San Luis Valley

Wetland and Wildlife Conservation Assessment

Historic and Current distribution of Wetlands and Riparian Areas: Recommendations for Future Conservation

Second Edition – May 8, 2019

Prepared By:

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In Association With:

Rio Grande Basin Roundtable

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2 Acknowledgements

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The Intermountain West Joint Venture (IWJV) 30+ year hydrologic extent GIS analysis of Colorado wetland areas was a key component in the development of recommendations for conservation priorities. We thank Patrick Donnelly for leading the IWJV effort and for his help in summarizing and interpreting information for the San Luis Valley. Funding for this effort came from Colorado Parks and Wildlife, Bureau of Land Management, Ducks Unlimited, Inc. and the U.S. Fish and Wildlife Service. Special thanks goes to Grant Wilcox, Aquatic GIS specialist with Colorado Parks and Wildlife, for his time and expertise in further analysis of the IWJV data.

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3 Executive Summary

The San Luis Valley Wetland and Wildlife Conservation Assessment (Assessment) details the history of changes in wetlands to guide cooperative conservation goals for monitoring, management, and land conservation throughout the San Luis Valley (SLV) for natural resource agencies and organizations. This Assessment involves local, regional, and state staff and support from the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), Colorado Parks and Wildlife (CPW), Natural Resource Conservation Service (NRCS), U.S. Forest Service (USFS), Ducks Unlimited, Inc. (DU), Intermountain West Joint Venture (IWJV), National Park Service (NPS), and numerous other individuals and organizations dedicated to promoting cooperative partnerships to manage, monitor, and conserve habitat resources across the SLV. In 2018 the IWJV completed an analysis of 30+ years of satellite imagery of the western half of the state of Colorado. This information identified changes in hydrologic extent from 1984 to 2017 within valley river basins. General Land Office Surveys (GLOs) from the 1870s were geo-referenced to provide pre-settlement information about the SLV, specifically locations of wetlands, riparian areas, and rivers. Some wetland areas were digitized from GLOs, however, further work is needed to complete this portion of the project. Further GIS analysis of wetland types by season and ownership was completed by CPW Aquatic Geographic Information System (GIS) specialist, Grant Wilcox.

Results from this project, include 35 priority species fact sheets specific to the SLV that incorporates known survey data, research, and other information to develop habitat matrices based on life cycle events. Partners in the SLV have long desired a GIS vegetation layer that was consistent across boundaries. Vegetation mapping completed from 2006 -2008 on seven of the public areas in the SLV was compiled and a GIS layer created that grouped vegetation associations and communities into comparable habitat types. These habitat types were consistent with those used in the fact sheet matrices. The GIS analysis of hydrologic extent coupled with the habitat layer provided partners with a first look at wetland habitat resource availability for three pre-selected species: cinnamon teal, sandhill crane, and white-faced ibis. These species represent species of concern, have been or are being studied in the SLV, and/or utilize similar resources as many other species such that results could be extrapolated to identify declining wetland habitat resources across the SLV. Overall, results indicate that:

- A SLV-wide decline (at least 50%) in wet acres since 1984.
- Clear indication of loss of habitat during the drought periods in the decade of the 2000s.
- The loss of wet acres indicates that there is less available resources for wildlife witch may concentrate wildlife populations and/or may lead to declines in populations.
- Slow recovery of wet acres in some areas since the drought of early 2000's.
- Private lands provide more wet acres, about 70%, than public land.
- Early spring migration habitat (Feb – March) has the least number of wet acres in the spring, prior to the presumptive April 1st irrigation season.
- Fall migration habitat has the least number of wet acres across all habitat types and ownership and has been reduced across time since 1984.
- The Baca National Wildlife Refuge has lost most of the wet acres that were available in 1984.
- The Monte Vista National Wildlife Refuge has also lost substantial habitat with little recovery since the drought time periods.
- Alamosa National Wildlife Refuge and Blanca Wetlands Management Area seem to have been able to provide the most consistent resources across time and habitat types.

- The habitat provided at Russell Lakes State Wildlife Area has increased in the last 15 years.
- Hydroperiods associated with wet meadow, grassland, mudflat/playa, and riparian on public areas have declined most dramatically and in some areas are no longer available.

Ultimately this assessment has identified needs for further analysis, potential future management actions, identified potential new partnerships, and outlined ways the information may be used by other agencies and organizations to help prioritize projects. The following are recommendations, actions, or specific projects that the partners have identified to begin working on:

- Develop an inter-agency collaborative committee to promote SLV-wide wetland management and monitoring strategies.
- Initiate a framework among SLV agency staff to develop annual management strategies and prioritize allocation of resources.
- Provide opportunities to engage with other public agencies that have wetland resources in inter-agency water discussions.
- Develop a SLV-wide monitoring strategy for priority wetland dependent species and their habitats.
- Develop monitoring strategies of priority species' habitat to determine carrying capacity of wildlife populations on public lands.
- Determine effects of loss of wet acres to wildlife populations.
- Work with Division of Water Resources (DWR) to pursue opportunities to provide early spring and fall resources for wildlife outside of the irrigation season.
- Prioritize ways to help improve/prevent further habitat declines at the Baca NWR.
- Identify main causes for the decline in habitat on the Baca NWR and find ways to restore function to this area.
- Conduct GIS vegetation mapping of McIntire Simpson and San Luis Lakes SWA and update the other 7 public areas already mapped.
- Create GIS layer(s) for crop information and a structure layer.
- Conduct further analysis of temporary hydroperiods with crop and structure layer.
- Provide the fact sheets, scorecards, and GIS information to land trusts such as Rio Grande Headwaters Land Trust (RiGHT) to use in grants to identify the types of resources that may be available on potential conservation easements and restoration projects.
- Work with Colorado Natural Heritage Program (CNHP) to develop a managed wetland Ecological Integrity Assessment to better interpret results seen in this GIS analysis.
- Conduct a more in-depth statistical analysis of changes in wet acres discussed in this document.

4 Introduction

The SLV is a high elevation montane basin in the Southern Rocky Mountains containing the headwaters of the Rio Grande. Ownership of land in the SLV creates a mosaic of public lands adjacent to private lands. Natural resource federal and state agencies and non-governmental organizations (Figure 4.1) along with private land conservation easements have protected large contiguous areas in the SLV.

The San Luis Valley Wetland and Wildlife Conservation Assessment (Assessment) was conceived to help identify where partnerships among natural resource agencies and other conservation organizations may be created to more efficiently and effectively manage limiting water resources for wildlife. Changes in irrigation practices over the past 40 years coupled with extreme drought conditions, mining of the aquifer, and promulgation of Groundwater Rules and Regulations have compelled natural resource partners to identify how cooperative efforts might occur across boundaries in order to continue to provide resources to high priority wetland dependent species utilizing the SLV during different times of the year.

Currently there is little information that tracks changes in wetland (hydrologic) extent across the SLV from pre-settlement to the present. Land use practices have changed over this time period along with changes in climatic conditions. Many objectives and goals for wetlands and associated wildlife species were put in place during and after the 1980's. The 1980's represents the wettest period on record over the past 1,000 years based on data obtained from a tree-ring analysis and has since been followed by the driest period on record (Correa 2007). Continued groundwater withdrawals that further lower the

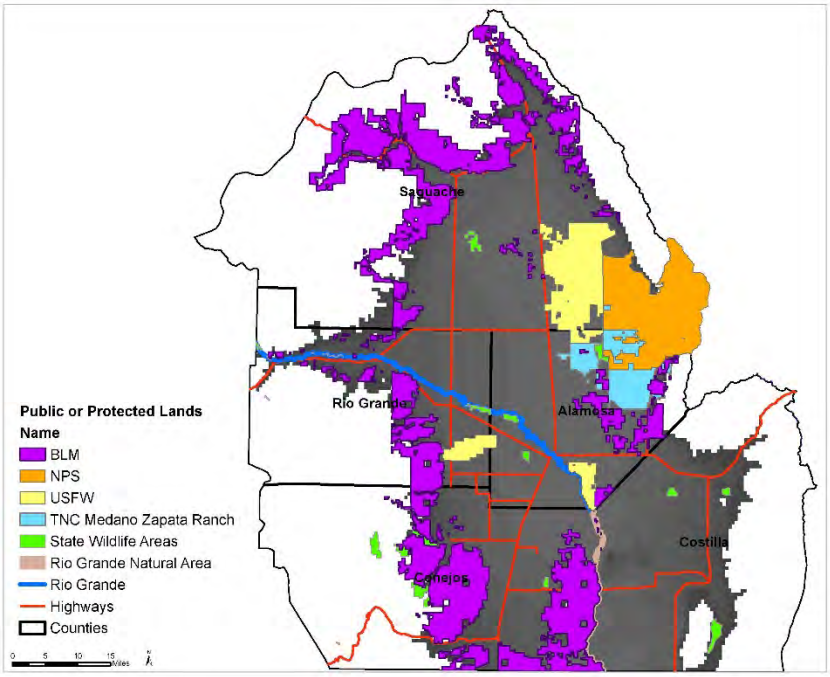

Figure 4.1. The 5 Counties comprising the floor of the San Luis Valley with public ownership

water table and mine the aquifer have exacerbated recent drought conditions and prompted the need for a better understanding of the current hydrological patterns of wetlands across the landscape. Identifying wetlands that are resilient, or maintain saturated soils to surface water flooding, during extreme drought conditions may help managers better allocate resources to the most appropriate locations. In an effort to better understand changes in wetland extent, partners provided funding for an Intermountain West Joint Venture (IWJV) GIS study to analyze 16 day Landsat imagery from 1984 to the present across the SLV. General Land Office (GLO) surveys from the 1870s were geo-referenced for the entire SLV as part of this project as well. For a full description of the methods used in the analysis of the IWJV study, please see Section 8.2.

Among natural resource agencies many plans, reports, and datasets exist for wetland habitat and species but they have not been compiled in order to develop a comprehensive repository that shows changes over time along with potential information gaps that could be addressed in the future. This project provided the opportunity to identify and compile all of the known digital data sets and information pertaining to wetland birds, plants, habitats or other wetland dependent species that have occurred in the SLV, primarily on public lands. A comprehensive spreadsheet was developed that lists all known datasets, location, owner, and format, along with species or habitat surveyed. Additionally, a vegetation or habitat map for public wetland lands using consistent terminology was created.

An important goal of this project was identifying priority wildlife species across boundaries that represented a wide range of conditions, that if met would meet all resource needs for a majority if not all of the wildlife species in the SLV. A total of 35 species were identified and include amphibians, mammals, and birds. Fact sheets were created for each species that include conservation status, life cycle needs, and matrices that display habitat requirements specific to each species' time spent in the SLV (See Appendix IV). These documents are similar in scope to fact sheets created by the CPW Wetlands Program and may, in the future include scorecards with SLV scores and rankings. These products will promote collaboration and cooperation among agencies to manage and monitor resources across the SLV in a unified way that has not occurred in the past. Conservation goals developed will direct future restoration, enhancement, and preservation of limiting resources and lands throughout the SLV for a wide range of priority species that all of the agencies and organizations recognize as important to sustain and maintain. Future projects that promote water efficiency and improve/enhance/preserve habitats providing these limited resources for priority species will be identified.

Assessment Activities and Products:

- Utilize the Intermountain West Joint Venture 30+ year (1984-2016) GIS method/analysis to track seasonal changes in wetland extent across the SLV.
- Collect existing digital surveys, reports, etc. of wetland dependent wildlife and habitats to create a repository of information.
- Identify priority wildlife species across natural resource agencies and develop 'fact sheets' for each species that highlight habitat needs specific to the SLV.
- Create one habitat GIS layer across public lands with consistent vegetation types
- Develop habitat matrices for each priority species
- Conduct a species specific GIS analysis of IWJV data for three key wetland dependent species
- Identify how natural resource agencies can work cooperatively to provide and monitor limiting habitat resources for wildlife across the SLV.

- Identify potential priority habitat conservation goals.
- Identify time of year and locations of limiting water resources.
- Recommend future conservation work targeting identified limiting resources for wildlife.
- Recommend future research needs.

This effort has built a strong collaborative network across many natural resource agencies in the SLV that will allow us to address current water resource issues and provide a roadmap to meet future challenges. The Assessment has also identified other agencies where partnerships and cooperative efforts could be strengthened such as with the State Land Board and the Great Sand Dunes National Park. The existing partner network is integral to the sustainability of our natural resources. This cooperative effort and future efforts among agencies will lead to a unified message that can be expanded to include conservation minded private landowners. Working private lands represent a large part of the habitat that currently exists for many species. The Assessment helps to identify important resources for wildlife that are available on private lands under existing agricultural practices. This project highlights resilient areas where wetlands, wildlife, and agriculture co-exist and are beneficial to the SLV community. Partnerships between agencies and landowners are essential to the continued availability of habitat resources and may be strengthened through this project's GIS analysis and Assessment.

Further, the project provides land trusts with important information for prioritizing conservation efforts related to priority species and limiting resources. Fact sheets and matrices can be utilized to provide support to land trusts seeking funding to conserve high priority lands with willing landowners. Products from this Assessment may be used by other organizations to help access funding for wetland/riparian restoration and enhancement projects and may be used to help prioritize spending on projects throughout the SLV. The framework for how natural resource agencies can better work together to provide water resources through cooperative efforts and maintain their adherence to water administration is an increasingly important need that currently does not exist. Finally, the Assessment may provide a template for others basins seeking to find ways to work cooperatively across boundaries and agencies.

5 SLV Background

Many land and water use changes have occurred in the SLV since European settlement in the 1800s. Following major expansion of settlements in the SLV during the mid-1800s, agricultural production became the predominant way of life for local residents, but was limited by the availability of surface and groundwater. To support a growing agricultural economy, irrigation systems were developed that included diversion of water from the Rio Grande and most other rivers and creeks throughout the SLV. Water users developed delivery systems through an elaborate system of ditches and canals, creation of drains, as well as the development of groundwater resources from pumped and free-flowing artesian well water, (see Buchanan 1970, Athearn 1975, Hanna and Harmon 1989, Emery 1996 and others). Use and allocation of both surface and groundwater is now regulated through complex water rights including the Rio Grande Convention Treaty of 1906, interstate "Compact" agreements, state and local irrigation districts, and groundwater sub-districts to name a few. Agricultural and other water uses have changed the amount and distribution of wetlands used by wildlife, as well as the frequency, timing, duration, and depth of flooding in wetlands throughout the SLV.

5.1 Climate

The climate of the SLV is semi-arid, with cold winters and moderate summers. The SLV receives on average about seven inches of precipitation per year dependent upon location in the region. About 60% of this precipitation occurs as monsoonal rains in July and August. The source of summer moisture comes from weather systems from the Gulf of Mexico and California moving from the desert southwest north through Arizona and New Mexico into the SLV. Long-term precipitation data from Saguache, Del Norte, and Manassa, Colorado suggest that alternating low and high precipitation cycles recur at about 20- to 30-year intervals (Figures 5.1, 5.2, 5.3). Dry periods in the long-term precipitation pattern occurred in the 1890s, 1930s, early-1950s, early-1970s, late-1980s, and mid-2000s (Thomas 1963).

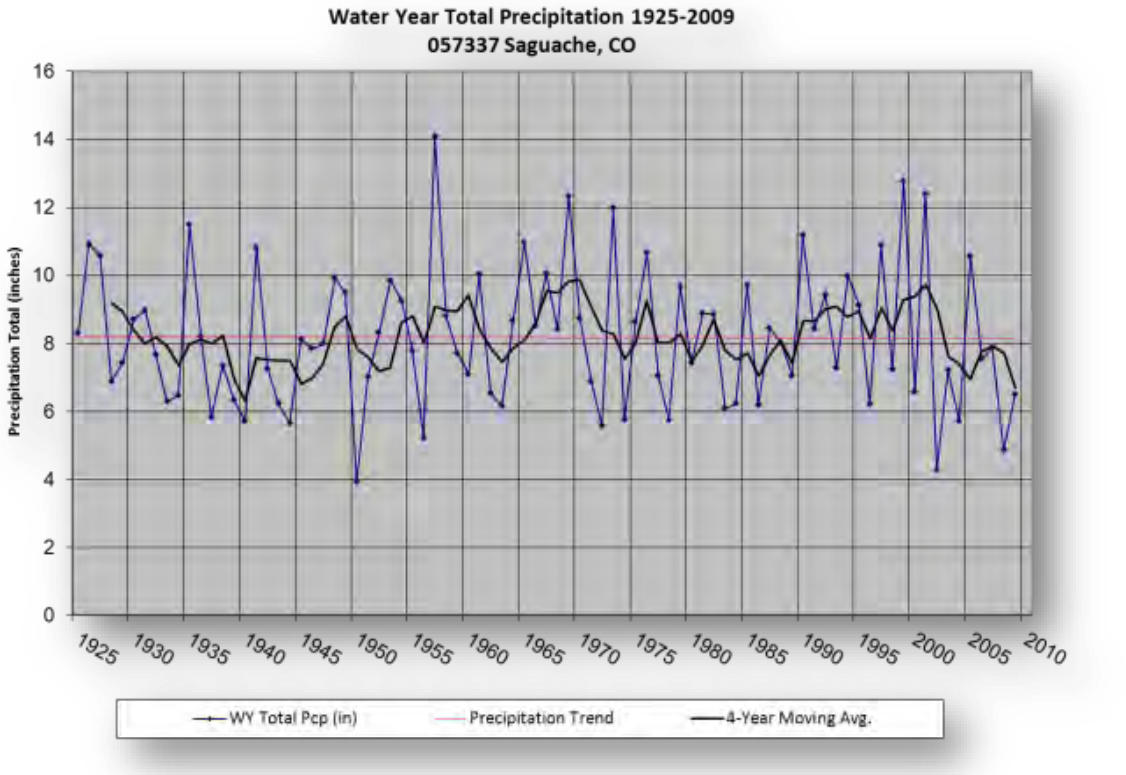

Figure 5.1.Total water year precipitation form 1925 to 2010 at Saguache, CO (from Striffler 2013; Baca NWR WRIA)

Generally, the long-term trend for total water year precipitation over time is fairly stable but varies somewhat by location (Striffler 2012). Recent studies have analyzed tree-ring data to reconstruct streamflow throughout the Rio Grande Basin (Correa 2007). These data suggest that the periodicity and duration of individual droughts has increased over the last 730 years.

Mean annual temperature is 42° Fahrenheit at Del Norte, Colorado. Temperatures of -20 to -30° Fahrenheit can be expected each year. The annual frost-free growing season averages about 90-100 days usually from late May through early September (SCS 1980), however wide annual variation occurs and July and August typically are the only consistent completely frost-free months. Evapotranspiration (ET) rates typically are 45-50 inches per year (Leonard and Watts 1989, Ellis et al. 1993), exceeding precipitation every month of the year with the largest deficits occurring in June (Leonard and Watts 1989). Prevailing winds usually are from the south-southwest with wind speeds of 40+ miles per hour

commonly occurring in spring and early summer. Snow cover usually is sparse on the floor of the SLV and sometimes is completely lacking during much of the winter (BLM 1991).

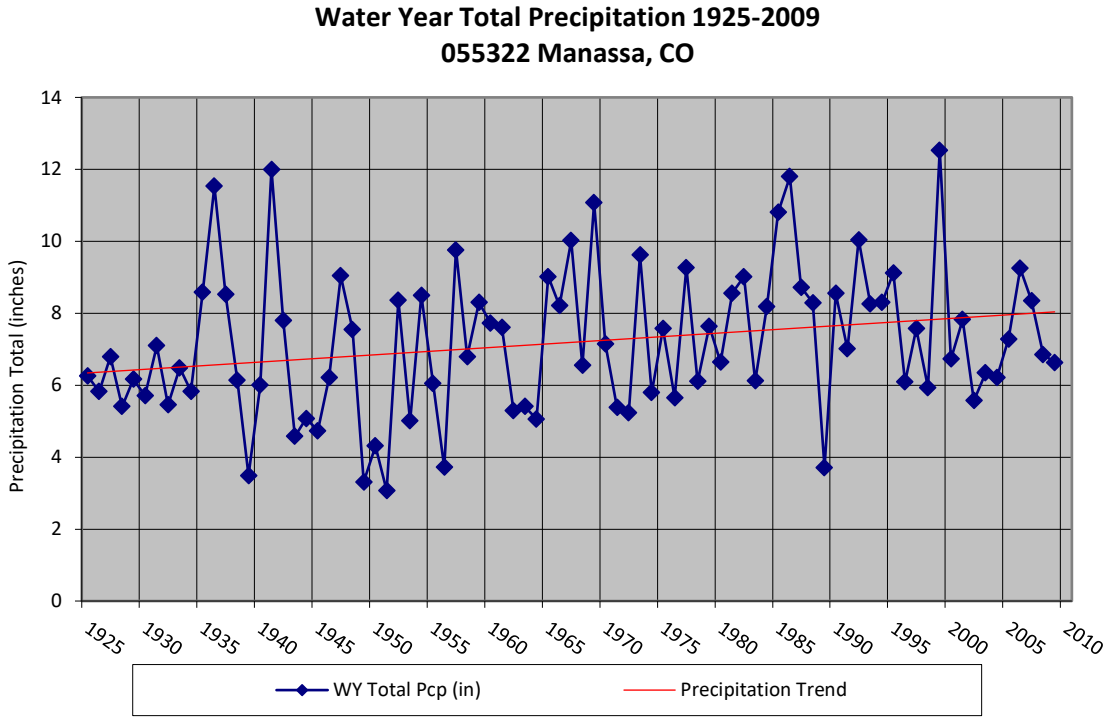

Figure 5.2. Water Year total precipitation at Manassa, CO 1925-2009, source: USHCN (Taken from Striffler 2011; Monte Vista NWR WRIA)

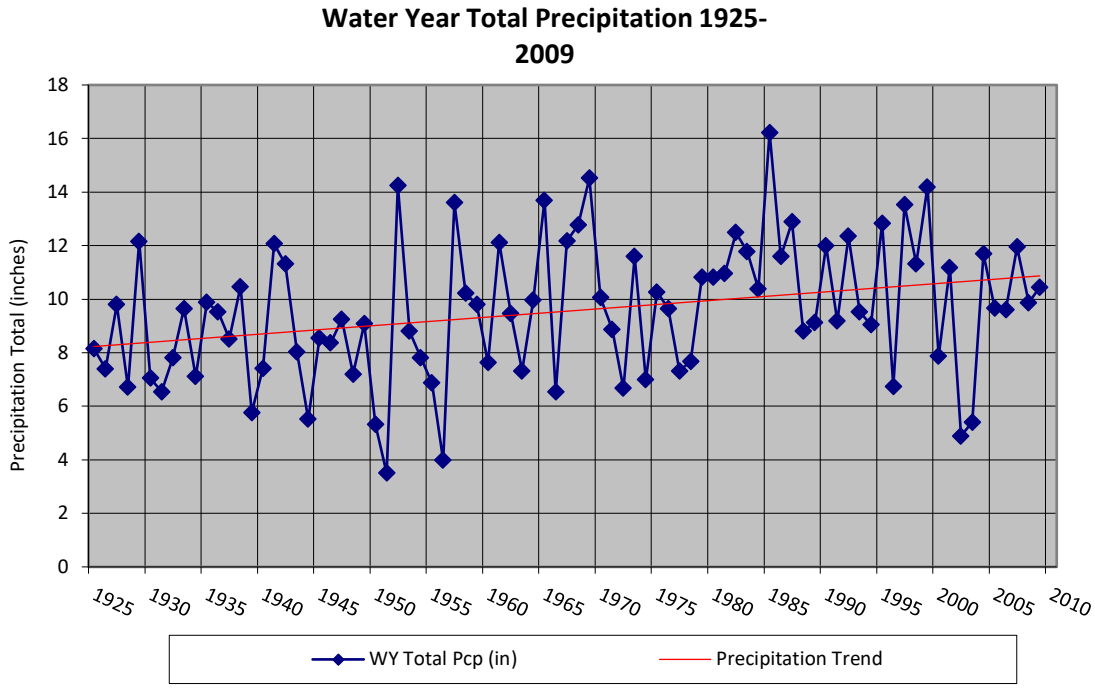

Figure 5.3. Water Year total precipitation at Del Norte, CO 1925-2009, source: USHCN (Taken from Striffler 2011; Monte Vista NWR WRIA)

5.2 Landscape

The SLV is the largest of a series of high-altitude, intermontane basins located in the Southern Rocky Mountains (Jodry and Stanford 1996). The SLV is part of the much larger Rio Grande Rift Zone that extends from southern New Mexico north through the SLV to its northern terminus near Leadville, Colorado (Chapin 1971, Bachman and Mehnart 1978).

The SLV Basin is a compound graben depression that was down-faulted along the base of the Sangre de Cristo Mountains, which resulted from extensive block faulting during the Laramide Orogeny. The Sangre de Cristo Mountains have normal faults on both sides of the range near the toe of the foothills. The fault lines in the SLV extend north of the Great Sand Dunes along the base of alluvial fans of the Sangre de Cristo Mountains. The San Juan Mountains bound the SLV on the west and were created by extensive Tertiary volcanism about 22 to 28 million years before the present (BP; McCalpin 1996). The Oligocene volcanic rocks of the San Juan Mountains slope gradually down to the SLV floor where they are interbedded with alluvial-fill deposits (BLM 1991). This volcanic rock layer originating from the San Juan Mountains extends over the Alamosa Horst, a buried ridge of the normal fault, separating the SLV into the Monte Vista Graben to the west and the Baca Graben to the east. The normal fault line trends north from the San Luis Hills to the Sangre de Cristo Mountains near Medano pass. The Baca Graben contains almost twice as much alluvium (about 19,000 feet thick) as the Monte Vista Graben because of its juxtaposition to the Sangre de Cristo fault zone (Figure 5.4; Zeisloft and Sibbet 1985, Burroughs 1981, Brister and Gries 1994).

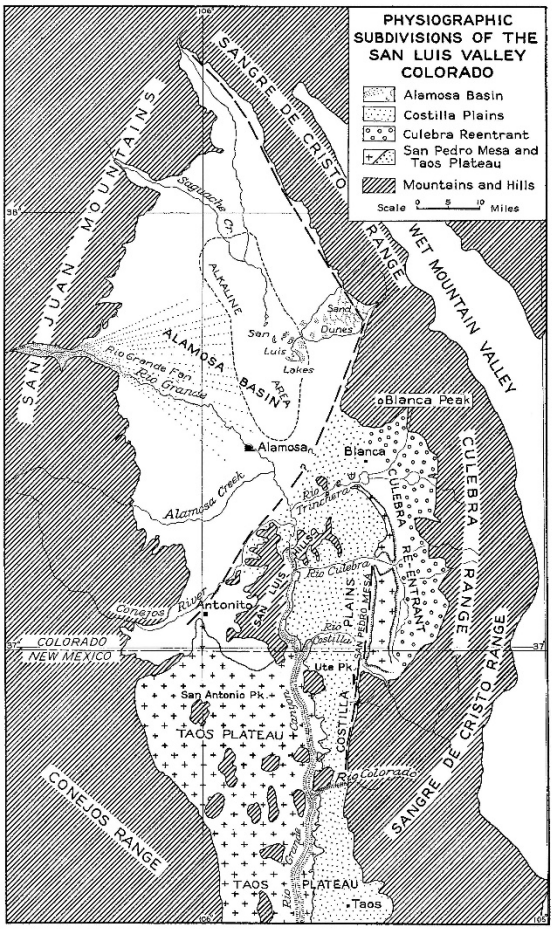

Figure 5.4. Physiographic subdivisions of the SLV, Colorado (Taken from Upson 1939)

From the Pliocene to middle Pleistocene time, a large high altitude lake, Lake Alamosa, occupied most of the SLV (Machette et al. 2007; Figures 5.5, 5.6, 5.7). This ancient lake went through several cycles of drying and flooding, ultimately accumulating sediments that are designated as the Alamosa Formation consisting of alternating beds of gravel and either sand, sandy silt, or sandy clay (Siebenthal 1910; Madole et al. 2008). Lake Alamosa existed for about three million years when it overtopped a low wall of Oligocene volcanic rocks of the San Luis Hills and carved a deep gorge that flowed south into the Rio Grande, entering at what is now the mouth of the Red River (Madole et al. 2008). Thus, interbedded clay layers in the Alamosa Formation are freshwater lake clays of varying color and depth and are more extensive in the northern portion of the Alamosa Basin where deposits may be up to 19,000 feet thick. The Alamosa Formation that contains Quaternary-age younger alluvium and surficial deposits, is underlain by the Santa Fe Group (Figure 5.8). The Santa Fe group is comprised of Pliocene and Miocene formations underlain by Echo Park alluvium and then Precambrian rocks.

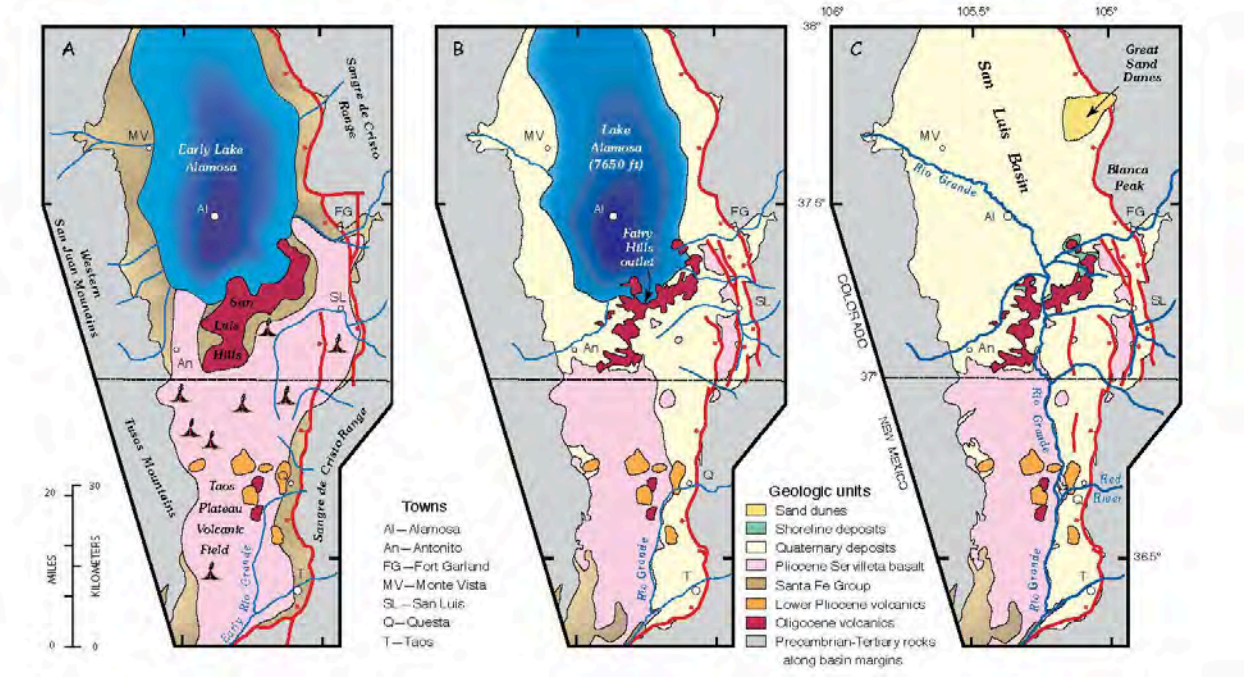

Figure 5.5. Simplified geological map of the San Luis Basin showing generalized geology and drainage patterns for the time intervals, A) 3.5-5 million years before present (BP), B)440,000 years BP, and C) Current (taken from Machette et al 2007)..

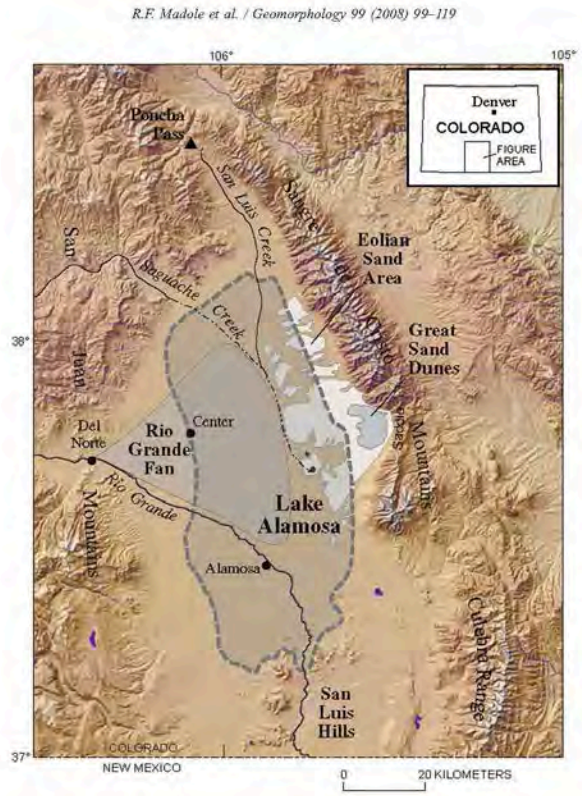

Figure 5.6. Location of Lake Alamosa in relation to the eolian sand sheet and Rio Grande fan in the San Luis Valley (Taken from Madole et al 2008)

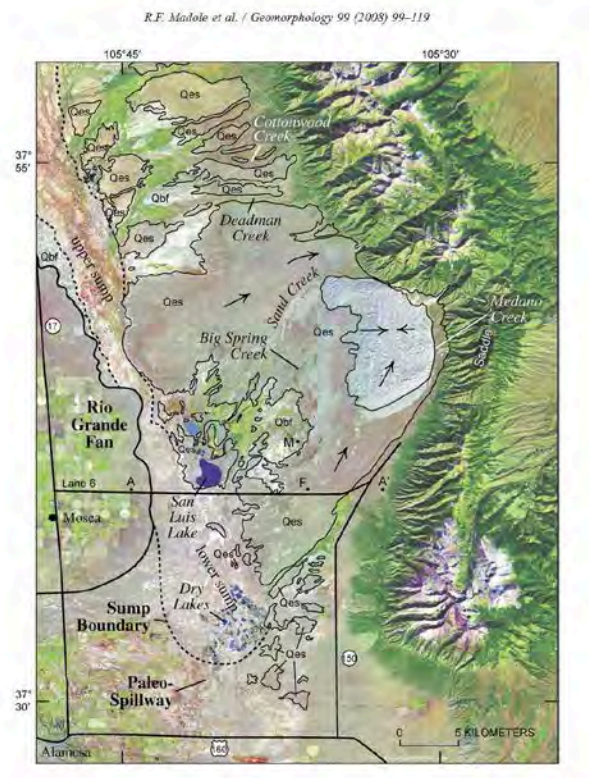

Figure 5.7. Location of the Upper and Lower Sump areas and Rio Grande Fan in the SLV (Taken from Madole et al 2008)

After the retreat of Lake Alamosa, and during the Pleistocene, sediments were deposited differentially during and between glaciations as melt water flowed through the Rio Grande system as far east as San Luis Creek. Wind moved eolian sediments from an area just east of the historic Rio Grande fan in a northeasterly direction towards the Great Sand Dunes in drought periods (Figure 5.6). Wind deflation occurred during times of drought and between periods of intermittent flooding. Eolian surfaces such as the sabkha, or salt-encrusted plain, were deflated and transitioned from a sand sheet to a dune field, and eventually to sand ramps on what is now the Great Sand Dunes National Park. This Eolian sand covers an area of about 625 km^2 of which 553 km^2 consists of low relief dunes and sheet sand (Madole et al. 2008). As much as 70% of the particles comprising the Great Sand Dunes are of San Juan Mountain or volcanic origin with the remaining particles originating from the Sangre de Cristo Mountains. The erosion of these particles occurred in what has been described as the Upper and Lower Sump areas, where a heterogeneous playa and dry lake wetland complex occurs along the axis of the Closed Basin (Figures 5.6 and 5.7; Madole et al. 2008). This wind deflation coupled with subsidence of the Closed Basin has been a factor in preventing external surface drainage to the Rio Grande.

5.3 Hydrology

5.3.1 Aquifers

The thick basin-fill deposits of interbedded clay, silt, gravel, and volcanic rock form two main aquifers (confined and unconfined) in the SLV (Burroughs 1981, Wilkins 1998, Hanna and Harmon 1989). The two aquifers are separated by a confining layer of discontinuous clay beds and volcanic rocks (Emery et al. 1973; Figure 5.8). The unconfined alluvial aquifer sits just below the surface to a depth of about 40+

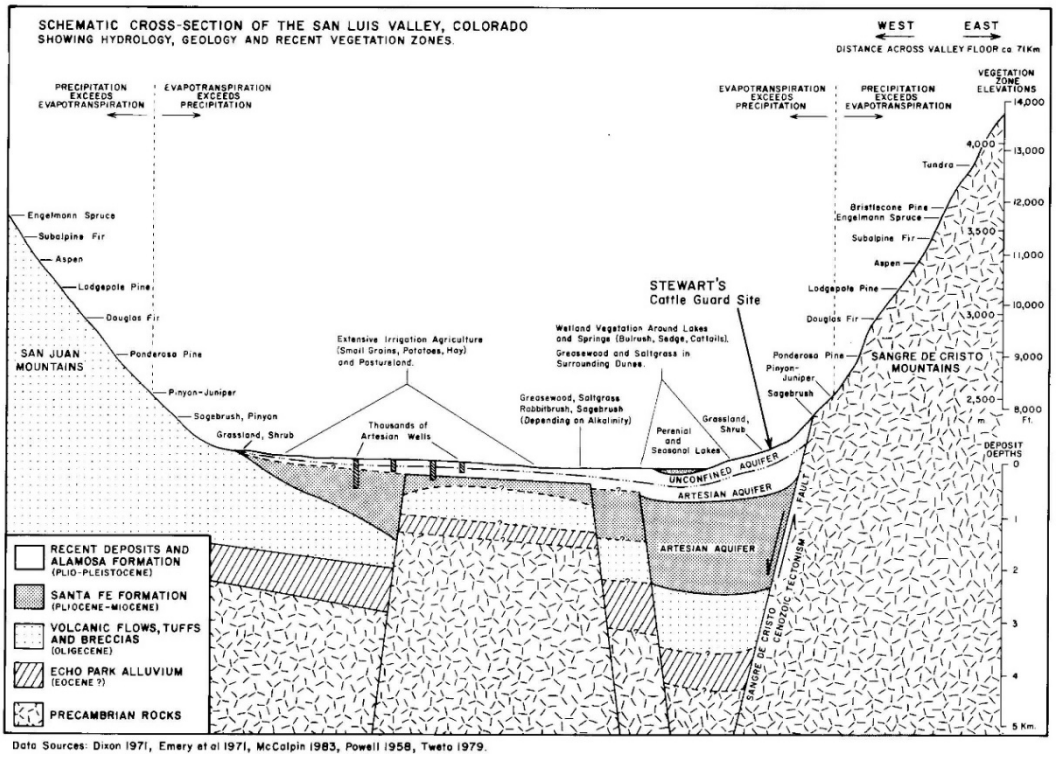

Figure 5.8. Schematic cross-section of the San Luis Valley, Colorado showing hydrology, geology, and recent vegetation zones (Taken from Jodry and Stanford 1989).

feet. Hydraulic conductivity of the unconfined aquifer can range from 35 to 235 feet/day, with the highest values near the western edge of the SLV (Figure 5.9; Hanna and Harmon 1989). Natural recharge to the unconfined aquifer occurs from infiltration of local precipitation along the margins of the SLV, infiltration of surface water from natural stream channels (i.e., Rock Creek and San Luis Creek), inflow of groundwater from the San Juan and Sangre de Cristo Mountains, and upward leakage of groundwater through the confining bed (Powell 1958, McGowan and Plazak 1996, Stanzione 1996). Recharge of the unconfined aquifer is strongly affected by annual changes in runoff from the surrounding mountains, which is a function of annual snowpack and spring snowmelt. Loss of water from the unconfined aquifer occurs from ET, discharge to streams and creeks, and some groundwater flow to the south.

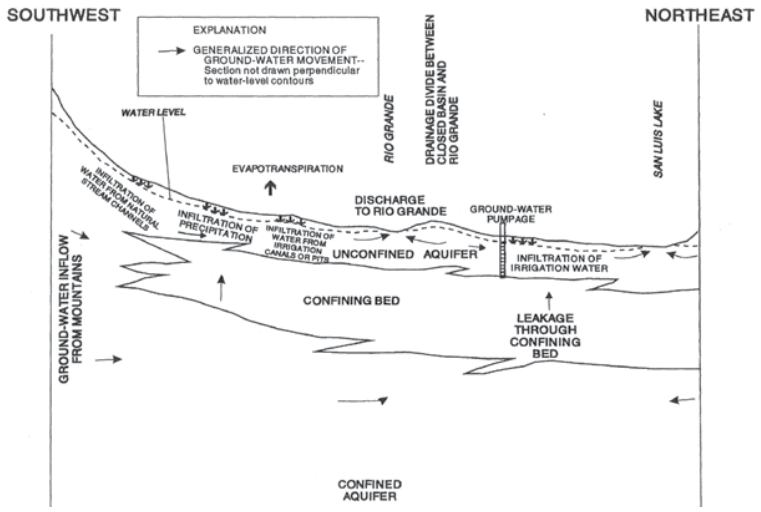

Figure 5.9. Schematic cross section of groundwater movement in relation to the unconfined and confined aquifers in the SLV, CO (modified from Hanna and Harmon 1989).

The confined aquifer occurs below the unconfined alluvial aquifer and consists of an active and passive zone (Figure 5.8). Along the periphery of the SLV, the unconfined and active confined aquifers are directly connected hydraulically. Recharge to the active confined aquifer takes place, in part, through the unconfined aquifer at these locations. The active confined aquifer is up to 4,000 feet below the land surface. Recharge to the confined aquifer occurs along the fault lines or margins of the SLV from infiltration of precipitation, infiltration of surface water, and inflow of ground water from the adjacent San Juan Mountains. Discharge from the confined aquifer occurs as ground water flows to the south and upward leakage through the confining bed occurs.

5.3.2 Riverine Systems

The Rio Grande enters the SLV near Del Norte, Colorado and flows to the south and east along the southern boundary of the Rio Grande alluvial fan (Figures 5.4; Figure 5.10, Appendix I). The river takes a more southerly direction at the town of Alamosa, Colorado where a low topographic and hydrologic divide (Powell 1958) historically stretched from the northern edge of the Rio Grande Alluvial fan to eight miles east of Alamosa and north to Blanca, which separated the Rio Grande floodplain from the Closed Basin to the north (Leonard and Watts 2008). Some current information indicates that the hydrologic divide that historically prevented hydrologic connectivity between the Rio Grande and areas to the north no longer exists due to ground water extraction, however, the divide may be reformed should the aquifer be restored to sustainable levels (Davis Engineering 2007). The entry of the Rio Grande into the SLV is bounded by a low elevation terrace on the south and west, which caused the channel to actively migrate, or “avulse” to the northeast of the town of Monte Vista, Colorado, and created a floodplain 200 to 300 times the width of the current average river channel width (Jones and Harper 1998). After turning south in Alamosa, Colorado, the Rio Grande floodplain is confined to the east by Hansen's Bluff

(Jones and Harper 1998). The Rio Grande's largest tributary, the Conejos River, and meet near the town of Sanford. The common lateral migration of the Rio Grande and Conejos River in the SLV created many geomorphic surfaces including sometimes split or braided channels, abandoned channels or sloughs and oxbows, natural levees, scroll bars, and terraces.

Tributaries of the Rio Grande including the, Conejos and Alamosa Rivers and La Jara Creek (5.10) originate in the San Juan Mountains and are fed by snowmelt during the spring. These drainages historically were supplied by some groundwater discharges associated with springs. The Alamosa River receives water from Spring and Rock creeks, while La Jara Creek received some discharge from Diamond Springs and the Alamosa River. Some surface water in La Jara Creek and the Alamosa River infiltrates to the underlying unconfined aquifer and historically their flows were discontinuous or dissipated in some years above their junction with the Rio Grande (Anderholm 1996, MWH 2005). Channels of the Alamosa River and La Jara Creek, which join the Rio Grande along the western boundary of the Alamosa National Wildlife Refuge, also have shifted frequently over time (MWH 2005). The area where the Alamosa River and La Jara Creek met the Rio Grande were commonly referred to as the Alamosa Marshes.

Annual variation in mountain snowpack influences Rio Grande and tributary discharge such as the Conejos River, sediment transfer and deposition, and duration of flood events. Prior to the 1940s, Rio Grande flows had a strong seasonal peak that typically occurred during June (average flow of about 1,100 cfs, from USGS mean monthly streamflow from the Alamosa gage) followed by declines through winter, which averaged between 200 and 300 cfs. Flows were slightly higher in Alamosa than Del Norte on average in December, February, and March prior to channelization of the river between 1925 and 1941 (Jones and Harper 1998).

Historically, the Closed Basin of the SLV received surface water inputs from creeks originating in the Sangre de Cristo and San Juan Mountains and from limited onsite precipitation. The mountain creeks that drain into the Closed Basin are derived from a combined watershed drainage area of about 4,662 km^2 (Leonard and Watts 1989). Water from creeks originating in the Sangre de Cristo Mountains historically emptied into San Luis Creek and terminated in the Lower Sump area on the Blanca Wetlands Management Area. Saguache and La Garita Creeks originated in the Cochetopa Hills and La Garita Mountain areas, respectively, of the San Juan Mountains (Figure 5.10, Appendix I). South and east of Saguache, Colorado, Saguache Creek lacks a single distinct channel with surface water flowing across the land surface as sheetflow in large snowpack years. This water temporarily and shallowly flooded shrublands and grasslands as it flowed toward San Luis Creek (Hopper et al. 1975). La Garita Creek flowed from the west meeting with Saguache and San Luis Creeks on what is now the Baca National Wildlife Refuge. Flows from these creeks have been measured near the San Juan Mountain foothills where some creek water infiltrates to recharge SLV aquifers (Anderholm 1996), consequently the historic amount of surface water in these creeks at the confluence with San Luis Creek is unknown. Saguache, La Garita, and San Luis creeks historically were perennial drainages except during drought and low snowpack years (Anderholm 1996). Sediments carried by Saguache and La Garita Creeks, that originate in the San Juan Mountains, are different than those in creeks that originate in the Sangre de Cristo Mountains which carried large volumes of sediment during the relatively short, but high discharge, peak flows in late spring, commonly creating sediment deposition and scour areas (Madole et al. 2008). Sangre de Cristo creeks may have been perennial in portions of their course, such as Cottonwood Creek, but often did not have enough flow to reach San Luis Creek, in part because some

creek water infiltrated and recharged local aquifers along the alluvial fan of the mountains. Monsoonal rains in July and August can produce flash floods in these creeks creating a secondary but lower than spring peak flow (USGS mean monthly streamflows).

5.3.3 Wetlands

Wetland systems are dynamic and are driven by or affected by topographic location, elevation, soils, hydrology, and climate. Wetlands in the SLV vary widely in type and in availability as climatic conditions change seasonally and annually. Wetlands will often have a mosaic of vegetation communities defined in part by the topography within the area. Subtle changes in topography, soils, or duration of flooding can be enough of a difference to influence the vegetation communities in a wetland. Wetlands in the SLV are often characterized by a combination of flooding duration and vegetation type. The hydrologic regime of each of wetlands may vary by season or annually depending on climatic conditions or location in the landscape (Mitsch and Gosselink 1993). For example, a specific area may have a longer duration hydroperiod one year due to high precipitation or snowmelt and high groundwater tables and then next have a much shorter period of flooding due to drought. Vegetation communities commonly have a delayed reaction to these changes in hydrology, transitioning from one type to another over a span of years if drought or wet conditions persist.

Wetlands may be described in many different ways, focusing on hydrology, type of vegetation, hydrogeomorphic attributes, or a combination of these. The National Wetland Inventory (NWI) uses the Cowardin system that first describes the wetland based on its hydrologic and topographic location features (soils) and then links them with vegetation. Palustrine emergent wetlands are the dominant type in the SLV (Figure 5.11, Appendix I). These wetlands are characterized by tall and/or short emergent vegetation communities with a wide range of hydrologic conditions (5.12; Cowardin et al 1979). Figure 5.12 shows the different types of palustrine wetlands occurring in cross section across a floodplain. This cross section accurately portrays, in general, the Rio Grande floodplain. Cottonwood/willow represent the forested wetland persistent type with greasewood and rabbitbrush shrublands characterizing the uplands.

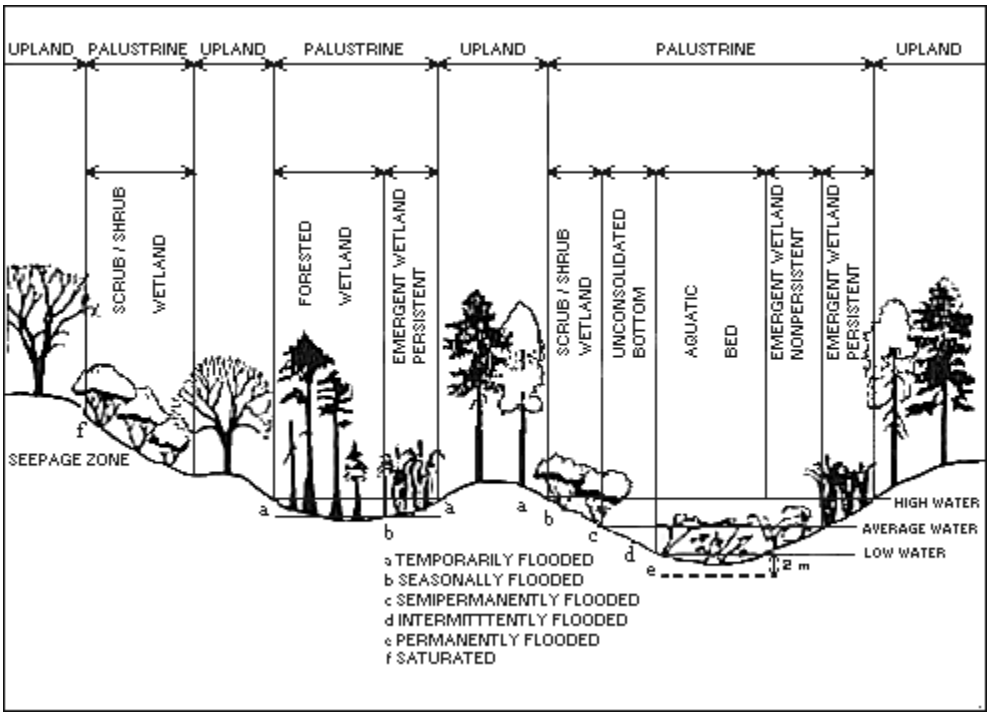

Figure 5.12. Distinguishing features and examples of habitats in the Palustrine System (taken from Cowardin et al 1979).

Wetland systems also may be categorized based on hydrologic characteristics, specifically how water flows through the area and what function it provides: recharge, discharge, or flow through (Mitsch and Gosselink 1993). Recharge wetlands provide water resources to the surrounding area through the soil as surface water levels lie above the level of the water table. Discharge wetlands receive water from groundwater resources as lateral hydrologic subsurface flow occurring at the toe of slopes or adjacent to recharge wetlands. Flow through wetlands are characterized by having a water input and output. Other types of wetland categories refer to the extent or duration of flooding that when combined with certain vegetation communities identify certain wetland types: Permanent, Semi-Permanent, Seasonal, and Temporary (see Section 9.2 for definitions).

Floodplain wetlands have a wide range of conditions as they transition from the river to upland sites with vegetation communities characterized by landform, hydro-period, and soils (Naiman et al 2005). Lower and higher elevation areas may occur throughout the floodplain given the historic migration or avulsion of the river over time. Riparian cottonwood and willow galleries occur adjacent to the river on natural levees along with sedges, grasses, and rushes. Abandoned river channels or back water sloughs may maintain permanent or semi-permanent water conditions promoting tall emergent species such as cattail and bulrush. Sedges, rushes, and grasses typically transition from these habitats and exist within seasonal to semi-permanent wetlands.

Seasonal wetlands occur throughout the SLV on broad floodplains of creeks and rivers, near seeps and springs, and in areas historically flood irrigated. These wetlands often contain a wide variety of short emergent vegetation including grasses, sedges, rushes, and forbs. Duration of flooding may vary widely with climatic conditions but usually occurs during the growing season for several months.

Playa wetlands are characterized by varying durations of flooding and drying within and across years. Playas in the SLV often have high salinities and vegetation communities, such as saltgrass (*Distichlis spicata*) that are adapted to these conditions. Playas in the Closed Basin area historically received surface water inputs from spring snowmelt, summer monsoons, and occasionally in winter when warm temperatures caused some snowmelt. Changes in the extent of different vegetation communities has resulted from periodic drying of playas causing the water table to lower and playas to dry out or become very shallow. Greasewood and rabbitbrush encroached toward the center of the playa, and monotypic stands of saltgrass could cover entire playa lake beds (Ramaley 1942). During wet years, surface water expanded and inundated shrubs, which shifted the community to plant species more tolerant of flooded conditions. If water and weather conditions remain consistent over several years distinct wetland vegetation zones become established from the margins to the interior of playa lakes. The deepest or inner areas of playa lakes support perennial and emergent plants such as smartweeds and pondweeds that transition to bulrush with spikerush becoming dominant towards the shoreline. Plants tolerant of higher salinities often occur in bands along the shoreline and include species such as alkali buttercup (*Ranunculus cymbalaria*) and silverleaf cinquefoil (*Argentina anserina*; Ramaley 1942). The globally endangered slender spider flower (*Cleome multicaulis*) may be present in some areas and adjacent to or within bands of saltgrass (Ramaley 1942; Heitmeyer and Aloia, 2013c).

5.4 Wildlife and Associated Conservation Plans

Within the SLV, wildlife species were adapted to floodplain wetlands, seasonal wetlands, wet meadows, and playas along with riparian corridors such as along the Rio Grande. Adjacent shrublands were also important. Historically, the alternating inter-annual wet and dry precipitation patterns in the SLV caused the availability of wetland habitats to be highly variable among years. Perennial and ephemeral streams, discharge from natural springs, and precipitation events during wet years may have helped maintain high water tables and surface water, and subsequently sheet ice, in many areas across the SLV during the winter. Most waterfowl, waterbirds, and shorebirds probably used the historic wetlands present throughout the SLV mainly during the spring and fall migrations, but local breeding populations are also significant (Gilbert et al. 1995). Early developments of irrigation systems and agriculture (particularly grain crops) likely benefited waterfowl and sandhill cranes and helped concentrate their use of the SLV. Beginning in the 1950s, duck populations and their management through habitat manipulations and regulations became a focus of wildlife conservation in the SLV (Ryder 1951, Hopper 1968, Hopper et al. 1975, Szymczak 1986, Jeske 1991, Gilbert et al. 1995). Explorer accounts document a surprisingly large amount of trout in the streams originating in the Sangre de Cristo Mountains as well as post settlement observations of the Rio Grande sucker (*Catostomus plebeius*). The state endangered Rio Grande sucker (*Catostomus plebeius*) also was observed in the creeks located in the area previously known as the Baca Ranch (USFWS 2005). Ungulates such as pronghorn (*Antilocapra americana*), mule deer (*Odocoileus* menionus), elk (*Cervus canadensis*), and bison (*Bison bison*) historically were common and utilized shrublands for winter forage as well as grasslands and wet meadows during the growing season.

The SLV is identified as one of the Intermountain West Joint Venture's (IWJV) priority landscapes and lies within Bird Conservation Region 16 (Southern Rockies/Colorado Plateau); is a geographic area of emphasis for spring and fall migration, breeding, and wintering waterfowl along with other species of concern such as the greater sandhill crane and threatened and endangered species in the Colorado Strategic Plan for the Wetland Wildlife Conservation Program (SSWRC 2011; CSWAP 2015); and an "emphasis area" in Ducks Unlimited's (DU) Colorado Conservation Plan (1997) and its International Conservation Plan (2005). The SLV is also an IWJV priority landscape for other priority bird species including neo-tropical migrants, secretive marshbirds, colonial nesting waterbirds, and other wetland dependent waterbirds. The SLV is the southernmost significant waterbird production area in the Central Flyway and the most important waterfowl production area in Colorado and is facing severe stress based on a Landscape Integrity Model for wetlands developed by the Colorado Natural Heritage Program (CNHP; Lemly et al 2011).

Natural Resource Agencies in the SLV support primary habitat conservation goals of the IWJV's Implementation plan (2013) for waterfowl during the spring migration and breeding period, namely to promote the long-term conservation of wetland habitats and their associated wildlife values as the 'primary contribution of the Intermountain West to continental populations of waterfowl lies mainly within the breeding and migratory periods…' of waterfowl's annual cycle. Wetland and riparian habitat types across the SLV including short and tall emergent, wet meadows, and riparian forest galleries that provide important energetic and structural resources required by a variety of waterfowl during the nesting, brood rearing, migration, and wintering periods. The mallard (*Anas platyrhynchos*) and northern pintail (*Anas acuta*) are priority species that utilize the SLV annually during migration,

wintering, and nesting. Shallowly flooded wetlands provide foraging resources while tall emergent habitats offer shelter for these species while staging in the SLV before they migrate further north in the spring. Some mallards and northern pintails remain in the SLV for breeding, brood-rearing, and molting which requires a variety of habitat types. Mallards are one of the most common duck species utilizing the SLV for migration, wintering and breeding, with a population of up to 25,000 (Olterman 1995). Northern pintails also stay in the SLV to nest although in lower numbers than mallards. Northern pintails are one of the first species to migrate through the SLV during spring migration (unpublished CPW migration data). These waterfowl along with others utilize SLV wetlands to supplement exogenous and endogenous fat reserves established on the wintering grounds. Research in the SLV indicates that mallards primarily nest in dense stands of Baltic rush with patches of cattail and bulrush (Gilbert et al 1996), while pintails prefer shorter vegetation and greasewood (*Sarcobatus vermiculatus*) communities where visual obscurity for the female is low. Habitats used by these and other species overlap during certain times of the year with northern pintails, for example, selecting for more specific and unique resources than mallards.

The San Luis Valley is a priority wetland area within three national bird conservation plans: the North American Waterbird Conservation Plan, the U.S. Shorebird Conservation Plan, and Partners in Flight. The SLV has several Important Bird Areas, located on Blanca Wetlands, RGSWA, and ANWR. Although the SLV is not listed specifically in the North American Waterfowl Management Plan (2012), the plan explicitly states that 'certain arid locations provide high value to waterfowl, but those values are inconsistent among years because of a highly variable environment'. Given the arid environment of the SLV and its importance at a regional scale to waterfowl and waterbirds in addition to not only variable climatic conditions but limiting water resources, the SLV fits well within this statement and therefore may be considered a priority regionally.

The SLV is located in the Partners In Flight (PIF) Physiographic Region 87 (Colorado Plateau) with specific habitats where the SLV is listed as important in the Lowland Riparian, Semi-desert shrubland, and Wetland categories. The SLV as an important area for a variety of species given the high use of riparian and wetland areas that a majority of species utilize during some portion of their life cycle. The PIF Tri-National Vision for Landbird Conservation (Berlanga et al 2010) states that 'Protection of stop-over habitats, especially along…riparian corridors...is a high tri-national priority'. Riparian habitats support about 80% of resident bird species but represent only 3% of the landscape and is therefore one of the rarest in the Intermountain West (PIF 2000).

The U.S. Shorebird Conservation Plan (USSCP; 2001) identifies the IWJV as the most important inland region of North America for maintaining shorebird populations such as the wilson's phalarope, a priority species occurring in the SLV. The IWJV Implementation Plan (2013) identifies the SLV as one of 18 Primary Key Shorebird Sites in the Intermountain West consistent with Regional status based on Western Hemispheric Shorebird Reserve Network criteria. The diversity of shallow seasonal wetlands in the SLV, open water, and exposed shorelines (mudflats/playas) and sandbars along the Rio Grande provide vital breeding and migration habitat for shorebirds. The USSCP and Intermountain West Regional Shorebird plan identify competition for water resources as the main threat to shorebird habitat.

The SLV is identified as the most significant waterbird area in BCR 16 supporting important breeding habitat for priority waterbird species such as the White-faced ibis (>200 pairs) and the entire Rocky

Mountain Population of greater sandhill cranes (SACR) during their spring and fall migrations. Other priority species include the American bittern, sora, Virginia rail, snowy egret, black-crowned night herons, and the eared, pied-billed, western, and Clark's grebes. The IWJV has outlined conservation strategies for a majority of these species supported by funding through the North American Waterbird Conservation Plan.

6 SLV History of Human Developments and Changes

6.1 Settlement

Native people first occupied the SLV about 10,000 to 12,000 years before the present (BP; Jodry et al. 1989). These people had a highly mobile lifestyle that depended largely on big game hunting. Initially, populations were relatively small with localized and often seasonal settlements, many of which were along the Rio Grande and former lakes, rivers, and wetlands of the SLV where the availability of water, wildlife, and shelter was more predictable. By about 2,000 BP, human populations in the SLV appear to have increased, small villages were established, and agriculture was developed along some waterways. Pueblo people were attracted to the SLV and, along with the Comanche, Utes, and other tribes, maintained some occupation of the region through the mid-1800s. Spanish explorers in 1540 found evidence that Pueblo people were diverting water from the Rio Grande in acequias or irrigation ditches (Jodry et al. 1989; Heitmeyer and Aloia, 2013a).

