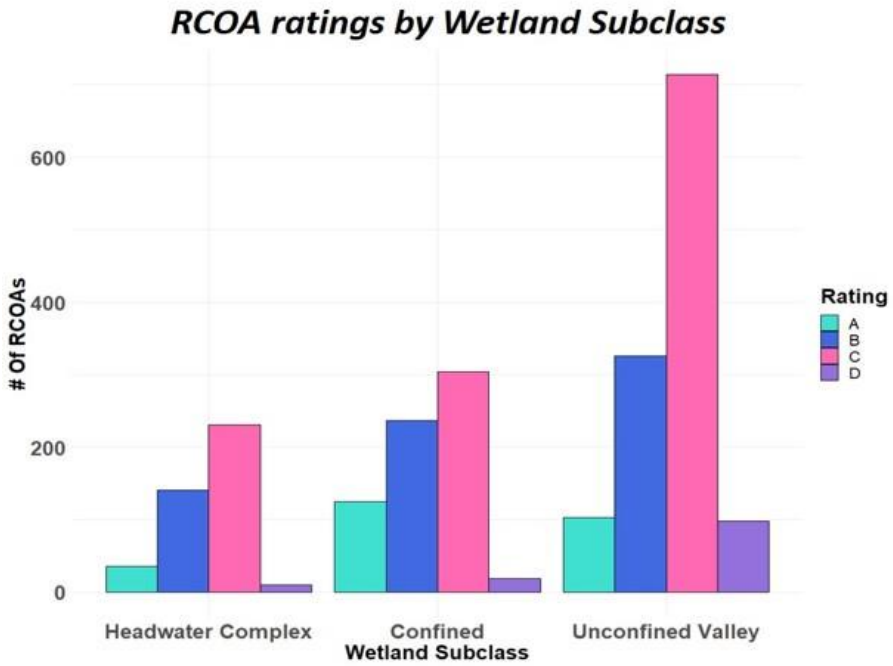

Figure 12. Distribution of RCOAs by wetland subclass and conservation rating.

Use of Portfolio

While the portfolio provides operational targets for conservation, it was largely developed using automated GIS spatial modeling with an initial quality-control check by inspection of the underlying maps. Accordingly, users should recognize that site-level evaluations are needed as a precursor to any conservation or restoration action. Yet, this is a flexible dataset where tools can be developed that allow updates to the portfolio based on user input and tracking projects for sites through time.

With respect to the ratings, they too are first approximations and some elements that affect conservation and restoration actions are not readily analyzed in a GIS at the site level. For example, access and ownership are complex issues which can affect the opportunity elements of conservation that are not reflected in the ratings. The quality of buffer around a site is not directly integrated into the ratings, i.e., if a site is surrounded by urbanized area versus upland natural land, that can affect conservation values. Lastly, the rating system does not account for dispersed land-use impacts such as grazing. There are ways to address these issues in a GIS environment, but they were beyond the scope of this project.

Overall, the toolkit with the RCOA portfolio represents the first comprehensive look at riparian conservation and restoration values in the Upper Rio Grande. It is a relatively straightforward, place-based perspective that conservation practitioners can use in planning and implementation of projects for improving overall riparian health and habitat connectivity in the basin.

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Appendix 1. RCOA development Details

RCOA Quality Control and Subclass Categorization

In the QC and wetland subclass categorization process, we clipped RCOAs as needed to ensure their boundaries were within each subclass type. If a segment of Confined wetlands was less than 1 km between two segments of Unconfined or Headwater wetlands, it was not clipped. Generally, if an RCOA crossed a Hydrologic Unit Code (HUC) 12 boundary[1], it was not clipped at the boundary unless it transitioned to a different HGM subclass at the boundary. However, if an RCOA contained two tributaries that met at a HUC 12 boundary, that RCOA was cut at the HUC 12 boundary even if both tributaries were in the same HGM subclass. Through this process, RCOAs that no longer met the minimum size threshold of 12 acres (5 ha) were eliminated.

USGS Hydrologic Unit Codes (HUCs) at the HUC 12 names were used to assign RCOAs a unique name (See "RCOA_NAME in RCOA attribute table). If the RCOA crossed more than one HUC 12 boundary, the HUC 12 that intersects the majority of the RCOA was used in the unique name and specified in the RCOA spatial layer attribute table (See "MoreThan_1HUC12" in RCOA attribute table). The unique naming convention for RCOAs also includes one of the three wetland subclass types (i.e., Confined, Unconfined, and Headwater Complex) and a Unique RCOA Identifier (see "UniqueID" in RCOA attribute table).

Vegetation Type Diversity Index

The Vegetation Type Diversity Index (VTDI) is based on based on the Shannon Diversity Index for species (Shannon 1948; Pérez et al. 2008), was calculated using PNRV types only. The VTDI accounts for both the number of PNRV types (*S*) and their relative abundance, with higher values representing greater vegetation diversity for an RCOA, which is considered a positive attribute in riparian ecosystems:

$$p_i = \frac{\text{Abundance of vegetation type } i}{\text{Total abundance of all vegetation types}}$$

$$H = -\sum_{i=1}^{S} p_i \cdot \ln(p_i)$$

[1]Hydrologic Unit Codes (HUCs) are watersheds delineated by United States Geological Survey (USGS), using a nationwide system based on surfaced hydrologic features (Jones et al. 2022).