Spanish settlers first entered the SLV between 1630 and 1640 and several Spanish expeditions to the SLV occurred in the 17th and 18th centuries, although extensive settlement did not occur until the 1800s. From 1780 to the early-1800s, the Utes were the principal claimants to the SLV and Colorado mountains. Zebulon Pike was dispatched to explore the Rocky Mountain region in 1806. His party established a winter camp along the Conejos River, but was later detained by the Spanish. This was the last U.S. sponsored expedition into the SLV until 1848, when John Fremont came through the valley in search of a route through the Rocky Mountains (Athearn 1975; Simmons 1999; Heitmeyer and Aloia, 2013a).

Hispanic settlement of the SLV began on Mexican land grants in the late-1840s and early-1850s, mainly Spanish missionaries and sheepmen (Buchanan 1970). By the late 1840s, scattered settlements were present throughout the SLV. In 1846, war occurred between Mexico and the U.S., which culminated in the Treaty of Guadalupe-Hildalgo in 1848 that ceded control of Colorado and other western areas to the U.S. After the U.S. occupied the southwestern region, a network of army posts was established with settlement, farming, and ranching expanding rapidly in the late 1850s. The Homestead Act of 1862 and the arrival of roads and railroads in the 1860s and 1870s facilitated substantial population growth. During the 1860s a series of roads were built in the SLV to facilitate travel north from Fort Garland. In 1879 a narrow gauge rail line was constructed to Alamosa, Colorado and agricultural goods were shipped to Denver, Colorado and other eastern cities. By the late-1800s sheep and cattle grazing were extensive in the SLV and valley farms were producing large quantities of potatoes, hay, and peas. Following major expansion of settlement into the SLV in the mid-1800s, farmers realized that irrigation was necessary if valley agricultural commerce was to survive (Athearn 1975; Simmons 1999; USFWS 2003; Siebenthal 1910, Follansbee et al. 1915, Brown 1928, Powell 1958, Buchanan 1970, Emery et al. 1973, Athearn 1975, Hanna and Harmon 1989, Leonard and Watts 1989, BLM 1991, Ellis et al. 1993, Emery 1996, Jodry and Stanford 1996, McGowan and Plazak 1996, Wilkins 1998).

6.2 History of Water Use

The first ditch to move water from local rivers to the interior of the SLV was the San Luis Peoples Ditch constructed in 1852. The first large ditch to move water from the Rio Grande, the Silvia Ditch, was constructed in 1866 (Holmes 1903) with the Ditch Boom beginning in the 1880s when many British and eastern investors sponsored construction of canals to provide irrigation water to agricultural areas. Many of the large canals diverting water from the Rio Grande, Alamosa River, La Jara Creek, Conejos River, and San Antonio River were completed in the 1880s and 1890s, such that 8,000 cfs of surface water was adjudicated by 1890. The substantial diversion of water from the Rio Grande in the SLV in the late-1800s led to an embargo in 1896 and the Rio Grande Convention Treaty of 1906 between the U. S. and Mexico. Under the terms of the Treaty of 1906, the U.S. guaranteed an annual water delivery in perpetuity of 60,000 acre-feet of water in the Rio Grande at the head of the Mexican Canal near El Paso, Texas. In 1929, a temporary compact for water use and delivery in the Rio Grande was ratified by Colorado, New Mexico, and Texas and in 1938-39 these states ratified the Rio Grande Interstate Compact, which provides for apportionment between states of the water of the Upper Rio Grande Basin on the basis of specified indices of flow at key gauging stations (Ellis et al. 1993).

As early as the late-1800s, farmers in the SLV began noticing increases in soil salinity, due to the expansion of surface irrigation, an increase in the unconfined aquifer water table, and increases in the amount of salts brought to the soil surface (Holmes 1903). Buildup of alkali was most common in areas that formerly had been in salt desert shrub; soils in these areas were locally known as adobe and covered with chico brush (greasewood). Technically, the soils in these former salt desert shrub areas were initially defined as San Luis sandy loam (Holmes 1903). Saline soils with high carbonate levels are common in the salt desert shrub areas and when irrigated for prolonged periods during the growing season, with capillarity moving soluble salts to soil surfaces. As a result, eight drainage ditches were established by 1921 (Natural Resource Commission 1938, Thomas 1963) to help prevent salts from accumulating on the soil surface in addition to lowering the artificially raised water table. Two major groundwater conveyance ditches, the Bowen and Parma Drains were dug in the early-1900s.

Agricultural production in the SLV was enhanced by drilling thousands of wells into both the unconfined and confined aquifers starting in the late-1800s. Water flows from wells drilled into the unconfined aquifer are subject to annual variation related to fluctuating recharge rates from infiltration of local precipitation and runoff, whereas flows from wells drilled into the confined aquifer are artesian and are somewhat buffered from climatic conditions. Recharge of the unconfined aquifer may be artificially increased by the addition of groundwater resources applied for irrigation. By 1980 about 2,300 pumped wells existed in the unconfined aquifer in the SLV (Emery 1996). Artesian water in the SLV was discovered in about 1887 and within four years about 2,000 flowing wells had been developed (Emery 1996). By 1904 more than 3,200 artesian wells had been dug and by 1916 about 5,000 artesian wells were present and flowing in the SLV. By 1970 that number had increased to over 7,000 wells. Well pumping typically causes the unconfined aquifer to be seasonally lowered; the last time this aquifer was at or near capacity was the mid-1980s and the mid-1990s. Pumping from the confined aquifer has continually depleted the aquifer storage such that it has not been at capacity since the early-1950s (http://www.waterinfo.org/taxonomy/term/1620). The SLV has the highest concentration of center pivot sprinklers in the United States (Figure 6.1).

Groundwater pumping and diversion of groundwater discharge ultimately caused many discharge areas, such as the Spring Creek Spring at Monte Vista NWR, to dry up and discontinue seasonal flows (USFWS 2003). By the 1970s, the Spring Creek groundwater discharge point, or head, stopped flowing along with many other free-flowing artesian wells throughout the SLV that have declined in flow or stopped all together. In the early-1970s, the Colorado State Engineer placed a moratorium on new wells being drilled into the confined aquifer in the SLV. Since 1981, no well construction permits for new water appropriations, other than exempt domestic wells, have been issued in the SLV (Heitmeyer and Aloia, 2013).

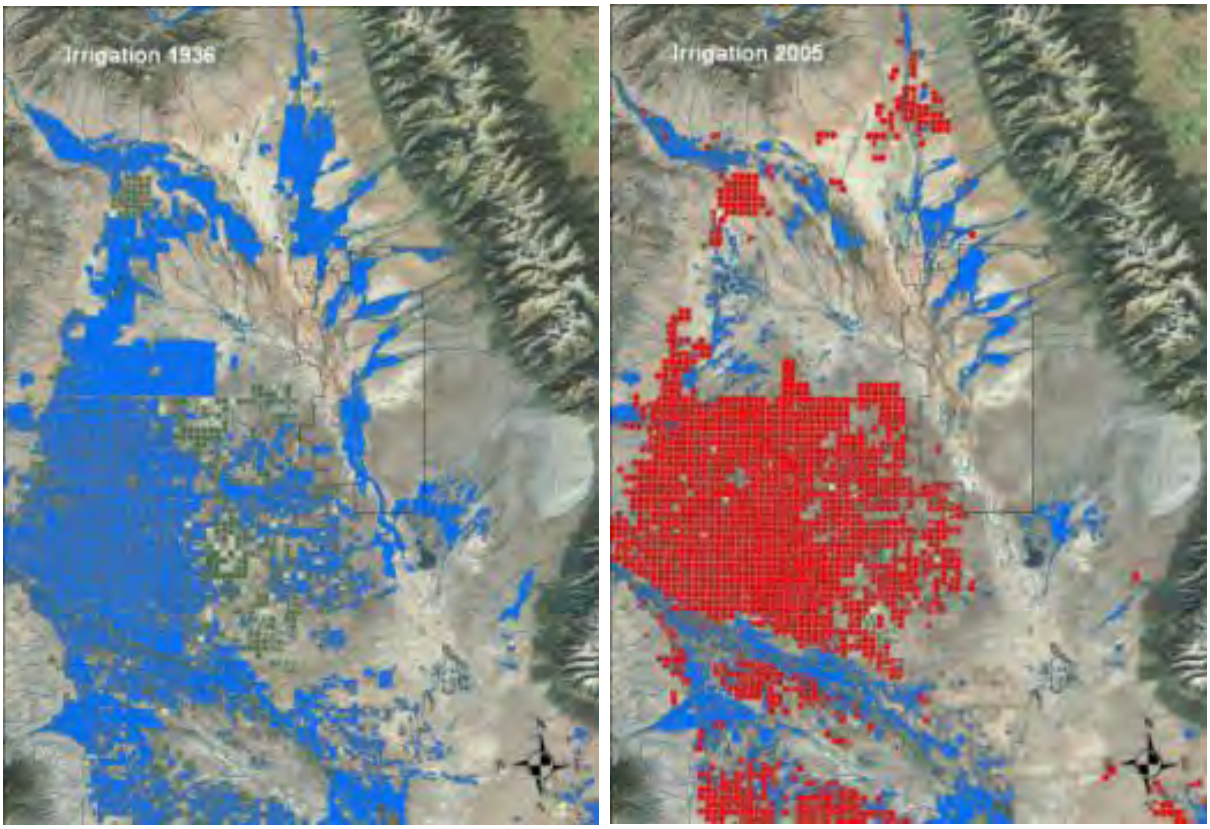

Figure 6.1. Irrigation in the San Luis Valley, 1936 and 2005 (Colorado Division of Water Resources, 2000)(Taken from Striffler 2013, Baca NWR WRIA)

During the 1960s the Colorado state engineer began enforcing Rio Grande Compact (Compact) deliveries (Rio Grande Compact Commission 1939). The Closed Basin Project (CBP) was proposed in 1936 (Natural Resource Committee 1938), but authorization and construction of infrastructure were not initiated until the 1970s. The CBP through the Bureau of Reclamation (BOR) was initiated to help meet Compact by extracting, storing, and subsequently diverting groundwater located in the Closed Basin portion of the SLV delivered via a canal to the Rio Grande (Figure 5.10). This would help landowners in the Closed Basin provide surface water to help meet Compact by salvaging water historically utilized by xerophytic vegetation such as black greasewood to supplement flows in the Rio Grande (Public Law 92-514 – Oct. 20, 1972; Geohydrology of the San Luis Valley, San Luis Valley Project, Closed Basin Division, Colorado, and Rio Grande Decision Support System (RGDSS) Feasibility Study, 2000; Emery 1979, U.S. Bureau of Reclamation Unknown date, Riverside Technologies, Inc et al 1998) (http://www.rgwcd.org). The CBP

drilled 170 shallow groundwater wells and constructed a 42-mile long conveyance Closed Basin Canal (CBC) and associated roads and infrastructure for delivery to the Rio Grande on the Alamosa NWR. Construction of the CBC started in the 1970s with continued construction on what are now Baca NWR lands in the early-1980s. As part of the CBC project, the BOR was required to mitigate for loss of wetlands by helping to maintain and/or conserve other wetlands in the SLV. Some of the areas receive additional water through the CBP. BOR wetland mitigation sites include Russell Lakes State Wildlife Area, San Luis Lakes State Wildlife Area, Alamosa NWR, and Blanca Wetlands Wildlife Management Area.

Initially, it was estimated that the CBP would be capable of producing and delivering an estimated 100,000 acre-feet of water to the Rio Grande annually. However, actual annual volumes have been significantly less due to lower than expected water yields from the wells. Currently, the CBP delivers about 15,000 acre-feet annually. High total dissolved solids (TDS) and iron bacteria infestations of wells also have compromised the effectiveness of this project. Regional pumping of groundwater for use in center-pivot agricultural irrigation sprinklers coupled with salvage pumping from CBP wells now exceeds recharge of the unconfined aquifer and negatively affects the hydrologic characteristics of the mitigation sites adjacent to the CBP.

In the mid-1980s, efforts began to recharge groundwater in the SLV. Currently, from November to January, six major irrigation companies may divert and hold Rio Grande water in their canals to assist groundwater recharge. These winter diversions and recharges occur only if river water is not needed to meet the 1939 Rio Grande Compact obligations. The Monte Vista and Empire Canals are two of the irrigation canals used for the recharge program and certain areas on the Monte Vista NWR receive this winter recharge water if available (USFWS 2003, Striffler 2012).

Future efforts to regulate over-appropriated and limited groundwater in the SLV is being directed by the Colorado State Engineer through promulgation of Groundwater Rules and Regulations, which will incorporate the development of an Augmentation Plan and sustainability requirements for maintaining the aquifer at pre-2002 (drought) levels for all water users in the SLV including natural resource agencies. A model was completed and continues to receive new data annually from wells throughout the SLV in order to try and accurately determine depletions incurred by wells. Six sub-districts were established in the SLV based partly on topography, geology, and hydrologic connectivity along with information from the model which showed that the area included in each district were appropriate (Figure 6.2). Each sub-district will be responsible for replacing depletion within its area of use through augmentation. Natural resource agencies may contract into a specific sub-district or they may develop their own Augmentation Plan to replace water depletions in time and place. Overall, the Augmentation Plan seeks “to prevent injury to senior surface water right holders, replace groundwater depletions, and maintain a sustainable aquifer” (Striffler 2012). With the promulgation of rules and regulations and legal formation of Sub-District #1 (the other 5 are currently in various stages of development) an irrigation season was put in place in 2012 for groundwater wells that mirrors the surface water irrigation season. Irrigation season dates are presumptively April 1 through November 1 but may be modified annually to better adjust to climatic conditions and also may vary by river system within the SLV.

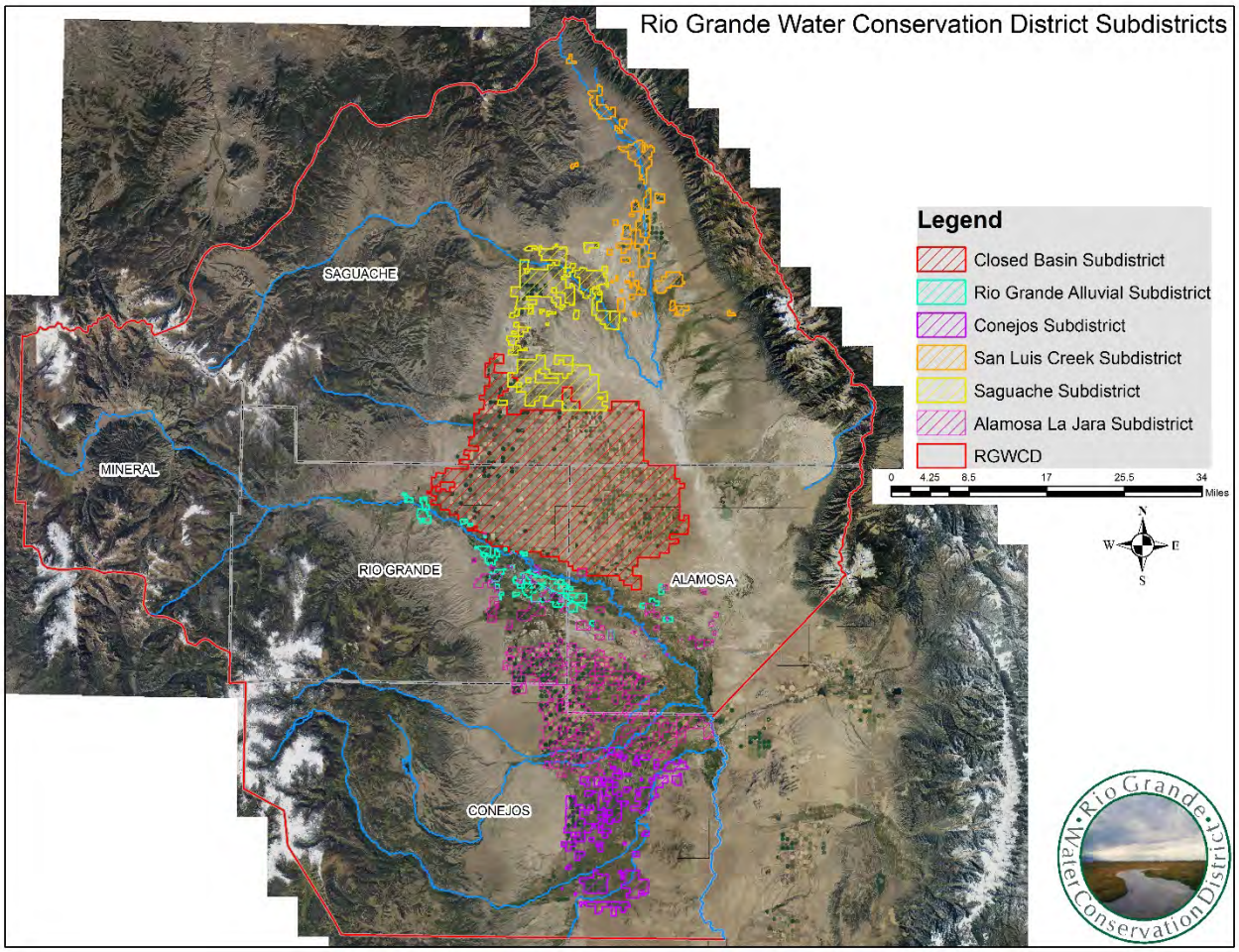

Figure 6.2. Rio Grande Water Conservation District Groundwater Subdistricts in the SLV (Taken from http://www.rgwcd.org/subdistricts).

6.3 Impacts to Wetlands and Riparian Systems

Alterations to hydrologic regimes throughout the Intermountain West, including the SLV, has been the greatest factor in the decline in health of wetland and riparian areas (Laubhan 2004). Streamflows throughout the SLV commonly peaked in May or June depending on their location and climatic conditions. High flow events caused over-banking of water onto the floodplain, providing seasonal and at times semi-permanent water conditions throughout the floodplain (Hubert 2004). More distinct floodplain depressions typically have more prolonged water regimes and contain persistent emergent wetland species such as soft stem bulrush and cattail. These type of wetlands are located in backwater sloughs, oxbow lakes, and seeps (near alluvial fans; Figure 5.12). Historically, sloughs associated with creeks and rivers were seasonally flooded in late spring and early summer from snowmelt, spring rainfall, river and creek overflows, and groundwater discharge. Some of these sloughs held water through June into July and in very wet years they may have held water year round (Ramaley 1929, 1942; Rees 1939). Changes in wetland and riparian hydroperiods resulted from the diversion of water from the Rio Grande and its tributaries along with Compact requirements, and the installation of groundwater

wells and other water-control infrastructure in the SLV that captured and diverted groundwater discharge and drainage. As center pivot sprinklers became the primary type of irrigation for crops, sub-irrigation declined in practice. Currently, prolonged drought, changes in agricultural practices (sprinklers, fall tilling, etc.), groundwater pumping, mining of the aquifer, earlier peak runoff, and changes in ditch administration related to augmentation for groundwater sub-districts have negatively affected regional hydrology and ecology of wetlands (Cooper and Severn 1992). For example, current groundwater levels have been described as below normal and much below normal at a monitoring well located on the Alamosa National Wildlife Refuge (USGS groundwater watch website, Site Number:372550105455001 – NA03701122CC1 ALA 4). As a result, floodplain soils adapted to maintaining high water tables (Hubert 2004) have become dry and no longer act as a buffer to dry climatic conditions. Thus, riparian forest species such as cottonwood have become old, even aged classes with little regeneration as root systems established during the first couple years of growth can no longer reach lowered water tables or react to large or quick changes in water resources (Shafroth et al. 2000, Anderson 2005).

Groundwater Rules and Regulations (Rules) for Division 3 (the Rio Grande Basin or SLV) Water Resources were initiated in the mid-2000's coinciding with a large modeling effort (Rio Grande Decision Support System – RGDSS) and the development of 6 sub-districts within the region (Figure 6.2). The first sub-district to become established in 2011 was Sub-District #1 (SD1). The State Engineer's Rules Governing the Withdrawal of Groundwater in Water Division No. 3 were submitted to the Division 3 water court in 2018 and have recently, March 15 2019, been approved. These Rules aim to maintain obligations of the Rio Grande Compact, protect senior surface water users, and sustain regional aquifers. Augmentation plans, individual or through the sub-districts, are required for any groundwater withdrawals (artesian and pumped) annually. Government agencies may not be included in a sub-district but may enter into a contract with a sub-district to be included in an augmentation plan. Each sub-district must propose a 'Plan of Water Management' that is then approved by the State Engineer. Sub-districts have a 20 year time period to meet sustainability of the aquifer but must show a positive trajectory towards sustainability during that time. The State Engineer and Division 3 Engineer may intervene prior to 2031 if it is clear that sustainability of the aquifer or other goals will not be met during that time and curtail groundwater withdrawals (public letter from Kevin Rein, State Engineer to Cleave Simpson, Manager of RGWCD; December 2018).

As part of the promulgation of these Rules, modeling and monitoring of the aquifer and stream levels would determine the impact from pumping on each river and the sustainability of the aquifer in the SLV for each sub-district. It was determined that the districts' goal would be to first recover and then maintain storage levels between -200,000 and -400,000 ac/ft). The aquifer lost 800,000 ac/ft of storage during the drought years (Figure 6.3; Rio Grande Water Conservation District) recovering approximately 350,000 ac/ft by 2017 after establishment of SD1. As part of SD1's plan of management to meet sustainability of the aquifer, the sub-district proposed fallowing 40,000 acres of land irrigated by wells through voluntary agreements with landowners. Programs such as the NRCS's Crop Restoration Enhancement Program (CREP) were initiated and targeted in areas along the Rio Grande to help meet the fallowing goal. To date, 8,086 acres which included 143 irrigation wells or about 10,000 ac/ft of water are enrolled in CREP. In 2018 an additional 1,190 acres were fallowed under a four year contract allowing the landowners to rotate which field was fallowed (SD1 2018 Annual Report). Unfortunately the drought of 2018 along with continued pumping negated almost all of the increases in storage (350,000 ac/ft gained), returning the unconfined aquifer to almost its lowest level again.

As water tables have diminished, the ability to move water through the soil decreases and becomes slower due to a lack of capillary action (Miller and Turk 1943). Characteristics such as capillarity within the soil provide a mechanism for moving water up and down through the soil profile based on the attraction between the soil and water in addition to soil texture and amount of available water. Therefore, re-wetting of the soil takes longer each year given that soils are dry and must slowly regain their ability to maintain soil moisture throughout the profile. Continued low flows in rivers and creeks along with declining groundwater resources prevents water tables from responding quickly to spring snowmelt and precipitation events. Additionally, fallowing of land in SD1, especially along the Rio Grande, may reduce the amount of wet acres available for wildlife. While reduced well pumping should help restore the aquifer, the location of fallowed lands may become of greater importance as wetland managers work towards providing declining wetland resources for wildlife.

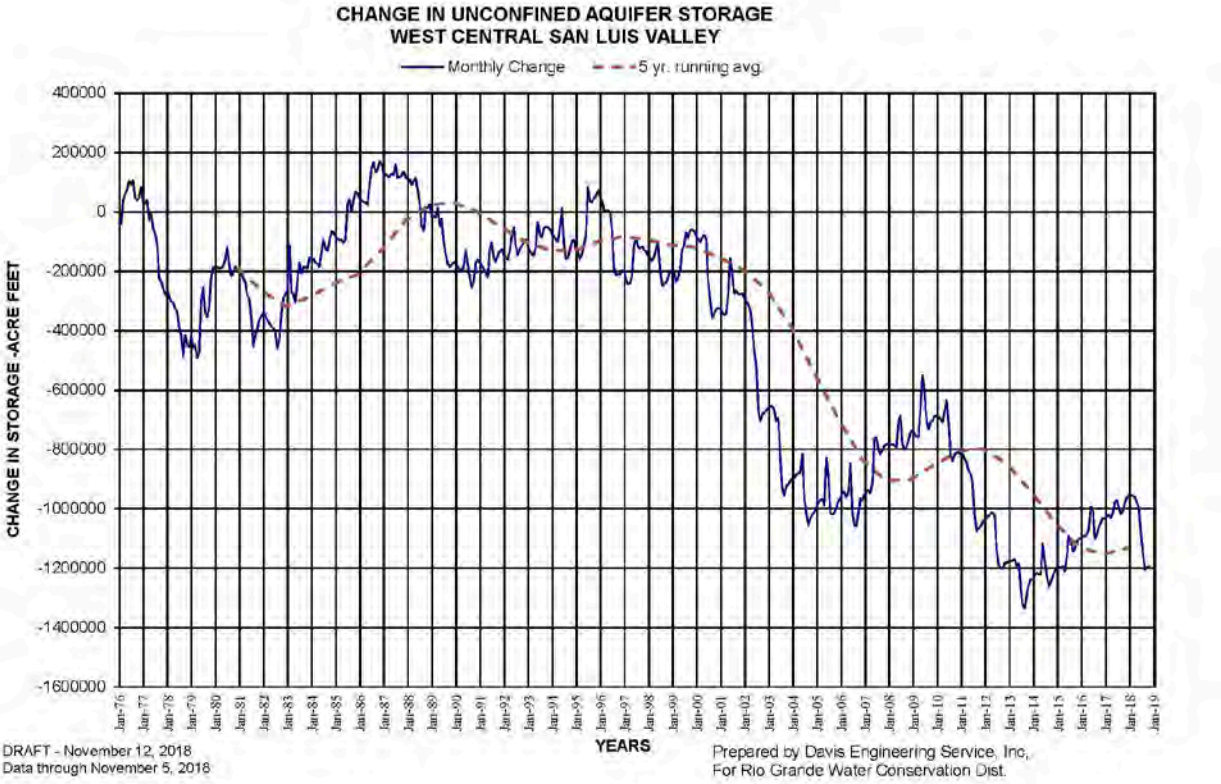

Figure 6.3. Change in Unconfined Aquifer Storage with 5 year running average in West Central SLV

Other changes to riparian and wetland habitats have occurred resulting from changes in the landscape for urban development, construction of roads, and public land management. Climatic conditions, land-leveling, livestock stocking rates, seasons of use, and duration are a few factors that have impacted the natural function of wetland and riparian areas. These factors vary over time and by location. The establishment and placement of roads, levees, ditches, and water control structures have greatly affected the hydrologic flow within these areas (Zeedyk and Clothier 2009). Many roads and levees are placed parallel to rivers and creeks within the floodplain, intercepting natural hydrologic flow and

altering wetland function along with providing large amounts of sediment through erosion (Zeedyk and Clothier 2009, Niemuth et al 2004). Over a century of alterations and use along the Rio Grande and its tributaries has highly altered the system such that many areas no longer function naturally and may not function at all.

6.4 Climate Change Effects on Wetlands

The Rio Grande National Forest Plan Review EIS 2017 states that climate predictions suggest that peak flows in the Rio Grande will increase and will continue to occur earlier over time (USDA Forest Service, 2017). Increased temperatures later in the season coupled with decreased stream flows will increase water temperatures within the streams and reduce the extent of overall flooding across the watershed. These impacts will affect wetland and riparian systems throughout the SLV including the aquatic and terrestrial wildlife that depend upon them.

The IWJV Implementation plan states that changing climatic conditions will have the greatest effect on bird species with low genetic diversity, that rely on resources in the arid west, and that are migratory due to decreases in connectivity between habitats. Increased temperatures predicted across the IWJV will most likely affect invertebrate prey populations in terms of abundance, diversity, and time of occurrence. Precipitation models vary predicting that certain areas will be drier and/or that the timing of precipitation events will change. Regardless, earlier spring snow melt is predicted across the region and will impact resources for all species potentially shifting migration patterns and timing along with nesting and breeding locations and timing. Long-term waterfowl datasets in the SLV show that dabbling and diving ducks are migrating through 1.8 and 0.8 days earlier every year over the past decade (CPW unpublished report, 2018).

Models in the Rio Grande Basin Implementation plan indicate that stream flows could decrease on average by 30%; perhaps exacerbated by the effects of dust on snow coupled with climate change that will lead to earlier spring runoff (two weeks earlier due to dust, 3 weeks earlier due to warmer temps) Deems et al. 2013 model. Studies indicate that spring runoff will be earlier, precipitation will decrease, and evaporation will increase which will result in reduced streamflow, increases in stream temperatures, increased evaporation that will lead to the need for an increase in agricultural water needs, along with reduced recharge of the aquifers and lower groundwater tables. The Upper Rio Grande Assessment study of climate change on the SLV (Dagmar and Vaddey 2013) indicates that by 2100 flows will decrease by about 30% from Del Norte to Ortiz and by 50% at the Rio Grande near Lobatos gage. Stream gage data from Del Norte shows the declining trend in Rio Grande flows from 1891 (Figure 6.4). Competing uses for water will be one of the biggest threats to wetland and riparian habitat for wildlife in the Intermountain west (North American waterbird Conservation Plan).

6.5 Potential Changes in Water Use

As drought conditions continue and water resources become more limited, the beneficial use of water rights, based on adjudication and particularly on irrigation rights, is being scrutinized by the Division of Water Resources (DWR). DWR is concerned that water is being improperly ponded and therefore wasted on wetlands that utilize irrigation water. An internal guideline directed at ‘waste’ water was drafted by retired DWR state engineer Dick Wolf in December 2017. An internal guideline was requested by DWR staff to provide consistency statewide to water commissioners when utilizing irrigation water decrees for wetlands. In September, 2018 natural resource agencies, wetland

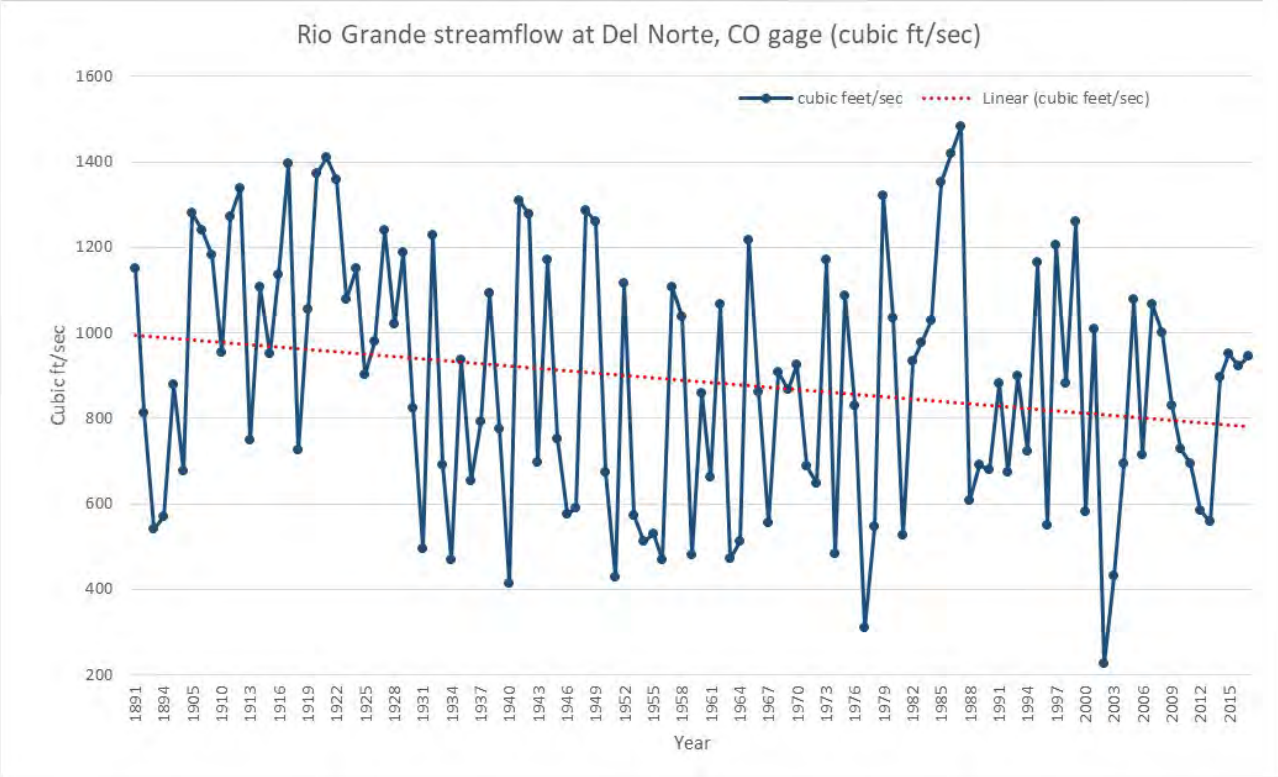

Figure 6.4. Del Norte Stream gage discharge (cu/ft/s) from 1891 to 2017

managers, and landowners in the SLV convened a one day seminar and tour for local and state DWR staff to help provide insight into how wetlands are irrigated on both private and public lands in the SLV. Written comments were provided to DWR staff in order to help provide constructive information in relation to the complexity of wetland systems across the state of Colorado. The following represents the major concepts that were provided to help direct the guidelines.

Wetland systems are dynamic and are driven by or affected by topographic location, elevation, soils, hydrology, and climate. Climatic conditions vary widely across the State of Colorado allowing for the production of over 640 wetland plant species (CNHP). Productive and healthy wetland systems typically will have a mosaic of vegetation communities visually defined by the topography within the area. Changes in topography (inches to feet of elevation change) will influence the vegetation of a wetland, therefore, many types of wetland plants or vegetation communities may be produced within one area or wetland unit by using different strategies that allow for varying water depths. It is important to note that because many different plant species are being promoted, there is not one overall depth or duration that can be quantified in order to meet the overall objective of providing a heterogeneous suite of species and water depths. Generally, wetlands naturally vary hydrologically by season and year with conditions varying widely, e.g. the amount of surface irrigation will be different by season and year.

The following list provides guidelines for typical use of irrigation of wetland plants

- Wetlands exist on public and private lands throughout the State of Colorado.
- A majority of wetlands west of the I-25 corridor are privately owned.
- Many private landowners commonly identify wetlands as irrigated native hay meadows or backwater sloughs that serve as delivery ditches.
- Natural wetlands such as abandoned channels or backwater sloughs have been used for over a century as part of irrigation delivery systems on public and private lands.
- Submergent aquatic vegetation, tall emergent, short emergent, grasses, and forbs which include a wide variety of moist soil plants are all important food sources for various wildlife at different times of the year.
- Vegetation communities may be managed or independently transition from one type of community to another based on changes in the timing, duration, and depth of flooding which is necessary to produce a wide variety of wetland plants.
- Each of the different vegetation communities and unique wetland plants that comprise those communities require a wide range of conditions in order to germinate, grow roots and/or set seed, and potentially maintain resources throughout the annual cycle.
- It is common to have 20 or 30 species of wetland plants within one system that has varying water depths, from flooded to moist soil.
- Wetland plants are adapted to a wide range of conditions and may beneficially use water outside of the growing season (frost free season) to expand their root systems and send new shoots to the surface.
- Submergent aquatic vegetation are wetland plants that require consistently flooded conditions (not ponded, can still be flow through).
- Irrigation of wetland plants (based on physiology) varies across the state, across basins, and within basins.
- The amount of irrigation needed to produce various plants in any particular wetland will vary by year based on the management prescription and also on climate.
- Open water may exist depending on conditions, time of the year, or past management strategies to promote a certain vegetation community.
- Winter sheet ice is a common practice that spreads water across the surface of the wetland and allows for differential melting in the spring that promotes the growth of some early season wetland plants to begin growing new ruderal shoots.
- Application of winter water is usually provided through some other water right but conditions may exist in the fall before the irrigation season ends that freeze the soil and allow for sheet ice to begin developing.

Exportation of water from the SLV has been an ongoing concern since the early 1990's with the AWDI proposals. Thus far, efforts to export water have been thwarted by the SLV community. As drought conditions persist across the state and front-range demand for water increases, renewed discussion about exporting water from the SLV to the front-range has resurfaced. Renewable Water Resources has purchased a ranch (2018) previously owned by Gary Boyce in the northern end of the SLV, adjacent to the Baca NWR, hoping to export 22,000 ac/ft of water to the south-metro Denver area.

7 Conservation

7.1 Investments in Wetland Conservation in the SLV

Wetlands have long been recognized for their ecological and economic value in the SLV. Over the past several decades, public wildlife and land management agencies, non-governmental organizations, counties, and private citizens have formed a productive network of conservation partners. Below we highlight some of the key organizational and funding components of efforts to conserve wetlands for wildlife in the SLV.

7.1.1 Colorado Wetland Wildlife Conservation Program

In 1997, CPW initiated a statewide Colorado Wetland Wildlife Conservation Program (Wetland Program). The Wetland Program provides funding and, working with numerous partners, protects, restores, and enhances wetland habitats for wildlife. The Wetland Program provides matching funds for the PFW Program, and has also funded over 80 individual projects in the SLV, affecting over 57,430 acres of wetlands and associated upland habitat; these investments have totaled nearly $21 million dollars in funding from CPW and its partners.

7.1.2 Ducks Unlimited, Inc.

Ducks Unlimited, Inc (DU) conservation programs have always had a strong biological foundation. That science and research tradition continues with hundreds of studies to address the habitat needs of waterfowl. Although a great deal of work has been done and many important questions answered, there is still much to learn about how the birds respond to landscape, habitat and environmental changes. DU has embraced an approach of constant monitoring and evaluation which allows for continual refinement of its habitat programs. In the end, such an approach ensures that each and every dollar invested in conservation programs is used as effectively and efficiently as possible. One of the DU's focuses are on restoration and protection of key areas across the Rocky Mountains that contain high-quality wetland habitats and concentrations of waterfowl. Wetlands in the San Luis Valley and North Park provide critical migration and wintering stopover points for Central and Pacific flyway ducks, sandhill cranes, water birds and shorebirds. The area is also among the most productive breeding habitats in North America for numerous duck and colonial wading bird species.

7.1.3 Land and Water Conservation Fund

The Land and Water Conservation Fund was established by Congress in 1965 to fulfill a bipartisan commitment to safeguard our natural areas, water resources and cultural heritage, and to provide recreation opportunities to all Americans. The fund supports acquisitions by Federal agencies from willing land owners (fee title and easements). From 1965-2013, over $40 million has been invested by LWCF in the San Luis Valley, providing over 130,000 acres of additional public lands for use and enjoyment, and protection of incredible natural and cultural resources. Table 7.1 shows the amount spent and acres acquired by agency.

Table 7.1. Land and Water Conservation Fund

Agency	Amount	Acres
BLM	$2,340,250.00	4239.22
NPS	$542,497.00	1089.99
NPS/USFS	$17,000,000.00	56994
USFS (Rio Grande)	$6,780,000.00	603
USFWS	$14,280,000.00	53642
USFWS (pending)	$1,000,000.00	14000

7.1.4 Land Trusts in the SLV

There is a wide variety of land trusts that work throughout the

SLV. Each land trust offers different types of incentives and structures for landowners that are seeking to conserve their land. The following table (Table 7.2) outlines the number of easements that currently exist and the total number of acres in easements that occur below 8,500 feet in elevation (Assessment is based on lands in the SLV below 8,500 feet).

Table 7.2. Conservation Easements in the SLV below 8,500 feet of elevation.

Easement Holder	# of Easements	Acres of Easements
Colorado Cattleman's Land Trust	30	29,547
Colorado Open Lands	8	52,000
Duck's Unlimited, Inc	21	16,372
Natural Resource Conservation Service (WRP)	16	6,138
Rio Grande Headwater's Land Trust	32	20,503
Rocky Mountain Elk Foundation	2	1,416
The Nature Conservancy	5	11,640
U.S. Fish and Wildlife Service	2	17,033
Grand Total	116	154,649

Colorado Cattleman's Land Trust (CCALT)

CCALT's mission is to Conserve Colorado's western heritage and working landscapes for the benefit of future generations. CCALT was formed in 1995 by the Colorado Cattlemen's Association (CCA) to help Colorado's ranchers and farmers protect their agricultural lands and encourage the intergenerational transfer of ranches and farms. CCA was the first state livestock association in the nation to form a land trust and they are ranked fourth in the nation in total acres conserved by a statewide or regional land trust. Since 1995, CCALT has partnered with >260 families across Colorado to protect >500,000 acres of productive agricultural land. This work has helped agricultural families to achieve their estate planning goals, pay down debt, save for retirement, pay for long-term health care and college education, diversify and expand operations, and preserve their agricultural heritage. CCLAT's work has also helped to preserve the natural resources that make Colorado such a special place to live and visit.

Colorado Open Lands (COL)

Colorado Open Lands (COL) is one of Colorado's most impactful non-profit land conservation organizations. In 37 years, COL has protected over 510,000 acres in Colorado. COL is committed to protecting land and water forever, ensuring perpetual conservation and preservation such that Coloradans recognize open lands are inherent in the fabric of our communities and fundamental to our quality of life. COL's goals are to: Strengthen Colorado's conservation ethic by connecting people with Colorado's conserved lands. Conserve land and natural resources that define Colorado and the quality of life enjoyed by its citizens. Build an enduring institution through organizational excellence that can keep the promise of perpetuity, and lead and support the evolution of the land trust industry in Colorado and the nation.

Rio Grande Headwaters Land Trust (RiGHT)

Founded in 1999 to help secure water for the future, the Rio Grande Headwaters Land Trust (RiGHT) is a 501(c)(3) non-profit and is the only local land trust that serves the entire San Luis Valley. RiGHT is committed to working with private landowners, public agencies, and other conservation organizations

to preserve the natural beauty and wildlife habitat of the area and to promote a sustainable agricultural way of life. RiGHT's goals are to protect and support working ranches and farms, water resources, wildlife habitat, scenic landscapes, and inspire a culture of conservation in the San Luis Valley.

Rocky Mountain Elk Foundation (RMEF)

The mission of the Rocky Mountain Elk Foundation (RMEF) is to ensure the future of elk, other wildlife, their habitat and our hunting heritage. The Rocky Mountain Elk Foundation has more than 500 chapters across the country. The RMEF permanently protects crucial elk winter and summer ranges, migration corridors, calving grounds and other vital areas, while focusing on securing and improving hunter access throughout elk country. RMEF land conservation tools include: acquisitions, access agreements and easements, conservation easements, land and real estate donations, land exchanges and associated acres.

The Nature Conservancy (TNC)

The mission of The Nature Conservancy is to conserve the lands and waters on which all life depends. The Nature Conservancy in Colorado has helped protect more than 1 million acres and improve more than 1,000 river miles across the state.

U.S. Fish and Wildlife Service (USFWS)

The USFWS has designated two conservation areas in the SLV, the Sangre de Cristo Conservation Area and the San Luis Valley Conservation Area. These conservation areas are landscape-scale projects designed to conserve wildlife habitat in southern Colorado and northern New Mexico. Within the conservation areas the USFWS proposes to conserve up to 530,000 unprotected acres from willing sellers, primarily through conservation easements, though a limited amount of fee title purchases could be considered where appropriate. Prioritization of land for acquisition will be based upon lands that provide connectivity between existing protected areas and by protecting wildlife movement corridors, particularly riparian areas and provide habitat of eight focal species: Canada lynx, Rio Grande cutthroat trout, Wilson's phalarope, American Bittern, Gunnison sage-grouse, willow flycatcher, sage thrasher, and Lewis' woodpecker.

7.1.5 Natural Resource Conservation Service Programs

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Many practices are used to accomplish conservation goals in partnership with private landowners. Conservation practices and codes occurring in the SLV include, Stream Habitat Management Improvement (395), Riparian Forest Buffer (391), Stream and Shoreline Protection (580), Restoration and Management of Rare or Declining Habitats (643), Wetland and Wildlife Management (644), and Wetland Enhancement (659). SLV conservation program data was summarized from 2000-2018, no data was found to suggest that stream/riparian/wetland work was conducted from 2000-2004. However, that does not mean work was not conducted. In addition, no data was found for Mineral or Saguache Counties. The following table (Table 7.3) gives a summary of work completed over the past 13 years in the SLV by conservation practice. Work was completed by contracting outside entities.

Table 7.3. Summary of NRCS Conservation by practice from 2005-2018 throughout the San Luis Valley by total feet or acreage (all work was contracted out).

Practice	Feet/Acres Contracted
Stream Habitat Management Improvement (395)	212 Acres
Riparian Forest Buffer (391)	31.5 Acres
Stream and Shoreline Protection (580)	28308.6 Feet
Restoration and Management of Rare or Declining Habitats (643)	799 Acres
Wetland and Wildlife Management (644)	118.4 Acres
Wetland Enhancement (659)	48 Acres

Stream Habitat Management Improvement Practices (395) maintains, improves or restores physical, chemical and biological functions of streams. The purpose is to provide suitable habitat for fish and aquatic species and create riparian conditions that maintain ecological functions of stream habitats. Riparian Forest Buffer Practice (391) is used primarily for trees and shrub lands located adjacent to water bodies. The purpose includes creating shade, improving riparian habitat, reducing sediment, pesticide drift, restoring plant communities and increase carbon storage. Stream and Shoreline Protection Practice (580) is used widely throughout the valley particularly in Conejos County. The purpose of this practice is to prevent the loss of land or damage or water banks and shoreline, main flow capacity, reduce erosion and sedimentation from banks and improve or enhance the stream corridor for fish and wildlife, aesthetics and recreation. Wetland and Wildlife Management Practice (644) is defined as retaining developed or managing wetland habitats for wetland wildlife. With the purpose of developing, improving wetlands for waterfowl, shorebirds, fur-beavers or other wetland dependent flora and fauna. This practice was used only three time with last two decades. In Alamosa county 9.4 acres were conserved, Costilla, 100 acres and Rio Grande County only 9 acres. Wetland Enhancement practice (659) was used in Alamosa County on 23 acres and in Rio Grande County on 25 acres. This practice is used to increase capacity of wetlands for soil enhancement, hydrology, vegetation and plant and animal habitats.

There are a total of 16 Wetland Reserve Easements throughout the SLV comprising over 6,100 acres. These sites include a variety of habitat types including riverine, riparian, tall and short emergent wetlands, and wet meadows (Table 7.3).

This and additional information on these practices and their functions can be found in the NRCS Electronic Office Technical Guide on the NRCS website.

7.1.6 North American Wetlands Conservation Act

The North American Wetlands Conservation Act (NAWCA), enacted in 1989, provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, U.S. and Mexico. Although competition is high for grants in the U.S., conservation partners in the SLV have been remarkably successful in obtaining NAWCA funding. To date, 11 NAWCA grants totaling $9,150,000 have been awarded for conservation in the SLV, with over $25 million in partner matching funds, providing funding for many of the projects described in Section 7 (Table 7.4).

Table 7.4. NAWCA grants funded in the SLV over the past 23 years

Date	Amount of NAWCA grant	Partner matching funds	Lead grant partner
9/10/1996	$100,000	$193,000	The Nature Conservancy
3/1/1999	$1,000,000	$2,245,816	Ducks Unlimited Inc.
3/19/2003	$1,000,000	$2,687,750	Ducks Unlimited Inc.
6/9/2004	$50,000	$224,210	Ducks Unlimited Inc.
3/8/2006	$1,000,000	$3,572,422	Ducks Unlimited Inc.
9/9/2008	$1,000,000	$2,110,500	Rio Grande Headwaters Land Trust
3/11/2009	$1,000,000	$2,354,634	Rio Grande Headwaters Land Trust
9/9/2009	$1,000,000	$3,243,800	Rio Grande Headwaters Land Trust
3/9/2011	$1,000,000	$2,618,850	Rio Grande Headwaters Land Trust
3/6/2013	$1,000,000	$3,328,100	Rio Grande Headwaters Land Trust
4/26/2017	$1,000,000	$3,279,500	Rio Grande Headwaters Land Trust
Totals	$9,150,000	$25,858,582	

7.1.7 Partners for Fish and Wildlife

Implementation of the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program (PFW) in the San Luis Valley began April 1, 1990. Since its inception in the SLV, the PFW Program has been instrumental in restoring and enhancing numerous acres of wetland and wet meadow habitat, cottonwood/willow riparian habitat, as well as associated upland habitat, on private lands. The PFW Program has focused its attention on restoring and enhancing wetland/wet meadow and riparian systems to increase the habitat quality for waterfowl, water birds, passerines, and other resident wildlife species. To date, over 220 Wildlife Extension Agreements (WEA) with landowners have incorporated approximately 17,034 wetland acres, 7,408 acres of associated uplands, and over 123 miles of cottonwood/willow riparian habitat in the PFW Program. Landowners enter into WEAs for a minimum of 10 years, although some have signed agreements for 20 years. The cost/benefit return of the PFW Program in the SLV has been, and continues to be, exceptional because the PFW staff constructs the majority of the projects themselves and the flat topography of the SLV is ideal. The majority of restoration and enhancement activities are accomplished for $200 to $300/wetland acre with some projects being even more cost efficient.

7.1.8 Rio Grande Headwaters Restoration Project

The mission of the Rio Grande Headwaters Restoration Project (RGHRP) is to restore and conserve the historical functions and vitality of the Rio Grande in Colorado for improved water quality, agricultural water use, riparian health, wildlife and aquatic species habitat, recreation and community safety while meeting the Rio Grande Compact.

The RGHRP has worked with partners and over 60 landowners on 10 Projects to improve the condition of over 11 miles of streambanks on the Rio Grande. The projects have utilized a multi-faceted approach and have resulted in improved water quality, reduced streambank erosion, increased sediment transport capacity, increased quality of riparian areas, and proper functioning floodplains. These improvements truly enhance the overall condition of the Rio Grande in Colorado.

7.1.9 Trout Unlimited, Inc

Founded in 1969, Colorado Trout Unlimited, Inc (TU) is the state's leading non-profit, non-partisan organization providing a voice for Colorado's rivers. Colorado Trout Unlimited works to conserve,

protect and restore Colorado's coldwater fisheries and their watersheds. As the grassroots arm of our parent organization, Trout Unlimited, we use cooperation, collaboration, advocacy and education to promote conservation. The SLV Trout Unlimited Chapter is one of 24 chapters state-wide working to further this mission.

7.2 Economic Value of Wetland Resources in the SLV

Naturally functioning wetlands and riparian areas significantly affect and improve the health of surrounding lands and the entire ecosystem of the SLV impacting many socio-economic, political, recreation, and environmental issues. These habitats perform integral hydrologic and chemical functions that act as filters for pollutants, erosion control, flood control, and recharge aquifers (Mitsch and Gosselink 1993; Niemuth et al 2004). In addition, wetland habitats are one of the most important ecosystems providing habitat for a disproportionate number and type of species including threatened and endangered species (Lohman 2004). Though wetlands cover only 2% of the state of Colorado, wetlands and riparian areas are by far the most ecologically and economically significant ecosystem in Colorado. It is estimated that more than 80% of wildlife species depend on wetland and riparian areas at some point in their lives (Colorado Wetland Information Center, https://cnhp.colostate.edu/cwic/). Biological diversity and productivity are high in riparian habitats because they are transition areas between aquatic and terrestrial ecosystems that are inherently dynamic over time providing nutrients and sediments, are frequently flooded for short times, and are connected hydrologically to the surrounding areas (Naiman et al 2005, Hubert 2004, Mitsch and Gosselink 1993). Maintaining and improving the health of existing and historic wetlands and riparian areas will help sustain not only the wildlife and aquatic populations that depend upon them but will help local and regional water tables regain resiliency in times of drought or low flows in the river (Naiman et al 2005) and improve the health of the overall system.

Very few studies have been conducted to determine the economic value of wetlands in the United States or in Colorado. A study conducted in 1997 concluded that wetlands contributed approximately $14 trillion annually (Costanza et al 1997). These benefits stem from ecosystem services (such as wastewater treatment, flood retention, etc), recreation, jobs and salaries, among others. In the United States, federal duck stamp money and hunter's federal excise taxes annually fund state and federal programs for management of waterfowl habitat (wetlands) and acquisition of lands for protection and conservation (EPA 2006). The USFWS has estimated that 40% of the US population over the age of 16 participates in some kind of outdoor recreational activity, providing $150 billion annually to the US gross domestic product (Duck's Unlimited, Inc. website).

Colorado Parks and Wildlife through the Colorado Statewide Comprehensive Outdoor Recreation Plan (SCORP) conducted a survey of Colorado residents in 2008, 2013, and 2017 to determine what portion of the state's residents participated in outdoor activities and to further determine what types of outdoor recreation were being utilized. Each of the reports separated the state into 7 regions, of which, the San Luis Valley was a part of the South-Central region (note that more than the 6 counties in the SLV are part of that region). Data collected as part of the 2017 effort identified that $62.5 billion was spent statewide on outdoor recreation by 90% of the adult residents in Colorado. Fishing, Hunting, and Wildlife Watching accounts for $5 billion statewide and $723 million in the South-Central region. This region has one of the highest economic outputs statewide for wildlife watching at $277 million. Several economic impact studies have been conducted over the past 15 years. The following table (Table 7.5)

shows different data sources that have been used over the years to determine economic output statewide for hunting, fishing, and wildlife watching. The 2018 report used USFWS participation numbers and therefore has similar estimates.

Table 7.5. Taken from Table 10 (2018 CPW SCORP Report). Estimates of Annual Fishing, Hunting, and Wildlife Watching Expenditures from Comparable Data Sources Data Source

Fishing and Hunting Expenditures	Wildlife Watching Expenditures
CPW (2004)	$845,300,000	$526,000,000
CPW (2008)	$1,017,800,000	$703,200,000
USFWS (2011)	$1,551,577,000	$1,432,579,000
CPW (2013)	$1,604,218,256	$1,322,968,136
Current Study	$1,875,008,881	$1,495,180,053

Hunting activities in the six SLV counties account for approximately $12 million in economic output. This output reflects jobs, salaries, taxes, and expenditures associated with hunting activities. This output is associated with about 135,000 hunter use days (Table 7.6). These studies indicate the importance of outdoor recreational activities across the state as well as within the SLV as total economic benefit statewide accounts for about 10% of the state's total Gross Domestic Product.

Table 7.6. SLV County Economic Output from 'The 2017 Economic Contributions of Outdoor Recreation in Colorado' by CPW

County	Overall Hunting Economic Output($ in thousands)	Hunter Participation (Hunter Days)		
		Big game	Small game	Waterfowl
Alamosa	$1,480	7,766	3,115	1,534
Conejos	$2,418	25,244	3,086	142
Costilla	$756	8,012	70	256
Mineral	$940	11,696	404	41
Rio Grande	$2,440	17,725	5,762	1,454
Saguache	$3,963	45,481	4,007	1,049
Total	**$11,997**	**115,924**	**16,444**	**4,476**

Watchable wildlife activities are also known to provide substantial economic benefit, approximately $1.5 billion statewide in 2017, as well as locally. For example, the annual Monte Vista crane festival is a major event that brings thousands of visitors to Monte Vista, Rio Grande County, and the SLV every spring. A 2010 USGS Visitor Survey of the Monte Vista National Wildlife Refuge indicated that 10,000 people visit the refuge annually, with the majority visiting during the weeks before, after, or during the Crane Festival. A majority of visitors (65%), were from out of town and spent 2 or more days in the area spending on average $74 per person per day.

These local economic benefits highlight the need to maintain and conserve the existing wetland resources in the SLV. Given drought conditions, continued mining of the aquifer, and renewed scrutiny of using irrigation water to beneficially provide wetland resources (plants), agency cooperation to promote the economic significance of maintaining wetlands is increasingly important.

7.3 San Luis Valley Wetland Focus Area Committee

Focus Area Committees are local wetland working groups composed of local, state, and federal agencies, non-governmental organizations, and landowners who are focused on wetland conservation within a specific geographic area. Originally there were 10 focus areas created across Colorado,

including the San Luis Valley, formed to provide a local implementation component to the North American Waterfowl Management Plan (NAWMP) and to focus and concentrate protection efforts on wetlands in need of conservation. The NAWMP, its joint ventures and focus areas, are a key strategy employed by the Colorado Wetlands Program (CWP) to accomplish its goals and objectives. The diversified membership of SLV Wetland Focus Area Committee and the support of those members is significant as there is no known opposition in the State to voluntary wetlands conservation as identified in the CWP.

The San Luis Valley Wetland Focus Area Committee has been a successful model showing how a diverse group of stakeholders from the community and natural resource agencies can work together to protect and conserve wetlands. The community represented by the Focus Area Committee recognizes that even though the SLV's water resources are presently over-appropriated, protecting wetlands and their function ultimately help maintain the system including agricultural activities. Over the past several decades multiple entities have worked towards transporting water out of the basin. The Focus Area Committee is committed to working with the greater community to protect and enhance the SLV's water and wetland resources and oppose any water exportation proposals.

One of the key functions of the SLV Wetland FAC has been to annually review and rank Colorado Wetland Program projects. THE SLV Wetland FAC may propose specific projects or rank applications to the CWP from partners through the Wetlands Program funding process. The SLV Wetland Focus Area Committee performs a vital role in the ranking of projects which in turn helps the applications compete statewide for funding.

The SLV Wetland FAC also promotes various projects through partnerships as well as monetarily depending on if funding is available and can be delivered through other partner groups. Currently the SLV Wetland FAC is not an established or official entity such as a 501(c) 3 but works as an ad hoc group to support wetland conservation throughout the region.

8 Summary of Public Lands and Water Rights

Public lands across the SLV have been acquired since the 1900's, often retaining the water rights associated with the parcels. These water rights vary widely in source and adjudication. Table 8.1 provides information about public lands and the associated types of water rights one each parcel and entity. Water rights include but are not limited to groundwater wells, pumped and artesian, and surface water from a majority of the large river and creek systems throughout the SLV. CPW has trans-mountain diversions with a range of adjudications. The SLV National Wildlife Refuge Complex has conducted an extensive review of their water rights and resources, contained within three documents specific to each of the refuges as Water Resource Inventory Assessments.

Water available for wetland management on public lands has become more limited over time resulting from reduced river dynamics and stream flows, decreases in groundwater levels and discharges, and many local and SLV-wide water and land use issues (Emery et al. 1973, Cooper and Severn 1992, Ellis et al. 1993, Emery 1996, refuge annual narratives). For example, flows from Rock and La Jara Creeks and the Alamosa River no longer reach the Alamosa NWR except sometimes through drains or return flow from upstream ditches.

Table 8.1. Public land acres and summary of water rights

Agency	Area	Acres	NO Water Rights	Surface Water	Ground Water	Ground Water Wildlife/Waterfowl Adjudication	Other Adjudications
BLM	Blanca Wetlands	19,400		X	X	Y	
	McIntire-Simpson	1,537		X	X	N	
CPW	Higel SWA	1,129		X	X	N	Y
	Home Lake SWA	70		X		N	
	Hot Creek SWA	3,495		X		N	Y
	Mountain Home	715		X		N	
	Playa Blanca SWA	749		X	X	N	Y
	Rio Grande SWA	940		X	X	Y	Y
	Russel Lakes SWA	4,500		X	X	Y	Y
	San Luis Hills SWA	17,019	X			NA	
	San Luis Lakes SWA	2,400		X		Y	Y
	Sanchez Reservoir	3,058		X		N	
	Sego Springs SWA	642	X			NA	
	Shriver-Wright SWA	200	X			NA	
	Smith Reservoir	956		X		N	
FWS	Alamosa NWR	12,026		X	X	Y	
	Baca NWR*	92,500		X	X	N	
	Monte Vista NWR	14,834		X	X	Y	

*Authorized boundary acres on the Baca NWR

The following sections outline public lands by agency that are actively managed to provide wetland and riparian resources in the SLV (Figures 8.1 and 8.2). Other organizations and agencies that contain wetland resources such as conserved private lands, The Nature Conservancy, and the National Park Service (Figure 8.3, Appendix I) are not included in the following descriptions as they have different missions including but not limited to the protection of habitats rather than active management for wildlife. This Assessment has focused efforts on those lands that will need to work cooperatively through management to continue to provide necessary resources for wildlife.

8.1 Bureau of Land Management

8.1.1 Blanca Wildlife Habitat Area

Blanca Wildlife Habitat Area (Blanca Wetlands) is located about 10 miles northeast of Alamosa (Alamosa County), at the south end of a large interconnected series of hydrologically connected wetland basins within the Closed Basin of the SLV (Figure 8.4, Appendix 1). This area is located within the sump, or low lying area that collects water, where there is no natural outflow or surface water connection with the Rio Grande (Biohabitats Inc. , 2007). For thousands of years, the watersheds on the north end of the SLV (San Luis Creek, Saguache Creek, Big and Little Springs Creeks, Zapata Creek and other smaller streams) drained into this sump creating a series of connected saline basins known as playas. As late as the 1800's, maps of the site show either a lake or interconnected basins and marshes all across the eastern side of the SLV within this sump (Figures 5.6 and 5.7). By the 1950's, extensive water diversions and groundwater pumping eliminated the source of water for these wetlands, resulting in consequent drying of nearly all wetlands within the Closed Basin. Nesting populations of waterfowl and waterbirds declined by 50% during the 1960s and 1970s largely due to the loss of wetlands in the SLV. As a result,

the BLM initiated wetland restoration efforts in the 1960's to restore a portion of this area now known as Blanca Wetlands.

In 1991, the 9,714 acre tract of Blanca Wetlands was designated as a BLM Special Recreation Management Area and Area of Critical Environmental Concern due to the recreational, wildlife, riparian, scenic, and special plant and animal values on the site (BLM, 1991). Habitat in the Blanca Wetlands area can be described as a mosaic, providing wetland habitat in low elevation inter-dunal areas (encompassing nearly 200 wetland basins) surrounded by dry well-drained higher elevation shrubland habitat. Approximately 1,000-2,000 acres of this habitat is irrigated annually (roughly half of the basins), depending on additional lease water, etc., through intensive management including hundreds of miles of ditches and water control structures. These irrigated basins produce productive playa, wet meadow, and short and tall emergent marsh habitats that contain high densities and diversity of birds, amphibians, fish and macroinvertebrates, including 13 threatened, endangered and sensitive wildlife species (including refugia populations of Rio Grande chub) and plant species (slender spiderflower) and one unique, undescribed species of fairy shrimp. Blanca supports over 180 species of birds, including 19 species of waterfowl and 22 species of shorebirds, including the state's largest breeding population of western snowy plover and a number of waterbird species of regional, national, and hemispheric importance (Ivey and Herziger 2006). Blanca also supports 28 of the 35 priority species identified through the Assessment project. The area has been designated an Audubon Important Bird Area and Intermountain West Joint Venture (IWJV) Key site. In 2014, Blanca Wetlands was enlarged from 9,147 acres to 122,762 acres, to provide opportunities for wetlands connectivity and restoration (19,400 BLM, 17,626 other public lands, and 85,736 acres of private land; BLM, 2014).

Starting in the 1960's, the BLM began wetland restoration efforts by drilling a series of artesian wells to fill natural wetland basins on Blanca, because natural water sources that historically supported the wetlands in the area no longer existed. Forty-four wells provide irrigation water adjudicated for wildlife purposes. In addition, Blanca Wetlands is a mitigation site for the Closed Basin Project and receives 800 acre-feet of mitigation water annually from the Closed Basin Canal. Annual exchanges or leases of water, delivered through the Closed Basin canal, are often utilized to enhance conditions on the site.

Blanca Wetlands is closed to the public for nesting season from February 15 to July 15 annually. Wildlife watching (a Watchable Wildlife Site is available during the open season), waterfowl hunting and recreational fishing are key recreational opportunities on the area. Nearly a dozen wetland basins provide warm and cold- water recreational fishing opportunities, while other basins provide refugia habitat for Rio Grande chub, a state species of concern and BLM sensitive species.

For more information on the management of Blanca Wetlands WMA, please see Appendix III 17.1.

8.1.2 McIntire-Simpson Property

The McIntire-Simpson property encompasses 1537 acres along the Conejos River 6 miles upstream from the confluence with the Rio Grande. The property is adjacent to the State Historical Society's Pike Stockade, located 11 mile south of Alamosa and 4 miles east of Sanford in the San Luis Valley in south central Colorado (Figure 8.2, Appendix I). The site is rich in natural and cultural resources including an excellent example of a Narrowleaf cottonwood/ willow riparian and riverine wetland complex. McIntire Spring, historically called "Los Ojos" Spring, generates up to 6700 gallons of 60 degree F water a minute, which maintains open water throughout the winter providing winter habitat for a variety of waterfowl

and raptors including bald eagles. In the early 2000's the spring attracted so many eagles it was considered one of the largest winter roost sites in the state. The area also provides important nesting habitat for the endangered Southwestern Willow Flycatcher, and is designated as Critical Habitat for this species. Surveys over 15 years show that the site supports up to 50 pairs annually, meeting a large portion of the recovery objectives for this species in the San Luis Valley. Consequently, this property plays a key role in supporting the Habitat Conservation Plan. Yellow-billed cuckoo have also been documented on the site; the site is proposed Critical Habitat for the cuckoo. Other wildlife species common to the area are mule deer, elk, beaver, waterfowl, shorebirds, songbirds, snakes, reptiles, amphibians and a healthy insect population.

Native Americans have used McIntire Spring for centuries as a seasonal camp for hunting excursions into the valley. Zebulon Pike used the area as an emergency camp in the winter of 1804; the site is commemorated by a replica of the encampment at the State Historical Societies Pike's Stockade adjacent to the BLM. Another historical feature in the area is Governor McIntire's adobe mansion built in the late 1800's near McIntire Springs. Both properties were historically working cattle ranches, which also produced native grass and alfalfa hay. Portions of the property on the north side of the river were leveled for farming.

The BLM purchased the McIntire property in 1993 and the Simpson property in 2001 with Land and Water Conservation Fund dollars. An extensive irrigation delivery system, with associated water rights, is in place on the property. There are 4 irrigation wells on the property, with a total adjudicated flow of 2,545 gpm. There are also 7 stock water wells. Recently, BLM has re-drilled several of these wells, as well casing was deteriorating and reducing capacity. Surface water rights are diverted to the property from the East Bend Ditch, Los Alamo Ditch, Los Ojos Ditch #1 and Los Ojos Ditch #2. When all priorities are being delivered, about 25 cfs is available to irrigate the properties.

For more information on the management of the McIntire-Simpson area, please see Appendix III 17.1.

8.2 Colorado Parks and Wildlife

Colorado Parks and Wildlife manages 29 State Wildlife Areas (SWAs) in the SLV. The Assessment project has focused on areas below 8,500 ft elevation, 13 of the SWAs are therefore included (Figure 8.1, Appendix I). Among the most important wetland areas are Russell Lakes SWA, Rio Grande SWA, Higel SWA, and San Luis Lakes SWA. These properties are managed primarily to provide habitat for migratory birds and other wildlife, along with providing the public with hunting and fishing and wildlife observation opportunities.

8.2.1 Higel State Wildlife Area

The Higel SWA is approximately 4 miles west of the city of Alamosa along the Rio Grande in Alamosa County (Figures 8.1 and 8.5, Appendix I). The area contains approximately 2 miles of the active channel of the Rio Grande and 1,000 ac of floodplain wetlands. The HSWA provides important habitat for migratory, nesting, and roosting waterfowl and waterbird species, species of concern, and threatened and endangered species that are dependent upon declining wetland resources in the SLV. The HSWA contains native riparian forest galleries, tall and short emergent wetlands, wet meadows, and shrublands. The HSWA receives surface water during the irrigation season from the Centennial Ditch. This SWA is unique in that the Higel Family has a 25 year use agreement with CPW to graze cattle and

hay the meadows in exchange for surface water and use of the adjacent private land conservation easement for waterfowl hunting in the fall.

The HSWA is an important area for the endangered southwestern willow flycatcher (SWFL) and the threatened Yellow-billed cuckoo (YBCU) along with potential habitat for 31 of the priority species identified in the Assessment. The HSWA is one of the core locations identified in the San Luis Valley Southwestern willow flycatcher Habitat Conservation Plan (HCP) providing known breeding territories for the SWFL along the Rio Grande corridor. YBCU also have been documented during the breeding season on the area. Other species of concern such as the northern leopard frog, sandhill crane, and bald eagle commonly utilize resources on the area.

The variety of floodplain wetlands adjacent to upland habitats provide the public with various recreational opportunities such as hunting, fishing, walking, and bird watching. The HSWA is closed to the public for nesting season from February 15 to July 15 annually. Waterfowl hunting is one of the key recreational opportunities on the area in the fall and is conducted with a reservation system that allows for 25 hunter permits. Hunters may reserve dates up to two weeks in advance for hunting the area on Wednesdays, weekends, and holidays during the waterfowl season. This system helps ensure that hunters receive a quality hunt, usually meeting their limit on each visit.

For more information on the management of the Higel SWA, please see Appendix III 16.2.

8.2.2 Home Lake State Wildlife Area

The Home Lake SWA (HLSWA) is one mile east of the city of Monte Vista and adjacent to the Rio Grande and Shriver Wright SWA's south of the Rio Grande (Figure 8.1, Appendix I). The HLSWA provides important habitat for migratory, nesting, and roosting waterfowl and waterbird species and species of concern that are dependent upon declining wetland resources in the SLV. This area consists of a lake covering 70 surface acres that is open to the public year round for fishing and recreation. The lake receives surface water from the Lariat Ditch which typically flows into June. As surface water inputs decrease oxygen levels decline and the temperature rises. Two "solar bee's" were installed in 2009 in order to help maintain oxygen levels for the fish. As well, CPW Trans-Mountain water is used later in the summer and piped to the lake from the Empire Canal on the RGSWA to the HLSWA in order to try and increase oxygen and decrease the temperature. The lake is stocked several times a year with rainbow trout in order to maintain the recreational use for Monte Vista residents. Home Lake SWA's close proximity and easy access year round to the Home Lake Veteran's Home and the town of Monte Vista make it extremely valuable for improving the connection between wildlife and the environment to a large number of people.

8.2.3 Hot Creek (Poso) State Wildlife Area

The Hot Creek SWA (HCSWA) lies in Conejos County in the foothills of the San Juan Mountains approximately 25 miles southwest of the town of Monte Vista (Figure 8.1, Appendix I). There are several tracts associated with this SWA, portions of which are owned by the BLM but managed by CPW through a MOU. The Hot Creek tract contains approximately 4.5 miles of the mainstem of Hot Creek along with several smaller tributaries and approximately 1,880 acres of adjacent uplands. Hot Creek is a tributary of La Jara Creek and the Rio Grande. Several ponds were created naturally by beavers and represents one of the few remaining areas where the species of concern, the native Rio Grande Chub

still occurs in the San Luis Valley. Warm springs feed this creek which typically remains open during the winter. Vegetation ranges from grasses and desert shrub to pinyon-juniper and ponderosa pine. The Poso Tract lies to the southwest of Hot Creek and contains approximately 1,600 acres including the portions of Poso Creek and several large stock water tanks.

The HCSWA is an important area for a wide variety of terrestrial and aquatic species throughout the year. Willow habitat along the creeks and stock tanks may potentially be important for the endangered southwestern willow flycatcher (SWFL). Waterfowl commonly use the area as do big game species such as bighorn sheep, pronghorn, and elk. Currently the SWA does not allow hunting but is adjacent to 8,000 acres of state trust properties that are open to hunting.

8.2.4 Mountain Home Reservoir

Mountain Home Reservoir lies southeast of the town of Ft. Garland and is one of only a few public areas in Costilla County (Figure 8.1, Appendix I). The reservoir itself is privately owned by the Trinchera Irrigation Company and has a CPW conservation pool and perpetual easement that allows for public access. The conservation pool consists of 653 ac/ft of water including siltation. The entire area contains 715 acres. The reservoir is primarily used for recreational purposes including fishing. The reservoir can be an important area for waterfowl migration, nesting, and roosting.

8.2.5 Playa Blanca State Wildlife Area

The Playa Blanca SWA (PBSWA) is 3 miles southwest of the city of Alamosa and adjacent to the J.W. Mumma Native Aquatic Species Hatchery (Figure 8.1, Appendix I). The area contains portions of Rock Creek approximately 750 ac of wetlands and uplands. The PBSWA provides important habitat for migratory, nesting, over-wintering, and roosting waterfowl and waterbird species some of which are species of concern that are dependent upon declining wetland resources in the SLV. The PBSWA contains tall and short emergent wetlands, wet meadows, and shrublands along with some abandoned farm fields. The PBSWA has surface water rights on the Commonwealth and Sedman Seepage Ditches, however, it has been difficult to exercise these rights given infrastructure and drought conditions. There are several wells adjudicated for recreation, commercial, and irrigation uses that provide the majority of water to the wetland areas. This area has received little management in the past 20 years and is currently becoming a greater priority as wetland resources become more limited throughout the SLV.

The PBSWA close proximity to Alamosa provides recreational opportunities that include bird watching and waterfowl hunting. Hunting access is restricted to Tuesdays, Thursdays, weekends and holidays.

8.2.6 Rio Grande State Wildlife Area

The Rio Grande SWA is one mile east of the city of Monte Vista and adjacent to the Home Lake and Shriver Wright SWA's along the Rio Grande (Figures 8.1 and 8.6, Appendix I). The area contains approximately 4.5 miles of the active channel of the Rio Grande and 1,000 ac of floodplain wetlands. The RGSWA provides important habitat for migratory, nesting, and roosting waterfowl and waterbird species, species of concern, and threatened and endangered species that are dependent upon declining wetland resources in the SLV. The RGSWA contains native riparian forest galleries, tall and short emergent wetlands, wet meadows, and shrublands. The RGSWA receives surface water during the irrigation season from the Commonwealth and Centennial Ditches along with several small capacity wells and one very large warm water well that is adjudicated for waterfowl use. This well is artesian and flows year round to provide resources for waterfowl during all four seasons of the year.

The RGSWA is an important area for the endangered southwestern willow flycatcher (SWFL) and the threatened Yellow-billed cuckoo (YBCU) along with 31 of the priority species identified in the Assessment. The RGSWA is one of the core locations identified in the San Luis Valley Southwestern willow flycatcher Habitat Conservation Plan (HCP) providing known breeding territories for the SWFL along the Rio Grande corridor. YBCU also have been documented during the breeding season on the area. Other species of concern such as the northern leopard frog, sandhill crane, and bald eagle commonly utilize resources on the area.

The variety of floodplain wetlands adjacent to upland habitats provide the public with various recreational opportunities such as hunting, fishing, walking, bike riding, and bird watching near the town of Monte Vista. The RGSWA is closed to the public for nesting season from February 15 to July 15 annually. Waterfowl hunting is one of the key recreational opportunities on the area in the fall. A portion of the area is closed to provide a refuge to the birds and over-wintering habitat from December 1 to the end of the hunting season. This closure helps maintain a population of waterfowl late in the hunting season as they have areas to rest and be protected from hunting pressure. In addition, a warm water well helps to maintain open water conditions for geese and ducks that over-winter in the SLV.

For more information on the management of the Rio Grande SWA, please see Appendix III 17.2.

8.2.7 Russell Lakes State Wildlife Area

The RLSWA is located nine miles south of the town of Saguache within Saguache County and has been designated a National Natural Landmark. The SWA is within the Rio Grande Watershed, but more specifically the Saguache Creek watershed in the Closed Basin (Figures 8.1 and 8.7, Appendix I). The RLSWA provides important habitat for migratory, nesting, and roosting waterfowl and waterbird species that are dependent upon declining wetland resources in the San Luis Valley. RLSWA is a mitigation site for the Closed Basin Project with the objective of maintaining habitats for waterfowl, specifically, nesting habitat. Land for this SWA was acquired over time beginning in the early 1980's. RLSWA is comprised of approximately 4,500 acres, of which, Colorado Parks and Wildlife (CPW) owns approximately 1,250 ac while the rest is owned by the Bureau of Reclamation and managed by CPW under a Memorandum Of Understanding (MOU). RLSWA historically received water from Russell Springs, spring snowmelt from surrounding creeks, groundwater discharge, and summer monsoons. RLSWA wetlands are all currently maintained with groundwater through 4 large capacity artesian wells, 10 other metered wells, and 16 other small artesian wells.

The RLSWA contains natural playa lakes, historic creek channels, and a variety of wetlands. Wetlands vary from tall and short emergent to wet meadows dominated by inland saltgrass and the endemic slender spider flower surrounded by greasewood and rabbitbrush shrublands. About two thirds of the area is composed of intensively managed wetland impoundments and natural playa lakes while the rest contain the natural historic drainages of three branches of Russell Creek. The RLSWA supports 24 of the 35 priority species identified through the Assessment project.

The RLSWA contains a Watchable Wildlife Area that is open to the public year round off of Highway 285. The rest of the area is closed to the public for nesting season from February 15 to July 15 annually. Waterfowl hunting is one of the key recreational opportunities on the area in the fall. A portion of the area is closed to provide a refuge to the birds during the first split of the hunting season and the area is further restricted to morning hunting until 1pm during the first split. This closure helps maintain a

population of waterfowl throughout the hunting season as they have areas to rest and be protected from hunting pressure.

For more information on the management of the Rio Grande SWA, please see Appendix III 17.2.

8.2.8 Sanchez Reservoir

Sanchez Reservoir lies southeast of the town of San Luis and is one of only a few public areas in Costilla County (Figure 8.1, Appendix I). The reservoir itself is privately owned by the Trinchera Irrigation Company and has a perpetual easement that allows for public access. A conservation pool exists consisting of 1797 ac/ft of water and a gage height of 19.6'. The entire area contains 3,058 acres. The reservoir is primarily used for recreational purposes including waterfowl hunting and warm water fishing. The reservoir can be an important area for waterfowl migration, nesting, and roosting.

8.2.9 San Luis Hills State Wildlife Area

The San Luis Hills SWA is the newest state wildlife area in the SLV, protected in 2018 covering 17,019 acres of public open space along the Rio Grande in Costilla County (approximate size and location in Figure 8.1, Appendix I). The SWA contains 4.5 miles of the Rio Grande and thousands of acres of neighboring uplands to the public trust for all to enjoy. The property is one of the few remaining large, intact tracts of private land within the Rio Grande Natural Area and lies between the Alamosa National Wildlife Refuge to the north and New Mexico's Rio Grande Wild and Scenic River corridor to the south. There are no water rights associated with this SWA.

This stretch of the Rio Grande and adjoining lands are important to native fish and wildlife. A portion of the river that flows through the property is designated Critical Habitat for the endangered southwestern willow flycatcher, is an important area for a variety of bird, mammal and amphibian species, including bald eagle, river otter, and northern leopard frog. Adjoining the river are hilly shrublands that provide important winter range for mule deer, pronghorn, and Rocky Mountain elk herds that move from higher elevations to the valley floor during the winter months. Grasslands and sagebrush uplands also provide habitat for a variety of declining species, including mountain plover, sage thrasher, and horned lizard.

Western Rivers Conservancy (WRC) and its partners Costilla County, the U.S. Fish and Wildlife Service (USFWS), Great Outdoors Colorado (GOCO), Colorado Parks and Wildlife (CPW), the LOR Foundation and Colorado Open Lands protected the property. WRC and USFWS conserved the property through a conservation easement that was then conveyed to Costilla County. The property will be managed on Costilla County's behalf by CPW.

8.2.10 San Luis Lakes State Wildlife Area

This San Luis Lakes State Wildlife Area (SLLSWA) lies within Alamosa County approximately 15 miles northeast of the town of Alamosa (Figure 8.1, Appendix I). Historically water flowed from seasonal drainages off the Sangre de Cristo Mountains driven by snowmelt in the spring. Snowmelt from Medano Creek, Sand Creek, Big Spring Creek, Little Spring Creek, and San Luis Creek (including tributaries such as Saguache and La Garita Creek) flowed through this area and south in the 'sump' area of the San Luis Valley now encompassed by the Blanca Wetland Management Area (BLWMA). The SLLSWA shares boundaries with The Nature Conservancy to the east, the Baca National Wildlife Area to the north, and the BLWMA. The area is approximately 2,400 acres of which about 400 are wetland acres. The SLLSWA

is a mitigation site for the Closed Basin Project (CBP) and also contains several of the shallow wells associated with that project. All the wells are owned by the State Land Board and is leased from the State Land Board. Previously the area was both a state wildlife area and a state park with a large camping area. The entire property is now a state wildlife area.

The area contains natural playa lakes, notably Head and San Luis Lake. Head Lake is seasonal, flooding in the spring from creeks, sub-irrigation, or from monsoonal events in the summer. San Luis Lake is an alkaline, semi-permanent to permanent lake. The two lakes are connected by shallow wide drainages often referred to as the 'wetlands'. Many small temporary wetlands exist within the dunes throughout the area. A majority of the SLLSWA is covered by greasewood and rabbitbrush shrublands with associated grasses including Indian rice cut grass, alkali sacaton, salt grass, and needleandthread, to name a few. The wetland areas contain sedges, rushes, and forbs while the shorelines of the lakes and occasionally the lake beds may contain annual plants depending on the climatic conditions. This area provides valuable resources during the spring and fall migration for waterfowl, waterbirds, and shorebirds. The lakes are also important for several toad species. Wildlife species such as elk are common on the area as well.

Historical management was to provide recreation on San Luis Lake which included a 3 month transfer of water from CBP to San Luis Lake from June 15 to August 15 to pay for evaporation from the lake during that time. However the TDS increased and carp were introduced to the lake and negatively impacted habitat conditions for a variety of species such as the eared grebe colony which no longer exists there. Current management is to allow the San Luis Lake to fill and evaporate naturally. Water control capabilities are minimal in relation to surface water inputs regarding timing or flow. However, if water comes in to Head Lake from the north, water can be stored there for a while or allowed to pass through to San Luis Lake. A Seasonal closure exists from north part of San Luis Lake to the north boundary. The SLLSWA provides a variety of recreational opportunities including big game hunting and waterfowl hunting, camping, bird watching, and may offer some boating if San Luis Lake is full.

8.2.11 Sego Springs State Wildlife Area

The Sego Springs SWA (SSSWA) is approximately 3 miles east of the town of Manassa along the Conejos and San Antonio Rivers in Conejos County (Figure 8.1, Appendix I). The area contains approximately 1 mile of the active channel of the Conejos River, 0.5 miles of the San Antonio River, and 642 ac of surrounding uplands and wetlands.

The SSSWA provides habitat for migratory, nesting, and roosting waterfowl and waterbird species, species of concern, and may potentially provide some habitat for threatened and endangered species that are dependent upon declining wetland resources in the SLV. The SSSWA contains native riparian forest galleries, tall and short emergent wetlands, and shrublands. The SSSWA does not have any current water rights and is therefore, naturally, flooded or sub-irrigated based on climatic conditions and flow in the Conejos River. Two small wells exist on the property but are dried up (windmill driven). The Conejos River is an important over-wintering area for waterfowl as well as Bald and Golden eagles as it usually remains open throughout the winter.

The river corridors, wetlands and adjacent upland habitats provide the public with various recreational opportunities such as dove and waterfowl hunting, fishing, and bird watching. The SSSWA is closed to the public for nesting season from February 15 to July 15 annually.

8.2.12 Shriver/Wright SWA

The Shriver/Wright SWA (SWSWA) is one mile east of the city of Monte Vista and adjacent to the Home Lake and Rio Grande SWA's along the Rio Grande (Figure 8.1, Appendix I). The area contains a small portion of the active channel of the Rio Grande and approximately 200 ac of riparian woodland and floodplain wetlands. The SWSWA provides some habitat for migratory, nesting, and roosting waterfowl and waterbird species, species of concern, and threatened and endangered species that are dependent upon declining wetland resources in the SLV. The SWSWA contains native riparian forest galleries, tall and short emergent wetlands, wet meadows, and shrublands. The SWSWA does not have any surface or groundwater rights and is completely dependent upon precipitation and the water table which fluctuates with the river to maintain wetland conditions.

The SWSWA is open to the public year round for various activities included walking, biking, bird and wildlife watching, fishing and some hunting. The area contains a short maintained path to a wildlife observation structure.

8.2.13 Smith Reservoir

Smith Reservoir lies west of the town of Blanca and is one of only a few public areas in Costilla County (Figure 8.1, Appendix I). The reservoir itself is privately owned and leased by CPW with a conservation pool off of Trinchera Creek. The conservation pool consists of 810 ac/ft of water including siltation. The entire area contains 956 acres. A perpetual easement allows for public access. The reservoir has been primarily used for recreational purposes including waterfowl hunting and cold water fishing, however the conservation pool currently consists completely of silt.

8.3 U.S. Fish and Wildlife Service

There are three national wildlife refuges located in the SLV that are managed as a complex (Figure 8.2, Appendix I). These refuges provide a wide variety of habitat and resources for a many different wildlife species.

8.3.1 Alamosa National Wildlife Refuge

Alamosa National Wildlife Refuge (NWR) encompasses 12,026 acres in the central portion of the SLV (Figures 8.2 and 8.8, Appendix I). The refuge was establish in 1962 under the authority of the Migratory Bird Treaty Act with the authorizing purpose "…for use as an inviolate sanctuary or for any other management purpose, for migratory birds." Most of Alamosa NWR is located within the historic Rio Grande floodplain where Rock and La Jara Creeks and the Alamosa River entered the Rio Grande from the west. Hansen's Bluff forms the eastern boundary of the Rio Grande floodplain on the refuge. Historically, the Rio Grande had two split active channels in the lower half of the refuge and movement of the river across its floodplain over time created an extensive system of abandoned channel sloughs, oxbow lakes, and wet meadow depressions, some of which are still present today. Numerous land and water use changes have occurred surrounding Alamosa NWR resulting in significant hydrologic changes on the refuge (e.g., altered hydroperiods and limited overbank flooding events of the Rio Grande, virtually all water is diverted out of Rock and La Jara Creeks and the Alamosa River before they reach the refuge boundary, and lowered aquifer levels). As a consequence, hydrologic inputs rely on diverted surface water from the Rio Grande through a system of canals (Chicago Ditch, Costilla Ditch, and San Luis Ditch), the Mumm Well (artesian well), and mitigation water from the Closed Basin Canal. Additionally, significant modifications, such as the construction of an extensive water management

infrastructure system consisting of contour terraces, ditches, and water-control structures, have occurred on the refuge since its establishment.

Alamosa NWR contains numerous habitat types, including short- and tall-emergent wetland, wet meadow, riparian, grassland, and salt desert shrub, providing a diversity of habitat types for a wide array of wildlife species. The combination of natural and created wetland habitat on the refuge are important nesting and migration areas for a diverse assemblage of wetland dependent avian species. Numerous species of waterfowl nest on the refuge as well as shorebirds and secretive marsh birds. Riparian habitat on the refuge is important nesting and foraging habitat for the Federally endangered southwestern willow flycatcher (SWFL) and has Critical Habitat designation for SWFL.

Alamosa NWR provides numerous opportunities for a variety of public uses including wildlife viewing, photography, and hunting. Approximately 28% (3,390 acres) of the refuge is open for waterfowl hunting and limited upland game hunting. Fall water management on the refuge consists of roughly an equal split of wetted habitat inside and outside the waterfowl hunting area to ensure that adequate "rest" areas are available for waterfowl and to maintain quality hunting opportunities within the hunting area.

For more information on the management of the Alamosa NWR, please see Appendix III 17.3.

8.3.2 Baca National Wildlife Refuge

Baca National Wildlife Refuge (NWR), located in the eastern portion of the San Luis Valley (SLV), was authorized with passage of Public Law 106-530 (16 U.S.C. 410hhh-4), as part of the Great Sand Dunes National Park and Preserve Act of 2000, and its authorized boundary is about 92,500 acres (Figures 8.2 and 8.9, Appendix I). The Refuge was established by Secretarial Order in 2003 with the acquisition of the first parcel. The authorizing legislation was amended in part by the Omnibus Public Land Management Act of 2009, Public Law No. 111-11, resulting in the following purpose:

> *The purpose of the Baca National Wildlife Refuge shall be to restore, enhance, and maintain wetland, upland, riparian, and other habitats for native wildlife, plant, and fish species in the San Luis Valley. In administering the Baca National Wildlife Refuge, the Secretary shall, to the maximum extent practicable - (A) emphasize migratory bird conservation; and (B) take into consideration the role of the Refuge in broader landscape conservation efforts; and (C) subject to any agreement in existence as of the date of enactment of this paragraph, and to the extent consistent with the purposes of the Refuge, use decreed water rights on the Refuge in approximately the same manner that the water rights have been used historically.*

Baca NWR contains numerous habitat types, including short- and tall-emergent wetland, wet meadow, playa, riparian, grassland, and salt desert shrub, providing a diversity of habitat types for a wide array of wildlife species. Historically, water entered the refuge from mountain streams originating from the west side of the SLV (La Garita, Carnero, and Saguache Creeks) as well as creeks from the Sangre de Cristo mountains on the east side of the SLV. Extensive alterations in land and water uses surrounding the refuge have resulted in significant changes to the hydrology of Baca NWR (e.g., water from La Garita, Carnero, and Saguache Creeks is completely diverted before it reaches the refuge boundary as well as lowered aquifer levels). Currently, five creeks (Crestone, Spanish, Willow, Cottonwood, and Deadman) supply water to wetland, playa, and riparian habitats. Numerous species of nesting and migrating

wetland dependent avian species utilize these habitats on the refuge, especially the playas when they are wetted. Crestone Creek contains one of two remaining aboriginal populations of Rio Grande sucker (State Endangered) as well as a healthy population of Rio Grande chub (State Species of Special Concern).

Currently, very limited opportunities exist for visitor use on Baca NWR. A visitor use plan is being drafted and will identify future opportunities on the refuge. Limited migratory bird hunting and upland game opportunities will be allowed. However, waterfowl hunting will not be permitted primarily due to the lack of suitable water available during the hunting season (i.e., the creeks stop flowing in late summer and wetland habitat.

For more information on the management of the Baca NWR, please see Appendix III 17.3.

8.3.3 Monte Vista National Wildlife Refuge

Monte Vista National Wildlife Refuge (NWR) encompasses 14,834 acres on the west side of the SLV (Figures 8.2 and 8.10, Appendix I). The refuge was established in 1952 under the authority of the Migratory Bird Treaty Act in response to local interest in protecting wintering waterfowl habitat along Spring Creek and reducing waterfowl depredation on nearby privately owned agricultural fields. The authorizing purpose of the refuge was for "…for use as an inviolate sanctuary or for any other management purpose, for migratory birds." Monte Vista NWR is bisected by three historic creek drainages (Spring, Rock, and Cat Creeks) that originate in the San Juan Mountains. Extensive alterations in land and water uses surrounding the refuge have resulted in significant changes to the hydrology of Monte Vista NWR (e.g., the spring which fed Spring Creek ceased flowing in the late 1960's, water from Rock and Cat Creeks is completely diverted before it reaches the refuge boundary). As a consequence, hydrologic inputs rely on diverted surface water from the Rio Grande through a system of canals (Monte Vista Canal and Empire Canal) and/or pumped groundwater from numerous wells. Additionally, significant modifications, such as the construction of an extensive water management infrastructure system consisting of contour terraces, ditches, and water-control structures, have occurred on the refuge since its establishment.

Monte Vista NWR contains numerous habitat types, including short- and tall-emergent wetland, wet meadow, grassland, and salt desert shrub, providing a diversity of habitat types for a wide array of wildlife species. The combination of natural and created wetland habitat on the refuge are important nesting and migration areas for a diverse assemblage of wetland dependent avian species. Numerous species of waterfowl nest on the refuge as well as shorebirds, colonial waterbirds, and secretive marsh birds. At times, certain management units on the refuge have hosted some of the highest densities of nesting ducks on the continent and depending on habitat conditions, Bowen Pond can have the largest nesting colony of white-faced ibis in Colorado. Additionally, 95% of the Rocky Mountain Population of Greater Sandhill Cranes rely on the wetlands and agricultural fields during the spring and fall migration.

Monte Vista NWR provides numerous opportunities for a variety of public uses including wildlife viewing, photography, and hunting. Approximately 24% (3,600 acres) of the refuge is open for waterfowl hunting and limited upland game hunting. Fall water management on the refuge consists of roughly an equal split of wetted habitat inside and outside the waterfowl hunting area to ensure that

adequate "rest" areas are available for waterfowl and to maintain quality hunting opportunities within the hunting area.

For more information on the management of the Monte Vista NWR, please see Appendix III 17.3.

9 Priority Species, Wetlands, and Habitat Matrices

Federal and state agencies identify priority wildlife species based on each agency's goals and objectives. Although overlap exists, not all species of concern are the same for each agency. The Assessment priority species were chosen by partners to capture species of concern as well as represent the wide diversity of wetland-dependent wildlife and their required habitats across the SLV. A total of 35 species were identified to represent all aquatic and terrestrial wildlife, which require wetland resources during all or some portion of their life cycle needs in the SLV. These species require a wide range of habitat types including riverine, wetland, riparian, playa, and cropland. Table 18.1 in Appendix IV lists all 35 species including mammals, birds, fish, and amphibians.

The 35 priority species were chosen collaboratively by partners. Many of the included species were pulled from the Intermountain West Joint Venture 2013 Implementation Plan priority species list, each agency's (BLM, CPW, FWS) lists of priority species and from discussions among the group. CPW priority wetland wildlife species have been identified through the Wetland Program Strategic Plan and the Colorado State Wildlife Action Plan. BLM priority species are identified in the BLM Sensitive Species list for Colorado. USFWS priority species are identified in the San Luis Valley National Wildlife Refuge Complex Comprehensive Conservation Plan (CCP).

9.1 Priority Species and Fact Sheets

The Colorado Wetlands Program has been developing fact sheets for all the species identified as of concern, threatened, or endangered throughout the State. Although each of these species may require similar habitat types regardless of location in the state, conditions vary. In an effort to further identify specific conditions for wildlife in the SLV, the partners developed fact sheets, specific to resources needed by each species in the SLV. These fact sheets are similar to those developed by the CWP but contain additional information on habitat use by season or life cycle event specific to the SLV. Habitat matrices were developed to better indicate how and when a species uses a particular resource and for what purpose. The best available information for each species was compiled for the following sections of the fact sheet:

- General Description
- Physical Characteristics
- Range and Conservation Status
- Communication
- Life History Activities in the SLV
- Habitat Requirements
- Management Recommendations
- Monitoring Recommendations
- References

The process of developing these fact sheets helped partners to identify key life cycle events, habitats, wetland types, and needs for future management, monitoring, and research for not only these 35 species but all species in the SLV dependent on a variety of resources tied to water. These Fact Sheets may be used by partner agencies, land trusts, or other organizations in the SLV to help provide insight on particular projects in relation to species needs (see Appendix IV) which is available as a separate but accompanying .pdf file to the Assessment.

9.2 Wetland and Habitat Types

Wetland types determined to be important for the 35 priority species include: Permanent, Semi-Permanent, Seasonal, Temporary, and Riverine. These terms also match the hydrologic extent categories used in the IWJV analysis (hydrologic extent do not refer to actual wetland types, just a duration of flooding). For the purposes of this Assessment when using the hydrologic extent GIS modeling by the IWJV, categories that describe the duration of flooding will be used and are defined below:

- Permanent: Wet or flooded for more than 9 consecutive months of the year
- Semi-Permanent: Wet or flooded for 6 to 8 consecutive months of the year
- Seasonal: Wet or flooded for 3 to 5 consecutive months of the year
- Temporary: Wet or flooded for 1 to 2 consecutive months of the year

It is important to note that the IWJV modeling refers only to the duration of flooding and does not incorporate vegetation and soils that are necessary to identify wetland types. In general, each of these hydrologic types may contain a wide range of habitat types and vegetation communities that vary depending on depth of water, topography, season, management actions, climatic conditions, and other factors. Further analysis to determine wetland type using this hydrologic extent data may be done in the future for the entire SLV especially in reference to the 'temporary' group. Please see Section 9.b. for a further discussion of the habitat types used as part of the effort to determine limiting resources for priority species. An analysis was done to determine the amount of different habitats available by hydrologic duration for three representative priority species (cinnamon teal, sandhill crane, and white-faced ibis). Riverine was added to the four wetland types in order to better represent conditions for several of the priority species that require flowing water but is not included as a separate category in the IWJV GIS modeling.

In order to better identify limiting resources for each priority species the type of wetlands, and more specifically, the types of habitats that each species utilize for different life cycle events were needed. Partners identified habitat types that were representative across boundaries that would adequately describe required resources. From 2006 to 2008 the Baca, Alamosa, and Monte Vista NWRs were mapped to determine vegetation types using the Refuge Lands GIS database incorporating an infra-red aerial flight and modelling to separate vegetation types based on reflectance. The Blanca Wetlands Wildlife Management Area (BLM) and the Russell Lakes, Rio Grande, and Higel SWAs were also mapped using this technology using the Refuge Lands database from 2007 to 2008. The National Vegetation Classification System was used at the Alliance and Association level to describe the vegetation. Not all of the areas were completed in exactly the same way (the SWAs and BLM were 100% field-truthed while the NWRs were approximately 20% field-truthed to populate the rest of the polygons using a model) and the level of specificity also varied. With these data differences in mind, all of the alliances and associations were grouped into 9 different categories determined by the Assessment group. These

categories broadly describe and represent the variety of vegetation communities or habitat types that are required during some life history event by one or more of the 35 priority species. The following Table (9.1) lists the 9 Vegetation or Habitat Types and the type of wetland where they may occur.

Table 9.1. Consolidated Vegetatoin/Habitat Types linked to Wetland Types

GIS Vegetation/HabitatTypes	Wetland Types
Crop (grain)	None
Grassland	Temporary
Mudflats/Playas	Permanent, Semi-Permanent, Seasonal, Temporary, River
Open Water	Permanent, Semi-Permanent, Seasonal, Temporary, River
Riparian Forest (Cottonwood/Willow)	None
Wet meadow	Temporary, Seasonal
Short Emergent	Semi-Permanent, Seasonal, Temporary
Shrubland	Temporary
Tall Emergent	Permanent, Semi-Permanent, Seasonal

Below are brief definitions of each of the habitat types.

Crop (grain): Irrigated for short periods of time consisting of grains such as barley.

Grassland: Irrigated for short periods of time, dominated by a variety of grasses and forbs.

Mudflats/Playas: Moist areas, sometimes along lake shorelines, that may or may not be saline with sparse vegetation or bareground.

Open Water: Bodies of standing or running water of varying depths (lake, pond, backwater slough, river) that may have vegetation on the periphery but does not have other emergent vegetation growing within the water.

Riparian Forest (cottonwood/willow): Habitat adjacent to rivers or streams dominated by willow and or cottonwood trees.

Short emergent: Plant communities comprised of various species that are < 50 cm in height that grow in wetlands with various hydrologic periods.

Shrubland: Areas dominated by rabbitbrush, greasewood, four-winged saltbush or other associated species.

Tall emergent: Plant communities comprised of various species that are > 50 cm in height that grow in wetlands with typically long durations of flooding.

Wet meadow: Areas that are dominated by inland saltgrass or other grasses or forbs, may or may not be saline, and may be temporarily or seasonally flooded.

The 'Habitat Type' column was added to all of the GIS layer attribute tables from the vegetation mapping project so that information could be added to each polygon describing it as one of the 9 different habitat types. An analysis of the total acres that occur on each public land by habitat type is

listed in Table 9.2. Shrubland comprises about 61% of the total landcover followed by short emergent at 14% of the total acres across all public lands.

Table 9.2. Habitat Types (Acres) by Public Area									
Habitat Types	**ANWR**	**Blanca**	**BNWR**	**HSWA**	**MVNWR**	**RGSWA**	**RLSWA**	**Grand Total**	**% of Total**
Cropland			118	3	863	8		**993**	**1**
Grassland	436	44	5485	254	344	163	145	**6872**	**5**
Mudflat/Playa		649	7338				3	**7991**	**6**
Open Water	644	790	66	83	420	205	454	**2662**	**2**
Riparian Forest (Cottonwood/Willow)	230	1	115	114	28	364	1	**853**	**1**
Short emergent	6207	542	10125	533	6930	299	1321	**25957**	**20**
Shrubland	2703	4220	67318	26	3572	37	1270	**79145**	**61**
Tall emergent	1057	304	103	64	575	80	276	**2460**	**2**
Wet meadow	114	938	645	30	818	2	949	**3495**	**3**
Grand Total	**11390**	**7489**	**91197**	**1103**	**12687**	**1151**	**4417**	**129434**	

Because the Baca NWR is the largest public land area at over 92,000 acres and is dominated by shrublands, the percent totals in the table above are skewed and a closer look at the other public lands to determine the dominant habitat type is warranted. Regardless, this table and mapping represents the first effort to compile SLV vegetation data into a comparable dataset. Please see Appendix I for vegetation maps (Figures 9.1-9.7) of each of the public lands utilizing these categories. A few categories were left out (for example Dunes) that were not associated with the 35 priority species and were of small acreage on the mapped lands. McIntire Springs (BLM) was not mapped nor was San Luis Lakes SWA. These areas would add most significantly to Riparian Forest, Mudflat/playa, and short emergent habitat types. Overall, this process helped to identify where mapping should be done in the future and where more information is needed to more accurately describe specific habitats. For example, only 3 acres are listed on the Russell Lakes SWA as mudflat/playa. This area contains many more acres of this type but was probably mapped as open water at the time. Future work will need to address habitat types vs current condition in order to more accurately identify and discern differences in type and availability.

The mapping effort helped identify where certain habitat types are most prevalent in relation to public lands. The Baca NWR and Blanca Wetlands WMA provide a majority of the mudflat/playa habitat. Short emergent is most common on the refuges while the Alamosa NWR, Monte Vista NWR, and Russell Lakes NWR provides the most tall emergent habitat type. The Baca NWR provides a majority of the grassland habitat.

9.3 Habitat and Life Cycle Matrices

The habitats described in the previous section (9.2) were used to help partners develop a table that paired habitats with life cycle events for each of the 35 species. A matrix for each species that visually shows the time of year, habitat type, and life cycle event was created using surveys, research, and expert knowledge for each of the species needs. These matrices were included in each of the species fact sheets (Appendix III). For example the Mallard occurs in the SLV year round (Table 9.3) using a wide variety of habitats while the endangered southwestern willow flycatcher uses a few habitats from late spring through early fall (Table 9.4). These matrices help show each species use of specific habitats over the annual cycle but also help to determine which types of habitats annually and across seasons are most important for multiple species. In addition, habitat types that are only used by a few species were also identified.

Table 9.3. Mallard SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop (grain)	Winter											Winter
		Migration								Migration		
Grassland				Nesting								
Open water	Winter											Winter
		Migration								Migration		
			Pre-Breeding									
					Brood Rearing							
							Post-Breeding					
Playa		Migration								Migration		
			Pre-Breeding									
					Brood Rearing							
							Post-Breeding					
Short Emergent		Migration								Migration		
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					
Tall Emergent		Migration								Migration		
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					
Wet Meadow		Migration								Migration		
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					

Table 9.4. Southwestern willow flycatcher SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian					Migration			Migration				
					Pre-Breeding							
						Nesting						
						Brood Rearing						
								Post-Breeding				
Short Emergent					Migration			Migration				
					Pre-Breeding							
						Nesting						
						Brood Rearing						
								Post-Breeding				
Wet Meadow					Migration			Migration				
					Pre-Breeding							
						Nesting						
						Brood Rearing						
								Post-Breeding				

Specifically these matrices help to better understand: 1) Use of habitats by season by each of the 35 species and 2) habitat types that are most important to the greatest number of species by season. The following table (Table 9.5) shows the number of species using each habitat by season and ranks the habitats by the greatest use based on the number of species that use the habitat. River was broken out in this table although it is lumped in with Open Water in the vegetation/habitat layer that was discussed in Section 9.1.

Table 9.5. Use of Habitats by Season and Number of Species Ranked

Rank	Habitat	Spring	Summer	Fall	Winter
1	Short Emergent	19	19	19	5
2	Open Water	18	18	18	5
3	Wet Meadow	15	14	17	7
4	Riparian Forest	13	12	13	6
5	River	10	11	11	9
6	Tall Emergent	10	11	11	2
7	Mudflat/Playa	10	10	11	4
8	Grassland	5	5	5	3
9	Shrubland	3	2	3	2
10	Crop	2	1	3	3

The table shows that the short emergent habitat type is used by the highest number of species during spring, summer, and fall. The River becomes the most used habitat type in the winter. In the previous section short emergent represents approximately 20% of the vegetation communities on the seven public lands that were mapped. Open Water represents only 2% but is ranked the second highest in use by the species identified in the Assessment. The Mudflat/Playa habitat is used by about 10 species in the spring, summer, and fall with a majority of that habitat occurring on only the Baca NWR and Blanca Wetland WMA representing only 6% of the total habitat acres. Combining the analysis of habitat availability with numbers of species needing that habitat clearly shows the importance of different habitat types to wildlife as well as indicating where limiting resources may exist.

10 IWJV GIS Analysis: Historic vs. Current Wetland Conditions in the SLV

The following information in Section 10 has been provided directly from a report by the Intermountain West Joint Venture and includes data from the entire area modeled in Colorado (Donnelly, 2018).

The first component, the IWJV project, was initiated to answer questions related to the wide spread demands for water use efficiencies that now unintentionally threaten longstanding land use practices that are beneficial to wildlife and have the potential to significantly alter the availability of limited wetland resources. Specifically, the IWJV project sought to estimate the impact conversion from flood irrigation to sprinkler irrigation has on wildlife in the west. The IWJV analysis is inclusive of all land ownership and wetland types and is intended to encourage coordination of landscape conservation among private interest, and state and federal lands. Incorporation of new technologies such as this analysis and modeling will allow final products to be rapidly adapted to specific partner needs at little or no cost when addressing targeted water conservation planning.

Historic (ca. 1870) wetland features delineated from General Land Office plats were georeferenced. Land ownership was defined as public or private. Public lands included identification of state or federal agency jurisdiction. No individual private landowner information was utilized. Spatiotemporal dynamics in wetland productivity was modeled from freely available Landsat TM satellite imagery. Satellite indices correlated to net primary production, soil moisture and open water extent were measured over a 32 year span (1984–2017) to account for annual climatic variability. Images were acquired from February through November at 16 day intervals to measure seasonal changes in wetland conditions. Surface water extent was measured using spectral mixture models to account for interspersion of surface water and vegetation characteristic of shallow emergent wetland systems.

10.1 Methodology

Spatiotemporal dynamics of wetland flooding was modeled from 1984 to 2017 using remote sensing and freely available Landsat Thematic Mapper satellite imagery. Surface water extent was measured using constrained spectral mixture models (Adams and Gillespie 2006) and sub-pixel water fraction that allowed a proportional estimation of water contained within a 30x30 meter pixel grid (Jin et al. 2017). This approach provided a more accurate account of flood extent when only a proportion of surface water was visible due to interspersion of emergent vegetation; a characteristic common to shallow seasonal wetlands of the West. Grid cells were considered flooded if surface water proportion were ≥ 20%. This was done to overcome reduced accuracy rates in grid cells with proportionately low surface water occurrence that resulted in false positives and over estimations of wetted footprints (Donnelly et al. in review).

Spectral mixture models were partitioned by multi-year oscillations in above and below average precipitation trends characteristic of broader climatic patterns in the West (Loik et al. 2004).

Trends were derived from data collected by 96 SNOTEL sites distributed throughout the western half of the state. We applied a local Moran's I function to these data to isolate regional patterns and as a result divided the state into northern and southern segments in order to isolate precipitation trends. Three to seven year climate periods of above or below average precipitation trends were identified within the southern segment (Figure 10.1).

Wetland response was averaged within these periods and divided into approximately 30 day intervals correlated to calendar months (January to November - December omitted). Applying this approach made it possible to isolate climate driven ecological means influencing wetland response (i.e. drought) and simultaneously reduced the potential of monitoring gaps resulting from poor quality Landsat data. Final analyses resulted in monthly wetland monitoring within six distinct climatic periods over a continuous 33 year span.

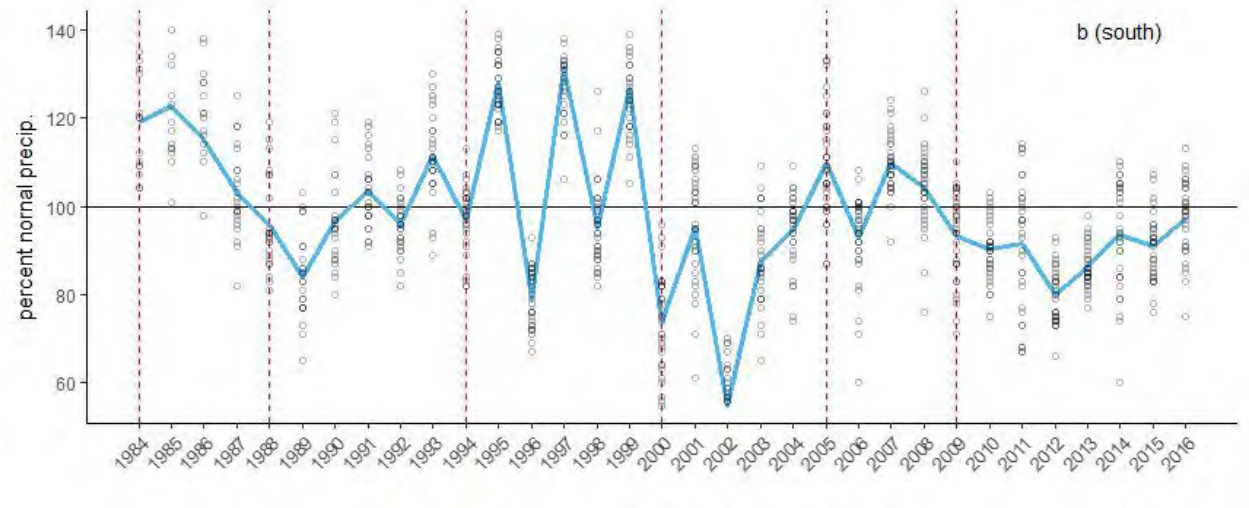

Figure 10.1. Percent normal precipitation trends within southern (b) climate segments. Dashed red lines mark beginning of climate periods used to average wetland response. Circles are represent percent normal precipitation recorded at individual SNOTEL sites used in trend estimation

Gridded estimations of wetland flooding were filtered spatially by clipping their extent to digitized wetland, riparian, and agricultural boundaries; hereafter 'wetland polygons'. This process eliminated the potential of false water positives in the model by removing anthropogenic features (e.g. buildings, and asphalt) and topographic shadow known to be misclassified as water (DeVries et al. 2017). Surface water acres were then summarized within wetland polygons. This process was repeated for all months and climate periods to link long-term hydrologic patterns to potential wetland sites identified. Wetland polygons were produced as a derivative of National Wetlands Inventory (NWI) data and digitized agricultural field boundaries. Agricultural field boundaries were representative of irrigated rangelands (e.g. wet meadows/hay meadows) and other agricultural practices that can provide seasonal wetland habitats, but are frequently omitted from NWI data. The aggregation of agricultural and NWI boundaries provided an exhaustive representation of wetland features occurring within the project footprint. All polygons were labeled by ownership (public or private) and public lands identified by administrative agency as means to summarize wetland values by land tenure.

No formal accuracy assessment was conducted. Identical methods applied in similar wetland systems in the Intermountain West achieved accuracy assessments of +90% (Donnelly et al in review). These rates are comparable to similar independent studies that have obtained accuracies of 93% (Jin et al. 2017). Completion of parallel wetland modeling efforts in other western states are anticipated to provide accuracy assessment of data outputs that will incorporate existing Colorado results.

The IWJV process incorporates a TRUEMET type avian bioenergetics model (CVJV 2006) for estimating wetland food resources linked to landscape dynamics. This analysis will identify bottlenecks in seasonal energetic availability potentially affecting life cycle needs of migratory birds or other wetland associated species. Public and private land contribution to resource availability will be estimated by evaluating patterns of land tenure influenced through annual and seasonal shifts in wetland condition. Change detection analysis will be used to account for net wetland loss (e.g. flood irrigation to sprinkler conversion, water right transfer, and subdivision) during the period of study. Threat assessments will be derived from this analysis to predict and quantify current risk and future loss of wetland and associated wildlife resources. Associated conservation actions will be monitored to evaluate conservation outcomes and track progress towards stated objectives within individual priority wetland areas. Objectives derived from evaluation of seasonal wetland dynamics and landscape carrying capacity will be provided as GIS decision support layers for wetlands conservation. All layers will be made available for download to inform concurrent federal, state, and local conservation planning and outcome based evaluations. Upon delivery a series of web based trainings will be provided to assist practitioners in data applications. Final outcomes will be published as peer reviewed scientific literature.

10.2 GLO

The ca. 1870 General Land Office (GLO) survey plats were assembled in a GIS. Wetland sites and site descriptions were extracted digitally from plats and surveyor notes to summarize existing ownership and land use patterns. GLO plats were assembled over the extent of priority wetland landscapes and made available to partners at the completion of the study to support additional research and planning needs.

10.3 GLO and 16 day Satellite Imagery Analysis Results

The GLO information was not consistent across the SLV as many different surveyors helped to complete the survey of the region. Some of the maps were more detailed than others and therefore may or may not have provided insights into the pre-settlement extent of wetlands. The GLOs were georeferenced and made available to partners with some wetland and riparian areas digitized. Because of the lack of

data provided by the GLOs, a comparison was not made between the historic hydrologic extent and present.

Heterogeneity in abiotic processes resulted in distinct concentrations of water and wetlands within select Colorado landscapes. Nearly 80% of wetland resources were attributed to only five of the 26 regions monitored; San Luis Valley, North Park, South Park, Gunnison, and Middle Park, with the San Luis Valley and North Park combining to make up 62% of these values (Figure 10.2). Remaining wetland resources were well distributed with Craig, Delta, Steamboat, Hotchkiss, and Meeker combining to makeup 12% of overall wetland abundance to provide important connectivity between higher wetland density regions. Estimations of Colorado's wetland distributions were fully inclusive of agricultural wetland benefits and for the first time provided a holistic view of wetland process and values in the western half of the state. While this summary is focused on distribution and abundance as an initial evaluation, it is recognized that these factors may not directly translate to measures of biodiversity or human and economic values.

Despite a 71% public lands majority in western Colorado, 87% of wetlands were privately owned (Table 10.1). In 20 of 26 regions, private ownership exceeded 90%. Browns Park was the only region of majority public wetland ownership due to the prominence of Browns Park National Wildlife Refuge. Throughout the state a majority of wetland sites were linked to privately owned, productive valley bottoms and riparian floodplains adapted to irrigated rangeland and hay production. High private ownership of these resources is conducive of volunteer incentive based conservation strategies that enhance and maintain natural floodplain function through application of existing land use practices benefiting wetlands, ranching, and wildlife. Alternately these patterns underscore the importance of limited public wetland resources and highlight the need of maintaining the ecological integrity and productivity of these sites.

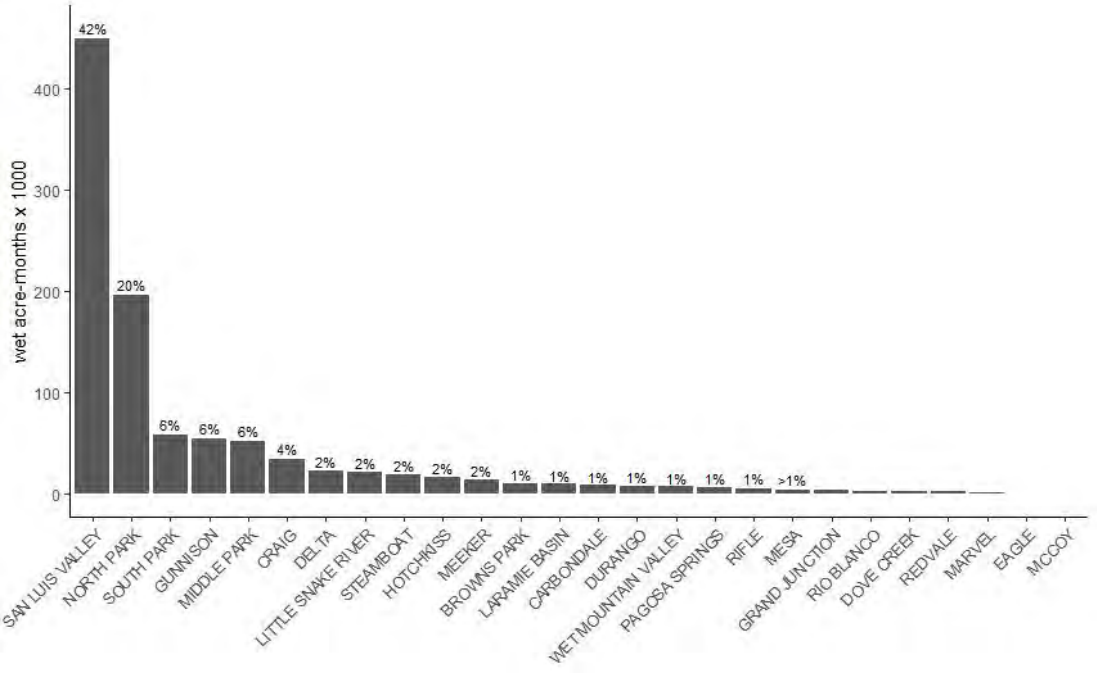

Figure 10.2. Western Colorado wetland distribution by region. Estimates quantified by acre-months where flooded wetland acres are calculated for each month and summed to estimate flooding over an annual cycle; January - November. Acre-months were calculated as a study period mean (1984-2016). Proportion of total wetland abundance (acre-months) within each region represented by numeric percentage.

The majority of regions monitored exhibited annual hydroperiods typical of snowpack driven wetland systems in the western United States (Donnelly - *unpublished data*). Spatiotemporal patterns of wetland flooding within these sites showed little variability due to predictable spring temperatures that reliably triggered snowmelt. April and May runoff resulted in steep increases to flooded wetland availability that peaked in June and rapidly declined to near pre-snowmelt abundance by August. Periods of exceptionally high snowpack did not result in increased wetland abundance. This response was influenced by riparian wetland systems characteristic of western Colorado, where underlying geomorphic features constrain lateral wetland expansion during periods of water abundance. Under high water scenarios, systems reached peak June abundance and maintained these levels through July in correspondence with extended runoff events. Periods of exceptional drought did not influence the timing of wetland availability, but limited overall peak abundance to 30-70% of normal.

Wetland diversity in the San Luis Valley was unique to Colorado due to the regions geography that straddles an eco-hydrologic boundary separating snowpack dominated hydrology from summer pulse water dynamics, driven by the North American monsoon (Loik et al. 2004).

Patterns of spring wetland hydrology were typical of more northerly snowpack driven systems and climbed sharply along predictable trend lines (April - June) during runoff (Figure 10.3). Wetland hydroperiods in late summer shifted to display higher rates of variability influenced by more stochastic monsoonal patterns (Adams and Comrie 1997). Short duration high intensity rainfall, characteristic of monsoon events, resulted in ephemeral wetland trends occurring in August with sites dry again in September due to high summer evapotranspiration. Presence of summer pulse water dynamics prompted bimodal wetland distributions (spring and late summer) during periods of pervasive monsoon rainfall (Figure 10.3, 2005-2008). Wetlands associated with ephemeral patterns were geographically distinct from floodplain sites and occurred within isolated closed basins on the east side of the valley.

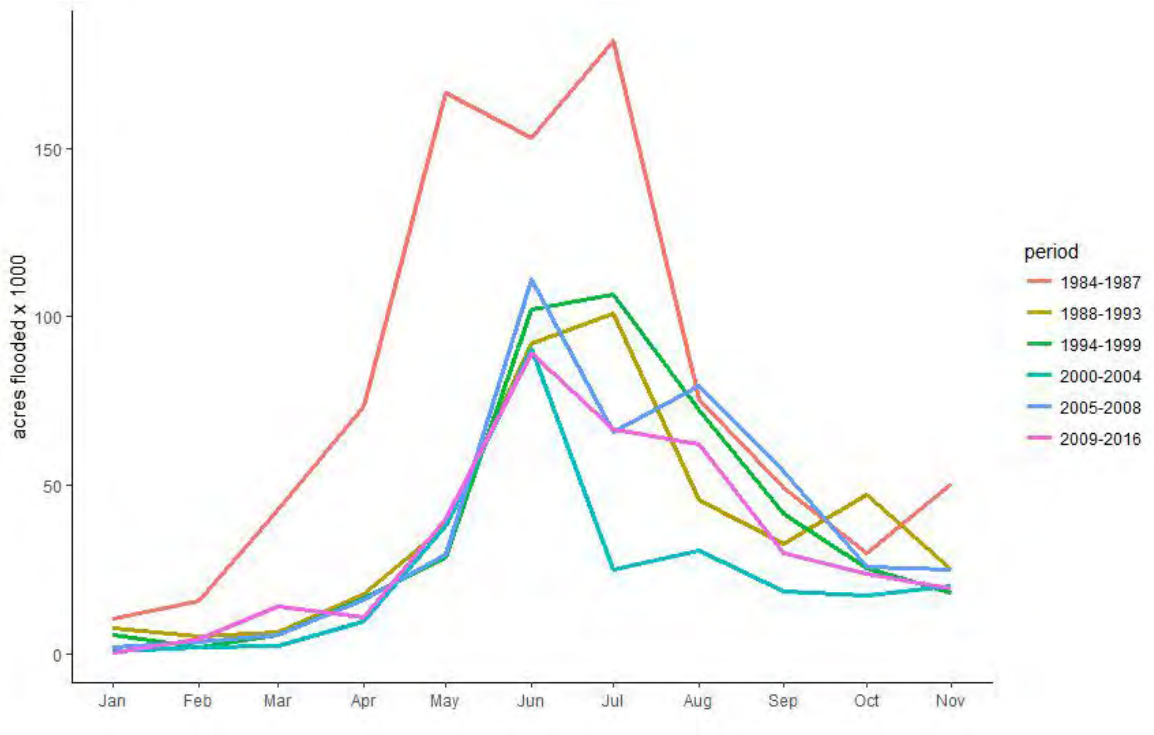

Figure 10.3. San Luis Valley annual wetland hydrograph. Estimated as period means between 1984 and 2016.

Above average snowpack in San Luis Valley watersheds throughout the 1980's resulted in wetland abundance approximately 60% greater from 1984-1986 than during periods observed subsequently between 1988 to 2017 (Figure 10.3). This response differed from other wetland landscapes in western Colorado that experienced similar snowfall patterns. Increased water availability within the Valley likely encouraged infrastructure and irrigation practices beneficial to wetland flooding. For example, prominent winter utilization of Artesian wells during this time would have increased cold season water storage (e.g. sheet ice) at lower elevations and accelerated spring wetland availability due to earlier melt times; a trend observed in the data (Figure 10.3, 1984-1987). Under these conditions water management decisions may have acted to augment already exceptional ecological trends that resulted in abnormally high wetland abundance in the early to late 1980's (Figure 10.4).

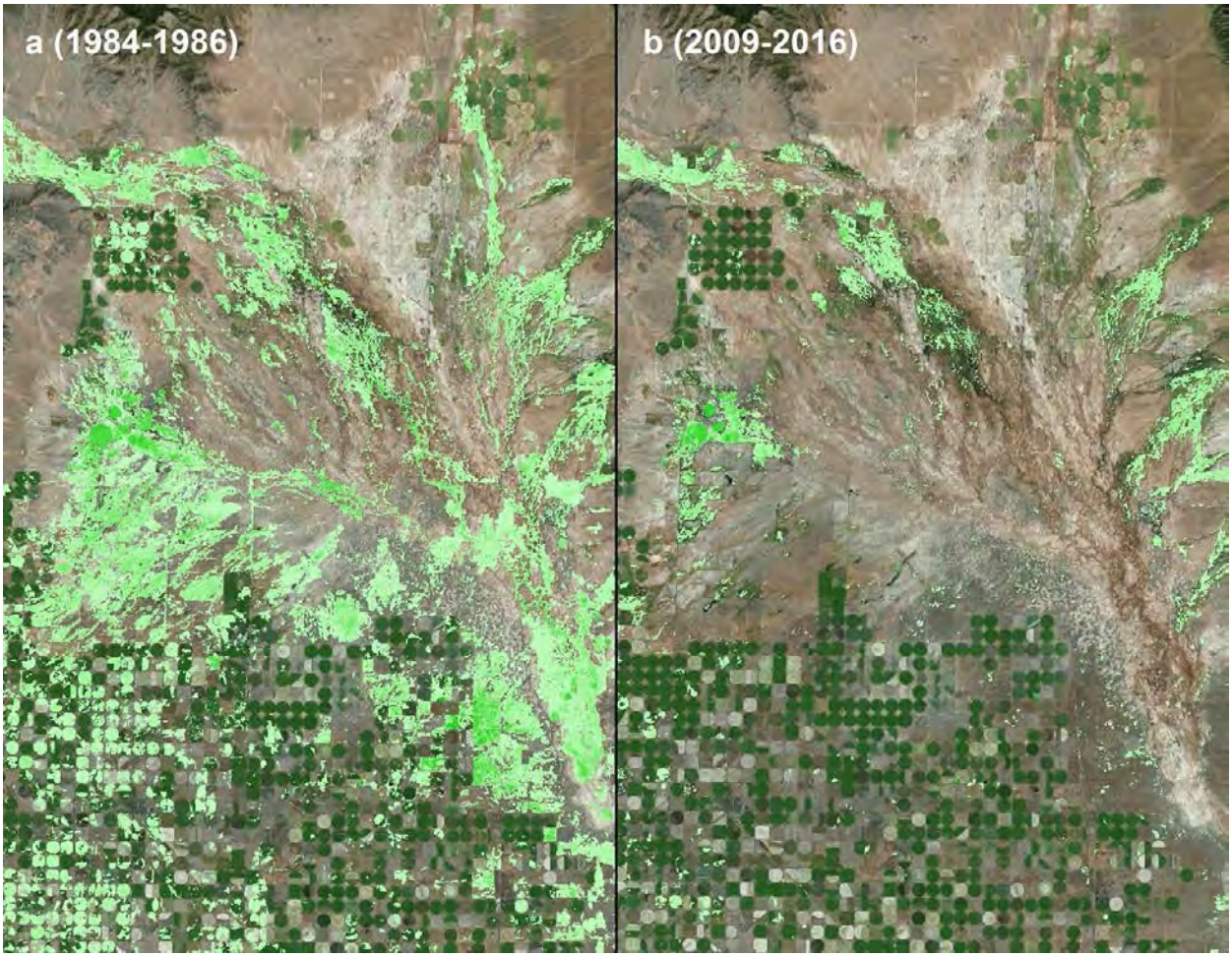

Figure 10.2. Light green shades representative of surface water extent within northern portions of the San Luis Valley for period (a) 1984-1986 and period (b) 2009-2016 (please note that the time periods have been changed slightly from the original report and include 2017 and 2018 data).

Table 10.1. Wetland private and public ownership by region. Wetlands quantified by acre-months where flooded wetland acres are calculated for each month and summed to estimate flooding over an annual cycle; January - November. Acre-months were calculated as a study period mean (1984-2016).

Region	Acre-months	Private	Public
San Luis Valley	418,258	93%	7%
North Park	151,972	77%	23%
Gunnison	53,427	97%	3%
South Park	53,316	91%	9%
Middle Park	45,966	89%	11%
Craig	30,506	88%	12%
Delta	23,354	99%	1%
Little Snake River	19,873	92%	8%
Steamboat	18,879	100%	0.01%
Hotchkiss	15,821	98%	2%
Meeker	13,472	93%	7%
Laramie Basin	9,644	97%	3%
Carbondale	8,444	99%	1%
Durango	7,552	94%	6%
Wet Mountain Valley	7,202	93%	7%
Pagosa Springs	6,444	97%	3%
Rifle	5,653	95%	5%
Mesa	4,174	100%	0.2%
Grand Junction	3,502	91%	9%
Dove Creek	2,526	91%	9%
Rio Blanco	2,418	75%	25%
Redvale	1,835	76%	24%
Marvel	865	92%	8%
Eagle	723	100%	0.4%
Browns Park	494	5%	95%
McCoy	478	94%	6%
All	906,799	87%	13%

11 Hydrologic Extent – Additional Analysis

The hydrologic extent analysis performed by the IWJV provided a wealth of information on surface irrigation in the SLV over the last 30+ years. In order to answer more specific questions about duration of flooding in relation to habitat types, species use, and public vs private land ownership, the partners sought further analysis of the data. CPW GIS specialist, Grant Wilcox, provided a breakdown of wet acres on public and private land, by period, season, and duration of flooding across the SLV. He also utilized the mapped vegetation layers on 7 of the public lands to provide further analysis of habitat for three different priority species on those lands. This information was used to help partners interpret results and develop recommendations for future work in the subsequent sections. Table 11.1 shows the total number of wet acres by time period and public/private ownership across the SLV.

Table 11.1 Overall acres wet by time period and ownership.

Time period	Total Wet Acres	% Compared to 1984-1987	% Private	% Public
1984-1987	326,217		75%	25%
1988-1993	134,666	41%	68%	32%
1994-1999	122,352	38%	69%	31%
2000-2004	98,768	30%	78%	22%
2005-2011	108,243	33%	80%	20%
2013-2017	135,164	41%	79%	21%

The table shows that 1984-1987 was the wettest time period over the 34-year period examined. This confirms earlier statements that the 1980s was an unusually wet period. The total wet acres during the 2000-2004 period is about 30% of the average total wet acres during 1984-1987 and is consistent with that span of time being the driest on record. Over a relatively short time scale we have seen a large range in wet acres. It's important to note that despite being the wettest time period on record, springs that had declined or all together stopped flowing prior to the 1980's did not increase or begin to flow again. This wet period is attributable to increases in precipitation that was reflected in surface wet acres. This table demonstrates that the SLV currently has less than half the surface wet acres than in the 1984 to 1987 period. Table 11.1 clearly shows that the majority of wet acres are on private property and that over time the proportion of wet acres is increasing on private property. Figures 11.1a-f (Appendix I) shows where these wet acres occur across the SLV in each of the time periods.

Given the loss of wet acres and the projected continued declines associated with climate change, understanding where resilient wet areas are is important for strategic land conservation as well as species and habitat management. These data and GIS layers can be utilized to begin to understand where resilient locations exist in the Valley during the driest seasons and the driest years. Most areas that were wet during the drought of 2002 and were wet during the 2005-2011 time period are the most resilient or durable. Overlap of wet areas across all time periods are shown in Figure 11.1g in contrast to the 1984-1987 time period. This 'resilient' layer of wet acres represents about 30% of the wet acres present in the 1984-1987 time period, similar to acres available in the 2000-2004 period (Table 11.1).

The hydrologic extent analysis was used to look at the Baca NWR as an example of how wet acres have changed over time in a particular location. Loss of wet acres at the Baca NWR over time has been dramatic (Figure 11h, Appendix I). Comparisons of wet acres across time periods indicate that between 10 to 15% is available during the driest years (2000-2004; 2005-2011) when compared to the wettest (1984-1987; Figure 11.1h, Appendix I). The wet acres available in the driest years is roughly 3,500 acres

which is less than 5% of the approximate total acreage (90,000) of the Baca NWR. Figure 11.1i shows wet acres over time by season on the Baca NWR and demonstrates not only the overall decline in wet acres but that regardless of time period all available habitats have declined over time; wet habitat is most limited in the fall with only slightly more available in the spring.

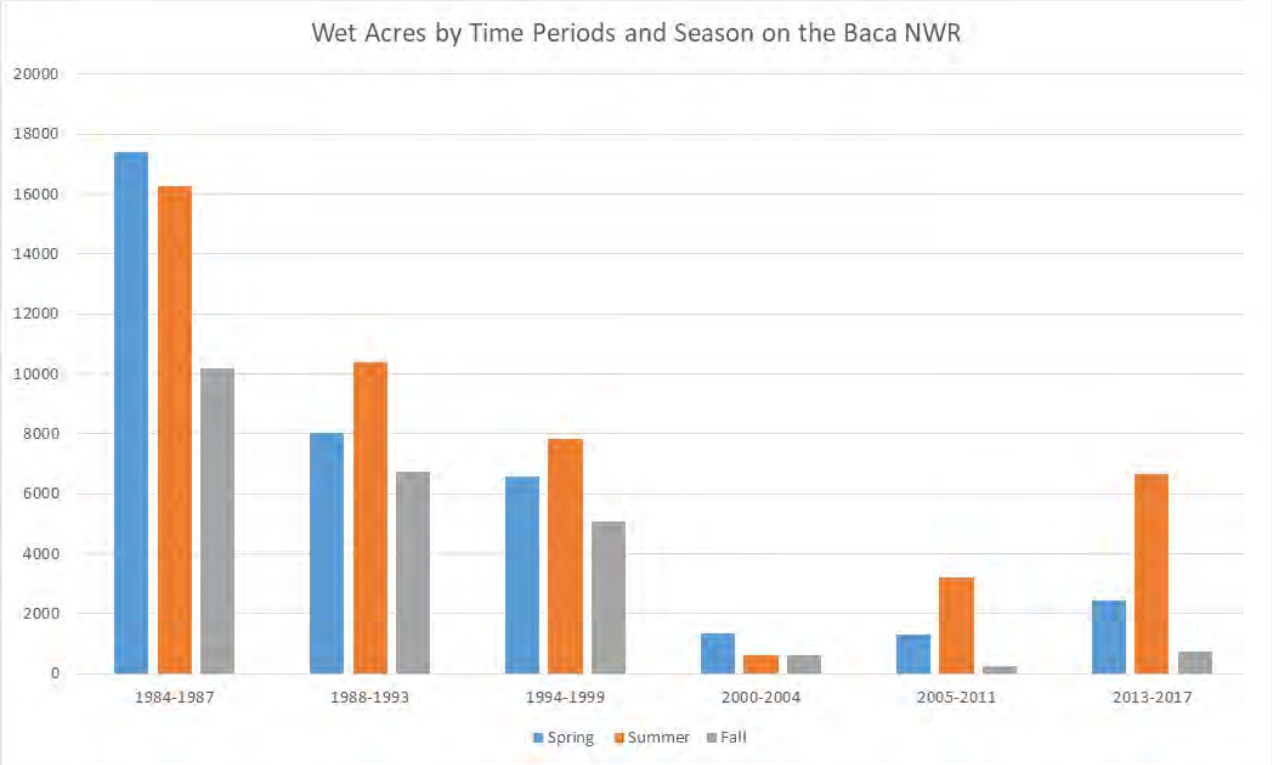

Figure 11.1i. Wet Acres By Time Periods and Season on the Baca NWR

11.1 Changes in Hydrologic Extent Over Time

The original dataset was then portioned into four different durations of potential flooding: Permanent 9 or more consecutive months, Semi-Permanent 6-8 consecutive months, Seasonal 3-5 consecutive months, Temporary 1-2 consecutive months (see Section 9.2 for additional details). The shortest duration of flooding, represented by the 'Temporary' category, contained the highest number of acres for each period. This is not a surprising result as wet areas with short durations are more common than longer duration wet acres in the SLV's semi-arid desert climate. However, the temporary category is not included in the following general analysis for the entire SLV as it needs to be refined for accuracy given the following:

1. Partners need to further define the 'Temporary' designation to determine potentially two different types of wetlands: wet meadow and playa.
2. Other layers such as soils and vegetation are needed to better understand the results of this short term hydrologic extent (1 to 2 months).
3. A GIS structure layer needs to be created that includes roads, buildings, dams, etc. as the model included many of these features within the temporary polygons considered 'wet' and has therefore inflated the number of acres actually 'wet'.

4. Many crop circles were included in the initial results which may or may not provide the type of resources that partners have identified as required habitat for species; crop information needs to be analyzed in conjunction with the hydrologic extent to more carefully define this portion of the data set to accurately represent appropriate habitat.

The following analysis will center on the remaining three durations of flooding: permanent, semi-permanent, and seasonal.

In general, results show that there has been a decrease in overall hydrologic extent from 1984 to the present by at least half for the three different hydroperiods (Figures 11.1a-f; Appendix 1). Following the drought of 2002, wet areas have rebounded to pre-2002 levels but not to levels identified in the time period of 1984-1987 (Table 11.2). The 1984-1987 time period reflects the wettest years in the past 1000 years (Correa 2007), therefore, declines in overall wet acres after that period were expected to some extent but have been exacerbated by drought conditions and mining of the aquifer that has lowered ground water tables. The total average amount (acres) of permanently, semi-permanently, and seasonally flooded areas has decreased over time (Table 11.2 and Figure 11.2). Figures 11.3a-f, 11.4a-f, and 11.5a-f (Appendix 1) show the changes in hydroperiods through time in the SLV as a time sequence.

Table 11.2. Hydrologic Extent (Acres) by Ownership (excluding Temporary)

Period	Grand Total (ac)	% of Private	% of Public
1984-1987	83638	69	31
1988-1993	43415	57	43
1994-1999	37407	58	42
2000-2004	25865	63	37
2005-2011	38531	72	28
2013-2017	44132	70	30

A comparison between wet acres in public and private landownership show that private lands contained the majority (about two-thirds) of wet acres across the SLV for these three hydroperiods. The permanent hydroperiod is the only period where wet acres on private and public lands are nearly equal or where private lands during any period had less acres than public land (Table 11.3). For the most recent time period, private lands contain 60 to 74% of the wet acres across the SLV compared to public lands.

The following graphs show the declining trend in percent of acres by hydroperiods and time for public and private lands. These graphs show how increasingly important maintaining wet areas on private lands becomes over time as public areas continue to decline in available resources. Figure 11.6 shows the permanent hydroperiods which has been least affected over time. Figure 11.7 shows the semi-permanent hydroperiod that has declined by over 10% on public lands over time. Figure 11.8 shows the seasonal hydroperiod which has experienced the largest decline in overall acres (Table 11.3) and represents the largest difference between public and private lands with the percent available increasing on private lands over time.

Table 11.3. Hydrologic Extent (Acres) by Ownership and Hydroperiod

Period	Hydroperiod	Grand Total (ac)	% of Private	% of Public
1984-1987	Permanent	9194	55	45
	Semi-Permanent	17140	57	43
	Seasonal	57304	74	26
1988-1993	Permanent	6487	49	51
	Semi-Permanent	14763	55	45
	Seasonal	22165	61	39
1994-1999	Permanent	6686	49	51
	Semi-Permanent	12364	56	44
	Seasonal	18357	63	37
2000-2004	Permanent	5516	54	46
	Semi-Permanent	8005	59	41
	Seasonal	12344	70	30
2005-2011	Permanent	6292	56	44
	Semi-Permanent	8176	68	32
	Seasonal	24063	78	22
2013-2017	Permanent	6601	60	40
	Semi-Permanent	9288	67	33
	Seasonal	28243	74	26

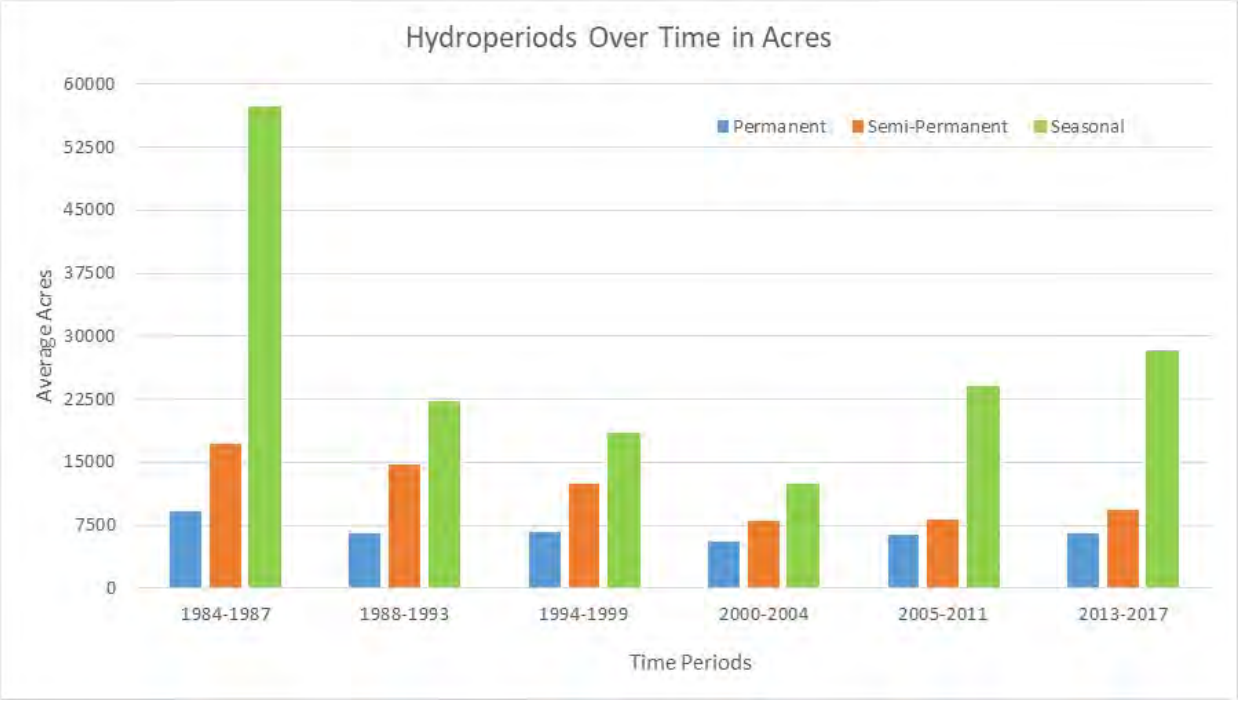

Figure 11.2. Hydroperiods over time in acres across the SLV

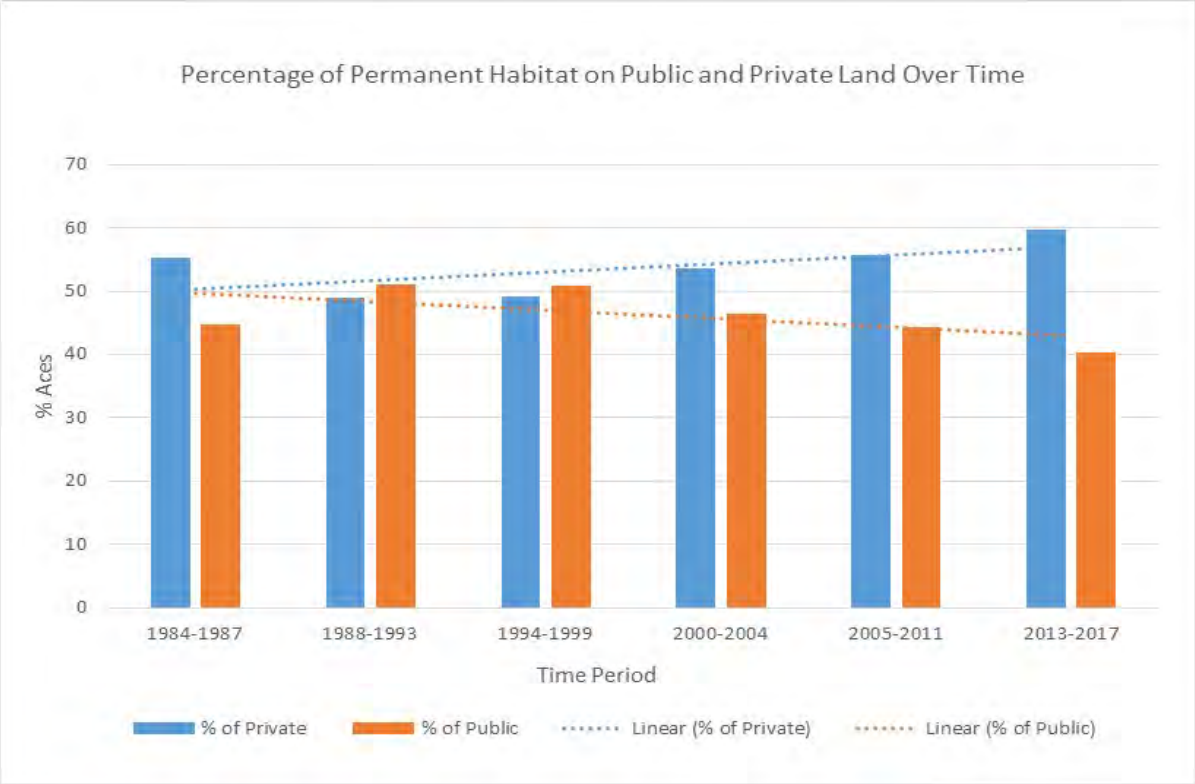

Figure 11.6. Public and Private Permanent Hydroperiod wet acres over time.

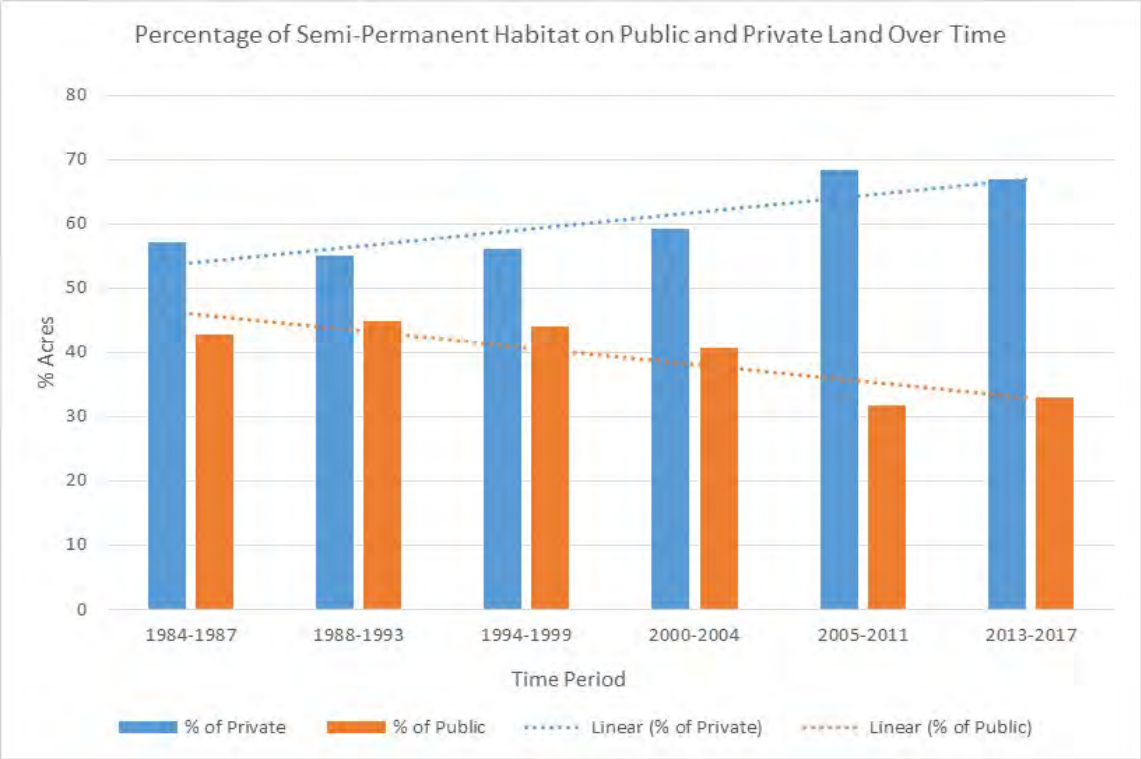

Figure 11.7. Public and Private Semi-Permanent Hydroperiod wet acres over time.

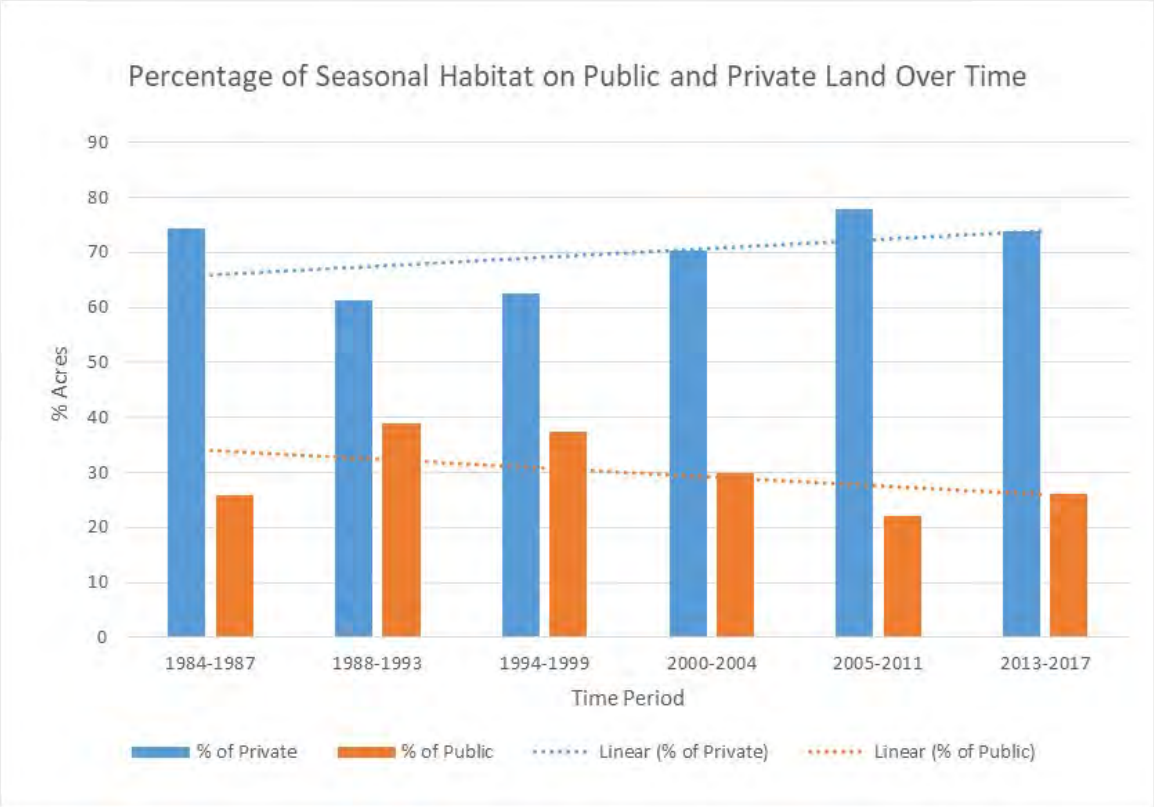

Figure 11.8. Public and Private Seasonal Hydroperiod wet acres over time.

Further analysis of the hydroperiods in relation to season (spring, summer, fall) are only relevant for the seasonal hydroperiod (3-5 consecutive months) as fluctuations between seasons on permanently and semi-permanently wet areas is often not captured due to the duration of flooding (greater than 6 months; see Section 9.2 for definitions). Private lands continue to provide the largest percent of acres across seasons (Table 11.4). However, the fall season represents the most limited number of acres regardless of ownership (Table 11.4 and Figure 11.9). This may indicate that public lands should may try to increase the amount of wet acres in the fall if it is determined that the current acreage is not meeting population requirements.

Table 11.4. Seasonal Hydrologic Extent (Acres) by Ownership and Seasonal

Period	Season	Grand Total (ac)	% of Private	% of Public
1984-1987	Spring	54278	75	25
	Summer	53597	75	25
	Fall	8578	62	38
1988-1993	Spring	19607	60	40
	Summer	20332	63	37
	Fall	7888	59	41
1994-1999	Spring	16144	62	38
	Summer	16430	65	35
	Fall	5405	64	36
2000-2004	Spring	11659	71	29
	Summer	10785	75	25
	Fall	4216	66	34
2005-2011	Spring	21490	78	22
	Summer	23169	80	20
	Fall	6489	76	24
2013-2017	Spring	26008	74	26
	Summer	26932	76	24
	Fall	6342	75	25

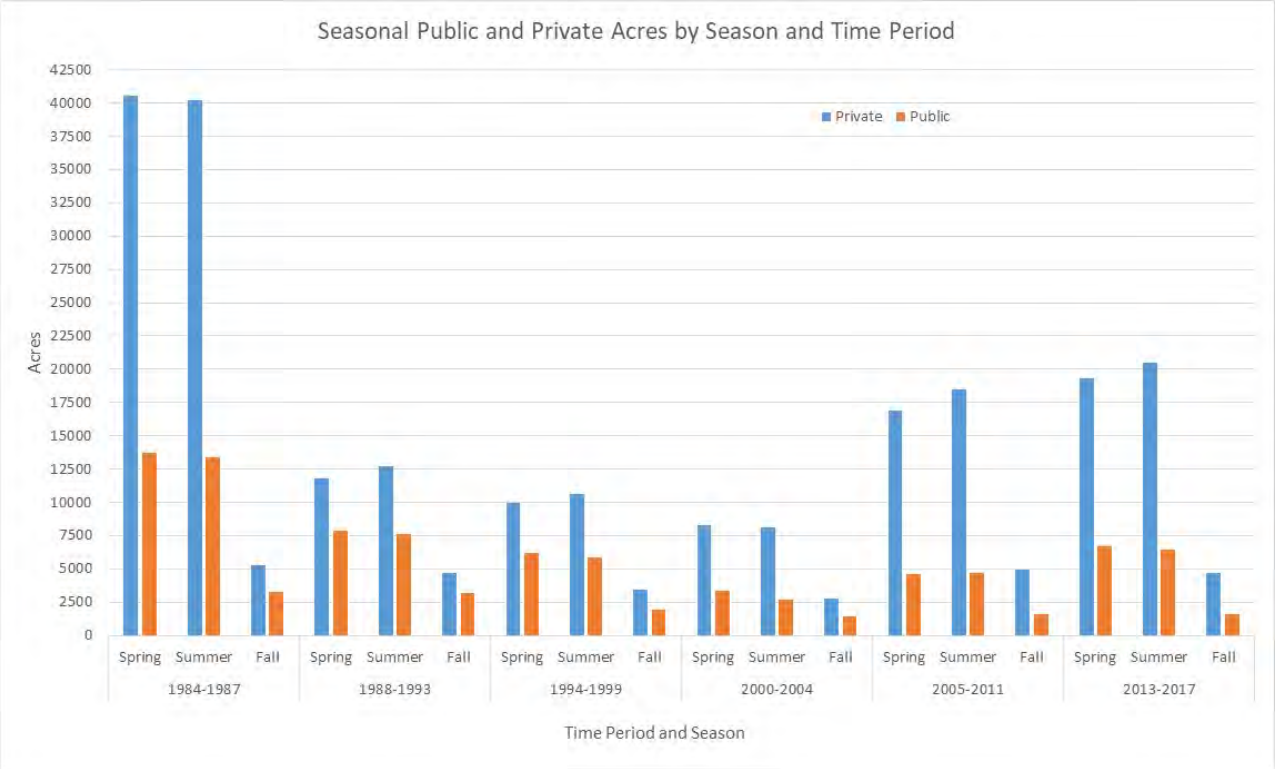

Figure 11.9. Seasonal Hydroperiod by public and private ownership across seasons and time periods.

This analysis can be further broken down on public lands by agency ownership to help better understand where these different hydroperiods occur and which lands have been impacted the most. While private lands have the majority of wet acres overall, the U.S. Fish and Wildlife Service (FWS) has the majority of wet areas in comparison to other public lands (Table 11.5). The high acreage with the FWS is due to the very large size of the Baca NWR, 92,000 acres. Counties, TNC, and National

Table 11.5. Permanent, Semi-Permanent, Seasonal Hydroperiods by Ownership

Period	Hydroperiod	BLM	BOR	CPW	NPS	SLB	USFS	USFWS	TNC	COUNTY	PRIVATE	Grand Total
1984-1987	Permanent	589	336	643	30	868	0	1578	71		5078	9194
	Semi-Permanent	582	765	454	125	592	1	4435	385	1	9800	17140
	Seasonal	755	311	952	408	1349	5	9595	1399	1	42530	57304
1988-1993	Permanent	536	385	503	47	955		842	44		3176	6487
	Semi-Permanent	953	471	497	425	617	1	3292	364		8143	14763
	Seasonal	575	333	295	536	752	1	5002	1106	1	13564	22165
1994-1999	Permanent	558	387	510	54	968		866	58		3285	6686
	Semi-Permanent	870	404	363	280	479	1	2798	239		6931	12364
	Seasonal	529	254	227	402	549	0	4084	837	1	11475	18357
2000-2004	Permanent	614	128	507	26	694	0	582	9		2957	5516
	Semi-Permanent	693	314	290	143	365	1	1280	174		4744	8005
	Seasonal	599	354	317	120	240	2	1820	223	2	8667	12344
2005-2011	Permanent	641	370	594	6	536	1	600	34		3511	6292
	Semi-Permanent	566	143	322	104	327	1	990	138		5586	8176
	Seasonal	648	329	503	144	280	3	3200	207	1	18748	24063
2013-2017	Permanent	729	378	561	30	307	0	619	39		3937	6601
	Semi-Permanent	546	250	386	84	362	0	1289	157		6216	9288
	Seasonal	823	473	516	130	367	5	4628	458	1	20842	28243

Park Service (NPS) have the least amount of wet acres. In the SLV, The Nature Conservancy (TNC) has acted as a middle man in acquiring lands that are then passed over to other entities. Since those boundaries have changed across time periods, lands contained in the TNC category may now be under other ownership or natural resource agency management. Based on the elevation limit for the project of below 8,500 ft, very little of USFS land falls within the project area, thus the small number of wet acres for this agency. Across time periods the BLM and BOR have maintained similar amounts of acres in each hydroperiods with little apparent change in average acres wet. The other federal and state agencies have seen overall decreases in the average acres in each hydroperiod across time periods (Figure 11.10). County and USFS acres were not included in the figures because there were so few acres (less than 5 acres in each period). Lands owned by the State of Colorado (CPW and State Land Board - SLB; Figure 8.1, Appendix I) have similar patterns across time for each of the hydroperiods. Based on the amount of wet acres on SLB lands and the continued decline of resources, identification of the quality and health of those wet acres may provide an opportunity for future partnerships and cooperative efforts with the SLB.

These results indicate that while wet acres have diminished over time and across all ownership, private lands are extremely important in providing available resources throughout the year in all seasons and hydroperiods. Maintaining and sustaining the agricultural landscape of the SLV will be more important in the future as water continues to be more limited.

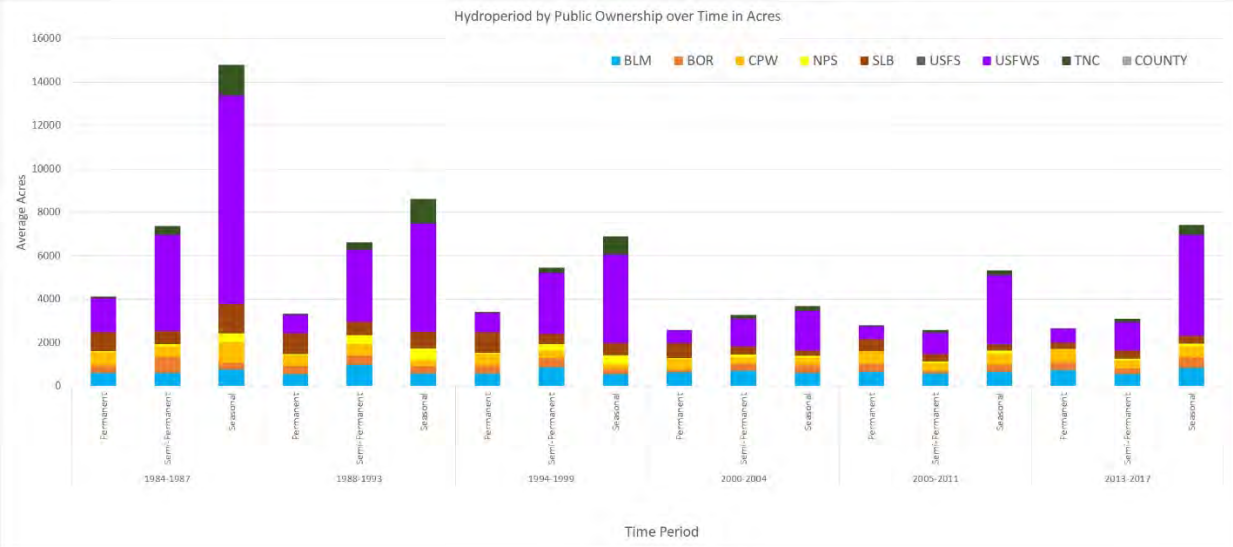

Figure 11.10. Hydroperiod by Public Ownership over Time in Acres

11.2 Specific Species Analysis

A total of 35 species were identified during the development of the Assessment. The partners picked three species to focus on whose habitat needs would reflect almost all of the different habitat types during each season to help identify where limiting resources may exist for all 35 species. The information provided in section 11.1 was further analyzed using the GIS vegetation layer that exists for seven of the most important public wetland/riparian areas in the SLV.

11.2.1 Cinnamon Teal

The cinnamon teal is a small dabbling duck in the family Anatidae. In the SLV, cinnamon teal use a wide variety of wetlands, from spring migration through nesting and into fall migration. During breeding and migration, cinnamon teal are widely distributed throughout the Great Basin and Intermountain West; they winter primarily in coastal areas and the interior of Mexico. The cinnamon teal is currently not federally or state listed as threatened or of concern but loss of wetlands limits suitable habitat, and local populations are detrimentally impacted by heavy metals and other water quality issues. The Colorado Breeding Bird Atlas states (Wickersham, 2016) that there are no statistical trends for cinnamon teal populations in North America. The cinnamon teal is a CPW Wetlands Program Tier 1 priority species. Cinnamon teal are common and widespread throughout the SLV during migration and breeding using a variety of wetlands, including alkali playas, temporarily flooded wet meadows and pastures, and emergent vegetation and open water in seasonal and semi-permanent wetlands and permanent water bodies. They commonly nest in relatively short, dense herbaceous vegetation, but also construct over-water nests in tall emergent habitats. Key public areas for cinnamon teal in the SLV during all life cycle stages include the Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, San Luis Lakes State Wildlife Area, and Rio Grande State Wildlife Area.

Complexes of different freshwater and alkaline wetland types in close proximity benefit cinnamon teal by providing a variety of habitat structure, water depths, and food types necessary to meet annual cycle needs. Given changes in water administration and agricultural crop practices the following needs should be considered:

- Large fluctuations in water levels (drying or flooding) during nesting can jeopardize nest success.
- In the SLV, water availability is limited in February and March prior to the surface and groundwater irrigation rules and regulations presumptive start date of April 1, therefore public lands with groundwater wildlife adjudications are extremely important.
- Promoting winter sheet ice in late fall, where available, may help provide some early spring habitat.

The habitat matrix developed for the cinnamon teal (Table 11.8 and also in the cinnamon teal fact sheet in Appendix 18) displays when the teal are present in the SLV, what life cycle event they are going through, and the habitat types that provide the required resources for those events. The habitat types listed in the table correlate to the habitat types in the GIS vegetation layer for the public lands. Teal begin migrating into the SLV in March and are in a 'Pre-breeding' state to prepare for the breeding/nesting season. All five of the habitat types identified as required for teal during their time in the SLV are important during this life cycle event. Nesting requires structural elements that the birds may find in short emergent, wet meadows, and tall emergent habitats. The habitat needs presented in Table 11.6 correlate to the monthly wet habitat availability information from 1984 to 2017 in Figure 11.11.

Table 11.6. Cinnamon teal SLV habitat, timing, and life cycle event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water			Migration						Migration			
			Pre-Breeding									
						Brood Rearing						
								Post-Breeding				
Playa			Migration							Migration		
			Pre-Breeding									
						Brood Rearing						
								Post-Breeding				
Short Emergent			Migration							Migration		
			Pre-Breeding									
				Nesting								
						Brood Rearing						
								Post-Breeding				
Tall Emergent			Migration							Migration		
			Pre-Breeding									
				Nesting								
						Brood Rearing						
								Post-Breeding				
Wet Meadow			Migration							Migration		
			Pre-Breeding									
				Nesting								
						Brood Rearing						
								Post-Breeding				

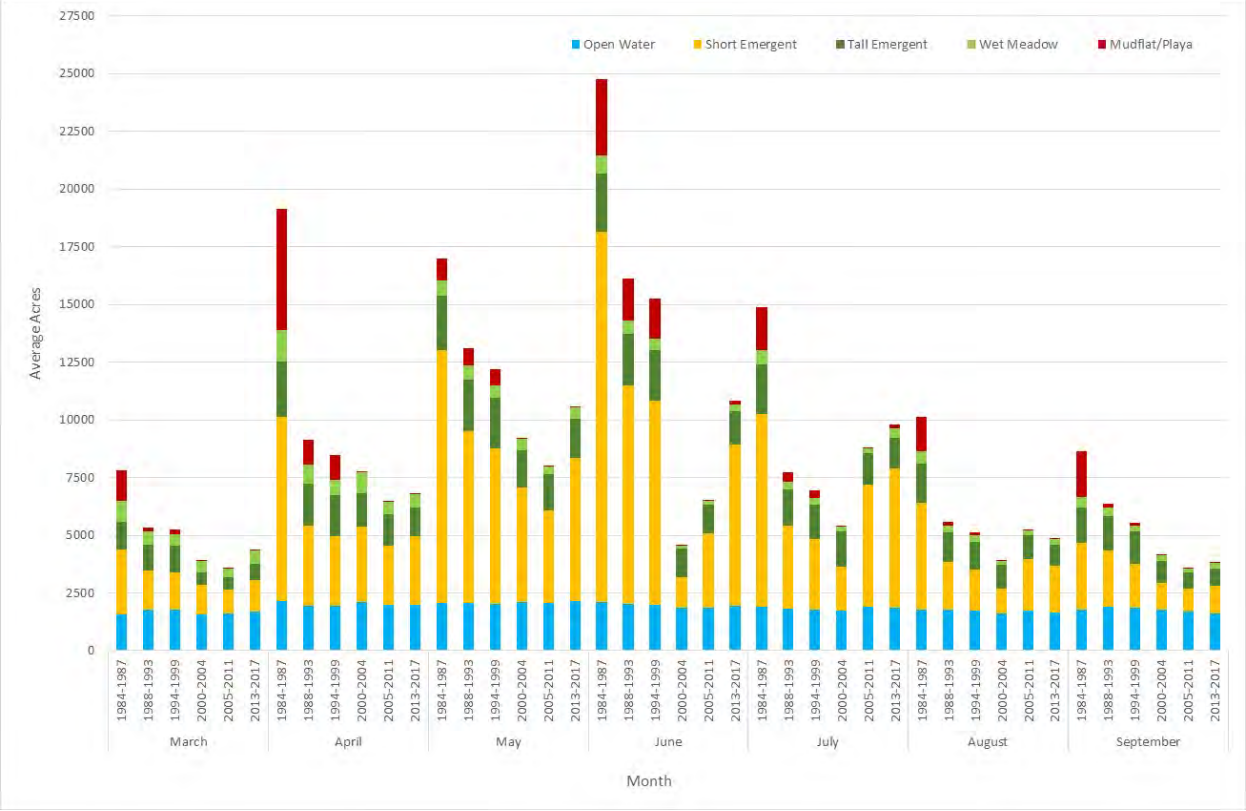

Figure 11.11. Habitat Types by Month and Time Period in Acres for Cinnamon Teal

The greatest number of available acres for each month for each habitat occurred during the first period (1984-1987). Over time, March and September are similar in the amount of resources by habitat type.

Interestingly, the mudflat/playa habitat has decreased to nearly zero during any month compared to pre-drought conditions in 2002. Short emergent habitats in June and July have rebounded from the drought years. Overall, availability of open water habitats on these public lands seems to have remained fairly consistent over time.

Analysis of habitat types by month over each period for each of the public lands further describes where and when resources were available along with how those resources have changed over time. For example, the available habitat by type in March across time and on each of the 7 public areas shows that early spring habitat is limited except on the Russell Lakes SWA and has decline over time on all other areas Figure 11.12 (See Appendix II for charts of all months, Figures 11.13, 11.14, 11.15, 11.16, 11.17, 11.18). Of interest are the changes over time in habitat availability on specific public lands. The Baca NWR provided by far the most mudflat/playa habitat than any other public area prior to the 2002 drought. After that time, the mudflat/playa habitat is fairly low to non-existent across time in all other areas. In general, habitat for cinnamon teal has decreased over time, is more limited in the fall, and there is less diversity with respect to the types of habitat available on each area. Between March and April, available habitat almost doubles in acres, generally from about 1,200 ac to over 2,000. Acres stay about at this level over time although some areas have distinctly less habitat such as smaller sized properties like Higel and Rio Grande SWAs that are tied to water fluctuations in the Rio Grande. Available habitat decreases in all public areas as the summer progresses with almost all providing less than 1,000 ac available for cinnamon teal in late August and early September. The Alamosa NWR and

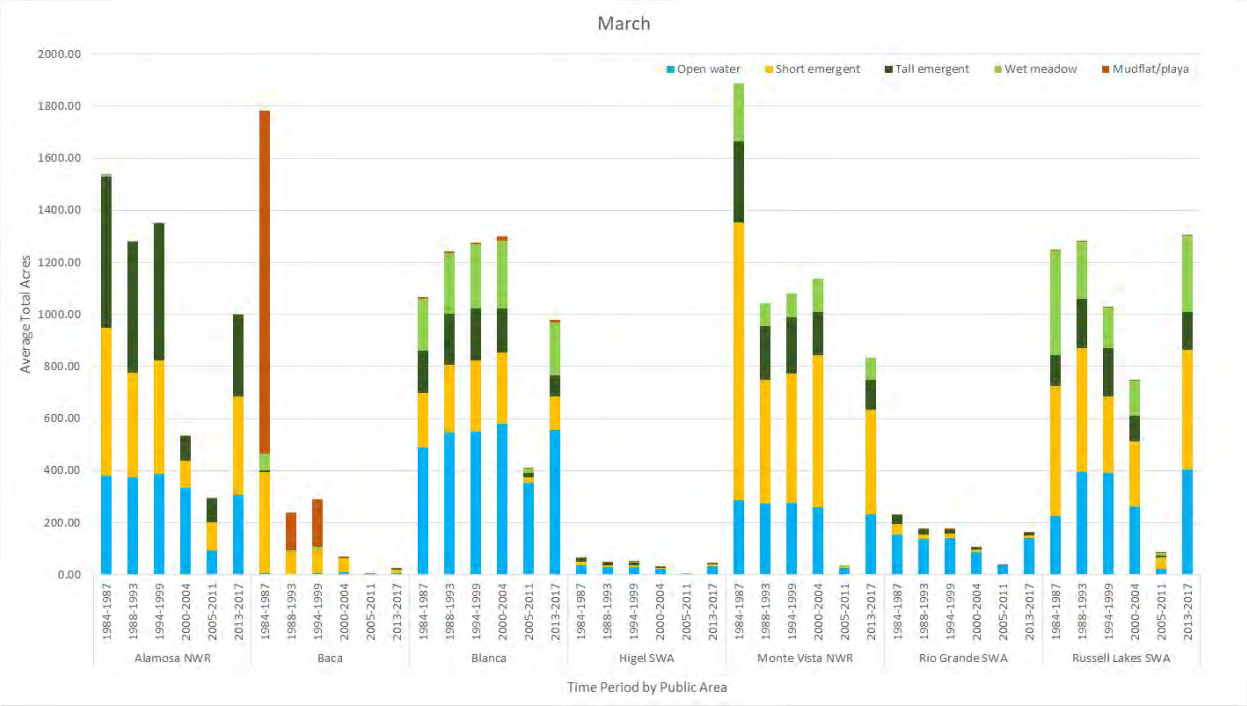

Figure 11.12. Available habitat types in March over the years by public land for Cinnamon Teal.

Blanca Wetlands are the only areas that have been able to maintain reliable resources into the fall period. Wet meadow habitat is the least available habitat across time periods after the mudflat/playa habitat. This type of habitat is usually comprised of shorter grasses such as saltgrass or foxtail barley, shallow water depths (a few inches) for short durations.

Unpublished spring waterfowl migration data from Russell Lakes SWA over the past decade indicates that dabbling ducks are arriving in the SLV 1.8 days earlier every year and diving ducks are arriving 0.7 days earlier per year (CPW unpublished report). Peak migration now occurs in March prior to the irrigation season which begins presumptively, April 1st. Thus, agency land managers dependent upon surface water to provide resources for early migrants in February or March will not be able to do so due to irrigation season restrictions. Areas such as Russell Lakes SWA and the Monte Vista NWR that have groundwater wells with wildlife adjudications allowing water use outside of the irrigation season will be increasingly important in order to provide these resources to migrating waterfowl. Given the changes to groundwater regulation and the cost to pump wells, the Monte Vista NWR has reduced their use of wells. This curtailment is illustrated in the decline identified in the GIS analysis showing less available resources over time on that area.

11.2.2 Greater Sandhill Crane

The greater sandhill crane is a large, long-legged and long-necked bird in the family Gruidae. Virtually the entire population of Rocky Mountain greater sandhill cranes migrate through and stage in the San Luis Valley during the spring and fall. Sandhill cranes are widely distributed throughout North America. The Rocky Mountain Population of greater sandhill cranes is comprised of about 20,000 cranes that breed in Idaho, Montana, Wyoming, Utah, and northern Colorado, and winter in New Mexico, Arizona, and Mexico. Most of these cranes move through Colorado during spring and fall migration and spend 1-2 months in the SLV during each migration, September-November and February-April. Several thousand cranes (primarily lesser sandhill cranes *A. c. canadensis*) from the Mid-Continent Population of sandhill cranes also migrate through the SLV. The Rocky Mountain Population of sandhill cranes are hunted throughout their range except in Colorado. The population is stable and is carefully monitored. Loss of wetland and associated upland habitat throughout the range is a conservation concern as are new regulations related to irrigation practices in the SLV that restrict water use before April 1 annually. The species is also listed as a Tier I priority species for the state of Colorado and is a Colorado State Species of Concern.

Because sandhill cranes use the SLV during migration, their habitat requirements are varied. Cranes require undisturbed roost sites and loafing areas; these are usually characterized by open, shallow water with no vegetation or short vegetation. Cranes also require foraging habitats where they can easily obtain energy and other nutritional requirements. They feed in wetlands on or near roost and loafing sites, and also move to croplands where they can feed on high-carbohydrate foods.

Key public areas for cranes in the SLV include Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Baca National Wildlife Refuge, Blanca Wetlands, Russell Lakes State Wildlife Area, Rio Grande State Wildlife Area, and San Luis Lakes State Wildlife Area.

Cranes need productive, undisturbed wetland roost and loafing areas throughout the SLV. These wetland habitats are most beneficial to cranes when they are near crop fields, providing easy access to food. Farming practices that allow waste grain to be available for foraging cranes, especially in spring, should be encouraged. Given changes in water administration and agricultural crop practices the following needs should be considered:

- Water availability is limited in February and March prior to the surface and groundwater irrigation rules and regulations presumptive start date of April 1, therefore public lands with groundwater wildlife adjudications are extremely important.

- Due to changes in water management, barley and other grains may not be as prevalent, in addition, fall disking of fields that leave bare dirt rather than stubble and waste grain may affect available foraging areas; discussion with local farmers in close proximity to public areas managed to provide crane roosting should be encouraged.
- Promoting winter sheet ice in late fall, where available, may help provide some habitat as ice melts and recedes in February and March.

The habitat matrix developed for the sandhill crane (Table 11.7 and in the sandhill crane fact sheet in Appendix 18) displays when the cranes are present in the SLV, what life cycle event they are going through, and the habitat types that provide resources for those events. The habitat types listed in the table correlate to the habitat types in the GIS vegetation layer for the public lands, with the exception of crop lands. Availability of croplands in March for foraging is not dependent upon irrigation or flooding of those lands. However, past studies (Iverson et al. 1987) show that crop lands that lie in close juxtaposition to loafing and roosting areas are preferred. Cranes begin migrating into the SLV in February and continue on their route to northern breeding grounds by mid to late April. They migrate back through the SLV during the fall beginning in September and continuing through November as they make their way south for the winter. The habitat types in Table 11.7 are presented in number of acres wet during each month over each time period on public lands in Figure 11.19. For example, the available habitat by type in February across time shows that early spring habitat is currently limited except on the Russell Lakes SWA and Blanca WMA (areas that have groundwater wildlife adjudications) and has declined over time on all areas Figure 11.20 (See Appendix II for charts of all months, Figures 11.21, 11.22, 11.23, 11.24, 11.25).

Table 11.7. Sandhill crane SLV habitat, timing, and life cycle event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop		Migration								Migration		
Grassland		Migration								Migration		
Open water		Migration								Migration		
Riparian		Migration								Migration		
Short emergent		Migration								Migration		
Wet meadow		Migration								Migration		

The greatest number of available acres for each month for each habitat occurred during the first period (1984-1987), with April providing the most resources across time periods. February and March appear to have the most variability across time periods with November consistently providing the least amount of resources. The most dramatic decline in available habitat overtime has occurred in February which highlights the decline of available habitat on public lands in the SLV since the mid-1990's. Open water and short emergent appear to have the highest number of acres consistently across months and time periods. Wet meadow habitat availability is greater in the spring than in the fall. The Alamosa NWR and Blanca Wetland WMA seem to have the most consistently available resources, although Russell Lakes SWA has been increasing the amount of habitat available, especially in early spring and late fall when other areas like the Monte Vista NWR have declined in availability (Figure 11.26). Declines in habitat availability for cranes at Monte Vista NWR is of concern because historically this refuge has been managed specifically for cranes and is central to public viewing opportunities like the annual Monte Vista Crane Festival started in 1983.

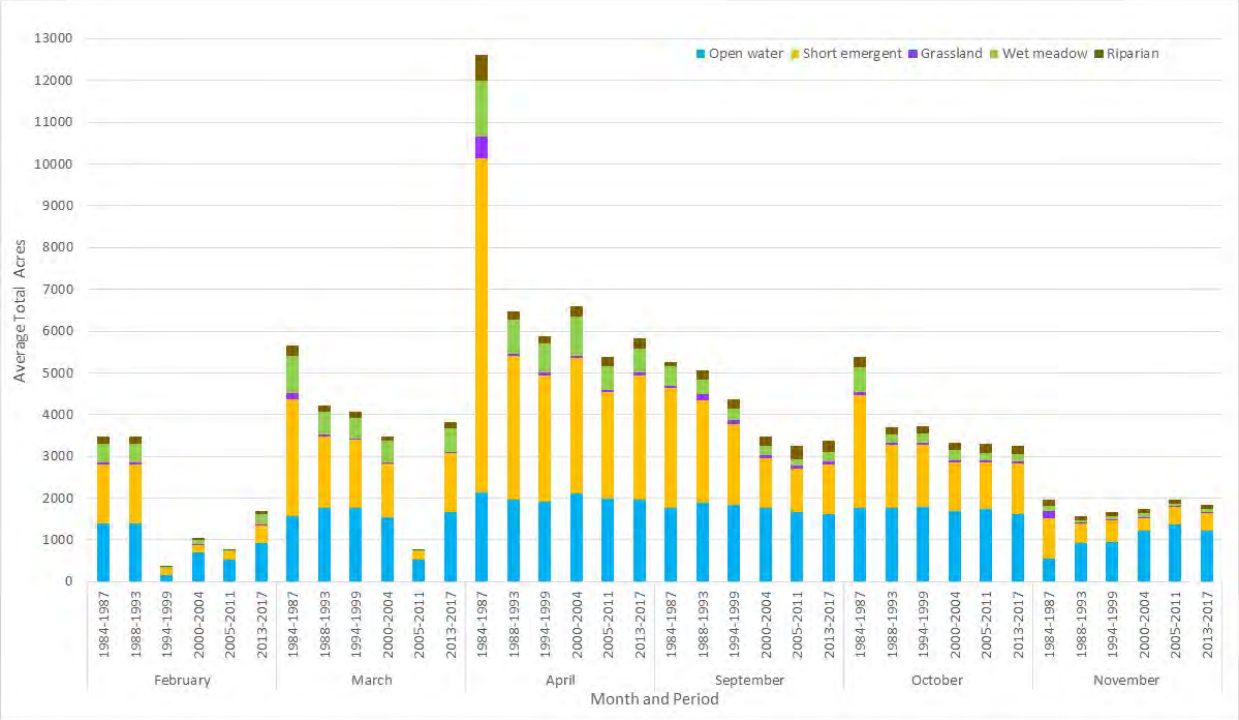

Figure 11.19. Habitat Types by Month and Time Period in Acres for sandhill crane

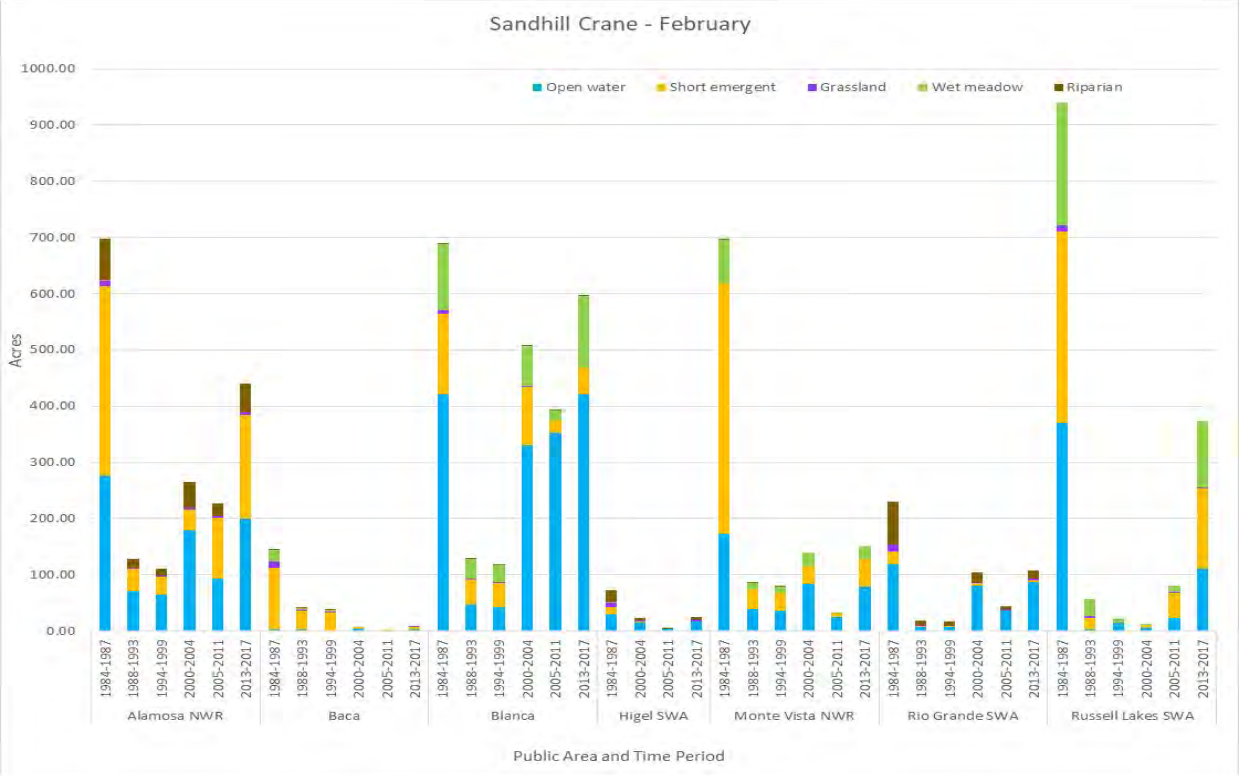

Figure 11.20. Available habitat types in February over the years by public land for sandhill crane.

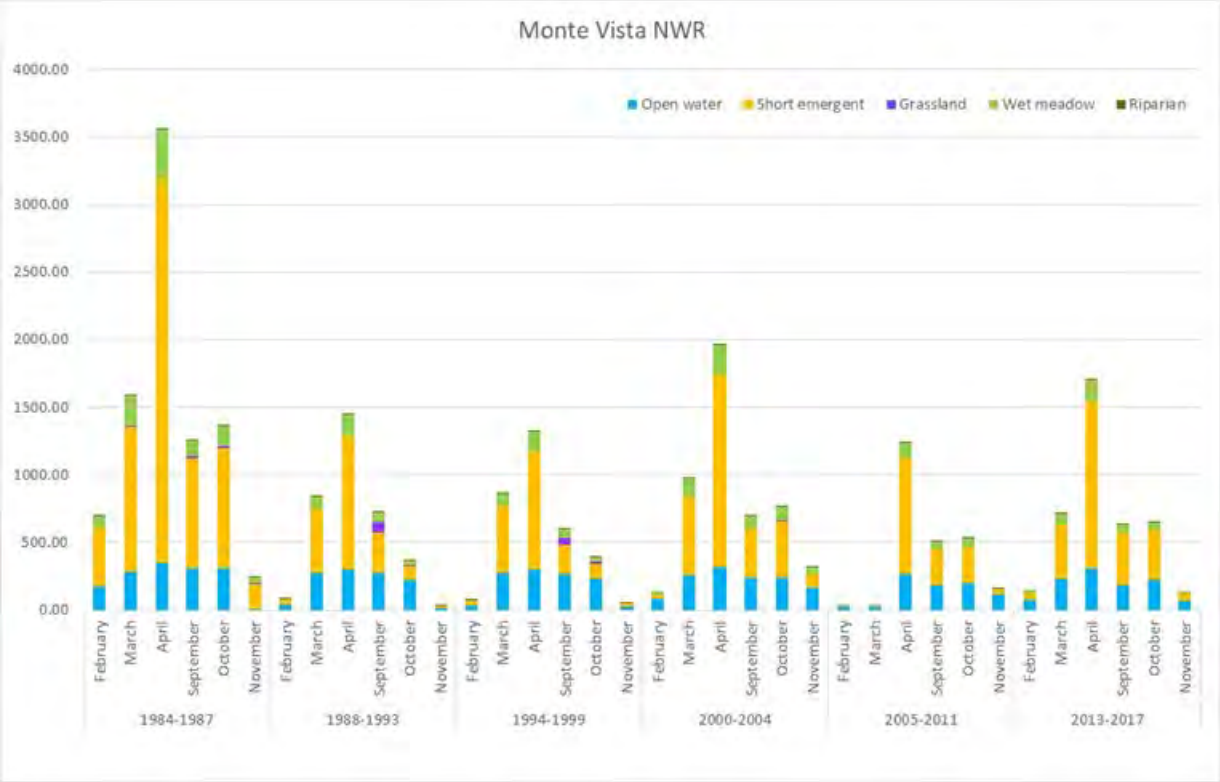

Figure 11.26. Habitat types on the Monte Vista NWR by month and Time Period for the sandhill crane.

11.2.3 White-faced Ibis

The white-faced ibis is a medium-sized wading bird in the family Threskiornithidae. The ibis nest colonially in dense, tall emergent vegetation in semi-permanent and permanent wetlands; foraging in hayfields, pastures, wet meadows, and shallow wetlands with short emergent vegetation.

White-faced ibis breed in the SLV and across much of the western United States, western Gulf Coast, Mexico, and South America. They winter primarily in coastal Louisiana and Texas, and into Mexico, as well as in southern California and Arizona. The Colorado SWAP (2016) has listed the bird as a Tier 2 species of concern and the BLM considers it a Sensitive Species. In the SLV, white-faced ibis are dependent upon large semi-permanent and permanent wetlands and playa lakes with stands of tall emergent vegetation for nesting habitat and roosting areas. Ibis use a variety of habitats for foraging habitat, including short emergent, wet meadow, shorelines and shallow open water portions of lakes and wetlands, and agricultural fields (primarily alfalfa). Extensive, productive feeding areas must be available in proximity to nesting sites in order for white-faced ibis to breed successfully. Wetlands that support nesting colonies should have stable water conditions during breeding, and avoid excessive drying or flooding. Disturbance at nesting colonies should be minimized. Key public areas for white-faced ibis in the SLV include the Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, Blanca Wetlands, and San Luis Lakes State Wildlife Area.

The habitat matrix developed for the white-faced ibis (Table 11.8 and in the white-faced ibis fact sheet in Appendix 18) displays when the ibis are present in the SLV, what life cycle event they are going through, and the habitat types that provide resources for those events. The habitat types listed in the table correlate to the habitat types in the GIS vegetation layer for the public lands. Ibis begin migrating

into the SLV in April and are in a 'Pre-breeding' state to prepare for the breeding/nesting season. All five of the habitat types identified as required for ibis during their time in the SLV are important during these life cycle events. Nesting requires structural elements that the birds may find in tall emergent and open water habitats. The habitat types in Table 11.8 are presented in number of acres wet during each month over each time period on public lands in Figure 11.27.

Table 11.8. White-faced ibis SLV habitat, timing, and life cycle event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Short Emergent				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Tall emergent				Migration					Migration			
				Pre-Breeding								
				Nesting								
					Brood Rearing							
								Post-Breeding				
Wet Meadow				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				

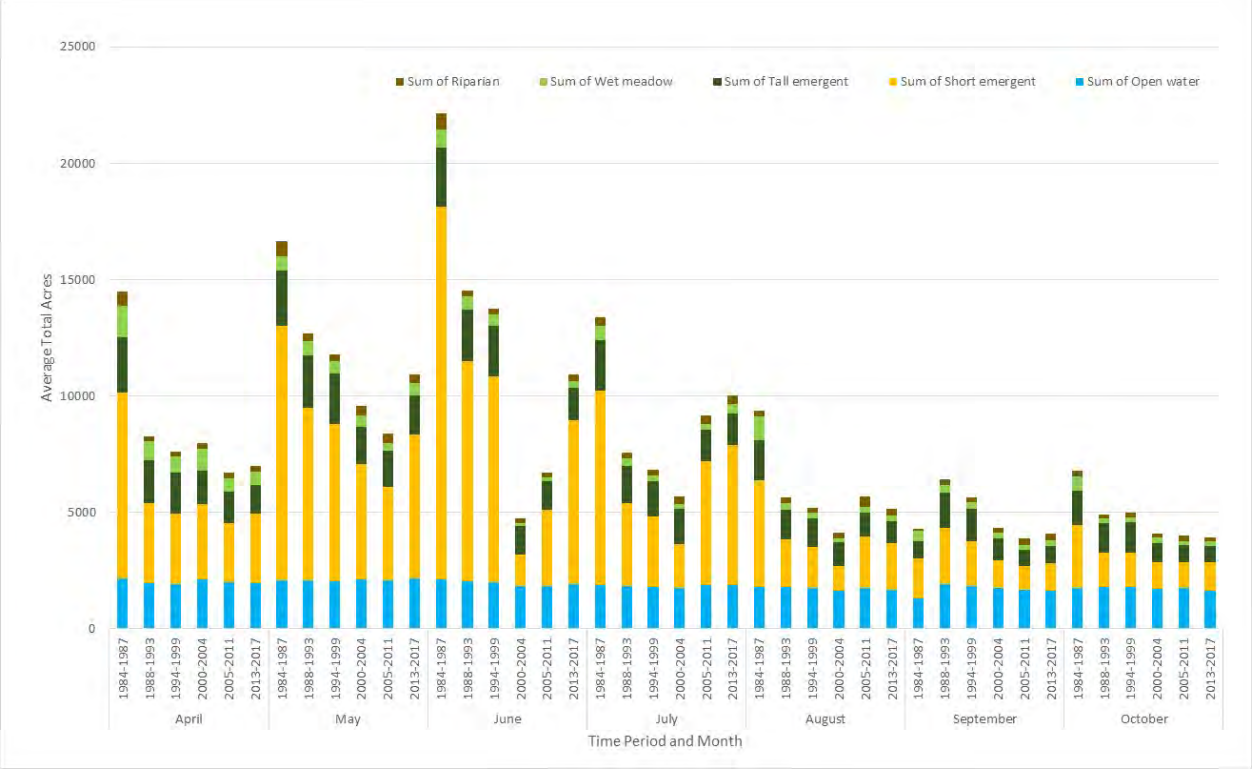

Figure 11.27. Habitat Types by Month and Time Period in Acres for white-faced ibis.

The greatest number of available acres for each month occurred during the first period (1984-1987) with the exception of September during the 1988-1993 time period. Available acres declined during the driest year on record (2002) but have rebounded to some extent during some months such as May, June, and July. However, early spring and fall represents the least amount of available acres with little to no increases since the lows in the early 2000's. Open water and short emergent appear to consistently maintain the highest number of acres across months and time periods. Wet meadow habitats are limited but appear to be most available in spring. For example, the Alamosa NWR and Blanca Wetland WMA seem to have the most consistently available resources, although Russell Lakes SWA has been increasing the amount of habitat available, especially in early spring and late fall when other areas like the Monte Vista NWR have declined in habitat availability Figures 11.28, 11.29, and 11.30 (See Appendix II for charts of all months, Figures 11.31, 11.32, 11.33, 11.34, 11.35, 11.36, 11.37). Tall emergent habitats increase in availability through the spring into summer and then decline into the fall (Figure 11.31).

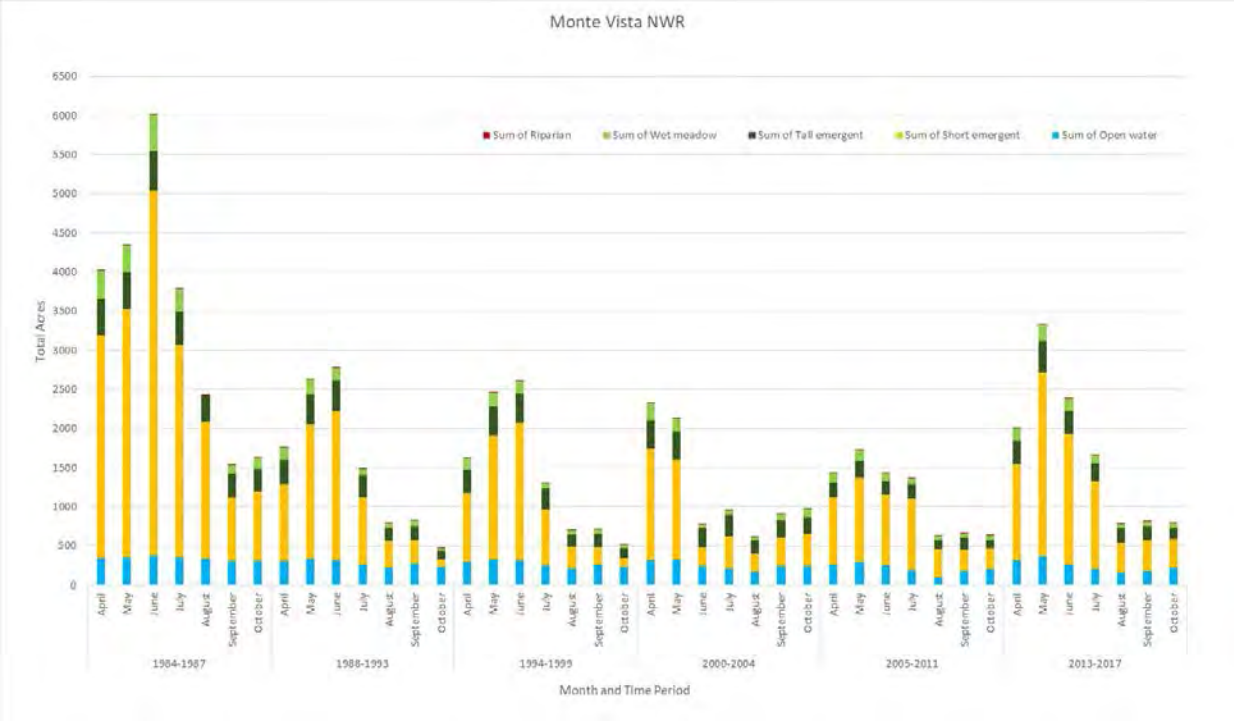

Figure 11.28. Habitat Types on the Monte Vista NWR by Month and Time Period for white-faced ibis.

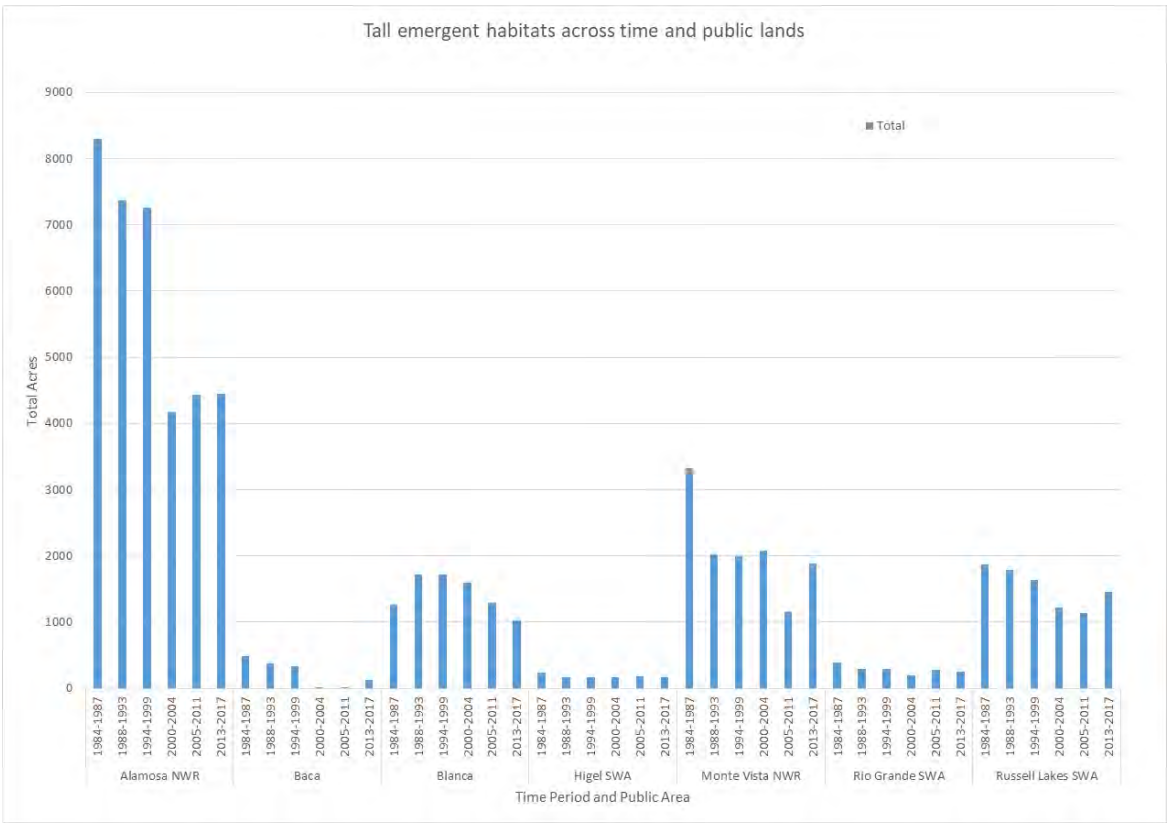

Figure 11.29. Tall emergent habitats across time periods and public areas

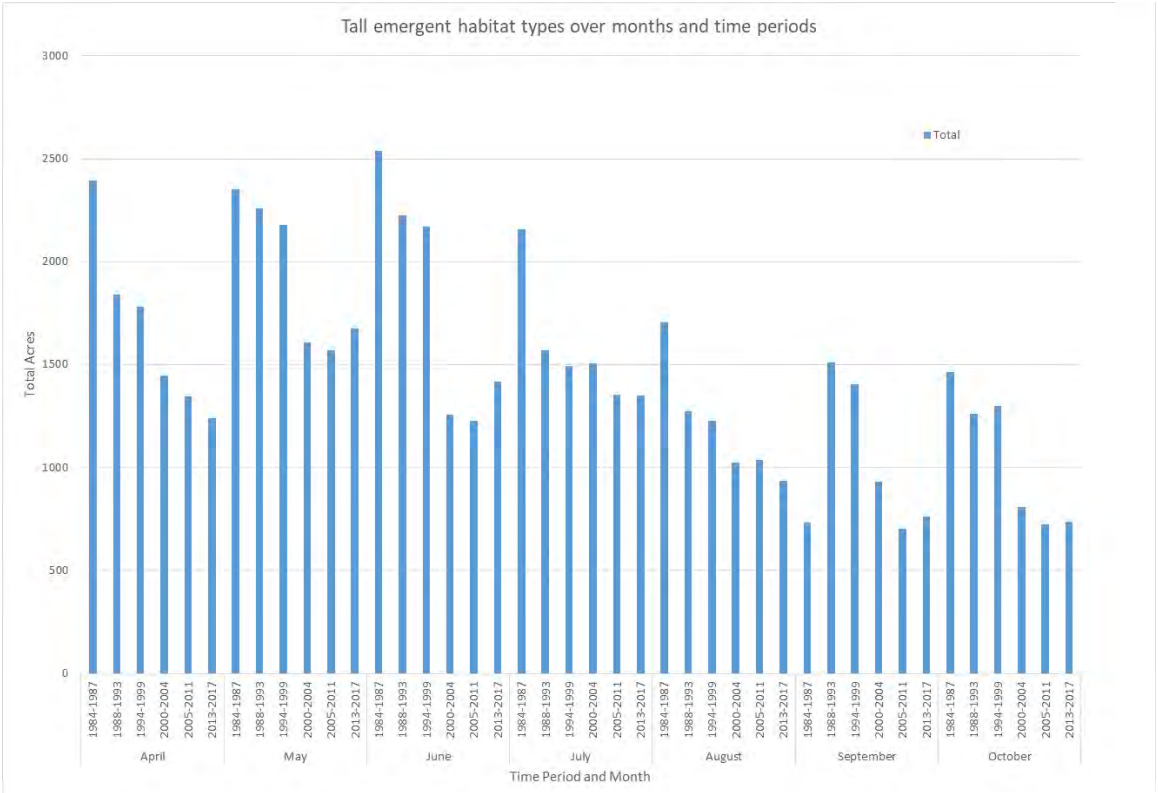

Figure 11.30. Tall emergent habitats available April through October on public lands over each time period for white-faced ibis

11.3 Conclusions

In general, the extent of flooded acres over time has decreased across the SLV. Climatic conditions have ranged from the wettest period (1980's) to the driest (2002). Several consistent and dramatic trends are apparent:

- Wet acres have declined by almost half since the 1980's.
- Private lands have the majority of wet acres.
- Early spring and fall wet acres are the most limiting.
- Wet meadow, grassland, riparian, and mudflat/playa habitat have declined the most and are the most limited types of habitats.
- The Baca and Monte Vista NWRs have seen the greatest decline in habitat across public areas.

The loss of habitat from the wet years and the recovery of habitat from the drought years is an important consideration for future management of habitat for wildlife in the SLV. Private lands contain the largest number of acres on average for all hydroperiods and are an integral component for providing resources to wildlife now and in the future. Resources are most abundant in the spring, declining through the summer and into the fall period. However, early spring (February and March) available resources are very limited. Early spring migrants such as the crane that depend upon wet areas for roosting will potentially be more concentrated on fewer and/or new, possibly less suitable areas. When wildlife are forced to concentrate in higher numbers on marginal habitat, the health of individuals typically suffers, potentially leading to population level declines by decreasing reproductive success and/or adult survival rates. The Monte Vista NWR has provided (since the early 1950's) resources for birds annually, however, given groundwater declines and the cost of pumping wells, this refuge has seen a large decline in available resources in recent years. The Alamosa NWR and Blanca WMA appear to have the most consistent resources across years and by habitat type. The Baca NWR has lost the most significant number of acres since the 1980's. And finally, the Russell Lakes SWA has recently increased wet acres available and for this reason may be becoming more important in providing early spring and fall available wet acres. This is supported by unpublished CPW spring waterfowl migration surveys showing increased sandhill crane use at Russell Lakes SWA over the past 5 years.

12 Identification of Resource Decline and Recommendations

Wetland and riparian habitats historically occurred throughout the SLV with available resources varying widely with climatic conditions. Development of roads, towns, and water throughout the SLV have fragmented and modified the historic landscape changing the timing and location of available resources. Drought conditions coupled with declining groundwater tables and constraints created by the development of a groundwater irrigation season have limited and may continue to constrain future water resources necessary for managing existing wetland habitats for waterfowl and other wildlife on public lands. Cooperative efforts among natural resource agencies utilizing the information provided in this Assessment along with further analysis, research, and development of partnerships are key factors in continuing to provide habitat as water resources become more limiting. Maintaining the current agricultural landscape that also provides a majority of the wet acres for wildlife is an important component to the continued health and sustainability of wildlife in the SLV. Working with landowners to maintain existing agricultural activities is one important component. Voluntary conservation of private lands that provide available resources to wildlife has been identified as an important element to the continued sustainability of wetland habitats across the SLV as water management and resources are

developed or land use changes occur (SLV NWR Complex 2012; Colorado State Wildlife Action Plan 2015).

12.1 Declining Resources

Development of the Assessment has identified some key declines in resources based on past research and surveys, availability by season, hydrologic extent, and land ownership. Some of the most important results include:

- Wet meadows, grasslands, and riparian areas seem to have the lowest number of acres and appear to be declining.
- The Baca NWR has lost most of its wet acres, formerly providing 1000's of acres of wet meadow habitat.
- Alamosa NWR and Blanca Wetlands seem to have been able to provide the most consistent resources across time and habitat types.
- Early spring (Feb. and Mar.) migration habitat has declined and has some of the lowest wet acres on public areas, the exception is Russell Lakes which is providing more of this over time.
- Fall migration habitat has declined and has the least amount of wet acres in relation to season across years on public areas in the SLV.
- The northern end of the Closed Basin (Saguache Creek to San Luis Creek) has seen a large decline in wet acres over time.
- Mishak Lakes is a protected TNC property lying between Russell Lakes SWA and the Baca NWR; understanding how this area has been impacted by the decline in wet acres may provide an opportunity to improve and connect currently managed lands.
- Some of the State Land Board lands contain wet acres, little has been done to cooperatively work with this agency which may be a potential avenue for new partnerships in the future.

12.2 Recommendations

Based on the information compiled and GIS analysis the partners have determined some preliminary recommendations that can be built upon as more information becomes available and as partners explore various ways to implement changes in management to better meet declining resources.

12.2.1 Management

Water management plans are an important component to the management of the wetland complexes on public lands in the SLV. Based on the information compiled in the Assessment and analysis of new GIS information, it is apparent that there are constraints to providing wetland habitat for wildlife at the appropriate time of year. Plans should be developed based on the unique attributes of the wetland system on each of the areas, specifically incorporating natural processes and mimicking natural hydrologic conditions where possible but with an understanding of how individual wetlands function within the greater landscape. Wetland complexes providing a variety of habitat components will create a diverse assemblage of resources and meet the needs of a wide variety of wildlife and aquatic species. Water management should seek to provide resources for these species based on their life history requirements throughout the annual cycle as represented by the 35 priority species matrices developed for the Assessment. As water resources continue to diminish, efficient and effective management should be planned to maximize available water resources. Habitat needs range from permanent, tall emergent

wetlands to temporary playa wetlands dominated by saline and alkaline tolerant grasses such as saltgrass. Foraging, nesting, and shelter habitat types are necessary throughout various seasons of the year in juxtaposition to one another.

Documented declines in wet acres may have led to changes in use by wildlife across the SLV over time. Determining use of various wetland habitats on public lands by wildlife during different seasons and climatic conditions is important for wetland managers to understand in order to try and provide the most limiting resources. Monitoring strategies that encompass all public wetlands in the SLV is integral to understanding how and if wildlife populations have declined as wet acres have declined over the past 30 plus years.

The application of winter irrigation to various wetland units (winter sheet ice) provides early spring migration habitat as the ice slowly melts creating new and available wetland resources over a long period of time. Winter sheet ice also helps maintain high water tables within the area during a period of time when evapo-transpiration is at its lowest point thus allowing for the most efficient use of water resources that will be utilized by early spring migrants to the SLV.

Management personnel from public land agencies should meet annually, early in the year to review water and habitat management plans, identify opportunities to collaborate on providing high-priority habitats, and identify and discuss issues of concern. A second meeting should be held at the end of the year to review management actions. This bi-annual information sharing should be documented and available to managers to provide a historical record of water and wildlife management issues and actions in the SLV. Recommendations for wildlife and land management agencies include but are not limited to:

- Create an inter-agency wetland management and monitoring committee to develop SLV-wide plans.
- Initiate partnerships with other public agencies and organizations that have wetland resources e.g. State Land Board, the National Park Service, and The Nature Conservancy.
- Create partnerships among agencies to allocate resources in areas with the ability to provide limiting habitat (such as the Monte Vista NWR in early spring) at the right time of year.
- Prioritize ways to help improve/prevent further habitat declines at the Baca NWR.
- Use migration data showing trends of earlier arrival of migrants to work with DWR to discuss how to meet early spring water resource needs for waterfowl, cranes, and other wildlife on public areas.

12.2.2 Monitoring

- Continued monitoring of surface water availability over time and across the SLV using methods developed by the IWJV.
- Develop monitoring strategies that help determine where resources are most limiting at specific times of the year.
- Develop monitoring strategies that show how changes in allocation of resources may influence wildlife populations.

12.2.3 Specific Projects

- Vegetation Mapping of McIntire Simpson and San Luis Lakes (GIS) and update to the other 7 public areas already mapped; explore potential to map vegetation on private land conservation easements.
- Develop a crop information and structure layer (GIS).
- Develop a more accurate analysis of temporary hydroperiods with additional GIS information.
- Determine hydrologic extent of wetland types by integrating soils, vegetation, and the existing NWI layer.
- Determine if changes in hydroperiods from one time period to the next was a result of a particular wetland unit transitioning between different types (permanent to semi-permanent, etc).
- Provide fact sheets and GIS information to land trusts such as RiGHT to use in grant applications and identify the types of resources that may be available on potential conservation easements.
- Complete a 'scorecard' incorporating data compiled in the Assessment along with data from other ongoing studies in the SLV to help organizations prioritize conservation and restoration projects.
- Work with CNHP to develop a managed wetland Ecological Integrity Assessment to better interpret results seen in this GIS analysis.
- Conduct a more in-depth statistical analysis of changes in wet acres discussed in this document.
- Identify main causes for the decline in habitat on the Baca NWR and find ways to restore function to this area.

13 Conditions and Limitations

This report was prepared by Cary Aloia and Jenny Nehring of Wetland Dynamics, LLC in full partnership with biologists from the Bureau of Land Management, Colorado Parks and Wildlife, U.S. Fish and Wildlife Service, U.S. Forest Service, and Natural Resource Conservation Service. Information stated within this report was obtained through reliable sources such as scientific journals, state and federal natural resource agencies, and other professional organizations as well as the professional knowledge and experience of Cary Aloia and Jenny Nehring.

The GIS information provided by the Intermountain West Joint Venture and further analyzed for the San Luis Valley by Colorado Parks and Wildlife GIS specialists is built upon a number of assumptions which required combining seasonal data into blocks of years instead of a year by year basis. The scale of the data both spatially and temporally requires that the conclusions drawn from the data be general trends at a high level instead of specific information about a specific location or date. The scale of the data does not reduce the value of the data but puts limitations on the conclusions that can be drawn from the data.

Wetland Dynamics, LLC is not responsible or liable for errors or inaccuracies depicted or reported by other entities or persons. This report was compiled with an unbiased and professional perspective based on past and present work experience in the San Luis Valley, CO. Wetland Dynamics asserts that the information in this document was compiled with the best available information and intent.

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15 Appendix I: Figures

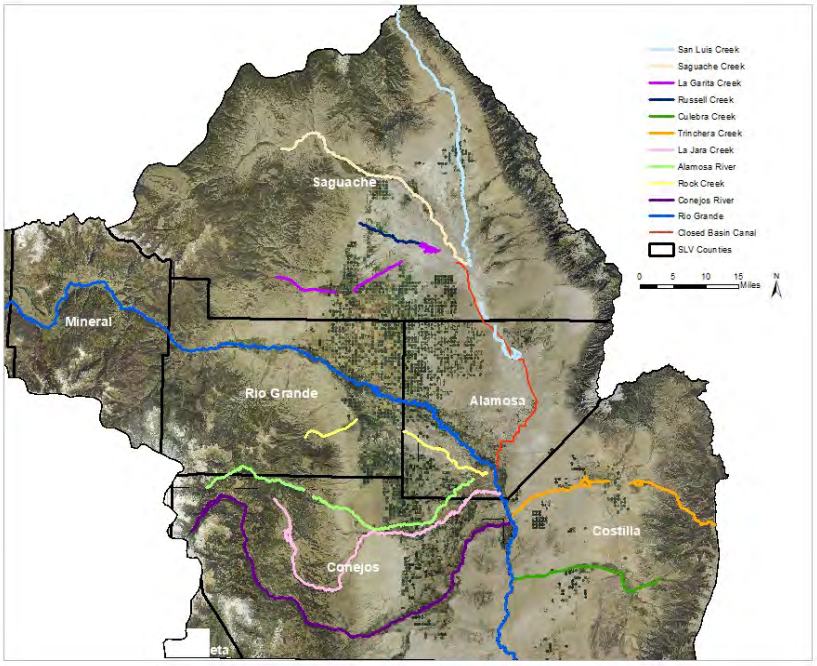


Figure 5.10. Major Rivers and Creeks in the SLV.

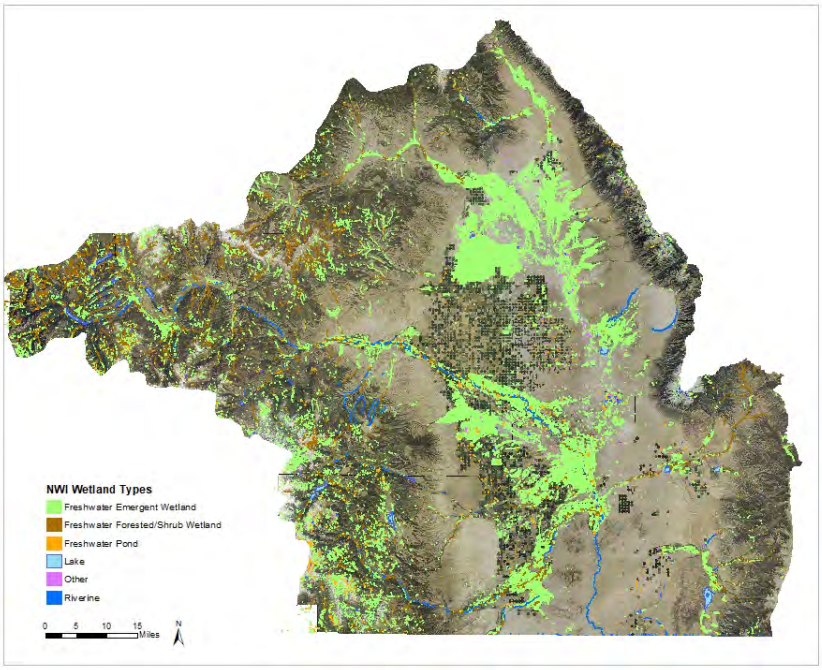


Figure 5.11. Cowardin Classification/National Wetland Inventory map of the SLV.

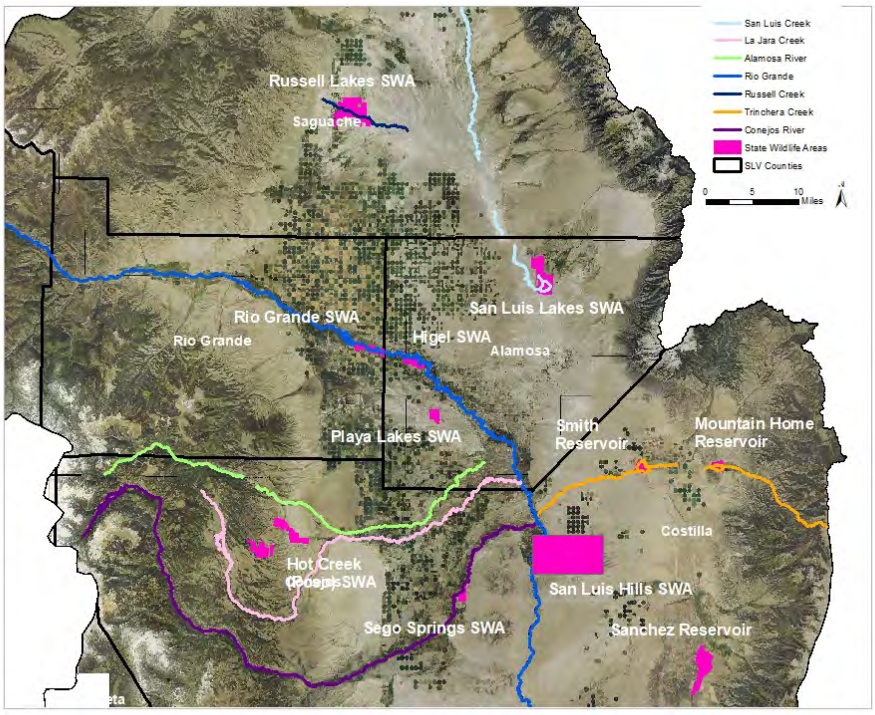


Figure 8.1. State Wildlife Areas and State Land Board lands, under 8,500 ft (note that the San Luis Hills SWA is approximate in size and location).

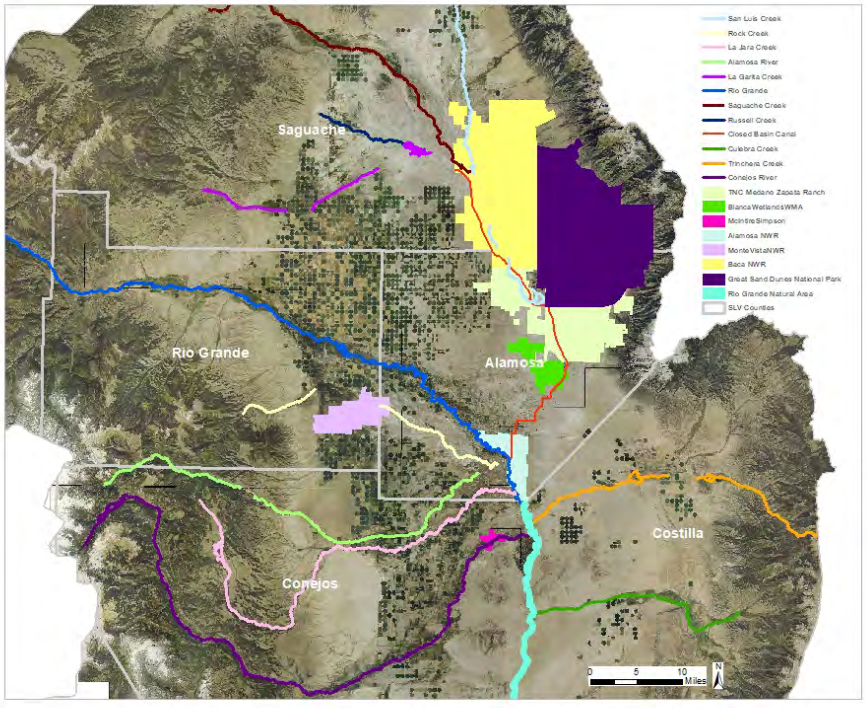


Figure 8.2. National Wildlife Refuges, Bureau of Land Management, Great Sand Dunes National Park, and other protected areas in the SLV.

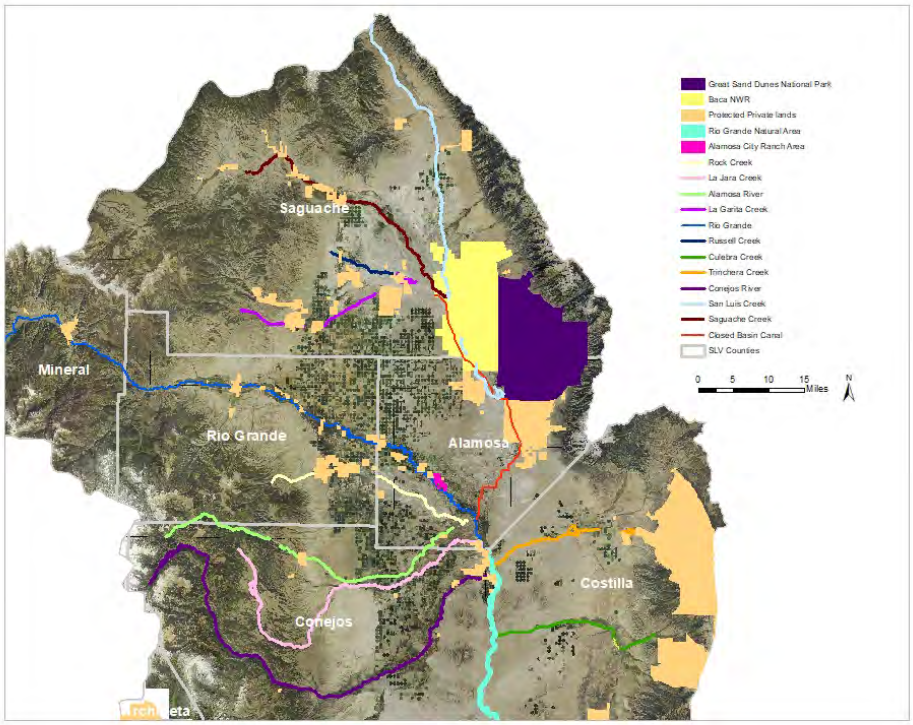


Figure 8.3. Protected private lands and other protected areas in the SLV.

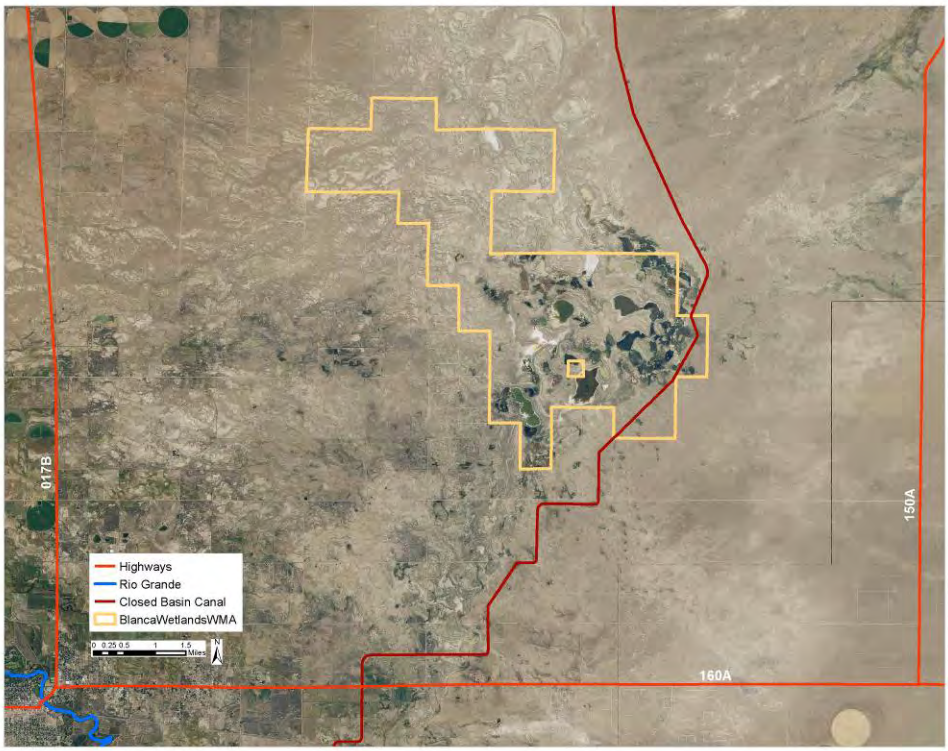


Figure 8.4. Blanca WMA location near Alamosa, CO.

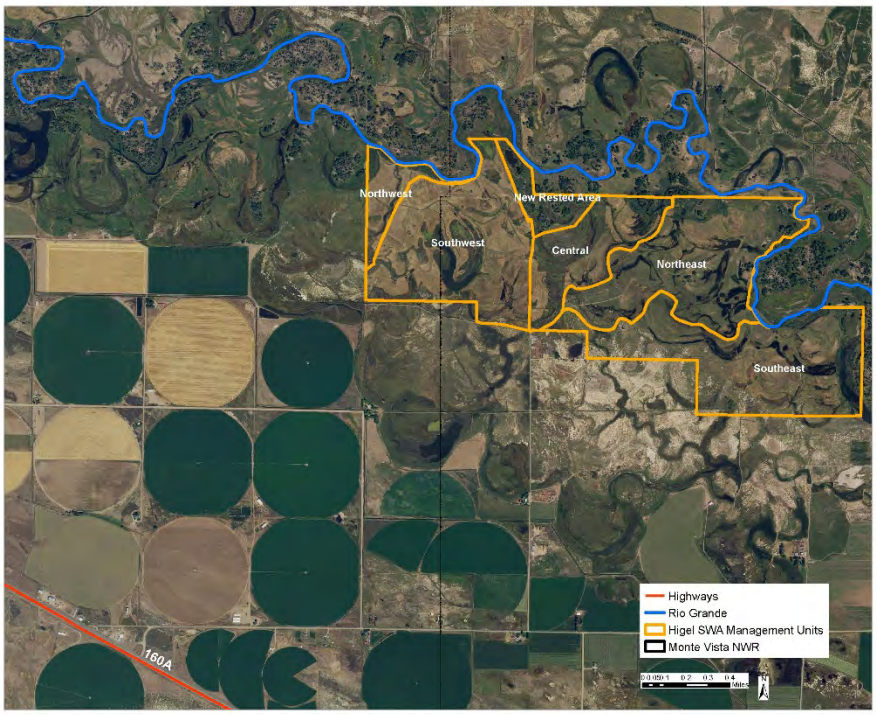


Figure 8.5. Higel SWA location between Monte Vista and Alamosa, CO.

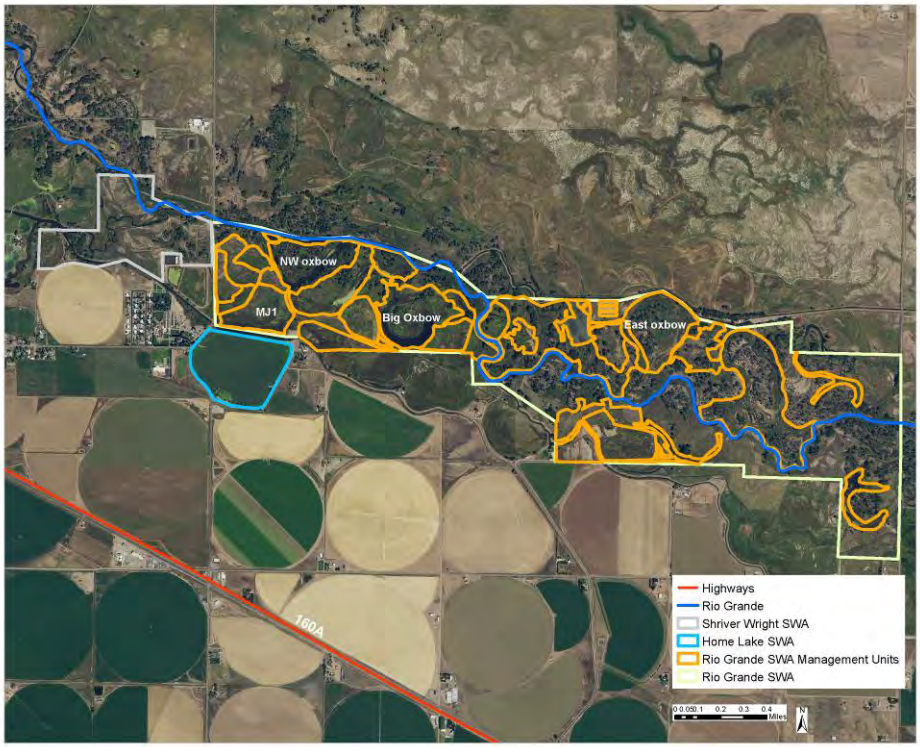


Figure 8.6. Rio Grande, Shriver/Wright, and Home Lake SWAs near Monte Vista, CO

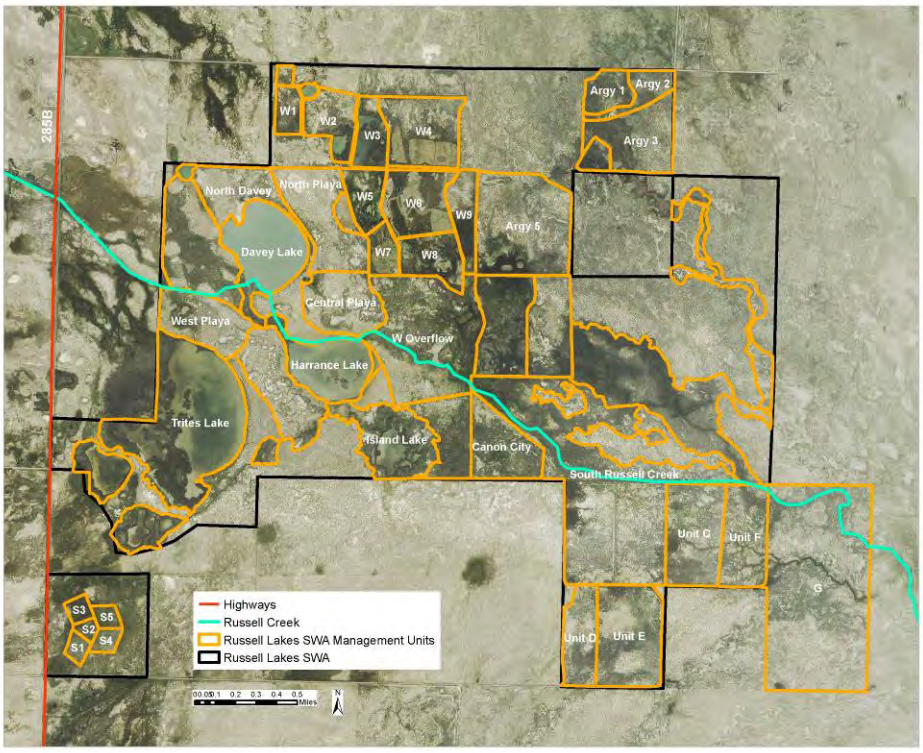


Figure 8.7. Russell Lakes SWA south of Sagauche, CO

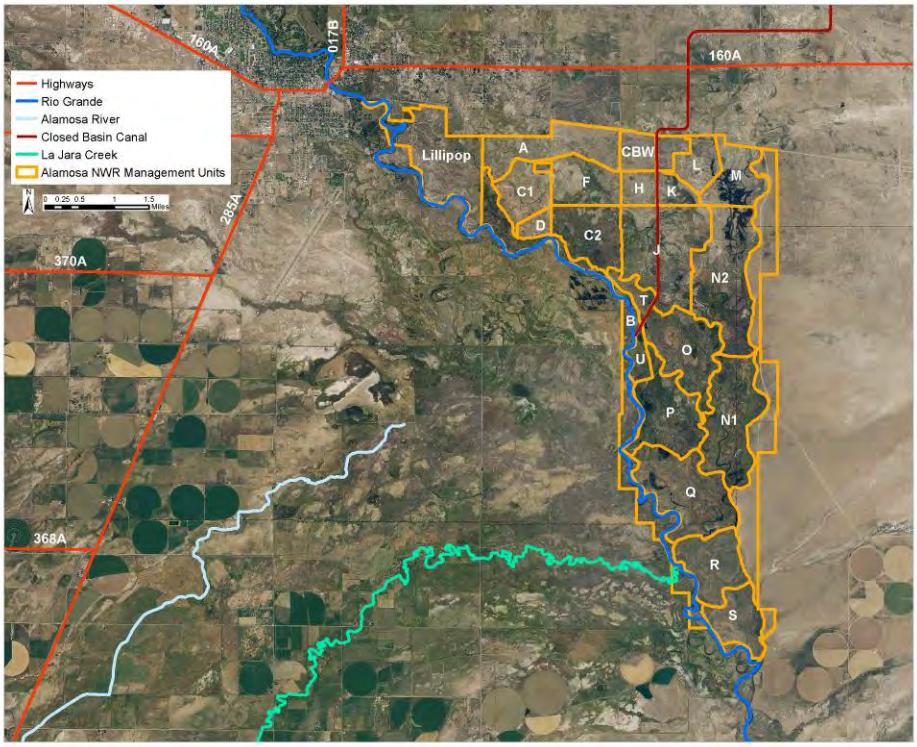


Figure 8.8. Alamosa NWR near Alamosa, CO..

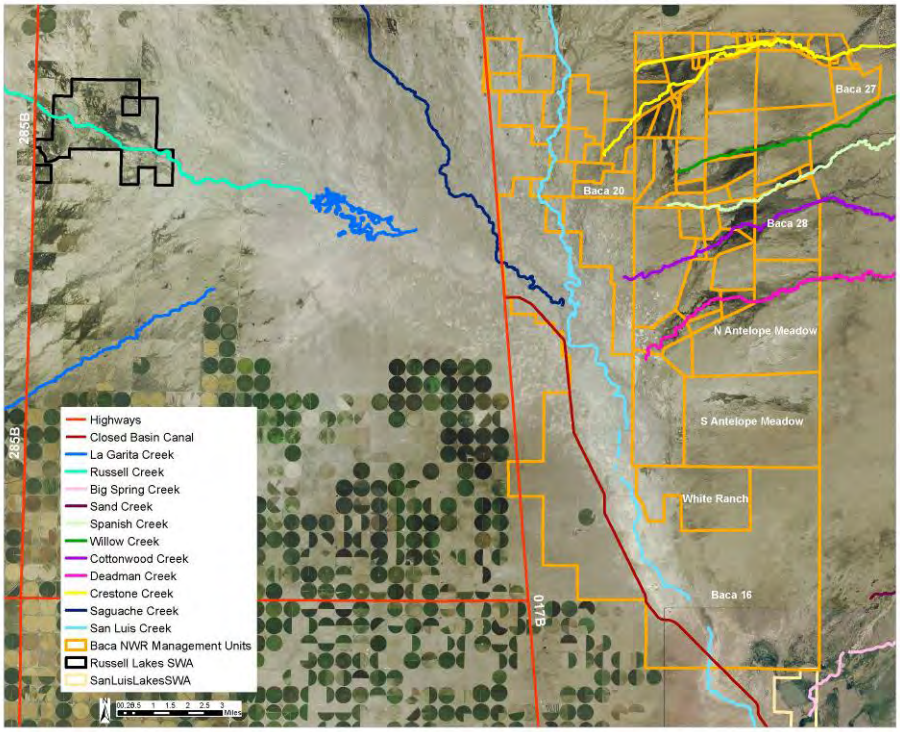


Figure 8.9. Baca NWR near Crestone, CO

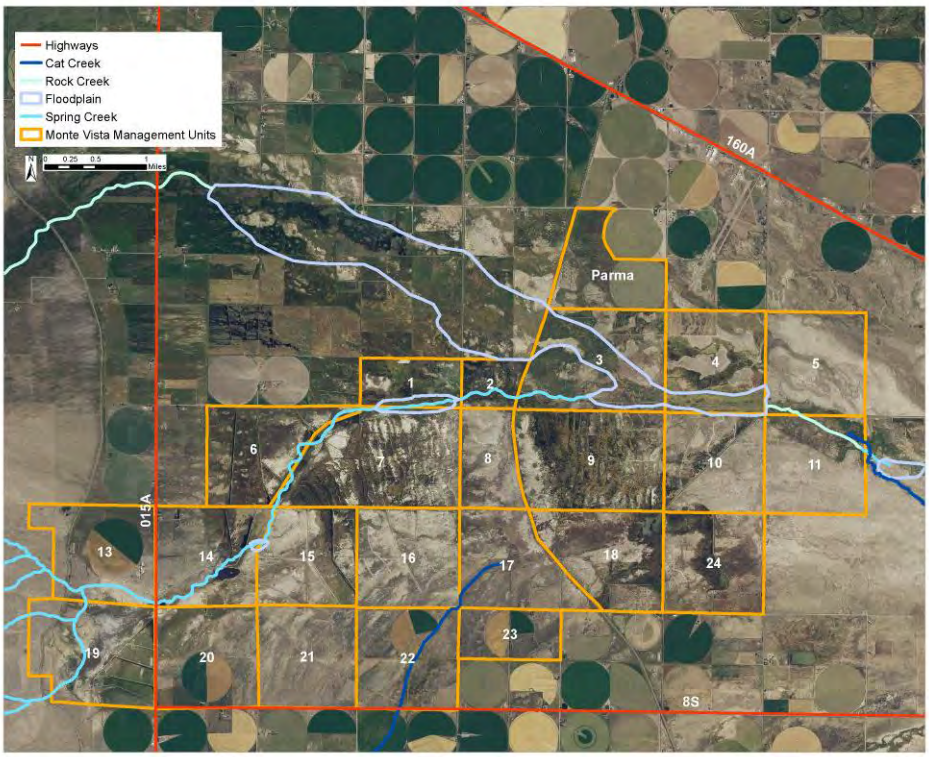


Figure 8.10. Monte Vista NWR south of Monte Vista, CO.

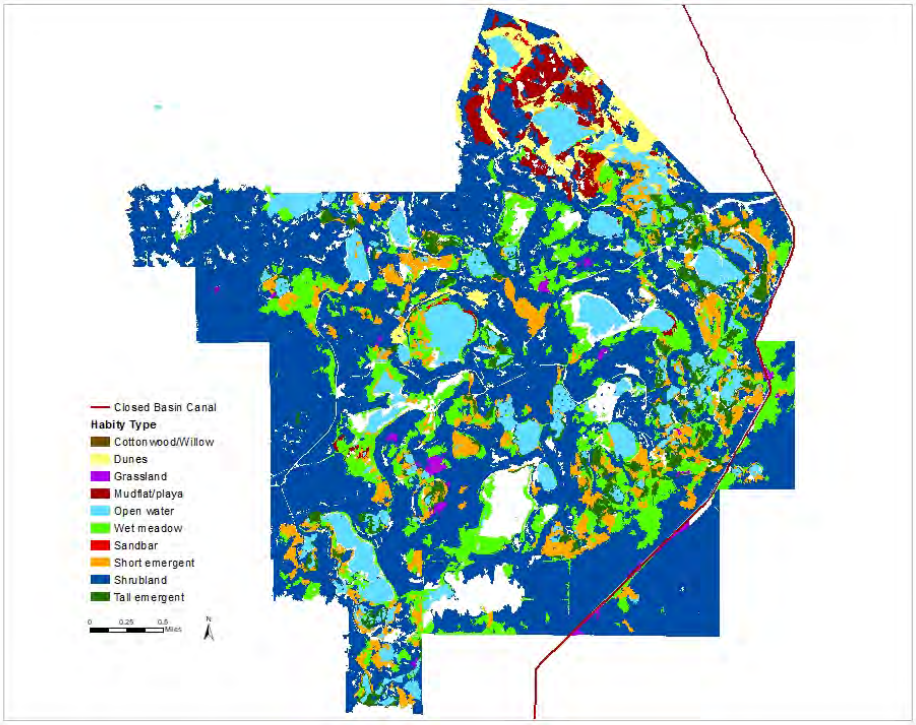


Figure 9.1. Vegetation map of Blanca WMA.

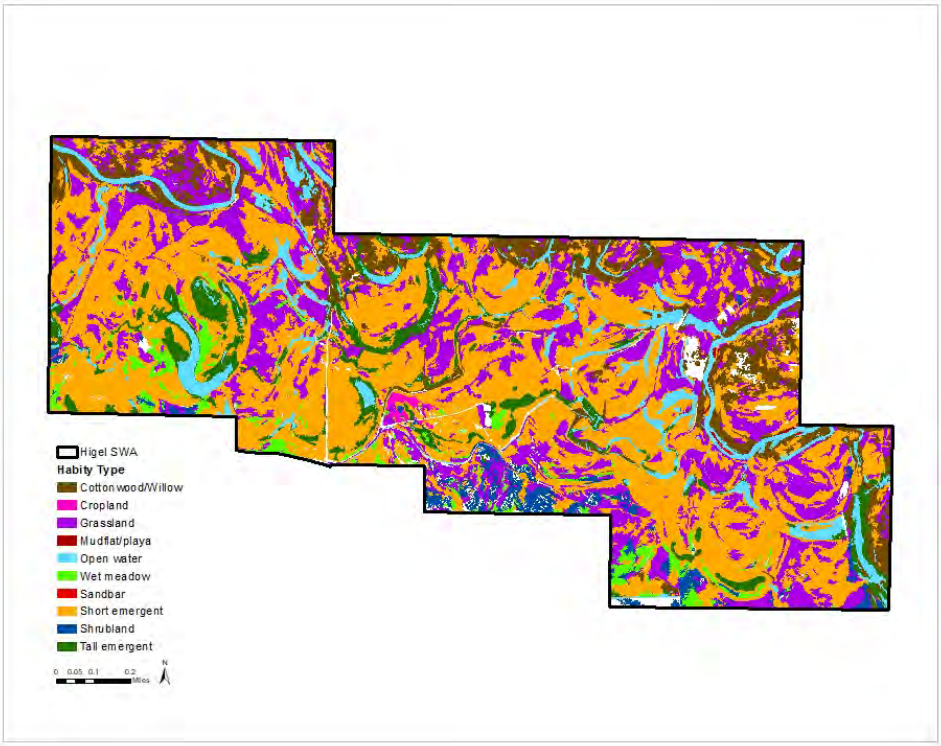


Figure 9.2. Vegetation map of Higel SWA.

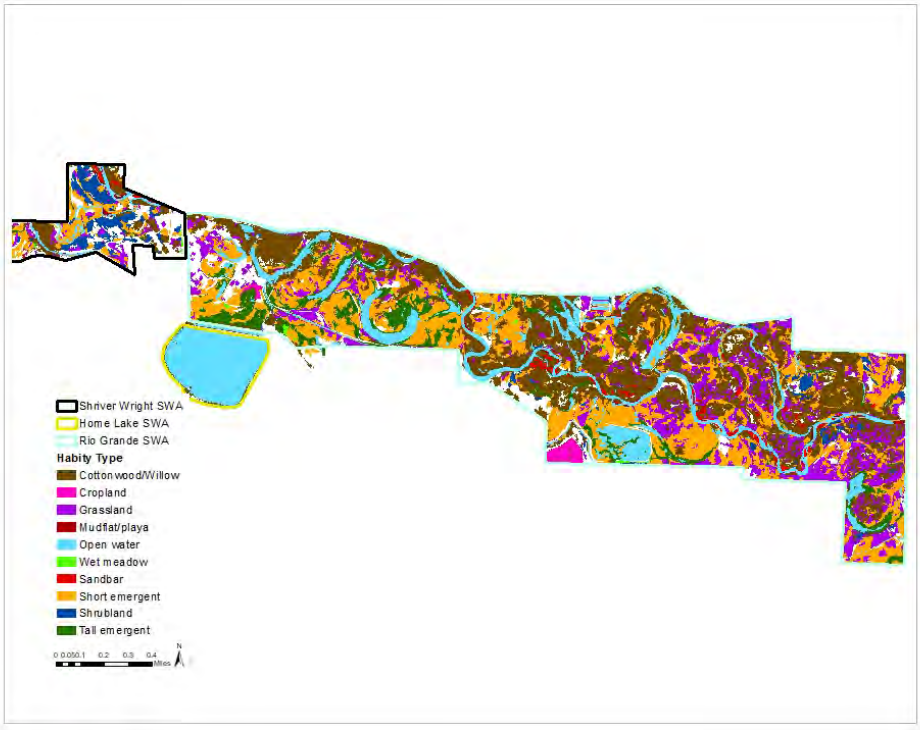


Figure 9.3. Vegetation map of Rio Grande, Home Lake, and Shriver/Wright SWAs

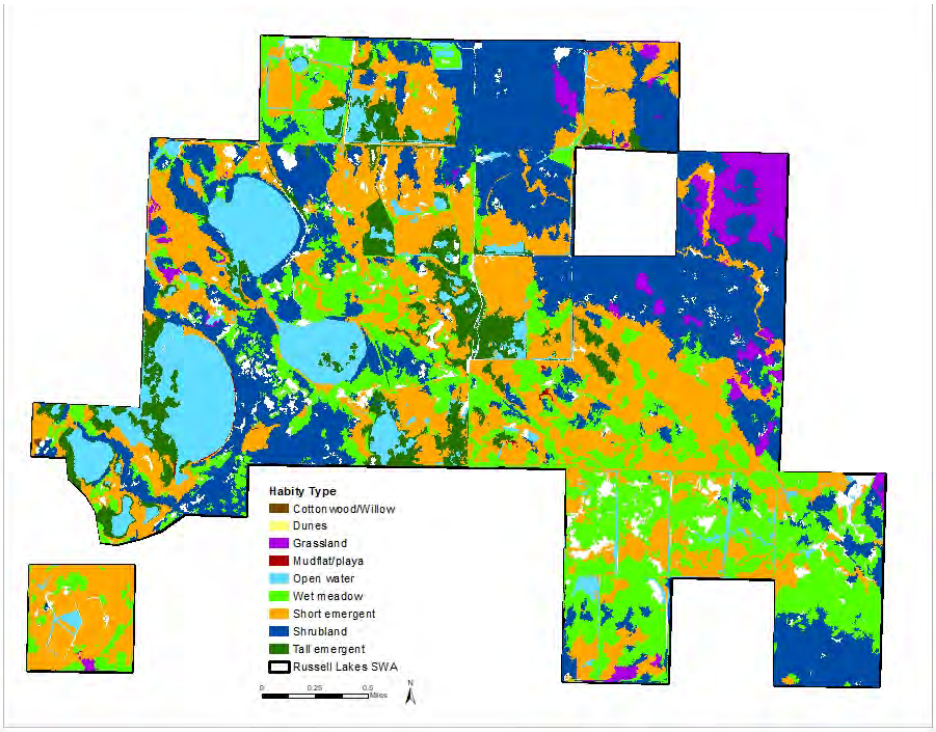


Figure 9.4. Vegetation Map of Russell Lakes SWA.

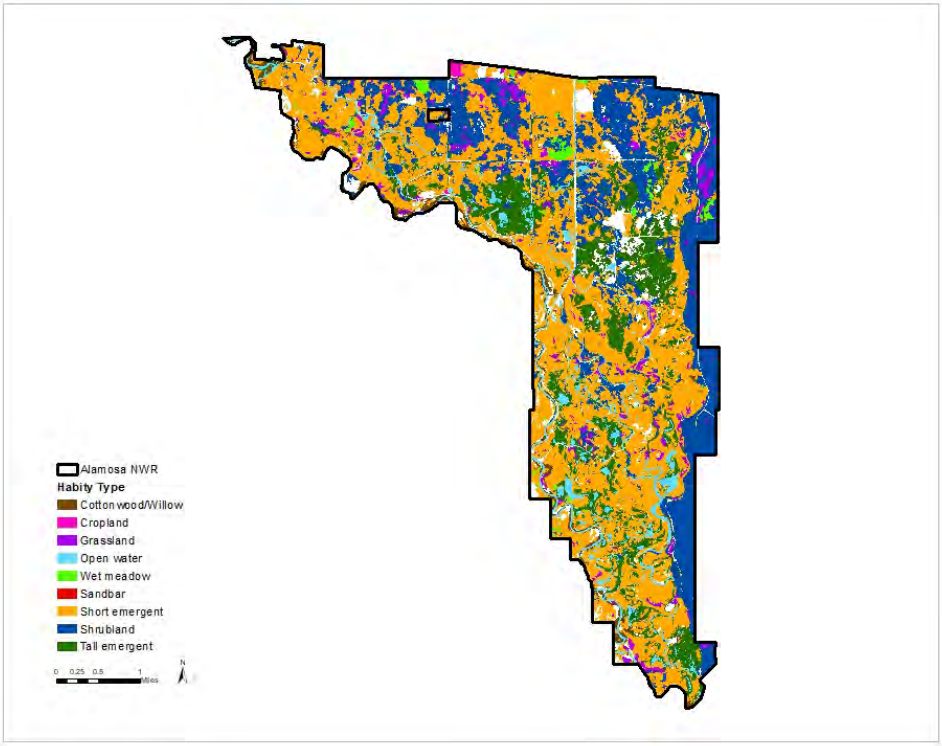


Figure 9.5. Vegetation map of Alamosa NWR.

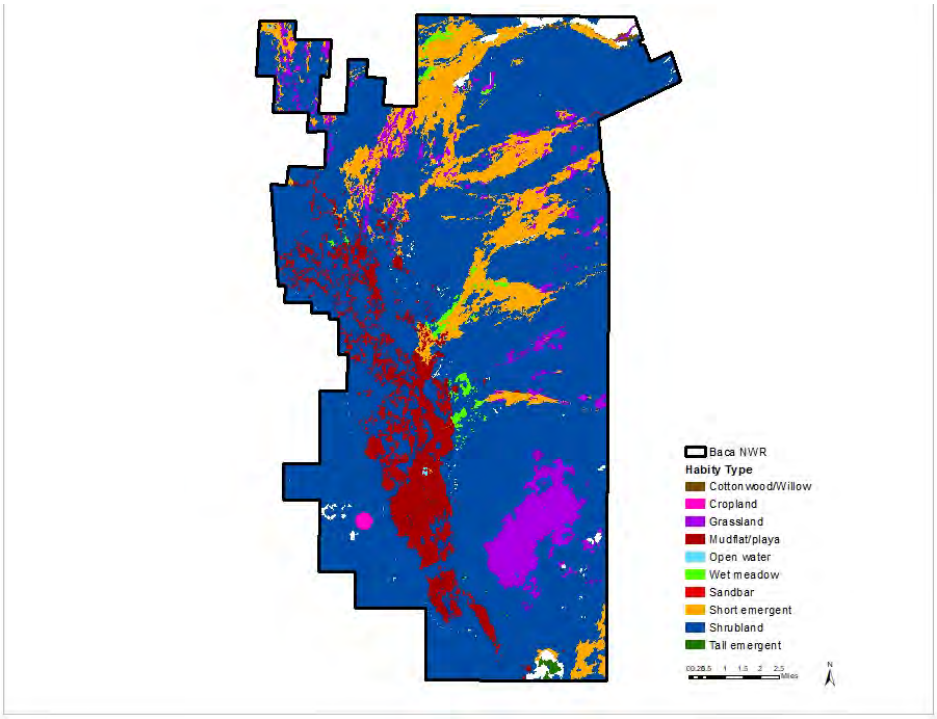


Figure 9.6. Vegetation map of Baca NWR.

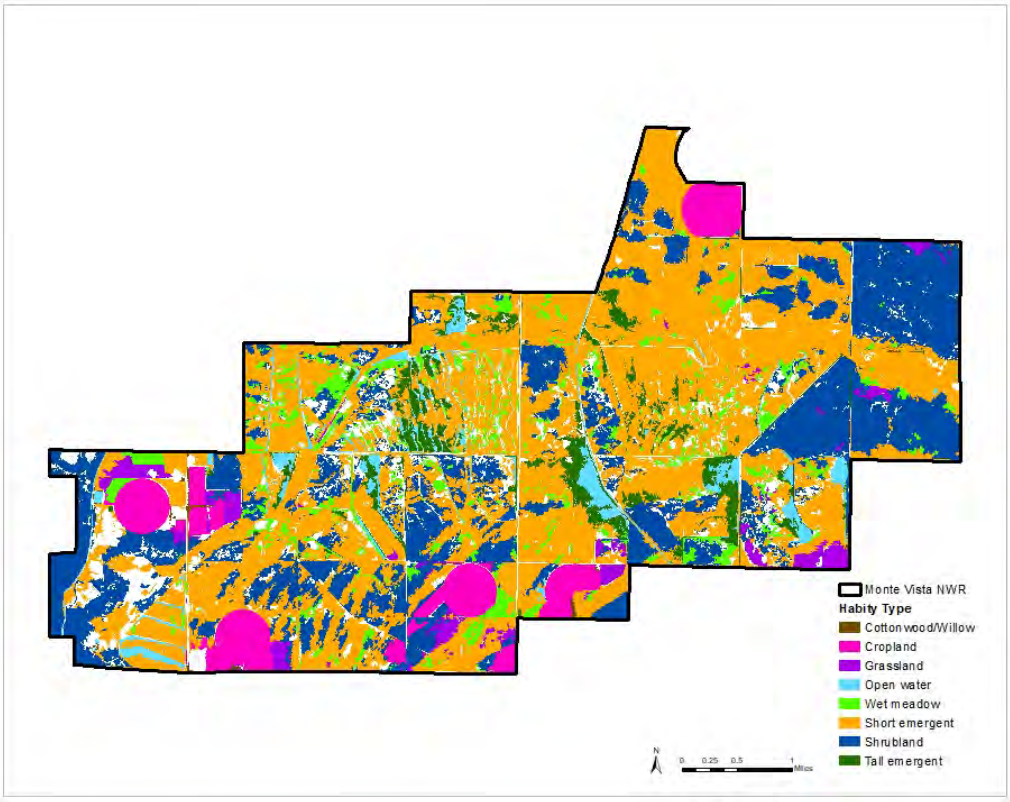


Figure 9.7. Vegetation map of Monte Vista NWR.

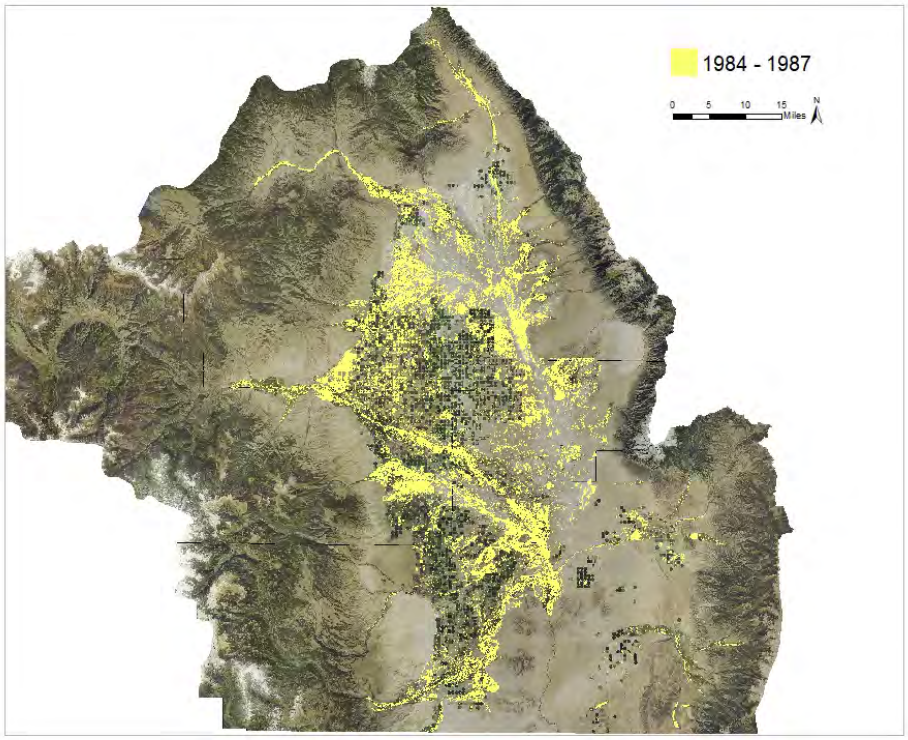


Figure 11.1a. 1984 to 1987 Wet Acres in the SLV

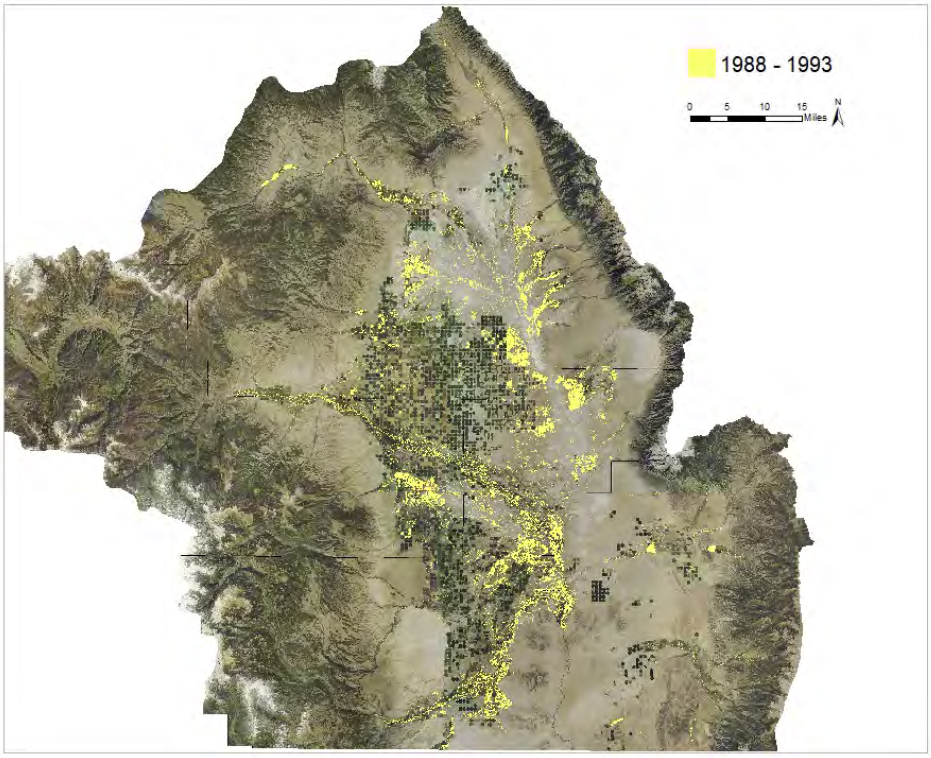


Figure 11.1b. 1988-1993 Wet Acres in the SLV

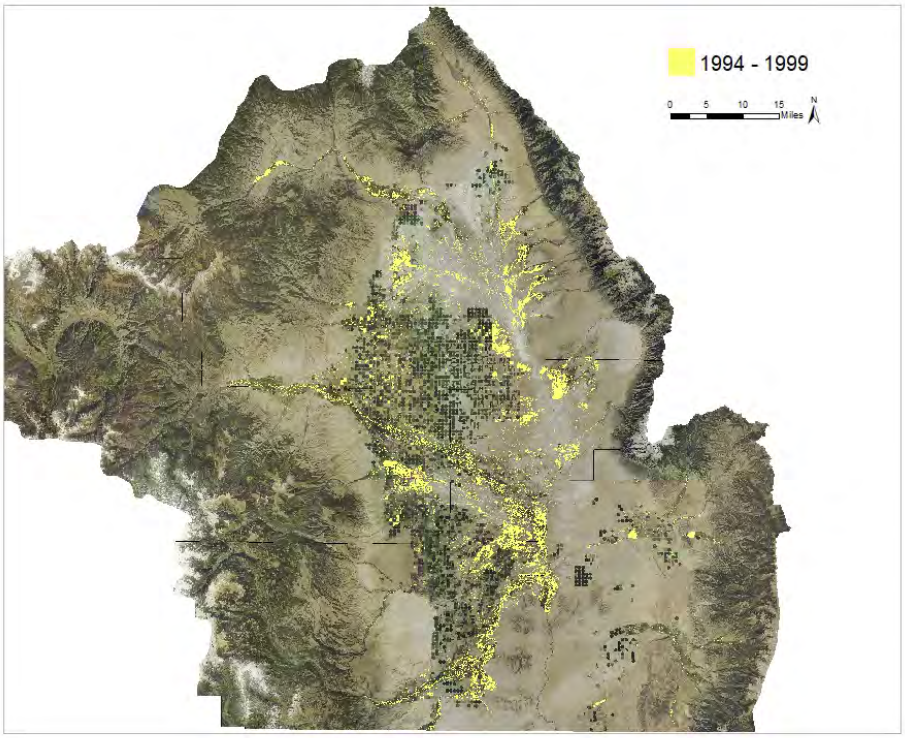


Figure 11.1c. 1994-1999 Wet Acres in the SLV

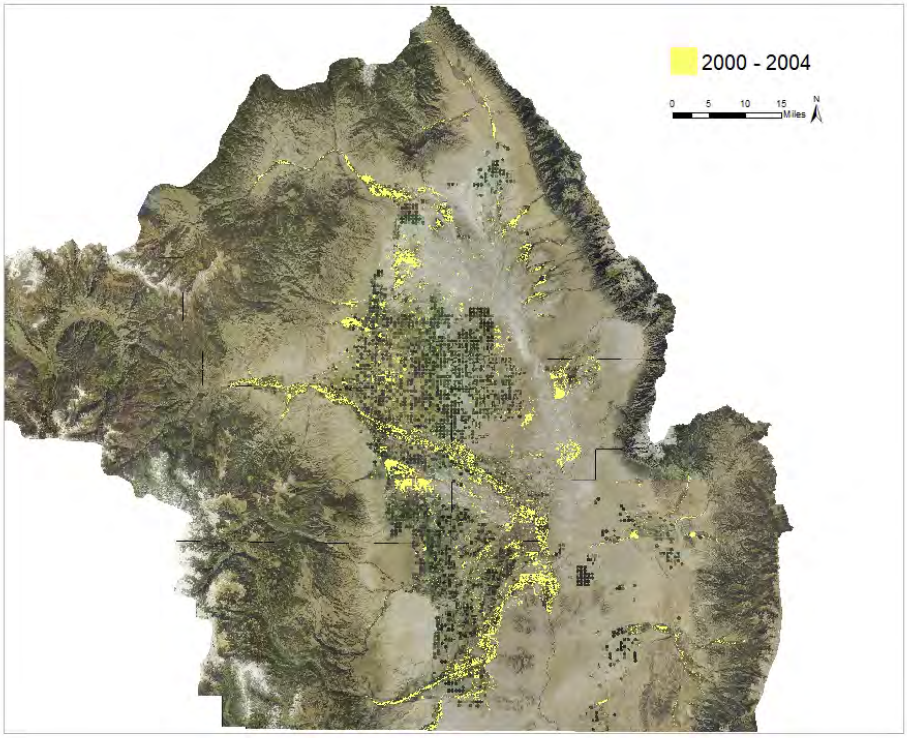


Figure 11.1d. 2000-2004 Wet Acres in the SLV

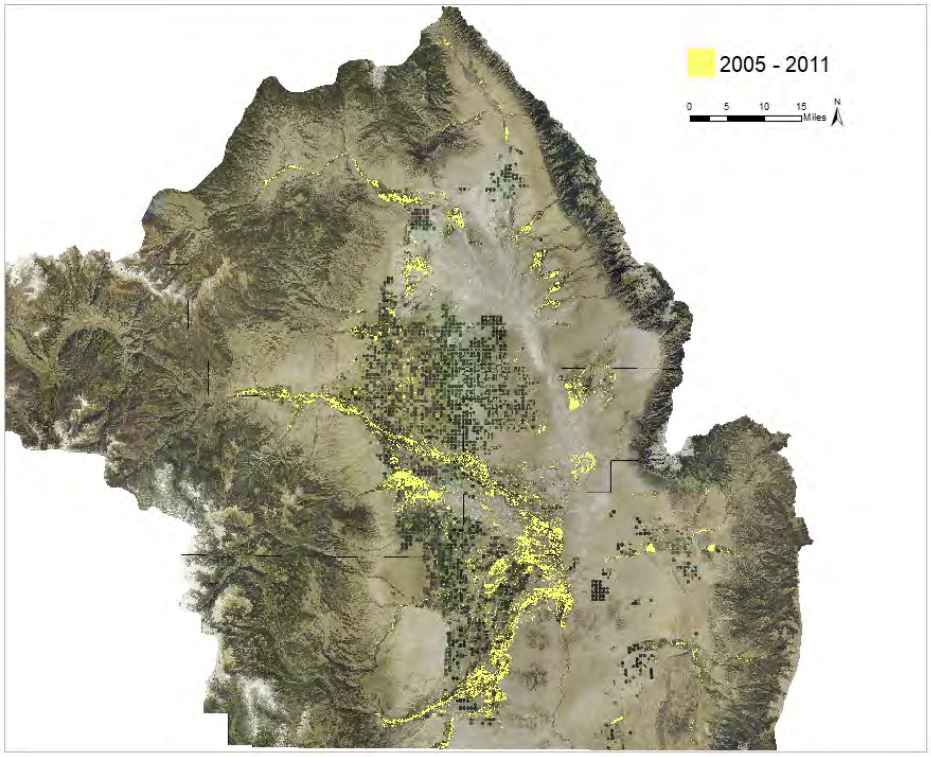


Figure 11.1e. 2005-2011 Wet Acres in the SLV

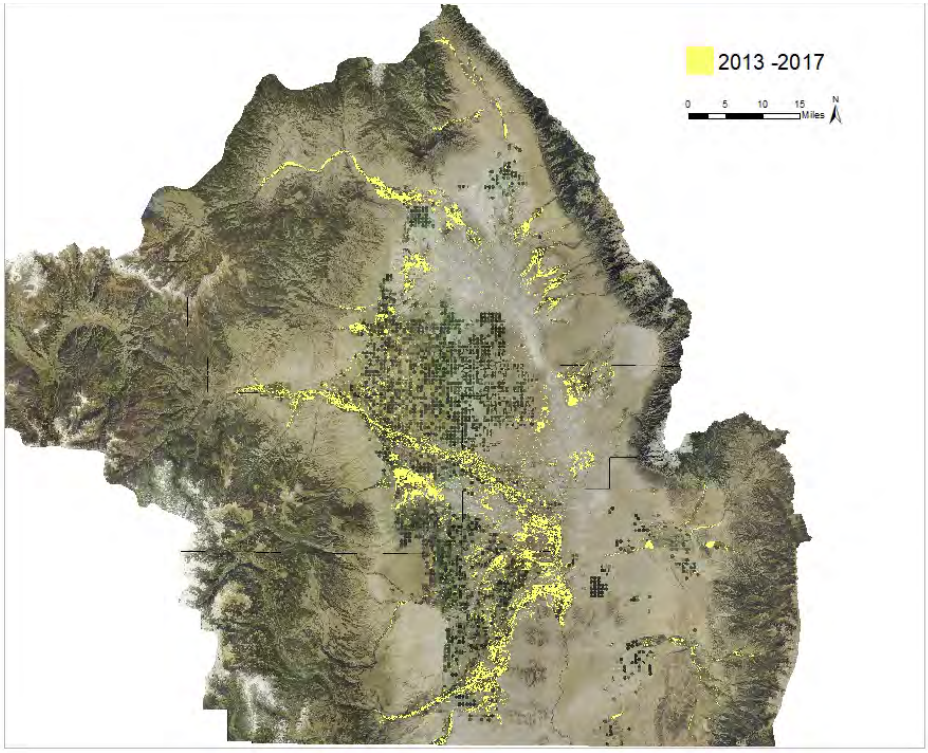


Figure 11.1f. 2013-2017 Wet Acres in the SLV

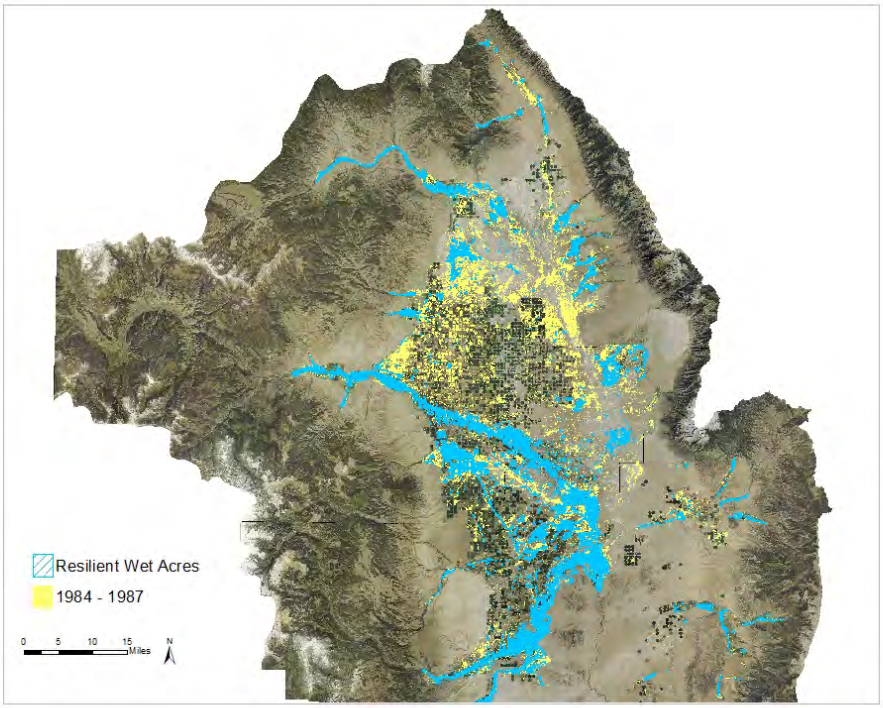


Figure 11.1g. SLV wet acres in 1984-1987 and resilient wet acres (wet across all time periods)

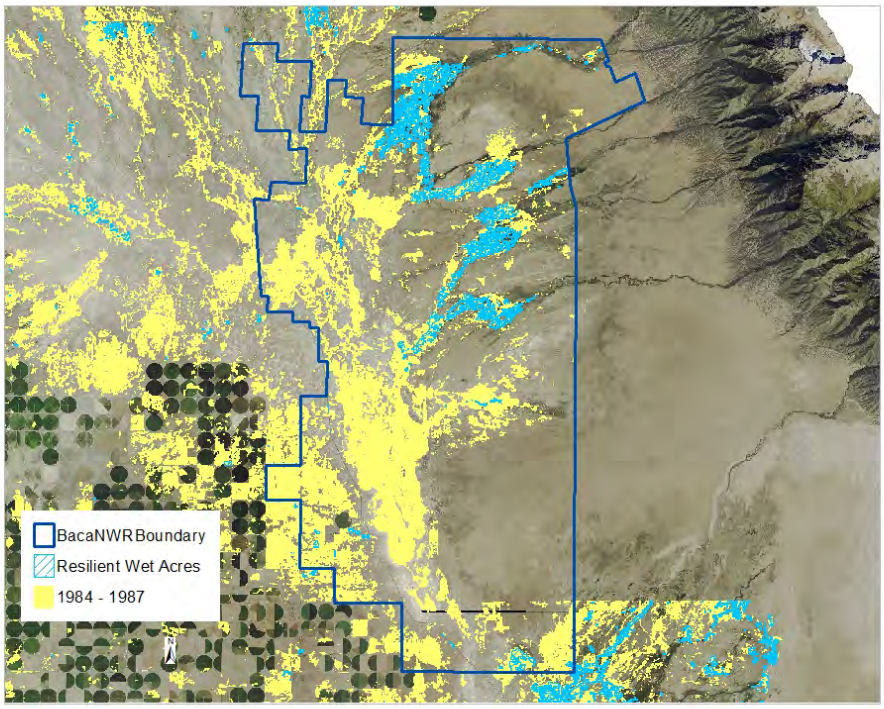


Figure 11.1h. Baca NWR wet acres in 1984-1987 and resilient wet acres (wet acres across all time periods).

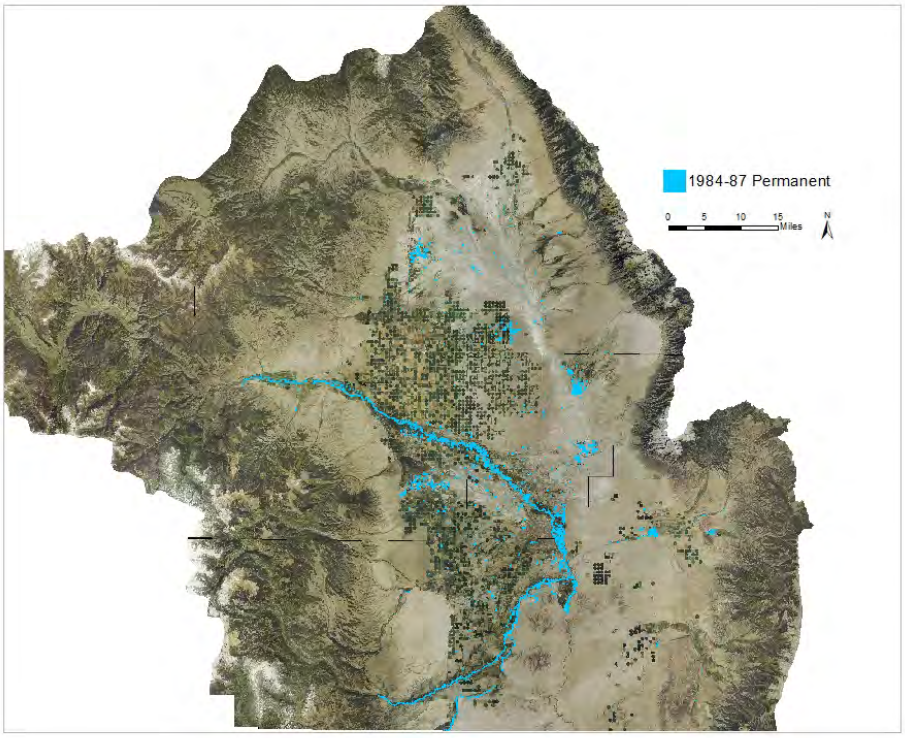


Figure 11.3a. Permanent hydroperiods 1984-1987 in the SLV

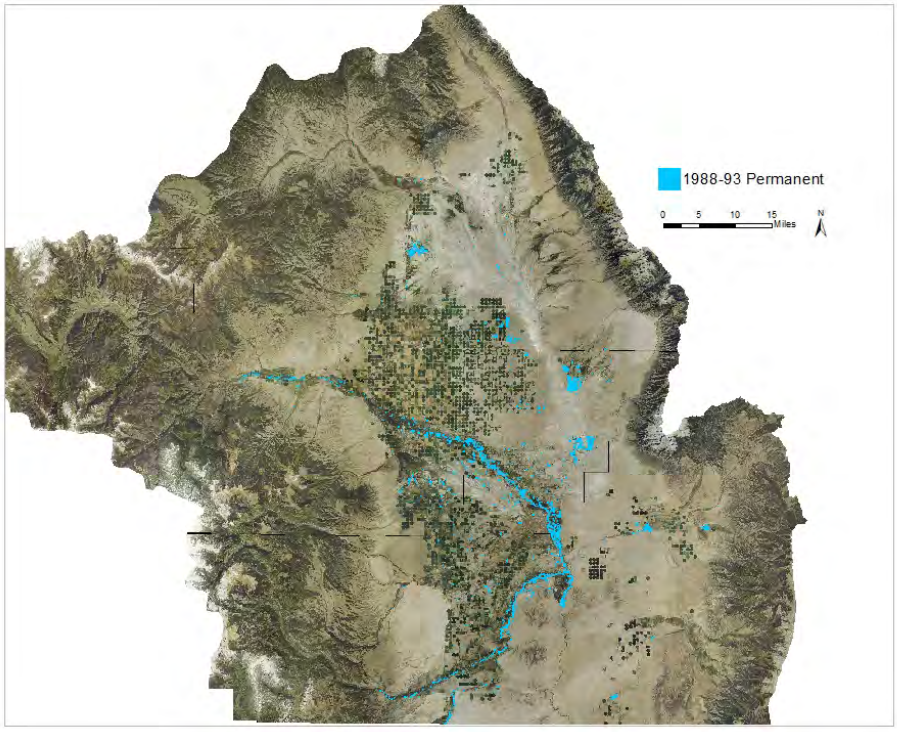


Figure 11.3b. Permanent hydroperiods 1988-1993 in the SLV

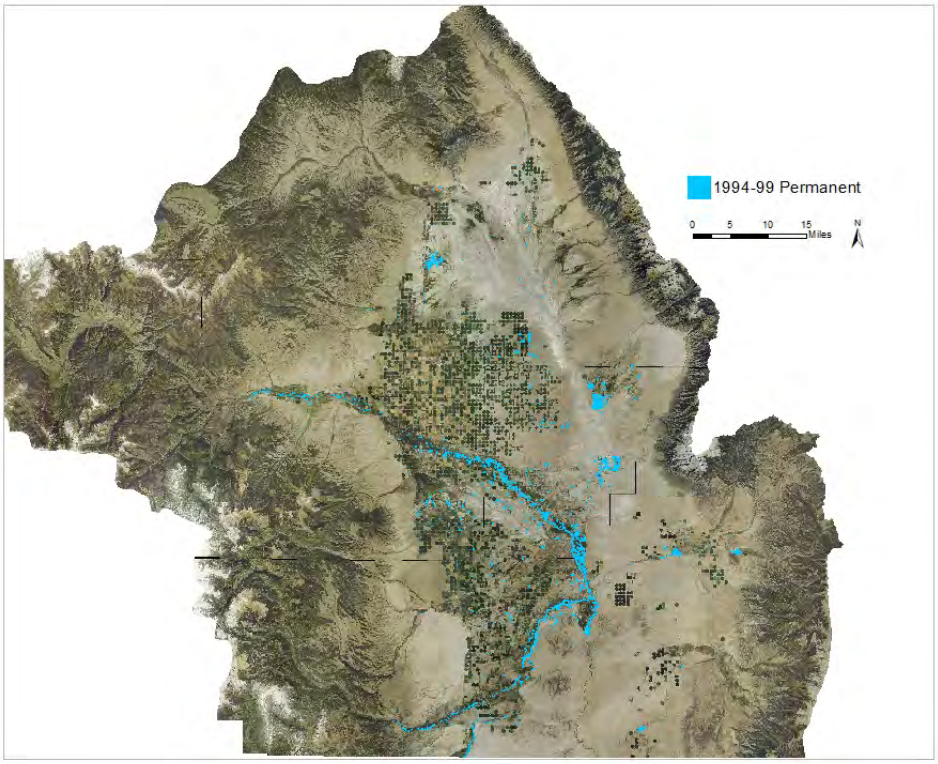


Figure 11.3c.Permanent hydroperiods 1994-1999 in the SLV

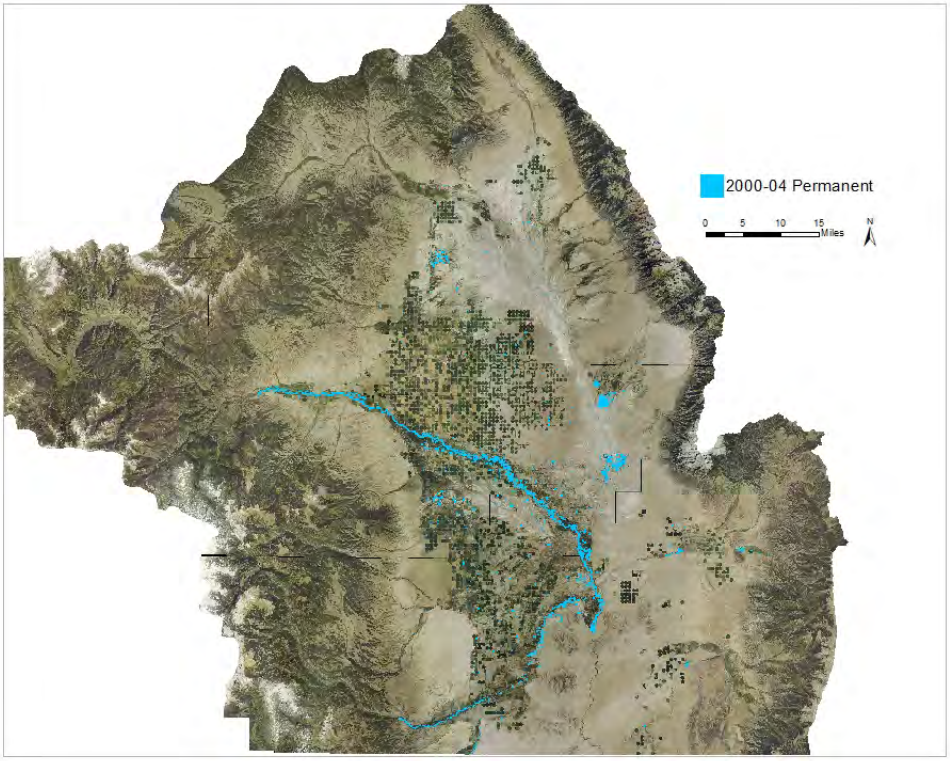


Figure 11.3d. Permanent hydroperiods 2000-2004 in the SLV

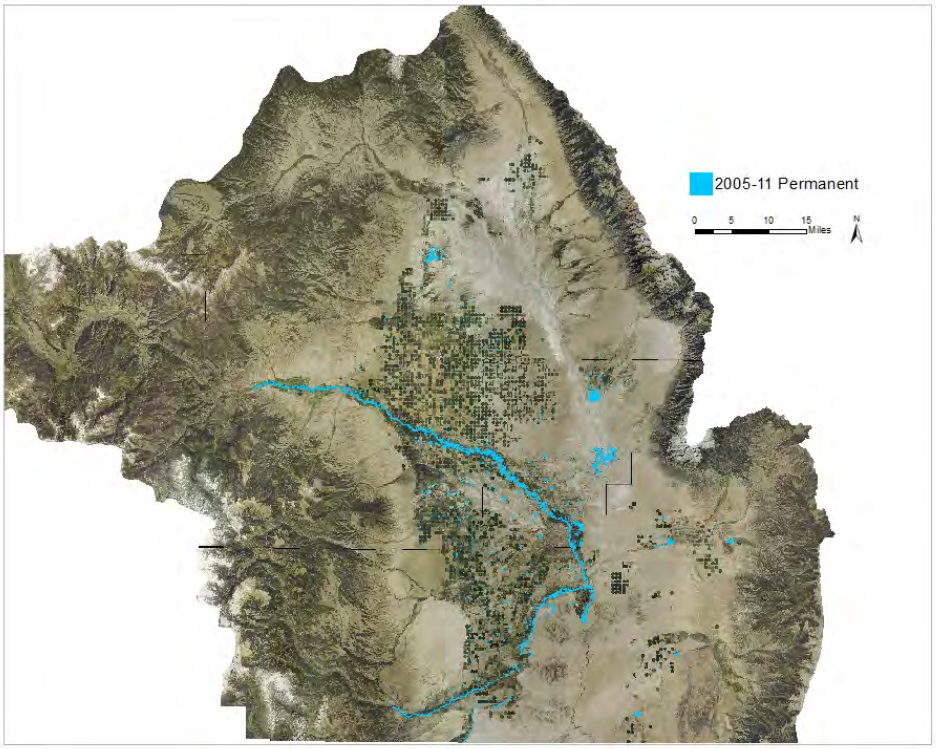


Figure 11.3e. Permanent hydroperiods 2005-2011 in the SLV

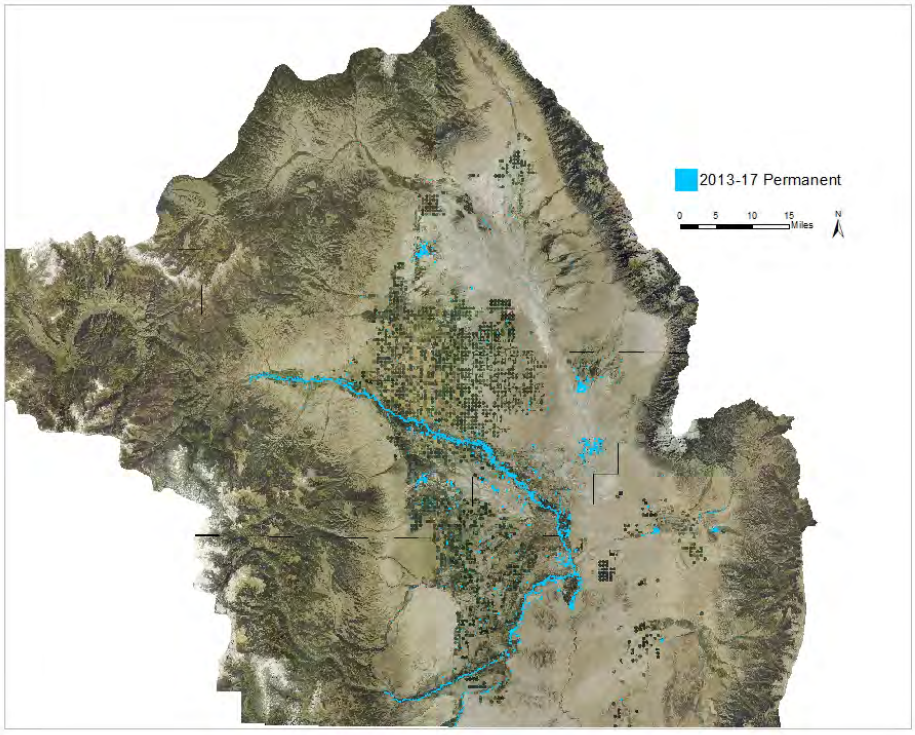


Figure 11.3f. Permanent hydroperiods 2013-2017 in the SLV.

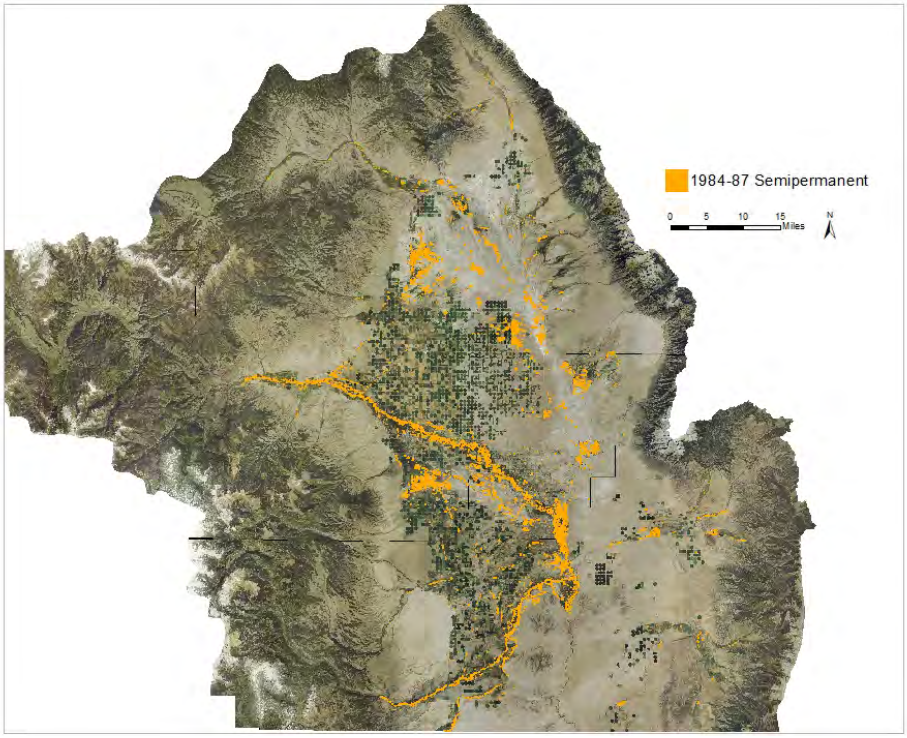


Figure 11.4a. Semi-Permanent hydroperiods 1984-1987 in the SLV.

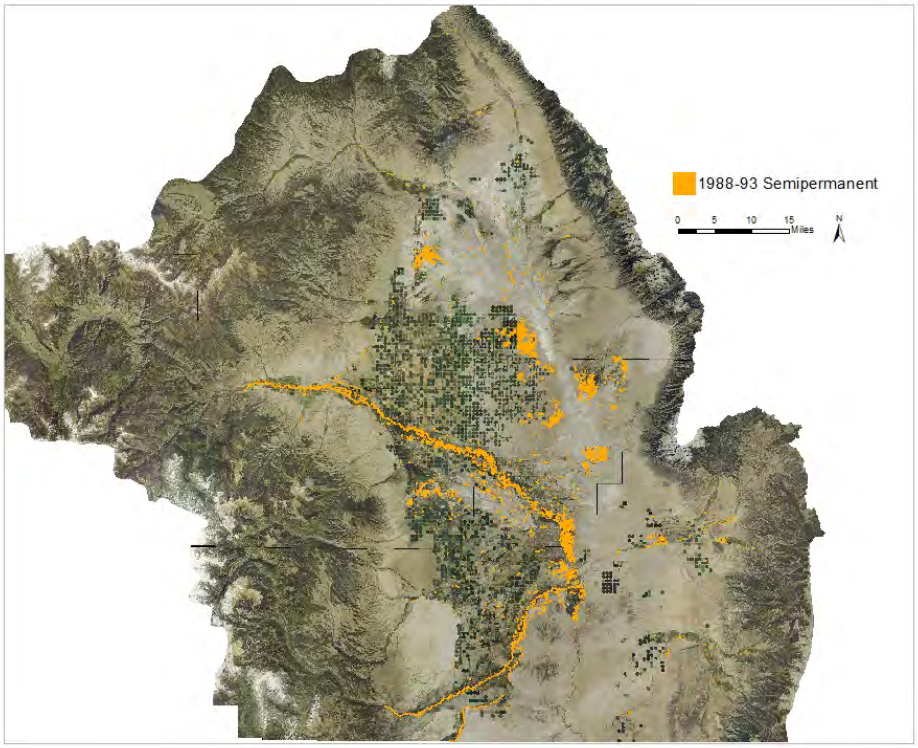


Figure 11.4b. Semi-permanent hydroperiods 1988-1993 in the SLV.

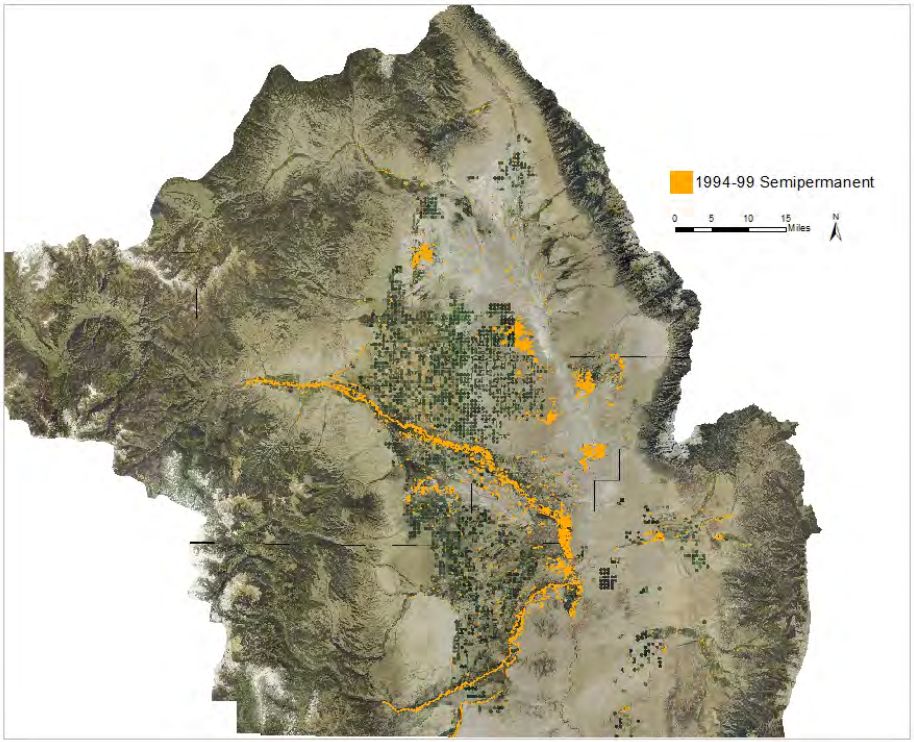


Figure 11.4c. Semi-Permanent hydroperiods 1994-1999 in the SLV

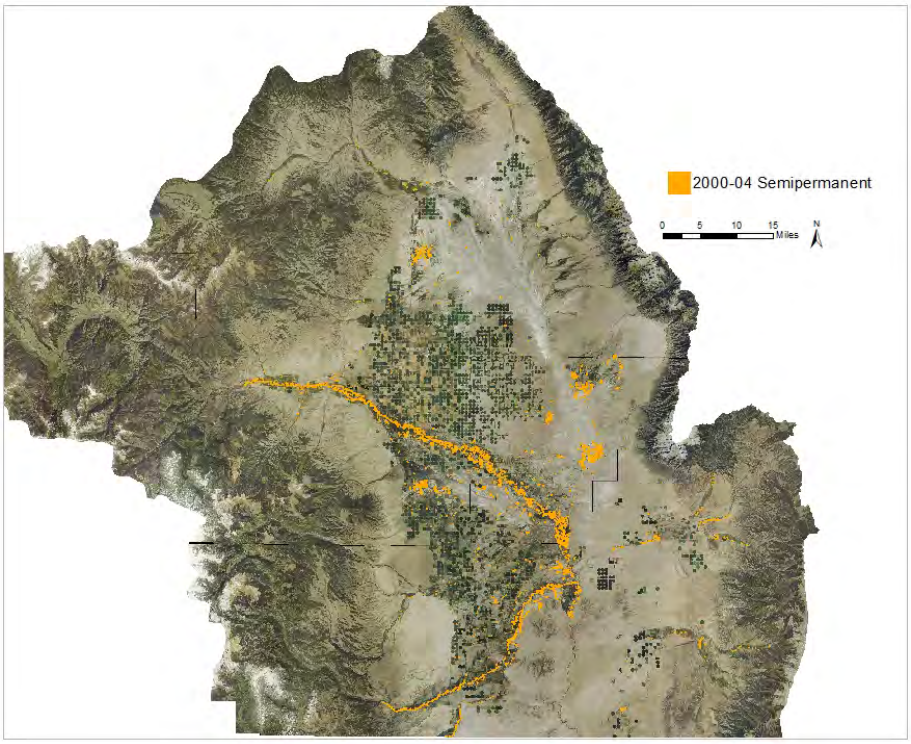


Figure 11.4d. Semi-Permanent hydroperiods 2000-2004 in the SLV

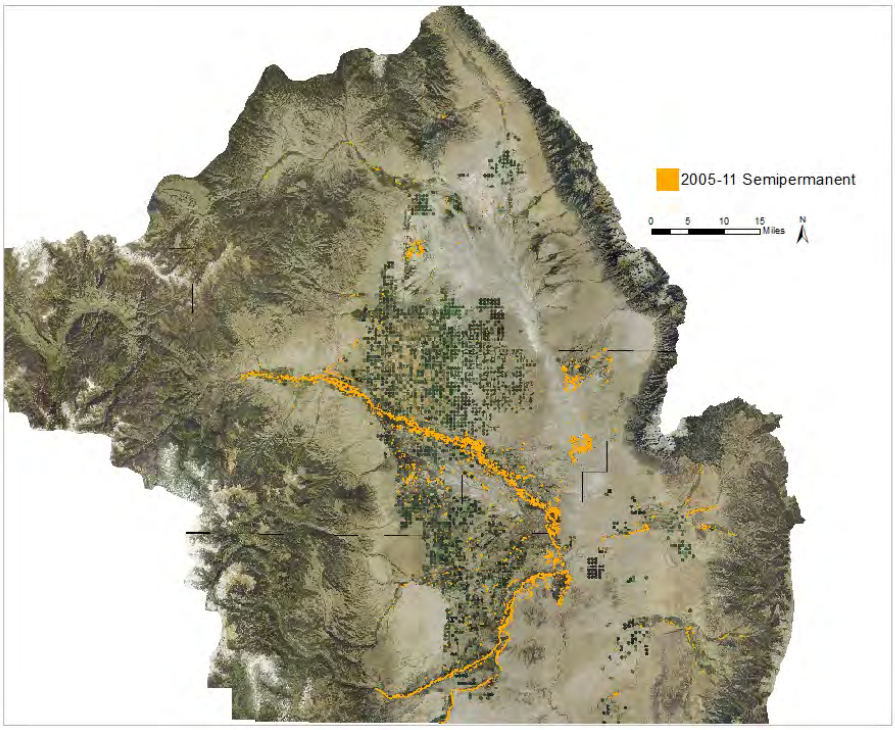


Figure 11.4e. Semi-permanent hydroperiods 2005-2011 in the SLV

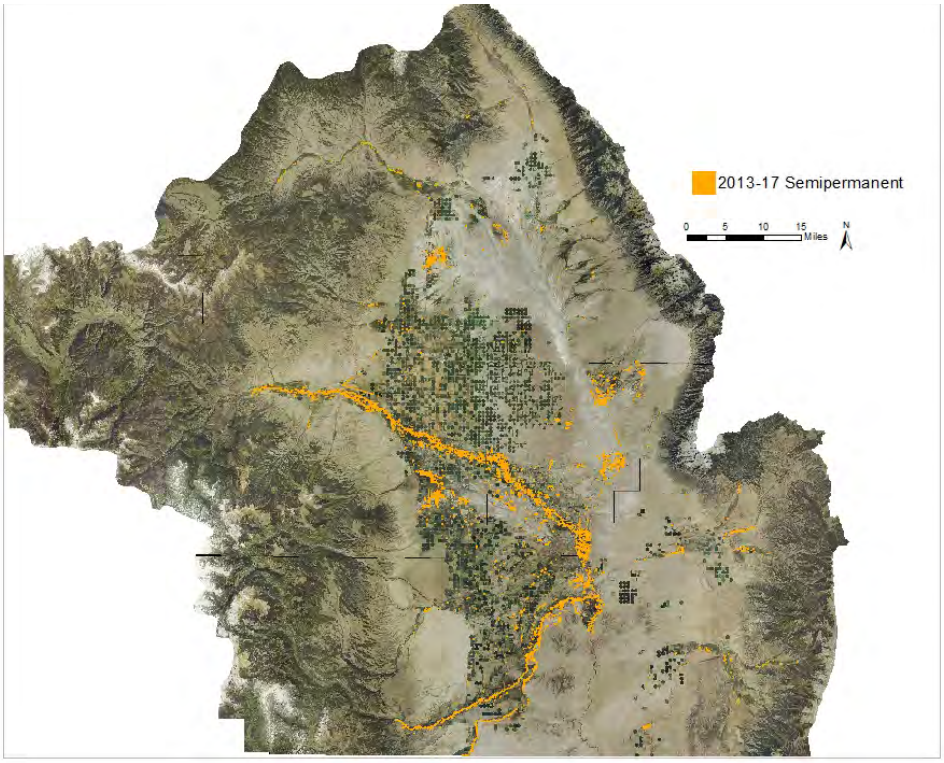


Figure 11.4f. Semi-permanent hydroperiods 2013-2017 in the SLV

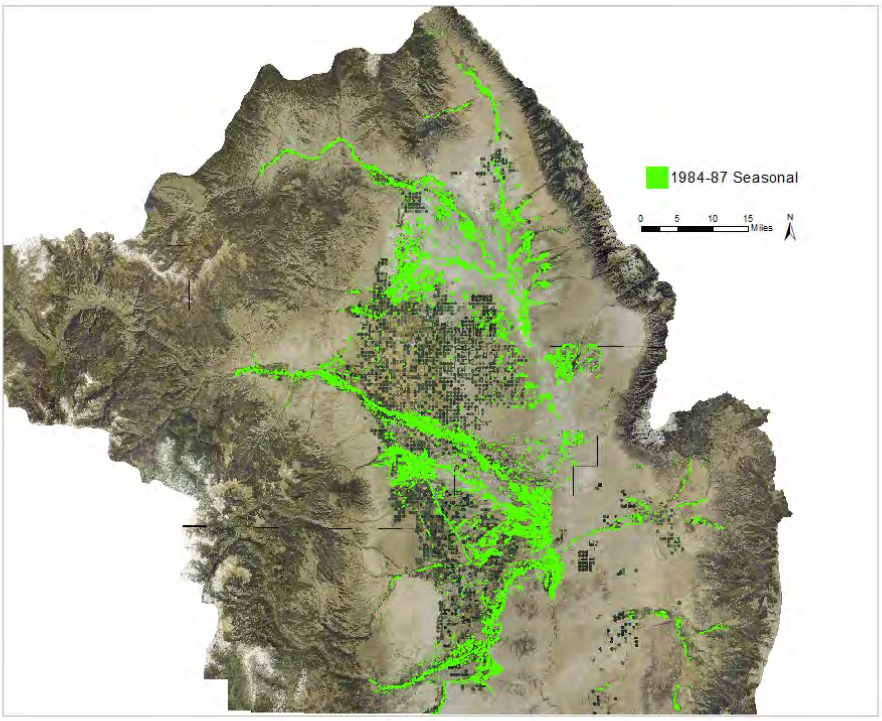


Figure 11.5a. Seasonal hydroperiods 1984-1987 in the SLV

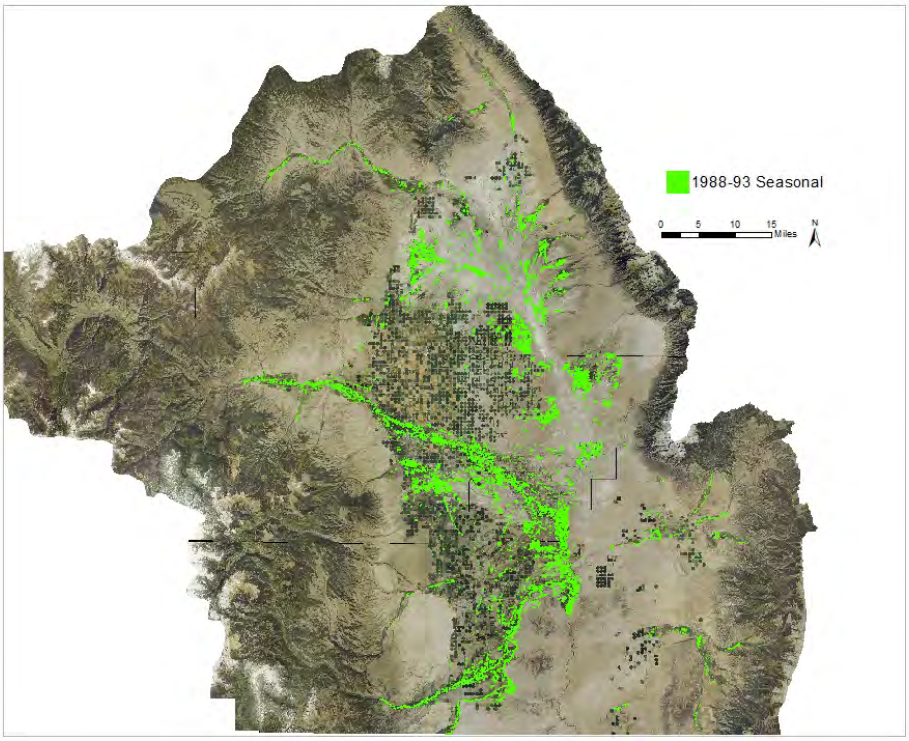


Figure 11.5b. Seasonal hydroperiods 1988-1993 in the SLV

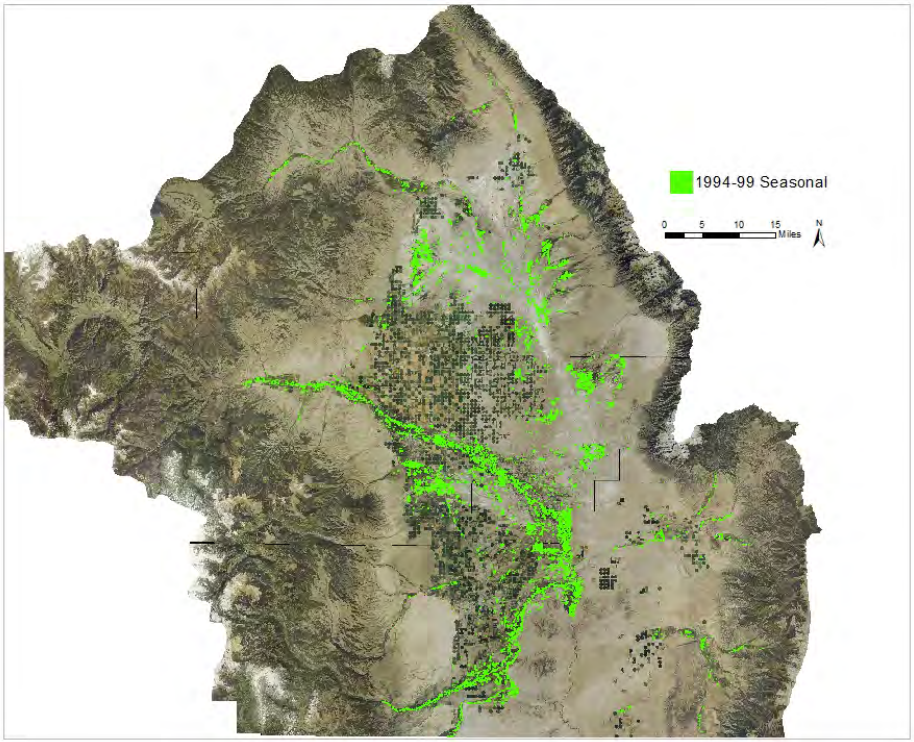


Figure 11.5c. Seasonal hydroperiods 1994-1999 in the SLV

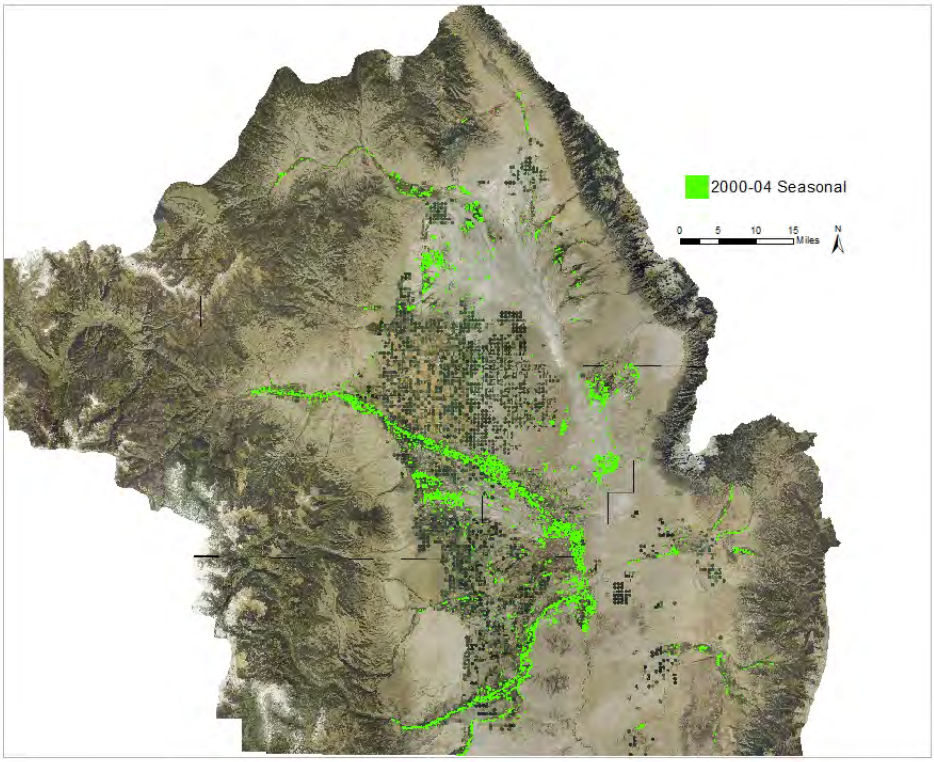


Figure 11.5d. Seasonal hydroperiods 2000-2004 in the SLV

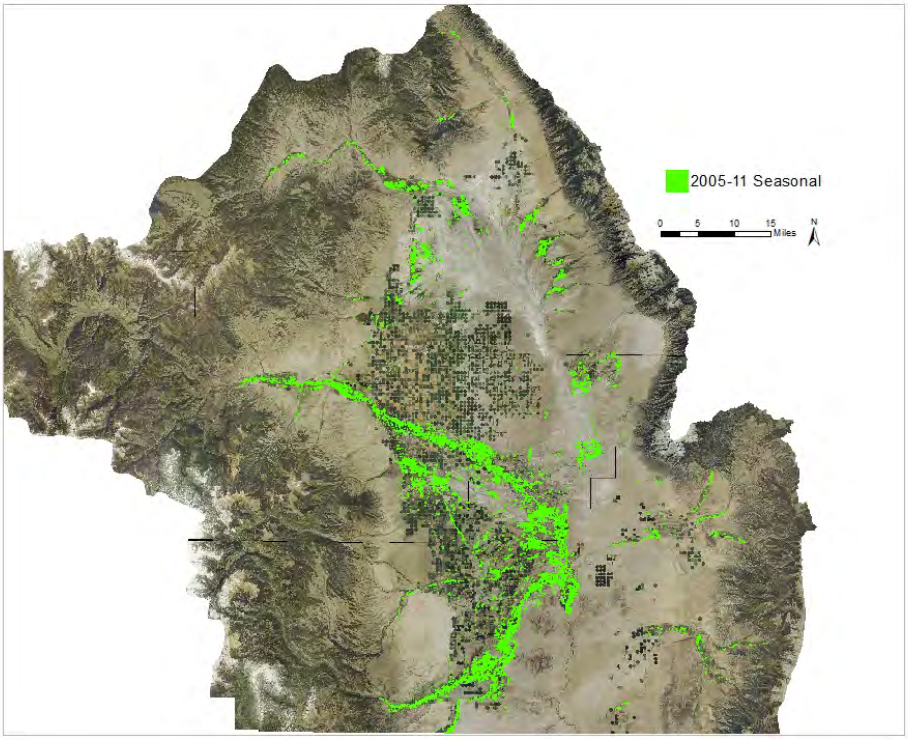


Figure 11.5e. Seasonal hydroperiods 2005-2011 in the SLV

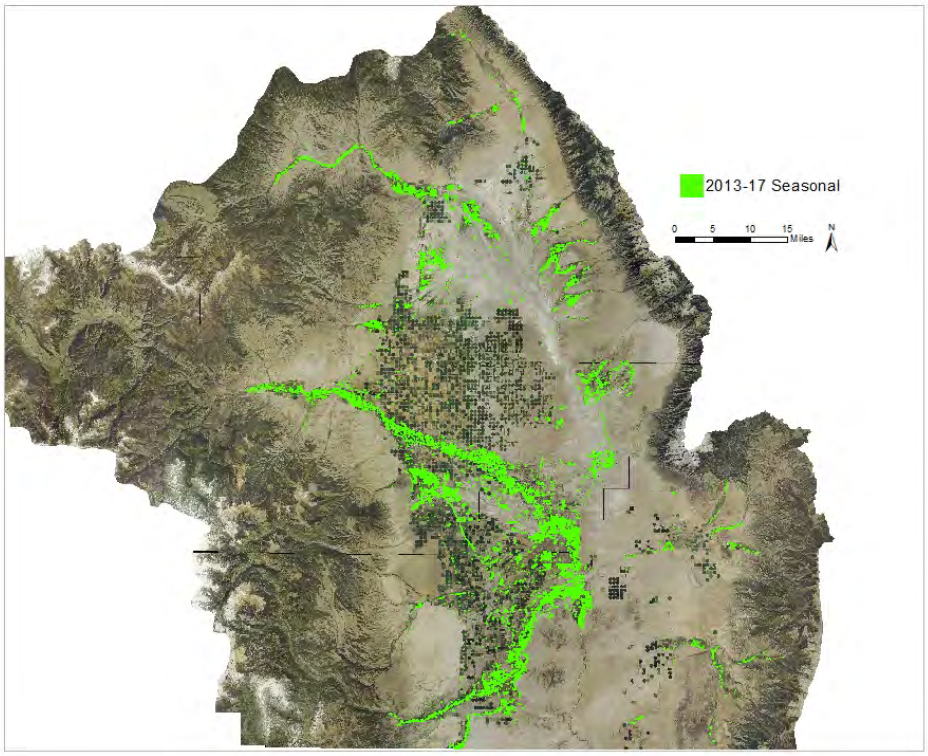


Figure 11.5f. Seasonal hydroperiods 2013-2017 in the SLV

16 Appendix II: Charts

16.1 Section 11.2.1 - Cinnamon Teal Charts

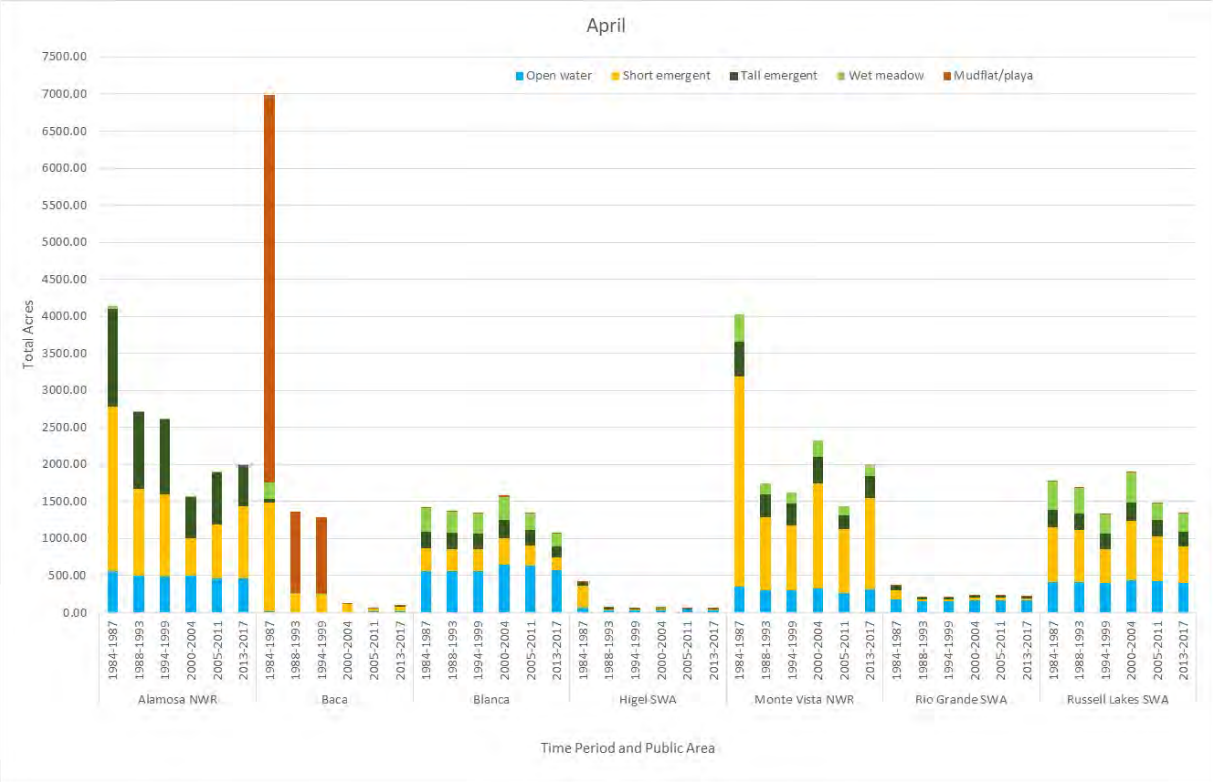


Figure 11.13. Habitat types by property and time period in April for cinnamon teal

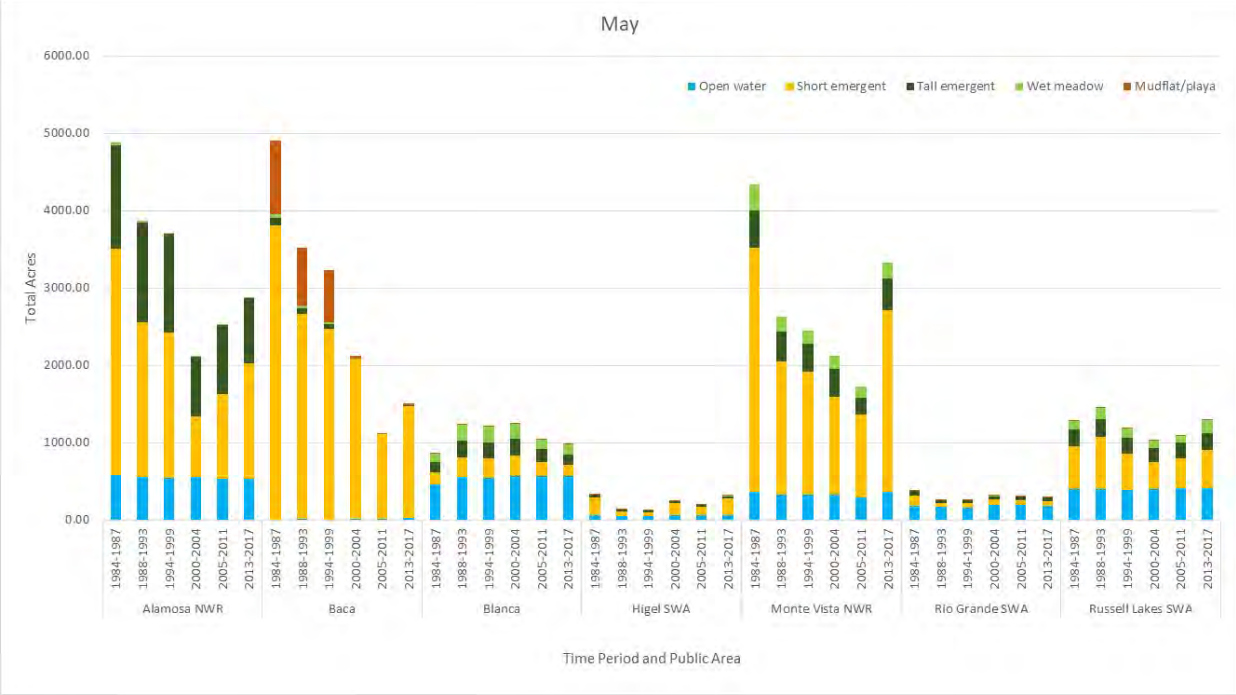


Figure 11.14. Habitat types by property and time period in May for cinnamon teal.

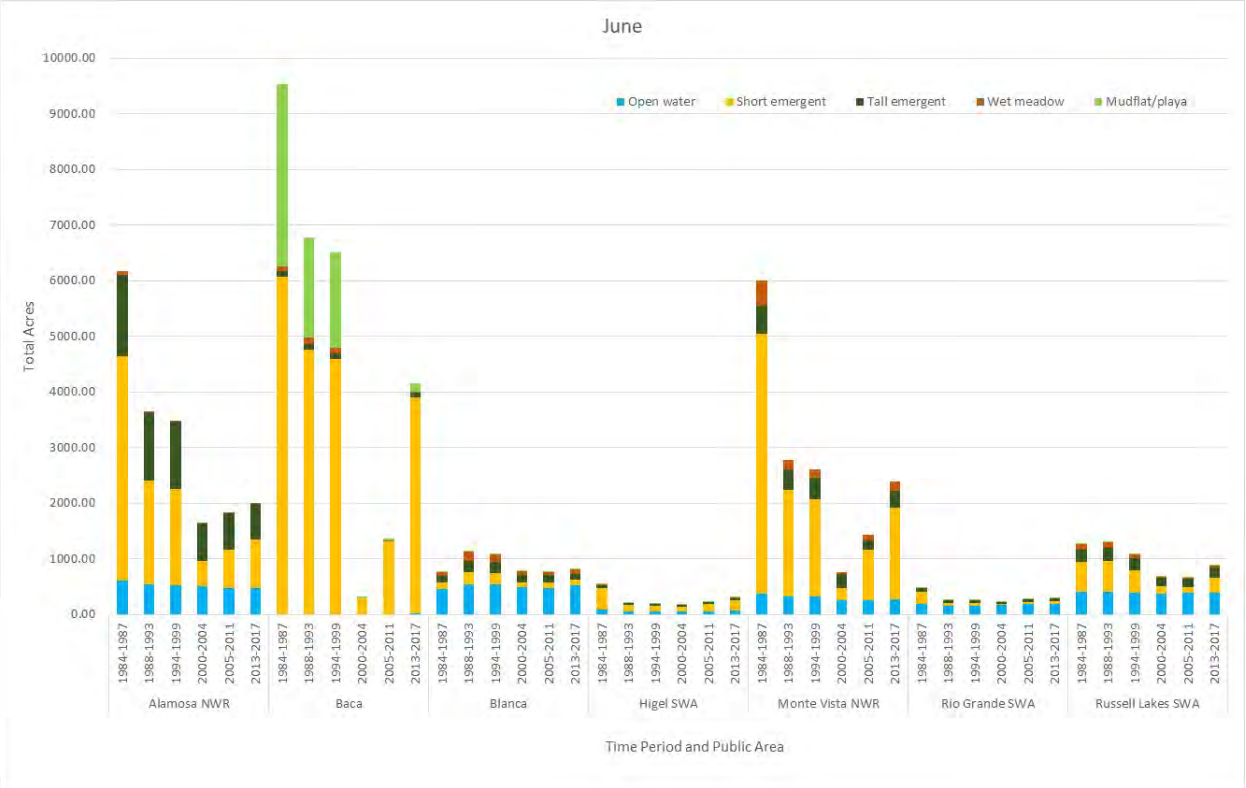


Figure 11.15. Habitat types by property and time period in June for cinnamon teal

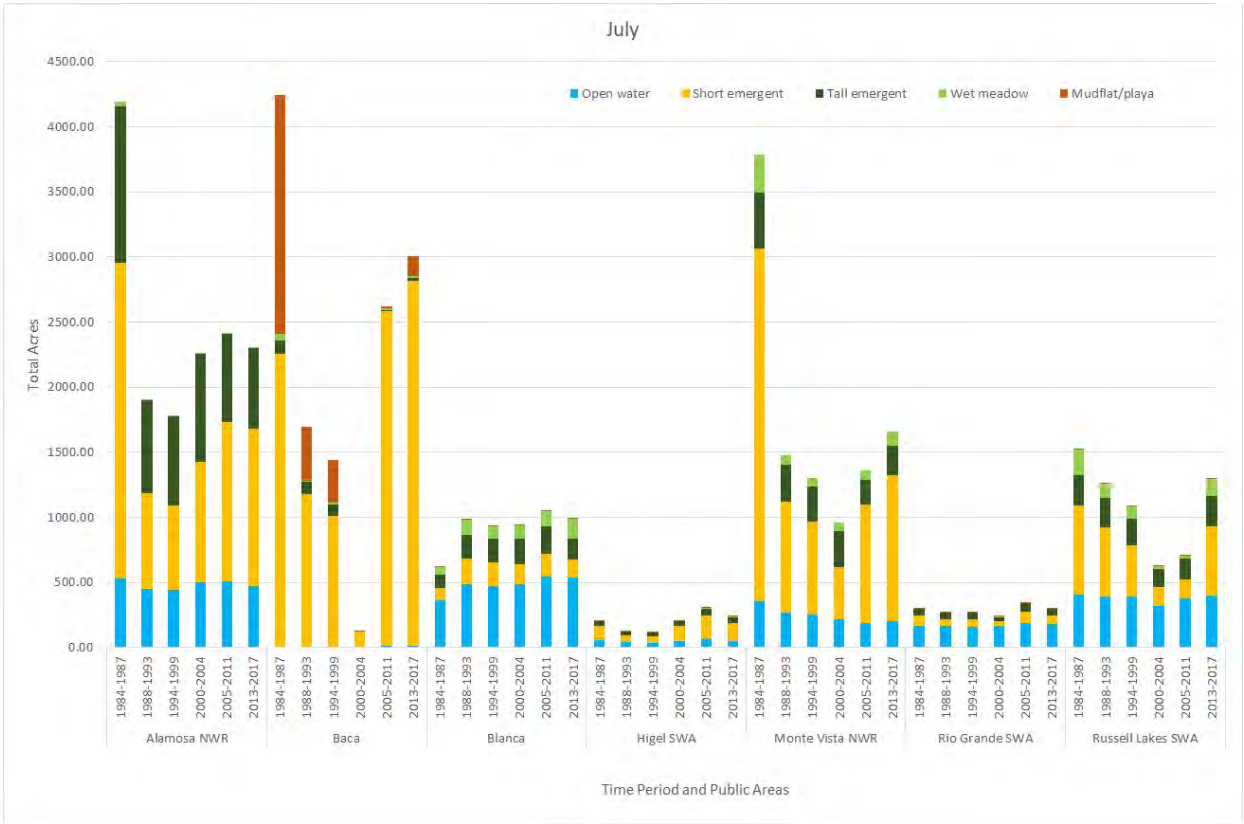


Figure 11.16. Habitat types by property and time period in July for cinnamon teal

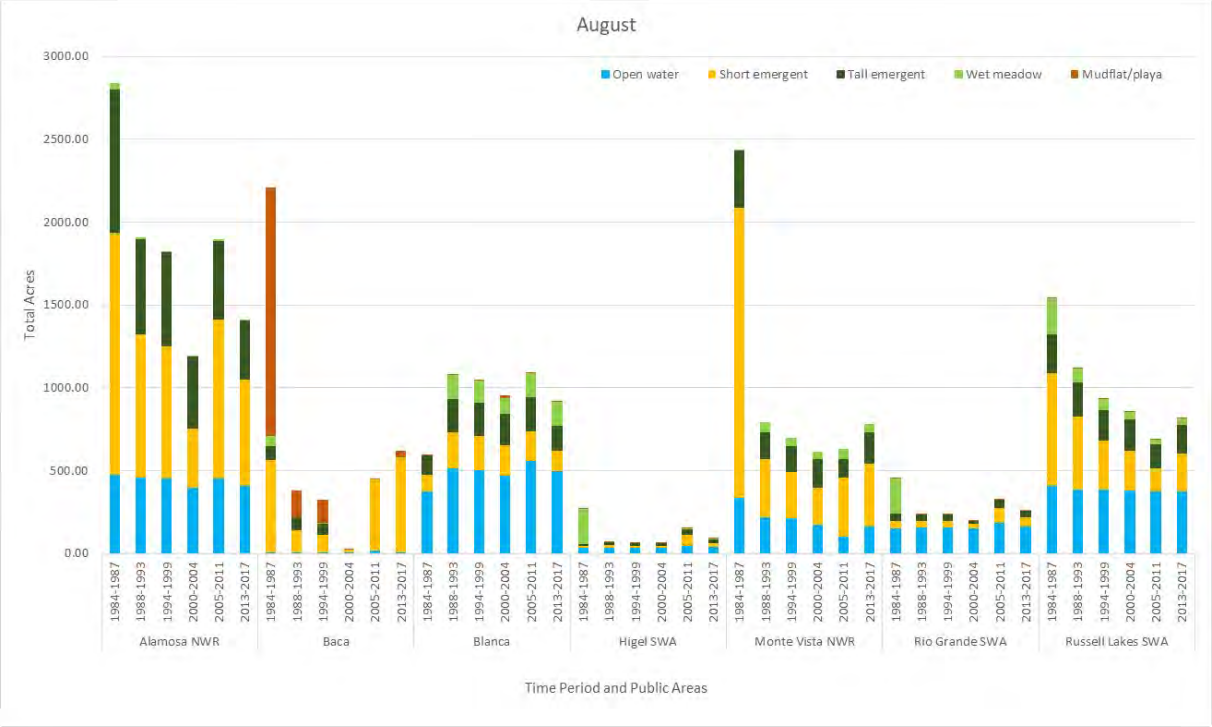


Figure 11.17. Habitat types by property and time period in August for cinnamon teal

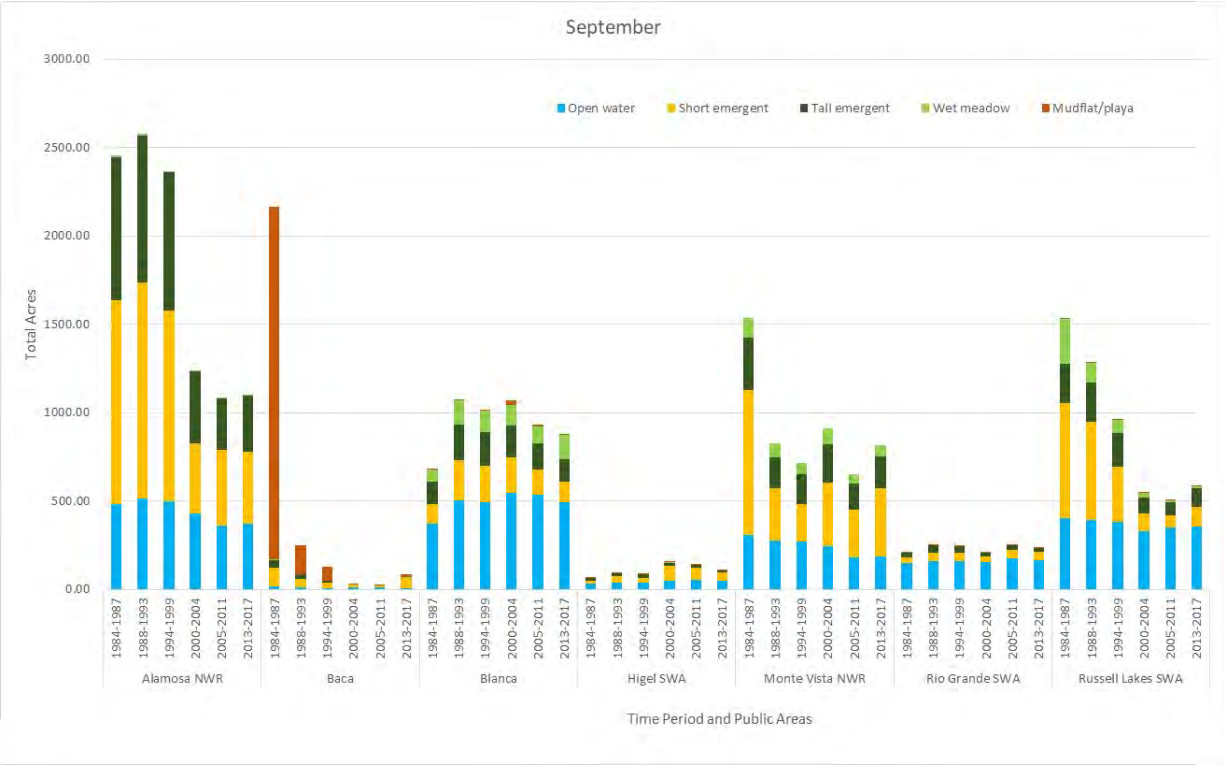


Figure 11.18. Habitat types by property and time period in September for cinnamon teal

16.2 Section 11.2.2 – Greater Sandhill Crane Charts

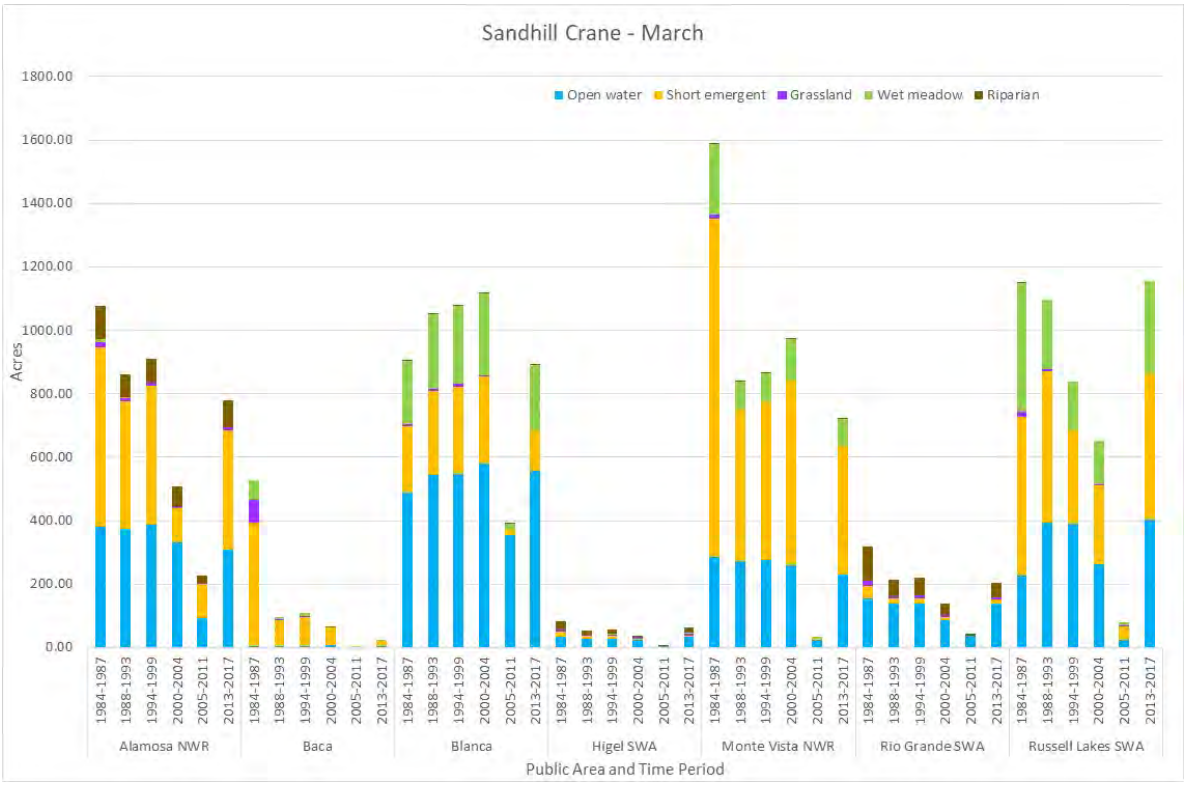


Figure 11.21. Habitat types by property and time period in March for sandhill cranes

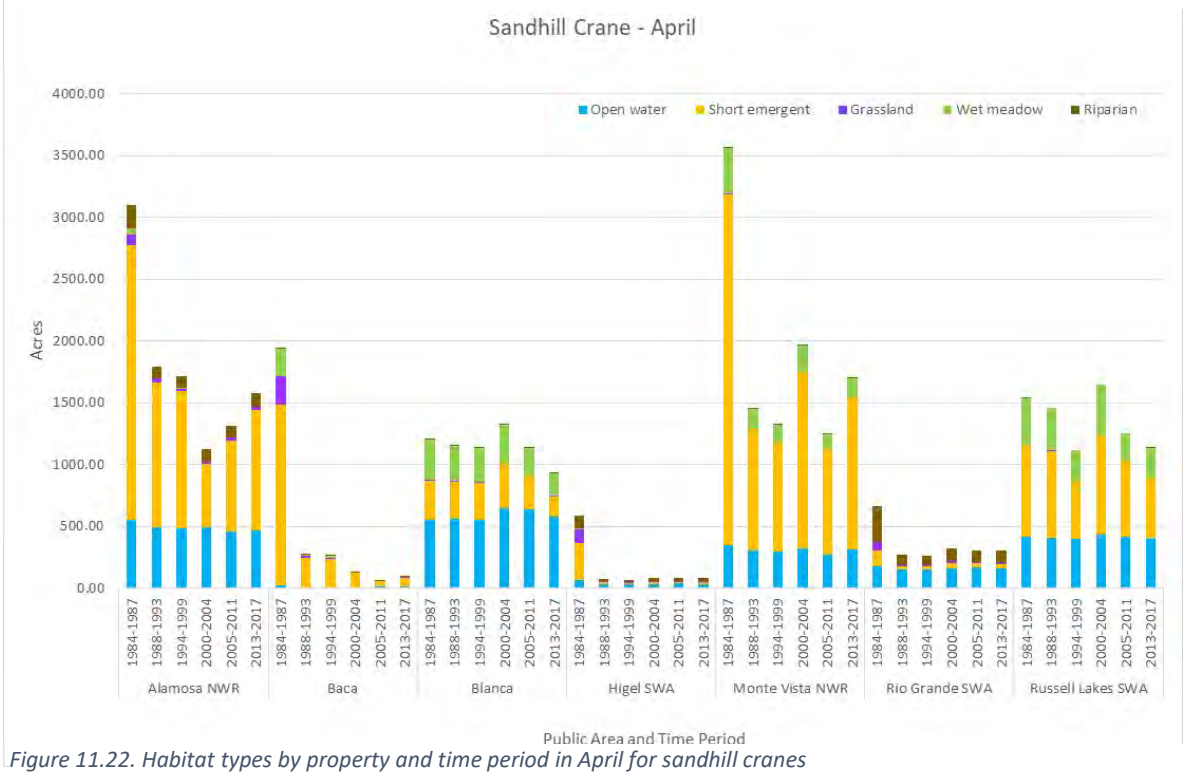


Figure 11.22. Habitat types by property and time period in April for sandhill cranes

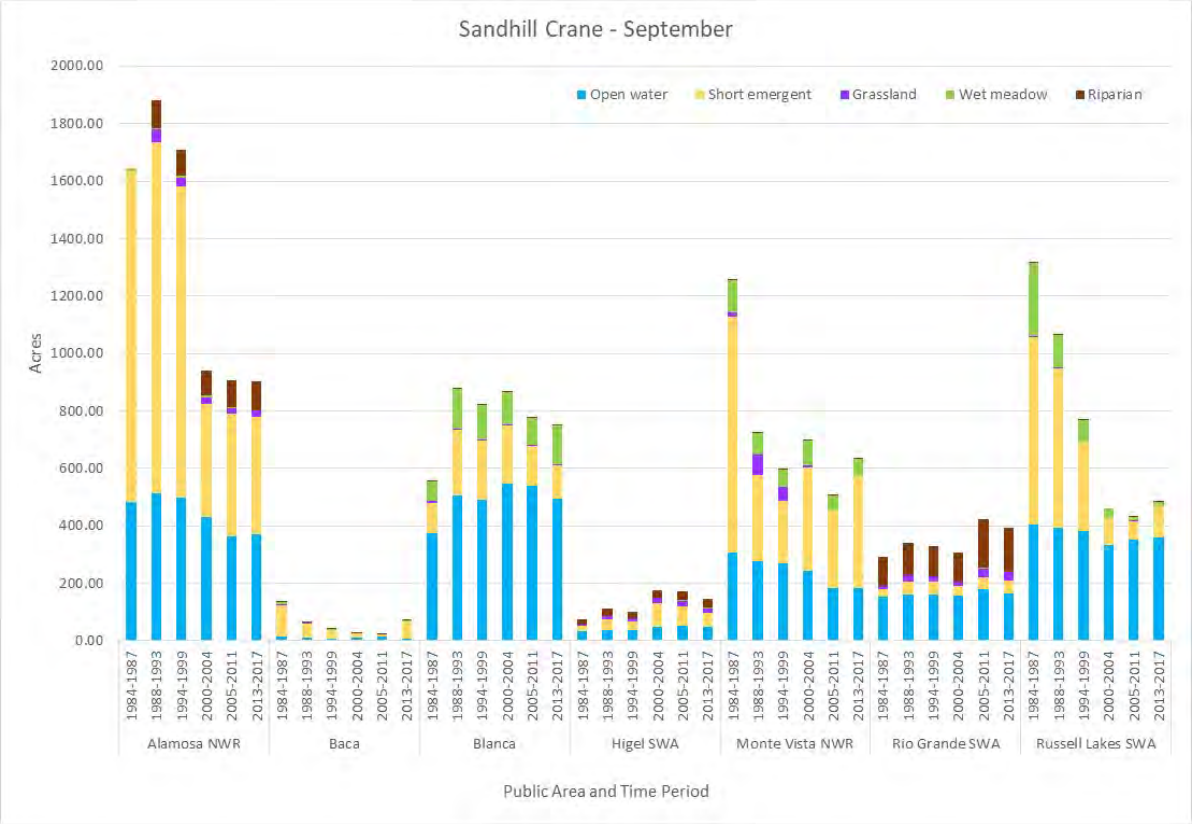


Figure 11.23. Habitat types by property and time period in September for sandhill cranes

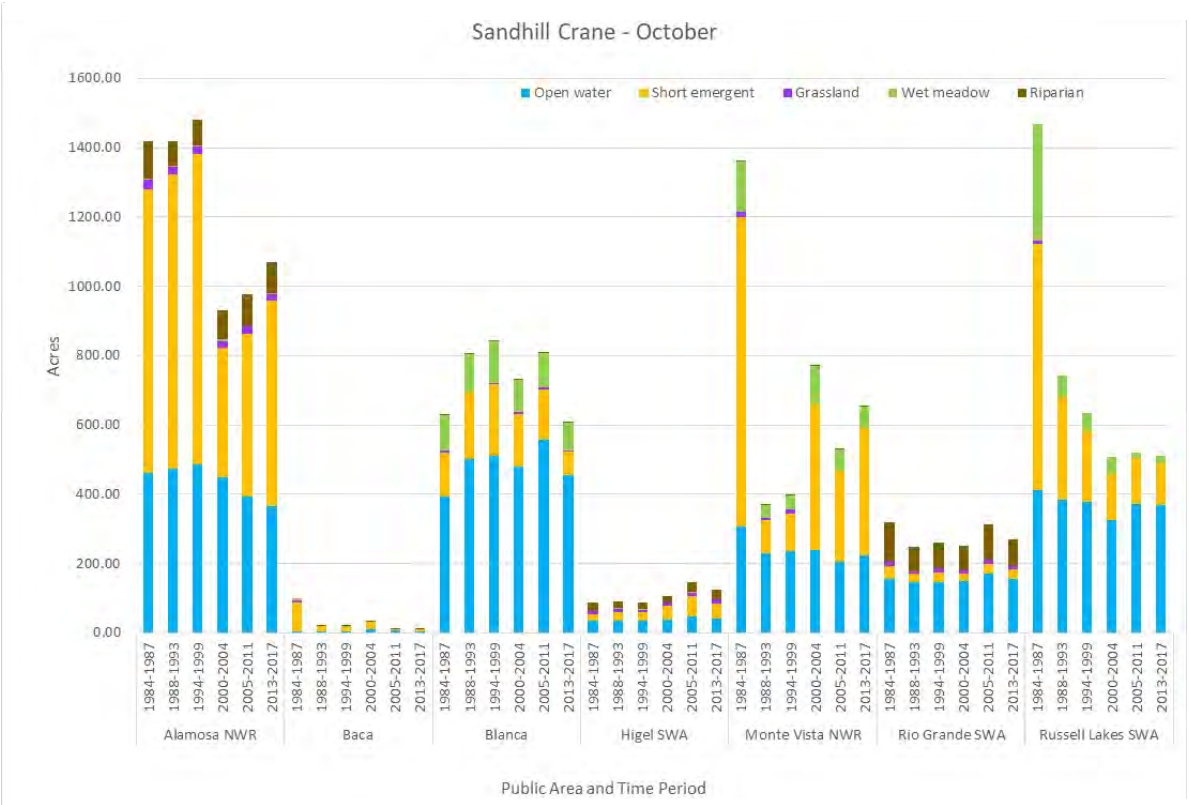


Figure 11.24. Habitat types by property and time period In October for sandhill cranes

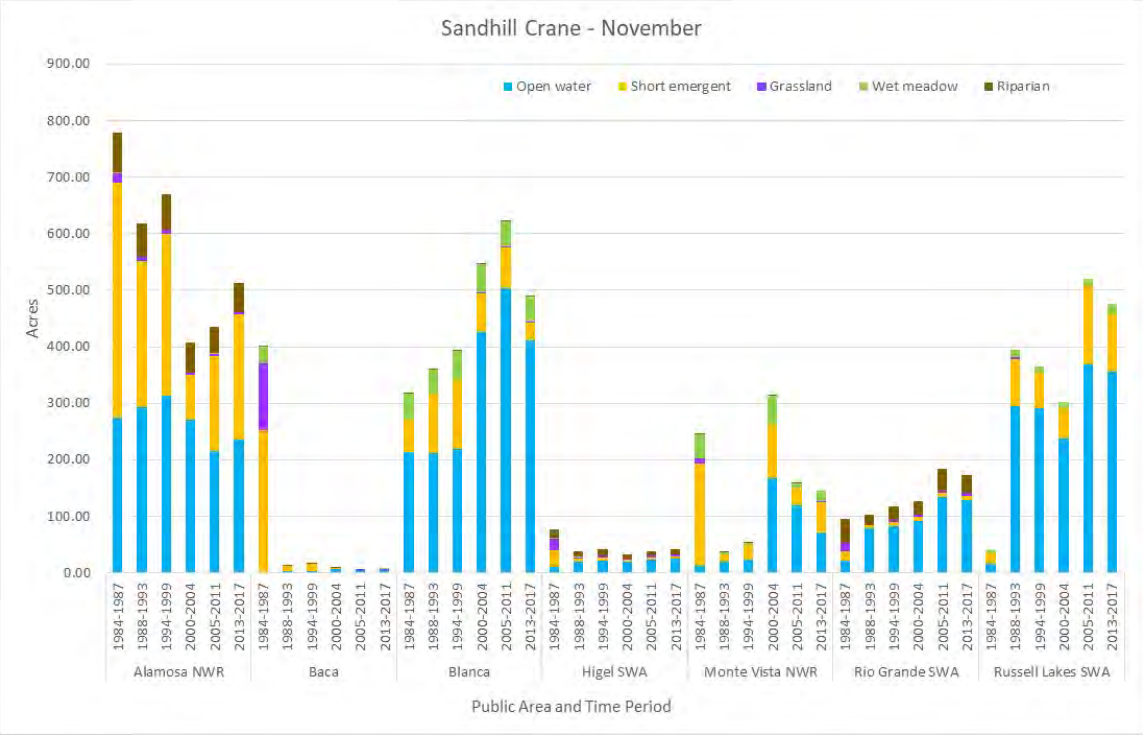


Figure 11.25. Habitat types by property and time period in November for sandhill cranes

16.3 Section 11.2.3 – White-faced Ibis Charts

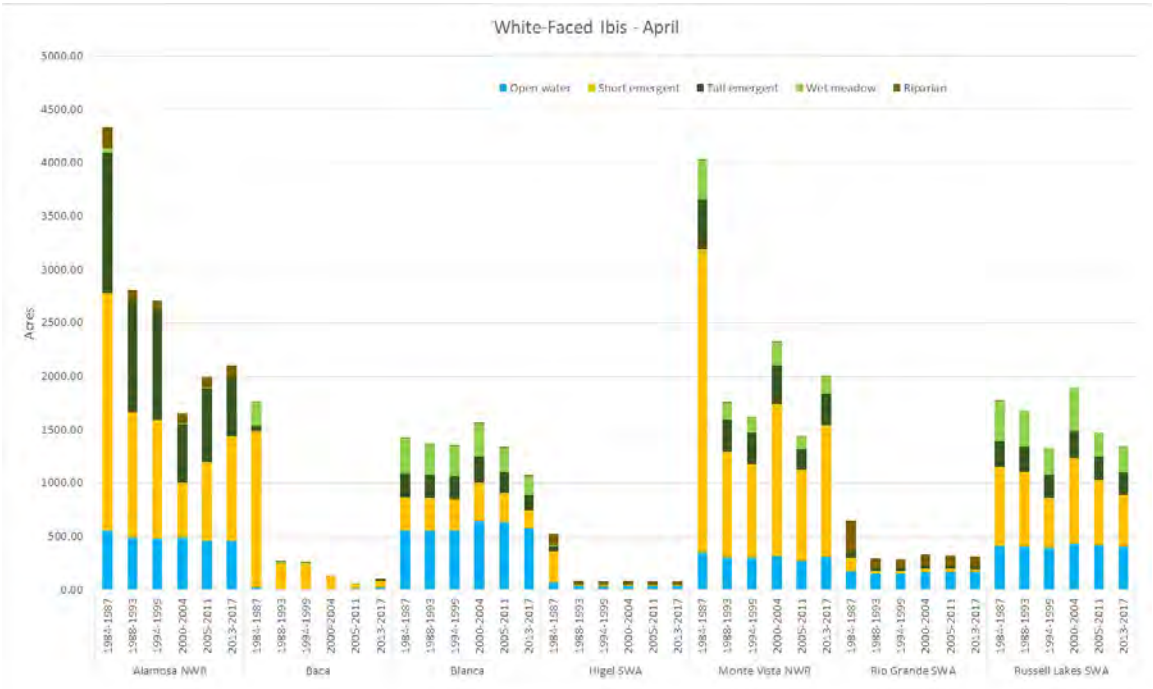


Figure 11.31. Habitat types by property and time period in April for white-faced ibis

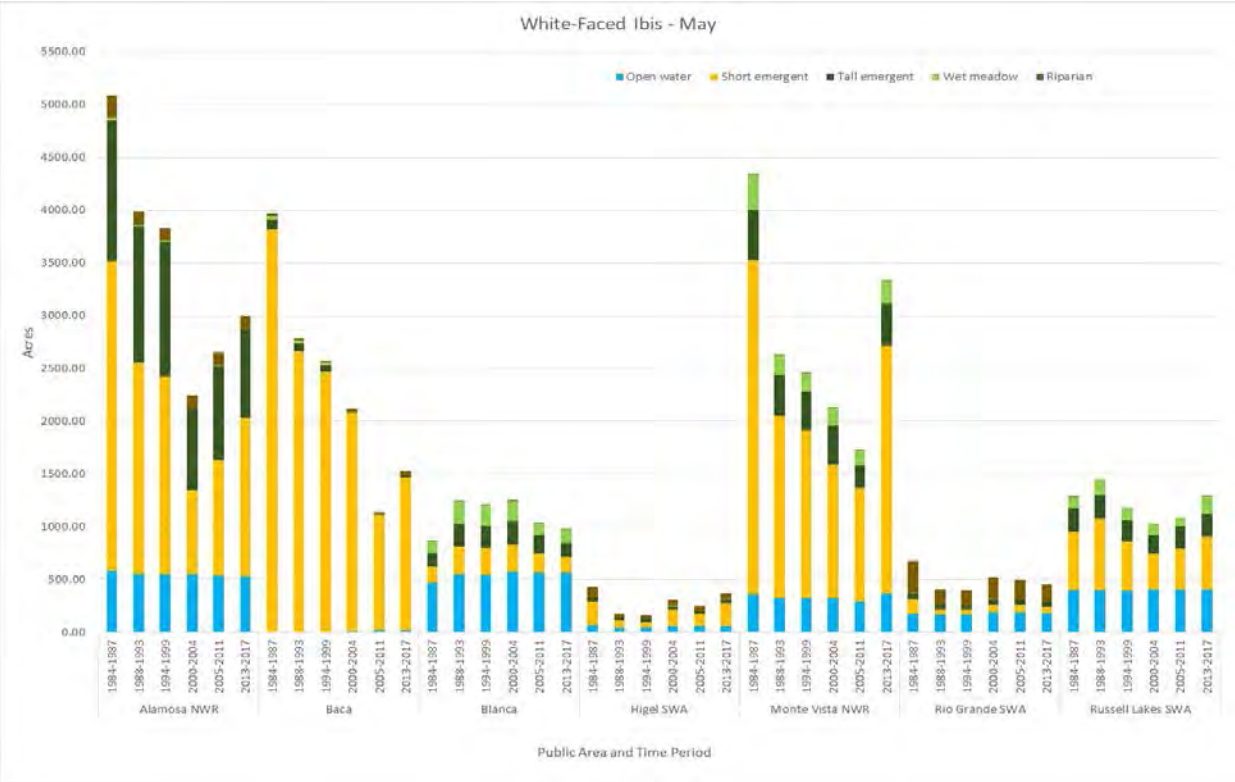


Figure 11.32. Habitat types by property and time period in May for white-faced ibis

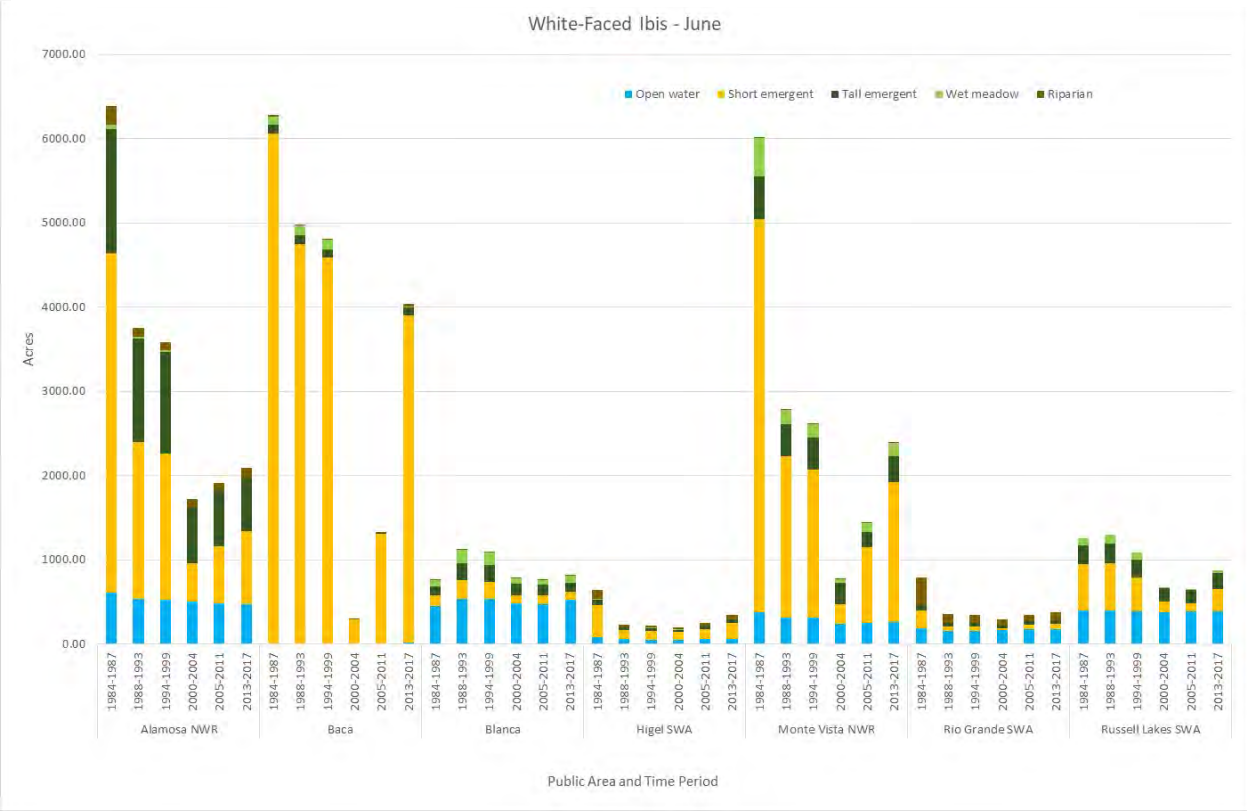


Figure 11.33. Habitat types by property and time period in June for white-faced ibis

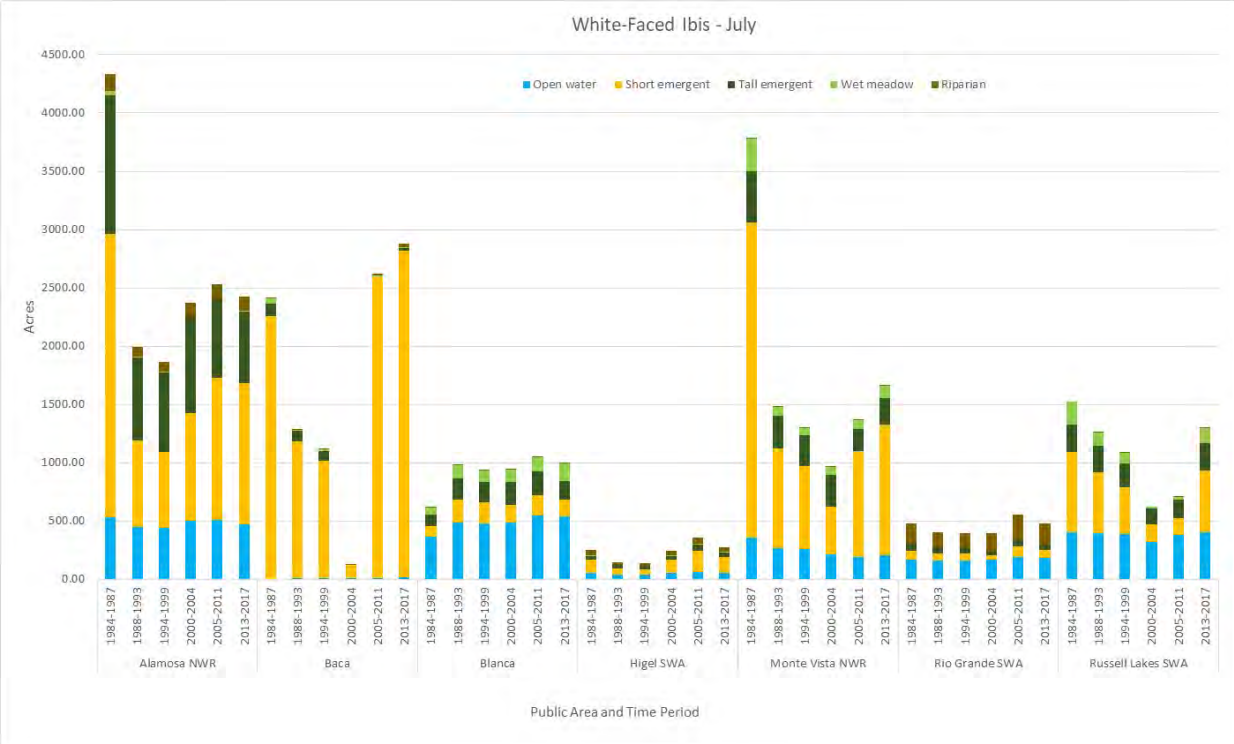


Figure 11.34. Habitat types by property and time period in July for white-faced ibis

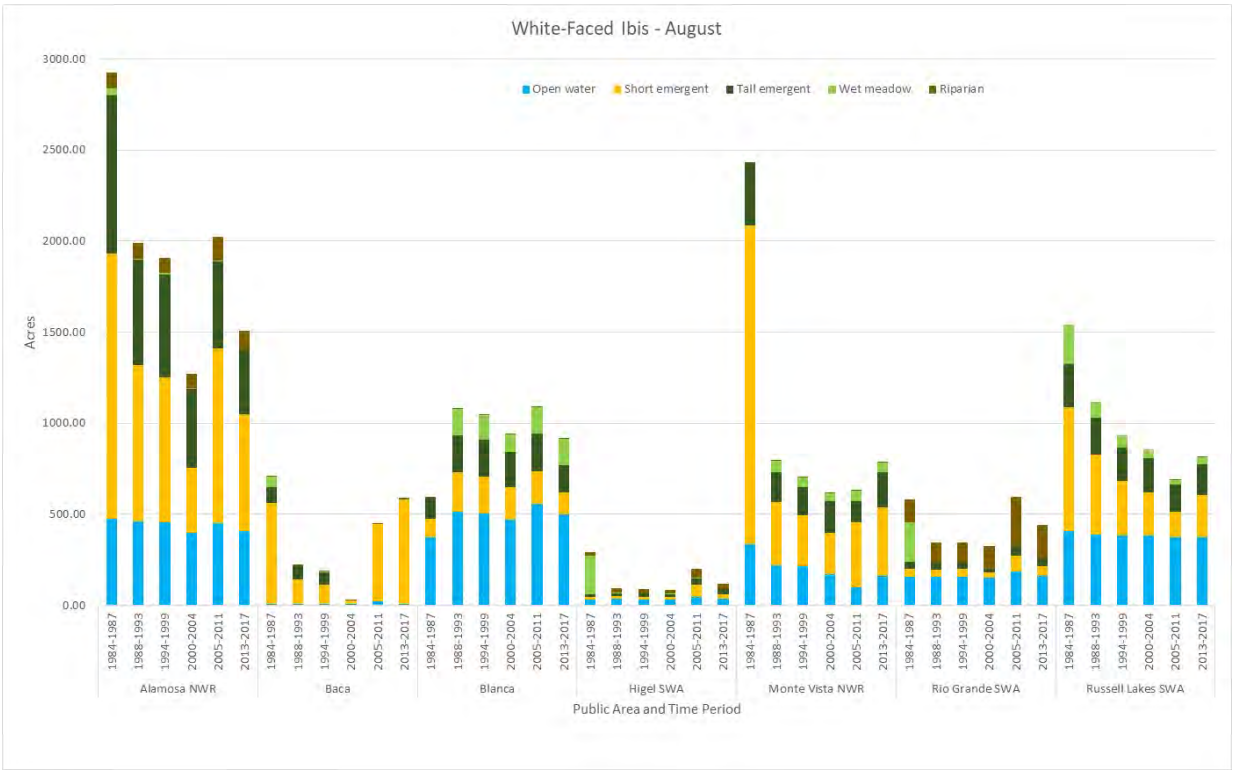


Figure 11.35. Habitat types by property and time period in August for white-faced ibis

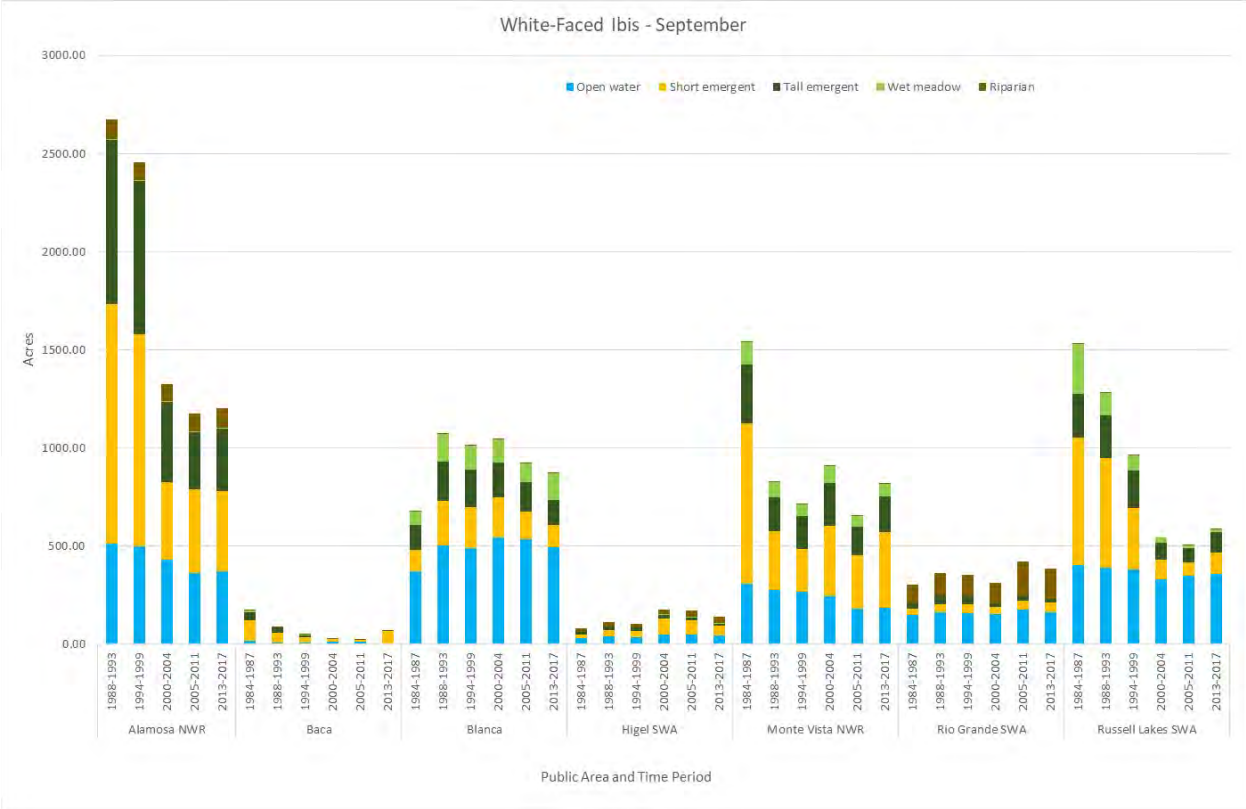


Figure 11.36. Habitat types by property and time period in September for white-faced ibis

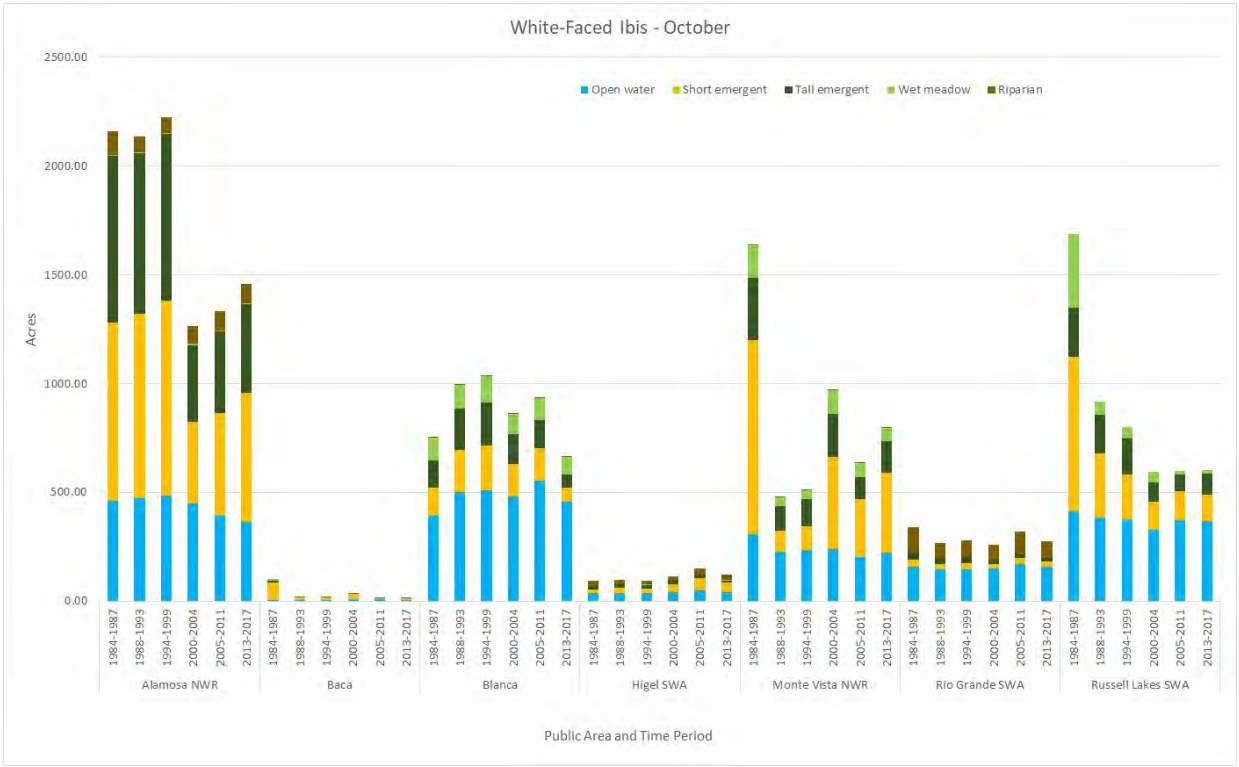


Figure 11.37. Habitat types by property and time period in October for white-faced ibis

17 Appendix III: Historic and Current Management of Public lands

17.1 Bureau of Land Management

Blanca Wetlands Management- BLM

Blanca Wetlands is the most southern link in a chain of shallow-water wetlands that extend from the Baca National Wildlife Refuge (NWR) south to State Highway 160 (Figure 8.2, Appendix I). Elevations within Blanca WHA range from 7,497 to 7,540 feet (2,285 to 2,298 m) above sea level, and a suite of wetlands, dating back to the Pleistocene, occur among the low sand dunes and expanses of desert grasses, rabbit brush, and greasewood. Prior to European agricultural development around 1880, small rivers and a myriad of wetlands emptied into the lowest lying area of the San Luis Valley where Blanca WHA exists today. Water was not able to move out of this low-lying "sump" except during extreme flood events.

Wetlands within Blanca Wetlands existed without human manipulation into the 1940s but as valley-wide pumping of the aquifer and diversion of surface flows for agricultural and domestic use increased, many wetlands began to disappear throughout the San Luis Valley. Because the Valley's confined aquifer rises to its high point directly underneath Blanca Wetlands, fairly deep water levels within some of these inter-dunal wetland basins persisted. In the 1960s, the BLM established the site as a Wildlife Habitat Area with the overall objective of providing and restoring wetlands and wetland wildlife habitat.

Before 1880 and the intense use of water for domestic and agriculture purposes throughout the San Luis Valley, Blanca Wetlands received pulses of snowmelt from ice-sheets on nearby foothills and small rivers. Re-creating those historic conditions is difficult given the much reduced modern water supply and physical barriers to water movement such as roads and the Closed Basin Canal. In an effort to restore these historic wetlands, from the 1960s to 1980s, the BLM drilled artesian wells to provide groundwater to the dry, historic wetland basins that existed on the site. Due in part to the statewide management focus on declining continental populations of dabbling ducks in the 1970's, water management at Blanca Wetlands during its first 30 years was relatively consistent in terms of timing, amounts, and location of water application. Deeper water was moved into wetland basins to maximize the ability to keep marshes or tall emergent habitats full through the summer, habitats that primarily benefitted waterfowl. In 2002, a severe drought throughout the Valley, coupled with new wetland managers at Blanca Wetlands, helped to reveal the importance of the shallow water habitats at Blanca, and new management strategies were developed to support these unique habitats. As the management focus shifted to shallow water ephemeral habitats (playa habitats), extensive studies were initiated to better understand these habitats and how to best manage them. Habitat improvement projects such as drying, burning and disking of selected wetland basins were initiated, while new irrigation approaches and accompanying infrastructure were developed to mimic historic disturbance regimes and flow conditions.

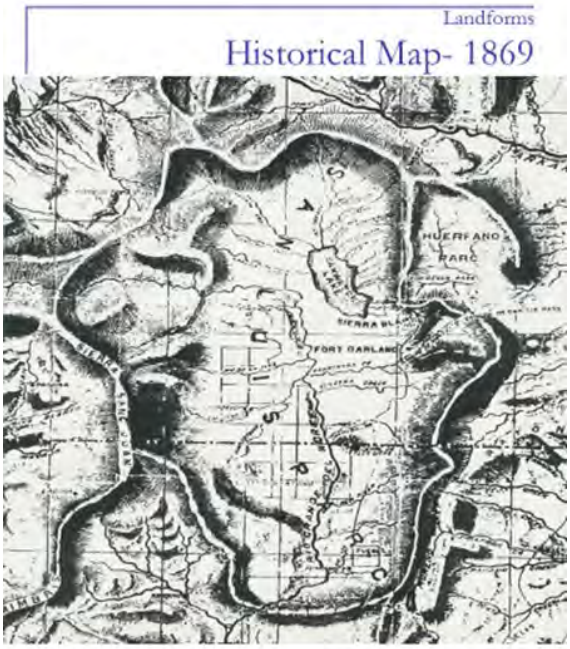
There is no electricity at the site, so water management relies upon gravity flow. Wells feed groundwater into basins, and water is then moved from these higher elevation basins to a series of lower elevation basins through a system of canals and water control structures. Wetland basins at the top of the system, fed directly by the wells are very fresh (0.1 ppt), and salinity levels increase as water is moved further through the system of canals and basins and finally ends in the playas which are very saline (up to 280 ppt). Because of the low producing wells that provide the primary source of water, irrigation of wetland habitats is a long, slow process. Irrigation must begin in late fall to create not only desired spring conditions, but to ensure adequate, late-summer and fall water levels in wetlands.

Water management practices for playas are designed, in part, to maximize the production of brine fly and brine shrimp to support foraging shorebirds and other waterbirds. Through years of observation and experimentation on the site, understanding when and how to manipulate water levels to support macroinvertebrate production have been developed. Other efforts to maximize shorebird habitats, including maintaining shoreline, spits, islands, moist soils, and shallow water important for shorebirds, without allowing playas to dry or overfill when birds are present, are prioritized. Having appropriate water depths at key times to produce relatively warm water temperatures, and managing a range of salinity levels, appears key to maximizing macroinvertebrate production.

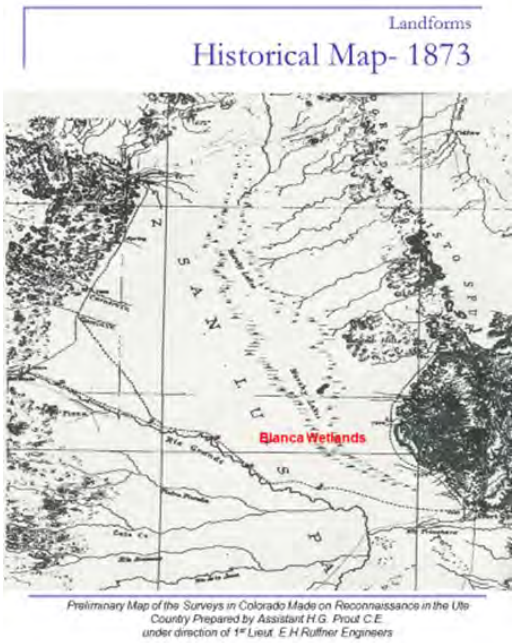
Water supplies available to Blanca Wetlands managers remain limited, primarily as a result of low producing, widely scattered wells and minimal available water from the Bureau of Reclamation's Closed Basin Canal. Total water annually available for wetland irrigation averages 3,000- 5,500 acre-feet, which includes 800 acre-feet of mitigation water from the Closed Basin Canal. Water production from wells is roughly one-half of the total adjudicated water for the wells. Flow rates can be significantly affected by artesian pressure; as pressure decreases, flows decrease. Wetland management at the site has been greatly influenced by constraints of the water management infrastructure and water availability. About half of the wetland basins are dried annually because of limited water supply and, to a lesser degree, to meet habitat management objectives. Efforts to address this limitation include: leasing water when supplies and funding are available; creating efficiencies in water management; creative partnerships; pursuing a "well-field" concept to offset individual well flow constraints and maximize flexibility; re-drilling wells to ensure failing infrastructure is not limiting flows; and investigating the feasibility of pumping wells.

General management direction for the site is described in the 1991 San Luis Resource Management Plan, which designated Blanca Wetlands as a BLM Special Recreation Management Area (SRMA) and Area of Critical Environmental Concern (ACEC) to protect the recreational, wildlife, riparian, scenic, and special plant and animal values on the site (BLM, 1991). These values include productive playa and marsh habitats that contain high densities of water birds, amphibians, macroinvertebrates, and 13 threatened, endangered and sensitive wildlife and plant species. The 1991 SLRA RMP (p. 20 4-1) identifies the need for special management on the site to maintain and improve wetlands for waterfowl production and the enhancement of additional wetlands. The SLRA RMP recommends restoring and enhancing an additional 1,175 acres of wetlands. A subsequent SLV planning effort, the San Luis Valley Waterbird Plan (Olterman 1995) recommends Blanca Wetlands expand up to an additional 5,000 acres of wetlands to assist in reaching managed wetland acre goals. In 2014, the SLVFO completed an

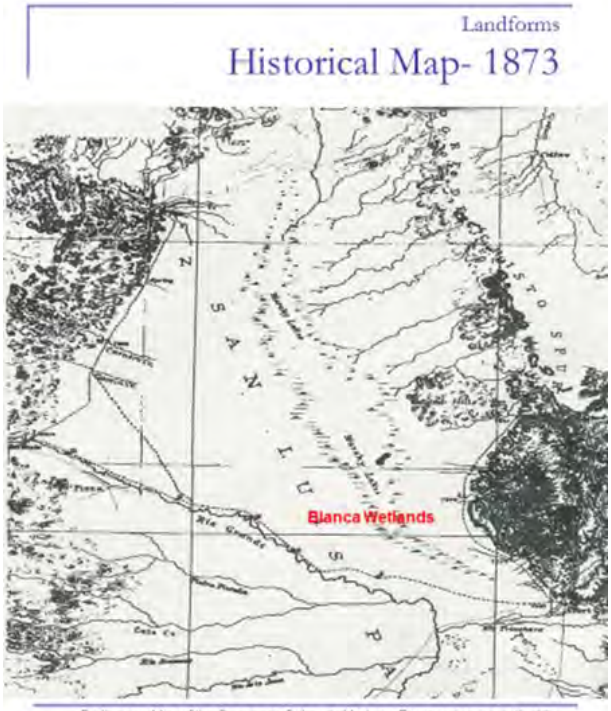
EA/Resource Management Plan Amendment to address these needs (BLM, 2014). The purpose of the plan amendment was to modify the boundaries of the Blanca Wetlands ACEC (increasing the ACEC from 9,714 acres to 122,762 acres) to incorporate current and historic wetland areas that meet the relevance and importance criteria to promote wetland ecological function, restoration, connectivity, and biodiversity.



Map of San Luis Parc of Colorado Territory and Northern Portion of New Mexico (Brayer W. Blackmore)



Preliminary Map of the Surveys in Colorado Made on Reconnaissance in the Ute Country Prepared by Assistant H.G. Prout C.E. under direction of 1st Lieut. E.H Ruffner Engineers



Preliminary Map of the Surveys in Colorado Made on Reconnaissance in the Ute Country Prepared by Assistant H.G. Prout C.E. under direction of 1st Lieut. E.H Ruffner Engineers

McIntire-Simpson Management- BLM

The McIntire-Simpson property encompasses 1537 acres along the Conejos River, 6 miles upstream from the confluence with the Rio Grande. Approximately 3 miles of the Conejos River runs through the property. The property supports an excellent example of a Narrowleaf cottonwood/ willow riparian and riverine wetland complex. McIntire Spring, on the south side of the Conejos River, generates up to 6700 gallons of 60 degree F water a minute, which maintains open water throughout the winter.

The BLM purchased the McIntire property in 1993 and the Simpson property in 2001 with Land and Water Conservation Fund dollars. An extensive irrigation delivery system, with associated artesian well water and surface water rights were acquired with the property. Both properties were historically working cattle ranches, which also produced native grass and alfalfa hay. Portions of the property on the north side of the river were leveled for farming.

Because these properties were acquired after the 1991 San Luis Resource Management Plan, there is nothing in that document providing management direction for these parcels. Because the properties were acquired for their riparian, water rights and threatened and endangered species values, management of this site has focused on those resources. The area provides important nesting habitat for the endangered Southwestern Willow Flycatcher, and was designated as Critical Habitat in 2013. Yellow-billed cuckoo have also been documented on the site; the site is proposed Critical Habitat for the cuckoo. Surveys over the past 15 years show that the site supports up to 25 pairs of Southwestern willow flycatchers annually, playing a significant role in meeting the Recovery Objectives of 50 pairs in the SLV. Consequently, this property plays a key role in supporting the Habitat Conservation Plan.

When acquired, irrigation infrastructure on the site was in poor repair. BLM has worked to improve ditches, dikes, and water control structures to most efficiently irrigate the property. Much of this work has been done with partners and various grant dollars. Partnership projects with Ducks Unlimited utilizing NAWCA funds, constructed levees on both the Simpson and McIntire properties to provide better water distribution and a more efficient flow through system. Other projects with other partners have included replacing headgates, installing flow meters in ditches, maintaining ditches and dikes, and other work.

When the property was first acquired, the largest well had an old diesel pump on it that was no longer functional. The old pump was removed, and that well, along with the others on the site, were left to flow freely as they are artesian wells. Over time, the wells on the property had also fallen in to disrepair, and old well casings and other issues were believed to be impacting flow rates. Starting in 2017, BLM began re-drilling wells and replacing well casings. To date, two of the 4 wells have been re-drilled, with plans and funding in place to complete the other 2 wells. In addition, BLM has also paid to have electric brought to the site (project to be completed in 2019), and intends to install pumps on at least some of the wells, in order to fully utilize the decreed water right. The importance of having this well water has been underscored in recent years of historic drought conditions. Although the property utilizes relatively senior surface water rights, during extreme drought the property has not been able to sustain moist soil conditions and areas of standing water throughout the Southwestern willow flycatcher breeding season, which appears essential for nest success. Pumped well water can augment surface flows to better support successful breeding on the site.

Other management actions undertaken to improve habitat conditions on the site include: decadent willow mowing to release new growth and create a multi-age stand; weed treatments; and willow planting along the Conejos River, as well as many studies and surveys to better understand management needs and response of wildlife to management actions.

17.2 Colorado Parks and Wildlife

Management of SWAs varies by area. Intensive management of wetland systems has occurred on the Russell Lakes, Rio Grande, and Higel SWAs since 2001. San Luis Lakes SWA has had some intensive management beginning in 2007. Some other areas contain water rights that are managed to support a fishery and or boating, contain dams, or may allow some grazing depending on the MOU with other agencies or landowners. A few have little to no active management.

Higel SWA

The HSWA incorporates a portion of the Rio Grande and its floodplain between the towns of Monte Vista and Alamosa (Figure 8.5, Appendix I). Historically, this area has been influenced by overbank events during spring run-off. However, water development to support agriculture has modified the timing, intensity and duration of run-off. Today, this area is a complex of floodplain wetlands containing backwater sloughs, oxbow lakes, and seasonal wet meadows fed by a network of irrigation ditches. Many of the sloughs adjacent to the river still receive some subsurface flow supplementing the surface irrigation of these features. The SWA was historically part of the Higel family's Ranch which still surrounds the area and was utilized for haying, grazing, and over-wintering cattle.

Current management practices promote large shallowly flooded open water areas that are important for foraging and migrating, waterbirds throughout the spring and fall. The SWA is dependent solely upon surface water irrigation rights that are tied to the irrigation season, presumptively April 1 to Nov. 1 annually.

The daily management of the Higel SWA is conducted by the Higel family as they hold a lease to hay and graze the SWA during pre-determined times of the year and with specific AUM's. Management for wildlife and public use coincide with maintaining historic land management practices that include the grazing of livestock and native hay production on the SWA.

The lease agreement between the Higel family and CPW allows for grazing of the property in designated areas at specific AUM's and during specific time periods. Designated areas for cattle grazing may be changed on an annual basis dependent on objectives for the area and changing resource needs.

Water management on a daily basis is the responsibility of the Higel family. Water rights associated with this property include 8 shares of Centennial Ditch water. The Higel family provides all the equipment and labor needed in order to maintain all ditches, reinstall washed out structures and ditches. The Higel family may utilize portions of the HSWA for growing and removing hay. Areas to be hayed may be amended as objectives or resource needs change.

Rio Grande SWA

The RGSWA incorporates a portion of the Rio Grande and its floodplain just outside of the town of Monte Vista (Figures 8.1 and 8.6, Appendix I). Historically, this area has been influenced by overbank events during spring run-off. However, surface water diversions to support agriculture and other needs have modified the timing, intensity and duration of run-off. Today, this area is a complex of floodplain wetlands containing backwater sloughs, oxbow lakes, and seasonal wet meadows fed by a network of irrigation ditches. Many of the sloughs adjacent to the river still receive some subsurface flow supplementing the semi-permanent and permanent wetlands. The area was historically grazed and farmed in a few locations.

CPW management of this area maintained semi-permanent to permanent conditions promoting tall emergent cattail and bulrush vegetation. Infrastructure in many locations was old, inefficient, with levees constructed outside of natural drainage pathways. Over the past 10 years management has shifted to promote a more diverse and heterogeneous suite of natural vegetation communities by mimicking natural processes and incorporating mechanical techniques to reduce undesirable monotypic stands of weeds and tall emergent plant species. Many areas have been set back in succession, however, a non-native and aggressive grass, reed canarygrass, has taken the place of the other tall emergent plant species in some locations where water control is difficult. This species was planted in agricultural areas as forage but has not proven effective and has spread through the ditch system. Current management practices promote large shallowly flooded open water areas that are important for foraging, migrating, and pre-breeding waterbirds throughout the spring and fall. Over time the Colorado Wetlands program along with funding from the North American Wetland Conservation Act has provided funding to improve, enhance, and restore many of the areas on the RGSWA.

Given the long-term drought and declining water tables that have resulted in diminished flows from wells, changes in timing of peak flows of the Rio Grande and the reduced duration of available irrigation water rights wetlands and habitats on the RGSWA have relied on additional resources from CPW owned trans-mountain water with wildlife decrees.

Russell Lakes SWA

Historically, several of the current units were duck clubs that created and expanded deep, open water habitats to provide waterfowl hunting opportunities. Waterfowl hunting continued to be the priority as acquisition of the duck clubs and surrounding lands for mitigation of the Closed Basin project occurred and established the RLSWA. CPW management of this area maintained semi-permanent to permanent conditions promoting tall emergent cattail and bulrush vegetation. Over the past 19 years management has shifted to promote more natural vegetation communities by mimicking natural processes. Much of the cattail has transitioned to the more salt tolerant bulrush and many areas have been set back in succession creating a more heterogeneous composition of plant communities. However, wetland development in the 1990's created large levees, borrow ditches, and promoted the impoundment of water and thus tall emergent plant species. In the southeastern portion of the State Wildlife Area many of these levees were constructed through historic Russell Creek drainage pathways (Figure 8.6, Appendix I). Overall, the development of these units were designed to utilize a groundwater resource (well) that was not sufficient to meet the objectives of the project. Given the long-term drought and

declining water tables that have resulted in diminished flows from wells, coupled with the poor design, restoration of the creek pathways was warranted in order to efficiently and effectively utilize available water resources. Phase I to restore the south drainage was completed in fall of 2017 with Phase II funded in 2018 to restore the central drainage pathway. Over time the Colorado Wetlands program has provided funding to improve, enhance, and restore many of the areas on the RLSWA.

As with most of the public areas in the SLV, one of the initial main objectives for RLSWA was to provide additional nesting habitat for waterfowl. As the drought continues and a better understanding of how the SLV functions in relation to waterfowl and waterbird life cycle events, migration habitat has become a priority while still providing some nesting habitat. The RLSWA remains one of the most significant white-faced ibis colonial nesting sites in Colorado. In addition, Trites Lake has become an important area for nesting grebes. Management of the lakes that incorporates drying on a 5 or 10 year cycle has promoted the growth of submergent and aquatic plant species and suppressed the carp population allowing for a greater diversity of invertebrate and wildlife use.

Grazing has occurred on the RLSWA over time in several areas. Over the past 10 years, U.S. Forest Service horses have grazed the Smith Tract (Figure 8.7, Appendix I) from approximately November through May annually. A temporary electric fence was installed in 2012 around the five units in order to prevent the horses from further damaging the levees. The consistent use of this area for the past 15 years may be negatively impacting the plant communities and thus reducing available wildlife resources. Weed species are prevalent in this area and represents the only area that Russian knapweed exists on the SWA. New species such as black henbane have recently also been observed in this area.

17.3 U.S. Fish and Wildlife Service

Historic to current Management: Alamosa NWR

Alamosa NWR lies within the floodplain of the Rio Grande (Figure 8.8, Appendix I). As such, numerous seasonal, semi-permanent, and permanent wetland areas existed prior to refuge establishment in 1963. At the time of establishment, numerous ditches, water diversion/control structures, and some levees had been previously constructed, however, much of this infrastructure was in poor or failed condition. Beginning in the mid-1960s, refuge staff began upgrading existing water management infrastructure as well as constructing new infrastructure including some levees, ditches, and water diversion/control structures. Similar to Monte Vista NWR, attempts were made to maximize the acreage of wetland habitat through the construction of some levees and installing water diversion/control structures at the highest points possible. Although some conversion of upland habitats to wetland habitat occurred, it was limited due to the large extent of naturally occurring wetlands in the floodplain. Primarily, there was some wetland habitat type conversion that occurred due to an increase in duration that irrigation water was applied, resulting in a reduction of seasonal and semi-permanent wetland habitats to more permanent wetland habitat.

Generally, since the late-1960s through the early 2000s, water management on the refuge had been static, with the objective of providing water and cover resources for breeding ducks. This management emphasis was fostered by the attraction of high numbers and densities of

breeding dabbling ducks to the flooded wetlands on the Monte Vista NWR. Long-term studies of nesting ducks indicated generally good nesting success and recruitment of young from Monte Vista NWR. These studies encouraged annual flooding of wetland habitats and expansion of Baltic rush and other short emergent wetland plant species on both Monte Vista and Alamosa NWRs. Similar to Monte Vista NWR, historic water management likely led to a reduction in vegetative species diversity.

The Rio Grande flows along the entirety of the western portion of the refuge, where sparse narrow and disjunct patches of woody riparian vegetation (dominated by coyote willow and narrow-leaf cottonwood) occurs. Generally, the woody riparian vegetation has declined along the Rio Grande in the recent decades, likely as a result of severe fluctuations in river flows in the Rio Grande and water tables. During times of low flow in the Rio Grande, water is often discharged from adjacent floodplain wetlands to the river or lower elevation ditches which function as a drain, consequently lowering the water table of these adjacent areas. Currently, low flows in the Rio Grande caused by diversions and groundwater use have likely contributed to decreases in local water tables, resulting in a decline in woody riparian extent and health. Recently, refuge staff have conducted numerous planning efforts and have shifted away from traditional management. For example, many of the levees that had been constructed irrespective of soil types and historic vegetation communities are being removed. Removal of these levees and other infrastructure are designed to eliminate irrigation of formerly upland habitats, allowing soil and vegetative communities to revert to historic conditions, while maintaining irrigation of "natural wetland areas". Locations of water diversion/control structures and ditches are being modified to minimize irrigation of upland habitats and restore hydrologic conditions to natural wetland areas. In many areas, the timing, depth, and duration of irrigation has changed to emulate historic hydrologic regimes while still utilizing the refuge's full water rights. More emphasis is placed on creating a diversity of wetland habitat types, comprised of the greatest vegetative species diversity, providing a suite of conditions to fulfill the life history requisites of a wide array of migratory waterfowl, shorebirds, secretive marsh birds, colonial waterbirds, and upland birds.

Due to the low and fluctuating flows in the Rio Grande, refuge staff are exploring ways, and modifying water delivery infrastructure, to use the refuge's irrigation water to maintain adequate water tables within the riparian corridor for willow and cottonwood growth, spread, and survival. Recent restoration activities have included planting of willow and cottonwood plants as well as installation of water diversion structures.

Historic to current Management: Baca NWR

For over a century, the area encompassed by Baca NWR was used as a cattle ranch. Land use was for hay production and cattle or sheep grazing. To enhance hay production on the property, a "catch and redistribute" irrigation system was developed. Creek water was diverted through ditches and then discharged at the highest points in the wet meadows. Unused water was captured in the low spots of the meadow and redistributed to the next high point where the process was repeated. Haying typically was completed in late summer and grazing of these areas occurred during fall and winter. This management scheme remained relatively constant for over 125 years. During the 20 years immediately prior to refuge acquisition in 2004, the maintenance and repair of water diversion/control infrastructure

generally was neglected and ditches and levees had to be repaired, cleared, or plugged annually. The aging water management infrastructure could not efficiently deliver water throughout the system and was continually impacted by high spring flows that often contained large amounts of sediment that washed out or plugged infrastructure. After refuge establishment, staff began replacing and repairing water diversion/control structures and ditches.

For the most part, annual water management on lands encompassed by Baca NWR has been consistent a century. Generally, available water resources were divided through the use of water diversion/control structures to provide equal distribution of surface water sheetflow across the largest area possible. The flow of ephemeral creeks coming out of the Sangre de Cristo Mountains can vary greatly on a daily and weekly basis and water management infrastructure can easily wash out if the flow exceeds the capacity of the structure or if structure manipulations cannot be changed quickly enough to prevent overflowing events. Most natural creek flows were diverted primarily to provide water for wet meadow habitats, which resulted in water rarely reaching the playa lakes area of the refuge.
Historically, virtually all of the wet meadow habitats were annually hayed and grazed including riparian habitats. After refuge establishment, water management across the refuge remained similar to management prior to establishment. The greatest management change was that cutting hay and grazing was reduced in wet meadows and grazing within riparian habitats was eliminated.

Recently, refuge staff have conducted numerous planning efforts and have shifted away from traditional management. For example, many of the ditches that had been constructed are being removed in order to minimize water application on lands that were historically uplands. Removal of these ditches and other infrastructure are designed to eliminate irrigation of formerly upland habitats, allowing soil and vegetative communities to revert to historic conditions, while maintaining irrigation of "natural wetland areas". Locations of water diversion/control structures and ditches are being modified to minimize irrigation of upland habitats and restore hydrologic conditions to natural wetland areas. Additionally, there is a greater emphasis on delivering water to the playa lakes than historically occurred. Although there is little control over the amount, timing, and duration of water availability, managing water resources to create a diversity of wetland habitat types, comprised of the greatest vegetative species diversity, providing a suite of conditions to fulfill the life history requisites of a wide array of migratory waterfowl, shorebirds, secretive marsh birds, colonial waterbirds, and upland birds is the refuge's primary objective.

Historic to current Management: Monte Vista NWR

Immediately prior to refuge establishment in 1952, the area surrounding and within Monte Vista NWR was predominantly irrigated pasture/hay and cropland. Many areas of native salt desert shrub habitat had been converted to irrigated pastures and hay land and numerous small levees, water diversion/control structures, and ditches had been constructed to facilitate irrigation. Shortly after the establishment of the refuge the construction of levees, ditches, and water diversion/control structures expanded considerably to maximize the amount of irrigated acres and create new wetland areas. Generally, this infrastructure was designed irrespective of soil type or historical vegetation community types. The development of

extensive networks of water diversion and conveyance ditches and canals, levees, and water control structures continued throughout the mid-2000s. As a result, this extensive development compartmentalized the refuge into approximately 80 distinct irrigated wetland sub-units.

Historically, water control infrastructure and the associated water management was designed to maximize the acreage of wetland vegetation across the landscape to benefit primarily nesting waterfowl and migrating sandhill cranes. Numerous management units on the refuge had some of the highest density of nesting ducks recorded in North America, which prompted refuge staff to try to maximize those habitat conditions across the refuge. As a result, significant acreage of upland shrub habitat was converted (via irrigation) to seasonal, semi-permanent, and permanent wetland habitats. For close to 50 years, irrigation practices on the refuge remained generally consistent, flooding many of the same areas with the same depth of water from spring through fall. As a result, vegetation communities have likely lost much of their species diversity and moved to near monocultures of Baltic rush or cattails.

Recently, refuge staff have conducted numerous planning efforts and have shifted away from traditional management. For example, many of the levees that had been constructed irrespective of soil types and historic vegetation communities are being removed. Removal of these levees and other infrastructure are designed to eliminate irrigation of formerly upland habitats, allowing soil and vegetative communities to revert to historic conditions, while maintaining irrigation of “natural wetland areas”. Locations of water diversion/control structures and ditches are being modified to minimize irrigation of upland habitats and restore hydrologic conditions to natural wetland areas. In many areas, the timing, depth, and duration of irrigation has changed to emulate historic hydrologic regimes while still utilizing the refuge’s full water rights. More emphasis is placed on creating a diversity of wetland habitat types, comprised of the greatest vegetative species diversity, providing a suite of conditions to fulfill the life history requisites of a wide array of migratory waterfowl, shorebirds, secretive marsh birds, colonial waterbirds, and upland birds.

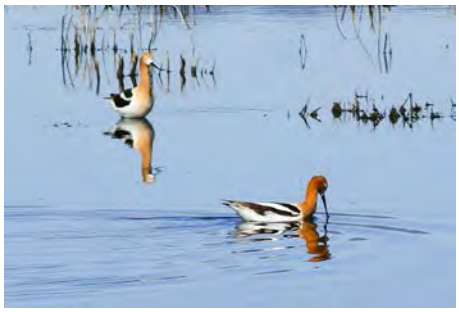
18 Appendix IV: Species Fact Sheets

Table 18.1. Priority Species included in the Assessment

Priority Species for Assessment	Common Name	Federal and State Listing Status	Colorado Wetlands Priority Species	Colorado State Wildlife Action Plan Status	BLM Sensitive Species	SLV NWR CCP Species List	IWJV Priority Species 2013 Implementation Plan
Amphibians	Great Plains Toad						
	Northern Leopard Frog	SC		Tier 1	X	X	
	Woodhouse's Toad						
Birds	American Avocet					X	
	American Bittern			Tier 2		X	X
	American Dipper						
	American White Pelican			Tier 2	X		
	American Wigeon		Tier 1				X
	Baird's Sandpiper						
	Bald Eagle	SC		Tier 2	X	X	
	Black-crowned Night-Heron						
	Cinnamon Teal		Tier 1			X	X
	Eared Grebe						
	Greater Sandhill Crane	SC		Tier 1		X	X
	Lewis's Woodpecker			Tier 2			X
	Long-billed Curlew	SC		Tier 2	X	X	X
	Mallard		Tier 1			X	X
	Northern Pintail		Tier 1				X
	Pied-billed grebe						
	Redhead						
	Savannah Sparrow					X	
	Short-eared Owl			Tier 2			
	Snowy Egret						
	Southwestern Willow	FE, SE		Tier 1		X	X
	Western Snowy Plover	SC		Tier 2	X	X	X
	Western Wood-Pewee					X	
	Western Yellow-billed	FT, SC		Tier 1	X	X	
	White-faced Ibis			Tier 2	X	X	X
	Wilson's Phalarope					X	X
	Yellow Warbler						
Fish	Rio Grande Chub	SC		Tier 1	X	X	
	Rio Grande Cuthroat T	SC		Tier 1	X	X	
	Rio Grande Sucker	SE		Tier 1	X	X	
Mammals	New Mexico Meadow	FT, ST		Tier 1	X	X	
	River Otter	ST		Tier 2			

FE = Federally Endangered, FT = Federally Threatened, N = Petitioned to list federally, determined to be Not Warranted, SC = State Concern, SE = State Endangered, ST = State Threatened

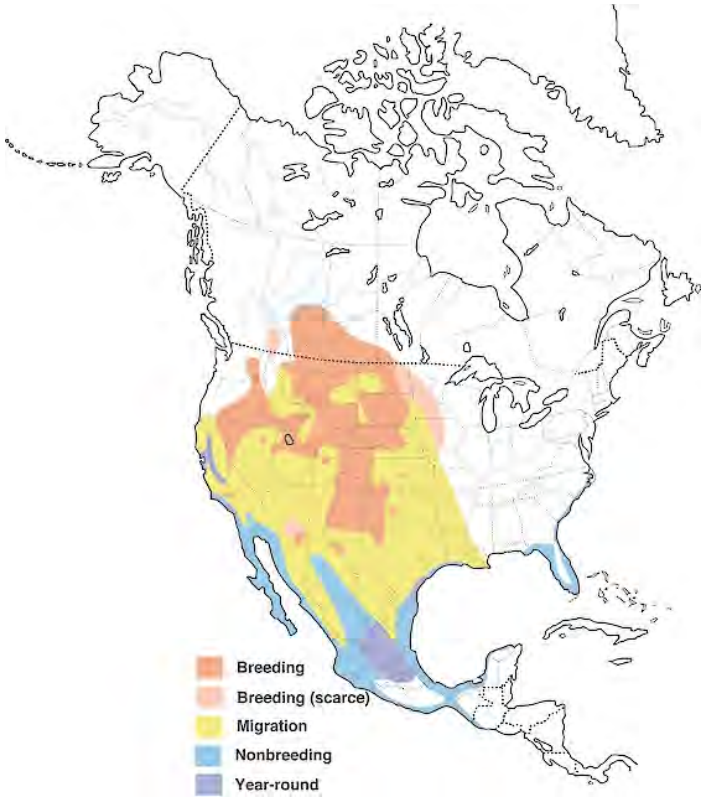
American avocet (*Recurvirostra americana*)



General Description: The American avocet is a shorebird in the family Recurvirostridae. In inland areas like the San Luis Valley, it uses a variety of shallow, mostly sparsely vegetated wetlands, and nests on the ground near water.

Physical characteristics: The American avocet is a large shorebird with long, blueish legs and a long, recurved bill. The sexes have similar plumage, but males are slightly larger than females, and the bill is more recurved in the female than in the male. Avocets have a distinctive black and white pattern on the wings and back. The head and neck feathers are cinnamon from the spring through breeding, and molt to a grayish white during the non-breeding period.

Range and Conservation Status: During breeding and migration, avocets are widely distributed throughout the West and the central plains of North America; they winter primarily in coastal areas and the interior of Mexico. The American avocet is currently not threatened or of concern but loss of ephemeral and seasonal wetlands limits suitable habitat, and local populations are detrimentally impacted by heavy metals and other water quality issues. The North American Breeding Bird Survey show that avocet populations are stable across their range. However, this survey indicates long-term declines of breeding avocets in Colorado, and the Second Colorado Breeding Bird Atlas also indicates a reduction in breeding extent statewide. Monitoring on Blanca Wetlands show an overall increase in population levels since 2013.



Communication: Avocets have a distinctive, loud alarm call (*kleet*) that is commonly used during the breeding season.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: American avocets feed primarily on aquatic invertebrates, but also consume seeds, terrestrial invertebrates, and small fish. They feed visually or by sifting through the water column or sediment, and generally forage at water depths <20 cm or on mudflats, and in habitats with little or no vegetation.
- Breeding system: Seasonally monogamous. Most pair formation occurs before arrival on breeding areas. Pairs defend feeding areas, nest sites, and broods. Avocets can nest in loose colonies. Pairs arrive several weeks before nesting begins.
- Nesting: Late April through June. Avocets have one nest per year, but pairs will re-nest if the first nest is lost. Clutch size is three or four eggs, laid over about 5 days. Avocets nest on the ground, and form a shallow scrape on unvegetated or sparsely vegetated surfaces, usually near water. They commonly nest on islands when available. Nests are often found on elevated salt-grass/greasewood hummocks as well as levees with water on both sides. Incubation is usually 22-29 days. Both parents incubate the eggs.
- Brood period: Late May to early August. Chicks leave the nest within 24 hours of hatching, and are led by the parents to nearby habitats with shallow, open water for feeding and vegetation for cover. Young avocets can fly about four weeks after they hatch.
- Post-breeding: After breeding, American avocets tend to form small flocks. They forage and migrate to wintering areas together.

American avocet SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration					Migration			
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Playa				Migration					Migration			
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				
Short Emergent				Migration					Migration			
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				
Wet Meadow				Migration					Migration			
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, American avocets use a variety of wetlands, including alkali playas, temporarily flooded saltgrass flats, seasonally flooded pastures, wetlands, and impoundments, and shorelines of lakes, semi-permanent wetlands, and permanent ponds. In all these wetland types, avocets prefer unvegetated or sparsely vegetated areas for foraging and resting. Avocets feed mainly in water < 20 cm deep, although they will occasionally swim in deeper water and forage at or near the surface. Avocets nest close to water in sites with little or no vegetation.

Key public areas for avocets in the San Luis Valley: Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the creation and protection of shallowly flooded wetlands with little vegetation. Additional considerations for avocet habitat are listed below:

- Complexes of shallow, unvegetated or sparsely vegetated wetlands that are flooded for several days, weeks or months during late March to late August. Proximity of these wetlands to larger wetlands with longer hydroperiods may be beneficial. Complexes, and individual wetlands in complexes, may be relatively small (several acres), but numerous complexes are desirable to allow avocet pairs to distribute themselves and take advantage of changing wetland conditions and food resources. Provide some habitat with water depths of <20 cm for foraging to benefit this species.

- Desirable habitat conditions for avocets (short, sparse vegetation and bare ground) are maintained in part by retaining salts in the soil. Impounding and regularly flowing fresh water (usually from a single point at the high point of the impoundment) across these habitats can result in conversions to more densely vegetated conditions. Careful management of hydrologic patterns is needed in these habitats.

- Nesting islands surrounded by relatively deep expanses of water may be valuable in providing protection from mammalian predators and improving avocet nest success. Nest sites should not be allowed to become overgrown with vegetation.

- Manage water to maintain the greasewood/saltgrass mound structure in the wetland complex to provide nesting habitat.

- Establish winter sheet ice in saltgrass, playas, greasewood/saltgrass areas that slowly drawdown in the spring to provide appropriate conditions for nesting and foraging; areas should be juxtaposed to other wetland areas that maintain some shallow water resources through the brood-rearing season.

- Where possible, minimize disturbance during breeding/nesting season.

- Minimize changes in water levels to avoid flooding nests or increasing predation during the nesting period.

Monitoring Recommendations:

Avocets are usually easily observed, but can be patchily distributed in appropriate habitat. Tracking the amount, distribution, and annual availability (e.g., hydrology) of important breeding habitats (alkali flats, ephemerally-flooded basins, and other sparsely vegetated shallow wetlands) would be useful for assessing the extent of the available breeding habitat for avocets. Annual or periodic surveys of breeding pairs and production of young, possibly using double observer methods, may be appropriate to assess breeding avocets in the SLV.

Other possible monitoring methods could be appropriate to assess avocet populations across the 4 key sites in the SLV (contact Brad Andres, FWS National Shorebird Coordinator for assistance).

Monitor water quality in key wetland sites for heavy metal concentrations in potential areas of concern.

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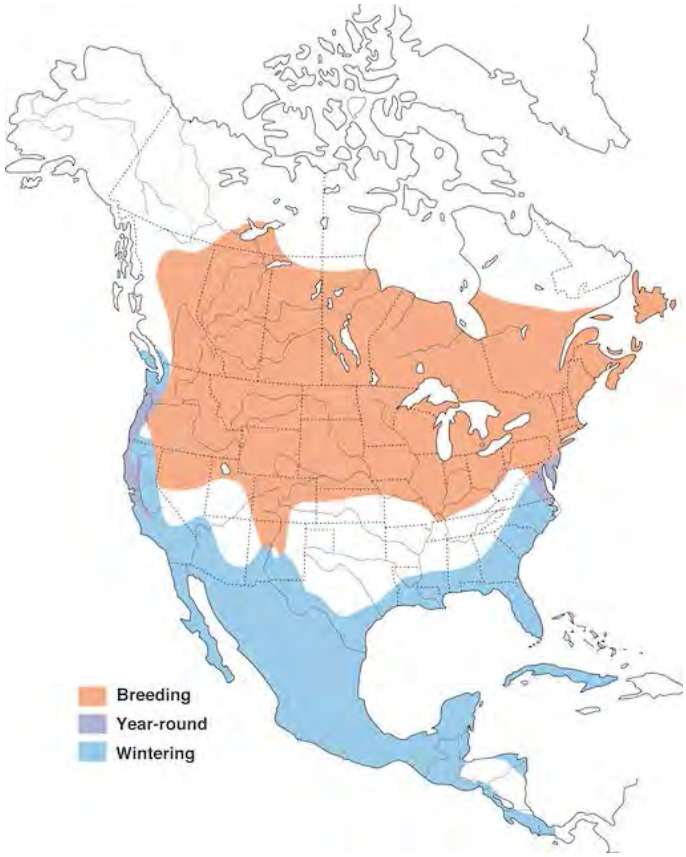
Jill Lucero, BLM Biologist, Personal Communication 2017.

American bittern (*Botaurus lentiginosus*)

General Description: The American bittern is a brownish, medium-sized heron. It inhabits wetlands with tall, dense vegetation.

Physical characteristics: Adults have brown upper parts and are heavily streaked brown and white below, with a black patch extending from below the eye down the neck. The bill is dull yellow to blackish, and the legs and feet are bright yellow to greenish. Sexes are similar, with the male slightly larger. Juveniles lack the black neck patch.

Range and Conservation Status: The American bittern is a species of conservation concern, primarily because of extensive loss of preferred wetland habitats throughout North America, and because little is known about the population status and basic biology of this species. The North American Breeding Bird Survey indicates a long-term decline in the continental population of bitterns. The Second Colorado Breeding Bird Atlas shows bitterns distributed throughout the San Luis Valley. The bittern is a priority species for Colorado Parks and Wildlife Wetlands Program. The Colorado SWAP (2016) lists the bittern as a Tier 2 species of concern and the USFS considers it a Sensitive Species.



Communication: A low, three syllable ("pump-er-lunk") call is common during the breeding season. The call is usually repeated several times in succession, and is often preceded by gulping and clicking sounds. Calling is most active at dusk and dawn and at night, although at the onset of breeding season bitterns regularly call during the day. Bitterns often sound a hoarse alarm call when flushed or are otherwise alarmed.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: American bitterns are carnivores, feeding on a variety of invertebrates, amphibians, fish, and mammals. They are solitary foragers and primarily rely on stealth to capture prey. Bitterns often feed along the edges of dense stands of vegetation, typically feeding on the ground or while standing or wading through shallow water.
- Breeding system: Thought to be primarily seasonally monogamous with minimal pair bonds, but may also be polygamous. Mostly asocial except when courting and mating.
- Nesting: Late May through early July. Nests are constructed of dead vegetation formed into a platform and lined with grasses or other available herbaceous plants. Nests are usually placed in dense, tall emergent vegetation over water, but are sometimes located in dry areas with dense, tall vegetation. Clutch size is 2-7 eggs. The incubation period is 24-28 days; bitterns will re-nest if a first nest is lost.
- Brood period: June to early August. Young are altricial and have yellowish brown down feathers at hatch. Young bitterns leave the nest by two weeks old, but continue to be fed by adults, and are thought to fledge by about 55 days old.
- Post-breeding: Can move long distances during the post-breeding period. May migrate in small groups.

American bittern SLV habitat, timing, and event													
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian				Migration					Migration			
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				
Short Emergent				Migration					Migration			
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Shrubland				Migration					Migration			
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				
Tall emergent				Migration					Migration			
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, American bitterns mainly use freshwater wetlands with tall emergent vegetation. They occasionally forage in sparsely vegetated wetlands, and nest in densely vegetated upland habitats. High interspersion of dense emergent vegetation and more open habitat types, and a high amount of edge between habitats, appear important. Foraging occurs in a variety of water depths but often <10 cm.

Key public areas for the bittern in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Blanca Wetlands, Russell Lakes State Wildlife Area, San Luis Lakes State Wildlife Area, and Rio Grande State Wildlife Area.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the protection and maintenance of large, shallow, freshwater wetlands with dense stands of tall emergent vegetation (bulrush and cattail); smaller wetlands with tall emergent vegetation that are in close proximity to each other and wetlands with shorter, sparser vegetation or upland habitats are also valuable. Management strategies should include maintenance of stands of dense tall emergent vegetation interspersed with short emergent and open water. Attention to water quality to avoid build-up of salts or potential contaminants is important. Human disturbance of tall emergent wetlands should be minimized during the breeding season for American bitterns.

Monitoring Recommendations:

American bitterns are extremely secretive and difficult to monitor, but broadcasts of recorded calls has proven to be an effective tool in detecting bitterns. Secretive marshbird call-back surveys have been conducted on Russell Lakes and Rio Grande State Wildlife Areas for 10 years. Surveys indicate that the number of bitterns detected have increased over the years.

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Personal Knowledge, Jenny Nehring and Cary Aloia, Wetland Dynamics Biologists, 2017

American Dipper (*Cinclus mexicanus*)

General Description: The American dipper is an aquatic passerine in the family Cinclidae. The dipper characteristically bobs up and down, using creeks and streams and is often found near waterfalls in the San Juan and Sangre de Cristo Mountains of the San Luis Valley.

Physical characteristics: The American dipper is short and square, approximately 14-20 cm in length. Dippers have a thick layer of feathers that helps them withstand cold temperatures when diving for prey in streams in addition to a blinking white eyelid, low metabolic rates, and blood that allows for a greater oxygen carrying capacity. They are typically darker in color during the breeding season and paler during the non-breeding season with female being generally smaller than the males. The birds are a dark grayish color with a lighter, browner head.

Range and Conservation Status: During breeding, migration, and wintering dippers are distributed throughout the western United States, Mexico, and Central America. The dipper is an altitudinal migrant meaning that it will winter in breeding areas if streams remain open and do not freeze solid but will move regionally to lower elevations with open water if rivers freeze and food availability becomes limited. This species may be present in the San Luis Valley during all life stages depending on annual climatic conditions. The Colorado Bird Atlas shows a decline between the 1st and 2nd editions but had relatively small sample sizes that may not account for upstream and downstream movements of the bird. This bird requires relatively clear, clean, healthy water within streams and therefore has shown some declines due to deteriorating stream conditions resulting from pollution, sedimentation, changes in stream flows, and poor riparian management associated with agriculture, mining, and logging. The bird is not currently of any special concern in Colorado but more research is needed to accurately identify population status.

Communication: Adult dippers have a 'post feeding song' that occurs after they have fed the fledglings, fledglings decrease begging for more food while the adult sings. Fledglings have a 'subsong' that is given in quiet sections of streams when a sibling is present and the adult is absent. Males and females have similar vocalizations consisting of a repetitive note types with no consistent number of repetitions.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: American dippers diet is composed entirely of animals such as aquatic insects, invertebrates, and some small fish and eggs. The dipper feeds by jumping or diving into rushing water at temperatures well below 0°C.
- Wintering: Birds may move to lower or higher elevations if conditions prevent continued residence, eg. Stream freezes solid between October and December.
- Breeding system: The dipper returns to its breeding territory between February and April if it did not remain over the winter. Pairing occurs during the winter with territories formed during March. Birds typically breed in April and May in Colorado along high quality streams dependent upon the timing of runoff.
- Nesting: The dipper creates bulky, domed nests that consist of moss on the outside with an inner cup of grass and leaves. Nest sites are located near water that is protected from floods and predators and has some sort of ledge for support. Many females will use the same nest site location year after year. They often create a nest in areas sprayed with mist from the stream or waterfall. Some birds have used man-made structures such as bridges and dams. Egg laying occurs from April through June with many birds starting a second brood after the first has fledged. Typically lay an average of 4 eggs with one laid per day. Incubation takes about 14 to 17 days
- Brood period: The young stay in the nest about 25 days with both parents feeding them. Nestlings can swim at 17 days and after fledging may stay together for another week.
- Post-breeding: After breeding, adults and young disperse to upstream drainages or to other adjacent drainages.

American dipper SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian	Wintering										Wintering	
		Pre-Breeding										
				Nesting								
					Brood Rearing							
							Post-Breeding					
River	Wintering										Wintering	
		Pre-Breeding										
				Nesting								
					Brood Rearing							
							Post-Breeding					

Habitat Requirements:

In the San Luis Valley, American dippers use rushing streams and rivers with riffles and waterfalls, usually in the mountains of the San Juans and Sangre de Cristos with only occasional use on the valley floor. Streams where the dipper nests are usually 15 m or less in width and 2 m or less in depth, although they may use larger rivers during the winter that do not freeze. Preferred streams are typically clear with little aquatic vegetation that allows them to forage for a variety of aquatic prey. Boulders, sand bars, and woody debris are necessary for perches. Nest sites require overhanging ledges or crevices along with nearby cover for escape from predators

Key public areas for dippers in the San Luis Valley: Baca Wildlife Refuge, Great Sand Dunes National Park, U.S. Forest Service lands, Hot Creek SWA, and the Rio Grande at 142 bridge - BLM. In the winter, dippers may be found on the floor of the SLV on public lands along the Rio Grande and Conejos River.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished with development and implementation of riparian management strategies that protect river and stream reaches in areas that commonly support this species. Specific recommendations include:

- Excluding cattle on USFS lands from access to entire stretches of rivers and creeks in order to allow for healthy riparian vegetation, stable banks, clean and clear water.
- Best management practices in relation to any mining operations to prevent pollution of headwater streams.
- Maintenance of in-stream flows annually to ensure perennial streams with rushing water, riffles, and appropriate aquatic insect populations for foraging.

Monitoring Recommendations:

Wintering, dispersal, and breeding information is necessary to understand the status of the dipper in the SLV. Between the 1st and 2nd edition of the Colorado Bird Atlas, observations of the dipper declined which may or may not be due to movement of the bird in and out of stream reaches that were monitored.

References:

Kingery, H.E. 2011. American dipper (*Cinclus mexicanus*). The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/amedip/introduction

Kingery, H.E. 2016. American dipper (*Cinclus mexicanus*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp 424-425. Colorado Bird Atlas Partnership.

American wigeon (*Mareca americana*)

General Description: The American wigeon is a medium-sized dabbling duck in the family Anatidae. This duck uses a wide variety of freshwater wetlands, but uses open water habitats with submerged vegetation more than most other dabbling ducks.

Physical characteristics: The wigeon is a chunky, upright duck. Adult males in breeding plumage have a white crown and forehead, and a broad dark green patch from the eye to the back of the neck. The rest of the head and neck is speckled black and white. The breast, back, sides, and flanks are pinkish brown, and the belly is white. The upper forewing has a large white patch, above a dark iridescent green bordered by black. Males in non-breeding plumage are similar to females. Females in breeding plumage have a brownish black crown, streaked with creamy white, and the rest of the head and upper neck are dusky gray and white. Body plumage is similar to the male but generally duller in color. The white wing patch is spotty, with only traces of green in the upper wing. The distinctive, goose-like bill is bluish gray with a black tip.

Range and Conservation Status: Breeds primarily in the tundra and boreal forests of Alaska and Canada. Winters broadly along the west coast and across the southern United States and into Mexico. Uncommon during the breeding season in the San Luis Valley, primarily occurring during spring and fall migration. The continental population has fluctuated between 1.7 and 3.5 million, with a slight declining trend in recent years. The wigeon is one of the top five most harvested ducks in Colorado. The American wigeon is a Tier 1 priority species for the Colorado Parks and Wildlife Wetlands Program.

Communication: The most common call used by males is a high-pitched, three-syllable whistle *whew-whew-whew*. This call is used throughout the year and in all social situations and habitats. A

variety of other whistles, guttural growls, and clucks are used, primarily during courtship and breeding.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: American wigeon is largely vegetarian, adding substantial amounts of insects and other invertebrates to the diet only during breeding. During migration they forage on submerged aquatic vegetation and other wetland and terrestrial plants, as well as leafy agricultural crops and seeds. They feed at the water surface or to about 20 cm depth. In uplands, wigeon graze similar to geese.
- Migration: *Spring* – wigeon depart wintering areas in February and March, and move in small groups. *Fall* - One of the earliest fall migrant ducks in North America, with numbers on stopover areas generally peaking in September and October. Large flocks can occur during fall, and wigeon often mix with other duck species.
- Breeding system: Seasonally monogamous. Courtship and pairing begins in fall and continues until spring migration; most females are paired when they arrive on breeding areas.
- Nesting: May through July. Wigeon have one nest per year, but pairs will re-nest if the first nest is lost. Clutch size is seven to ten eggs; females lay one egg per day. Wigeon nest on the ground, often far from water, in tall herbaceous cover or under shrubs or trees. Incubation is usually 25-28 days. The female incubates the eggs; males initially stay near the nest on open water, but most males desert females by the end of incubation.
- Brood period: June through August. The precocial young leave the nest within 24 hours of hatching, and are brooded by the female until fledging (about 6-7 weeks). The female leads the young quickly to open wetlands, where the young feed themselves; duckling diet is dominated by insects during the first two weeks after hatch, but shifts to mainly plant foods by fledging.
- Post-breeding: Male wigeon and females that fail nesting often move to large vegetated wetlands to molt following breeding (June and July). Post-breeding movements can cover substantial distances. Fledged young often remain with females as they begin fall movements.

American wigeon SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water			Migration						Migration			
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Riparian			Migration							Migration		
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				
Short emergent			Migration							Migration		
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Shrubland					Nesting							
Tall emergent			Migration							Migration		
				Pre-Breeding								
					Nesting							
								Post-Breeding				
Wet meadow			Migration							Migration		
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, American wigeon use open freshwater wetlands, and also forage in short emergent wetlands and wet meadows. The San Luis Valley is used by wigeon primarily during spring and fall migration, but a relatively small number remain to nest in well-vegetated upland and wetland habitats.

Key public areas for American wigeon in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, San Luis Lakes State Wildlife Area, Rio Grande State Wildlife Area, and Blanca Wetlands.

Management Recommendations:

Freshwater wetlands with abundant submergent vegetation provide valuable habitat for American wigeon during spring and fall migration. Productive wetlands with high abundance of emerging aquatic invertebrates are an important resource during spring. Although relatively few wigeon breed in the San Luis Valley, dense herbaceous or shrubby vegetation near open water wetlands provide valuable nesting habitat.

Monitoring Recommendations:

American wigeon occur in the San Luis Valley primarily during spring and fall migration, and often mix with other duck species. They are easily distinguished from other species during standardized waterfowl counts. During the hunting season, hunter surveys or wing barrels can be used to obtain an index to fall migration chronology and relative abundance of wigeon.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Mini, A. E., E. R. Harrington, E. Rucker, B. D. Dugger, and T. B. Mowbray. 2014. American Wigeon (*Anas americana*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/amewig DOI: 10.2173/bna.401

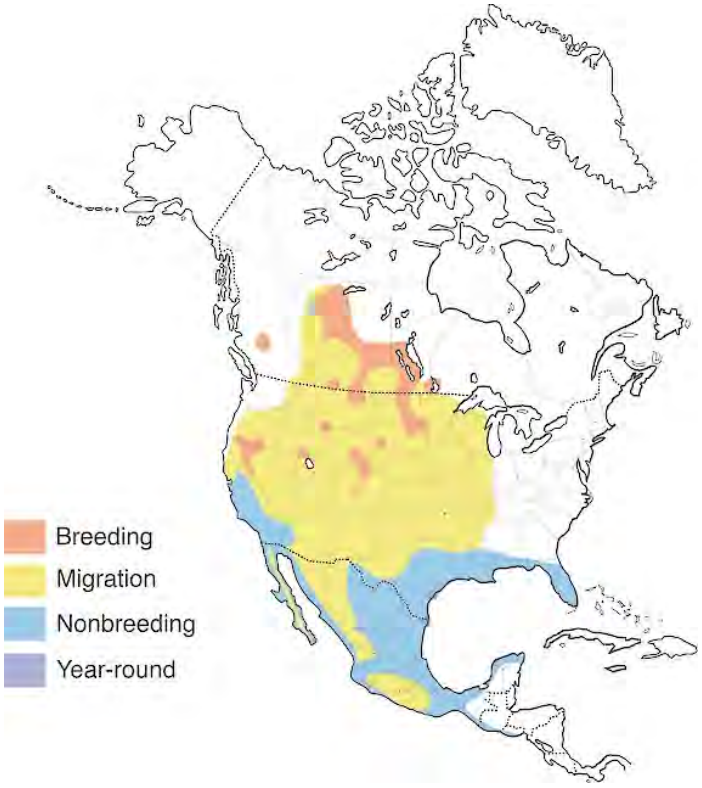
Ortega, C. P. 2016. American wigeon (*Anas americana*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 76-77. Colorado Bird Atlas Partnership.

American white pelican (*Pelecanus erythrorhynchos*)

General Description: The American white pelican is a large, fish-eating bird in the family Pelicanidae. Non-breeding groups of pelicans commonly use lakes, ponds, and semi-permanent wetlands in the San Luis Valley.

Physical characteristics: The American white pelican is easily identifiable from its large size, white overall plumage with black wingtips, orange legs, and large orange bill with a distensible pouch.

Range and Conservation Status: The American white pelican breeds at scattered locations across southern Canada and the western and mid-western United States, and winters mainly along the southern West Coast, Gulf Coast, and throughout Mexico. Nonbreeding and migrant pelicans can be found throughout the United States. In Colorado, pelicans have been documented breeding at reservoirs in North park, South Park, and the northeastern plains. This species is not known to breed in the San Luis Valley, but nonbreeding groups are commonly present from spring through fall. Pelican populations east of the Continental Divide appear to have increased in recent decades. The American white pelican is listed as a Tier 2 species of conservation concern in the Colorado State Wildlife Action Plan and is a BLM Sensitive Species.



Communication: Usually silent. Pelicans use several ritualized displays to communicate threat, courtship, or appeasement among individuals.

Life history characteristics:

- Diet and foraging behavior: Pelicans primarily eat fish, but also take amphibians and crayfish. In the San Luis Valley, carp are a major food source. Pelicans feed in open water, that is typically < 1 meter deep in wetlands, lakes, and rivers. Groups of pelicans often cooperatively forage by driving prey toward shallow water where it can be more easily caught.
- Migration: Pelicans usually arrive in San Luis Valley by April, moving in flocks of varying numbers. Fall migration is protracted and may include stopover by pelicans from other intermountain basins; most pelicans have left the San Luis Valley by October.
- Breeding system: Usually begin breeding at three years of age. Pelican flocks in the San Luis Valley may largely be comprised of young, nonbreeding birds, or individuals displaced from regional breeding colonies. Seasonally monogamous. Courtship and pairing begins at arrival on breeding sites. Nests in colonies on open islands in large reservoirs.

American white pelican SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Migration									
Open water				Nonbreeding resident								
								Migration				

Habitat Requirements:

Use of wetland habitats in the San Luis Valley is locally driven by availability of food and suitable roost sites. Shallow, open portions of wetlands, as well as ditches and slow stretches of rivers, provide feeding habitat. Large open water areas, such as backwater sloughs, or warm water ponds with islands or open shorelines and low disturbance provide loafing and roosting areas.

Key public areas for the pelican in the San Luis Valley: Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, and Rio Grande State Wildlife Area.

Management Recommendations:

On wetland feeding areas, drying cycles that maintain productivity and concentrate food items are beneficial. Although relatively tolerant of human disturbance away from breeding colonies, pelicans may abandon roost and feeding sites with high levels of recreational activity or other disturbance. Netting and other measures may be needed to reduce pelican impacts on aquaculture facilities.

Monitoring Recommendations:

Pelicans occur seasonally in the San Luis Valley. Little effort has been made to document their timing of use and distribution on wetland habitats. Origins and relationships of non-breeding pelicans in the San Luis Valley to breeding colonies in Colorado and elsewhere are unknown.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Hundertmark, C. A., and K. M. Potter. 2016. American white pelican (*Pelecanus erythrorhynchos*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 146-147. Colorado Bird Atlas Partnership.

Knopf, F. L., and R. M. Evans. 2004. American White Pelican (*Pelecanus erythrorhynchos*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/amwpel DOI: 10.2173/bna.57

Baird's sandpiper (*Calidris bairdii*)

General Description: The Baird's sandpiper is a small shorebird in the family Scolopacidae. It is a regular migrant in the San Luis Valley, and uses shallow, sparsely vegetated wetlands and shorelines of playas, lakes, and reservoirs.

Physical characteristics: Females are slightly larger than males. Mottled brown and buff or gray above and white below; paler in nonbreeding plumage. The bill is blackish and slightly drooping at the tip. The feet and legs are black or dark grey.

Range and Conservation Status: Breeds from Alaska across the Canadian arctic. Migrates through the western two-thirds of North America to wintering areas in South America. Baird's sandpipers appear to have a stable population. Baird's sandpipers use the San Luis Valley primarily during fall migration, but a few are observed during spring migration.

Communication: During the nonbreeding period, call include a high-pitched or hoarse *pr-r-r-reet*, a short *kree* or more drawn out *tchwereep*, and a short liquid whistle.

Life history activities in the San Luis Valley:

- <u>Diet and foraging behavior:</u> Baird's sandpipers feed almost entirely on aquatic and terrestrial insects, but also consume spiders and small aquatic crustaceans. Feeds by pecking at the surface or probing on wet soil or in water <4 cm, mainly in habitats with sparse, short or no vegetation. Less tied to feeding in water than other small sandpipers.
- <u>Migration:</u> *Spring* – Baird's sandpipers leave South American wintering areas in early March and migrate through the interior United States on their way to arrive on arctic breeding areas by late May. When observed in the spring in the San Luis Valley, they are found in April and/or May. They generally travel in small groups

or as individuals. *Fall* – Adult Baird's sandpipers generally leave arctic breeding grounds by August; young birds follow later and take longer to arrive on wintering areas. Baird's sandpipers migrate through the San Luis Valley, in flocks of varying sizes, July through September. Observations on Blanca Wetlands show peak numbers occurring within the first two weeks of August.

Baird's sandpiper SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration			Migration					
Playa				Migration			Migration					
Short emergent				Migration			Migration					
Wet meadow				Migration			Migration					

Habitat Requirements:

Baird's sandpipers use a variety of shallow, sparsely vegetated freshwater and alkaline wetland habitats in the San Luis Valley, including playas, short emergent, wet meadows, and shorelines of open water habitats. Because they are rapid, long-distance migrants, these sandpipers are likely primarily searching for sites with abundant, easily accessible insect prey.

Key public areas for Baird's sandpipers in the San Luis Valley: Blanca Wetlands, Baca National Wildlife Refuge, and Russell Lakes State Wildlife Area.

Management Recommendations:

. Conservation in the San Luis Valley of Colorado is probably best accomplished through maintaining complexes of highly productive, seasonal wetlands that produce pulses of insects during spring and fall for Baird's sandpipers. Additional considerations for Baird's sandpipers are listed below:

- Complexes of abundant, easily accessible, insect prey and foraging habitat less than 4 cm in water depth with focused timing of invertebrate density from mid-July through August.
- Provide ample shoreline foraging habitat, including islands and spits with moist soil conditions.
- Maintain sparsely vegetated shorelines on lakes, playas, and reservoirs.
- Where possible, in areas with the ability to alter hydrologic conditions and water quality parameters, careful management to promote salinity levels that limit vegetative growth is beneficial to this species.
- In areas of consistent and concentrated shorebird use, consider efforts to minimize disturbance during peak migration.
- Coordinate annual management efforts across the 3 key public areas in the SLV providing habitat for this species to ensure adequate quantity and quality of habitat during the migratory periods.

Monitoring Recommendations:

Baird's sandpipers move rapidly through migration areas, and often mix with other shorebirds. Based on IWJV recommendations and to be consistent with shorebird counts in other areas, multiple, coordinated counts of shorebirds in 2-week intervals during peak migration periods from mid-July through mid-September may provide a useful index of use in San Luis Valley wetlands by these sandpipers.

Observations at Blanca Wetlands suggest avian predation might be an issue and worth investigating.

Monitor macroinvertebrate biomass to understand influence of water management on timing of macroinvertebrate density to coincide with peak migratory periods.

Quantify shoreline foraging habitat to better understand the availability in 2-week intervals during the migratory season.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Moskoff, W., and R. Montgomerie. 2002. Baird's Sandpiper (*Calidris bairdii*). In P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/baisan DOI: 10.2173/bna.661

Intermountain West Joint Venture. 2009. Shorebird Habitat Conservation Strategy: Blanca Wildlife Habitat Area. 42pp.

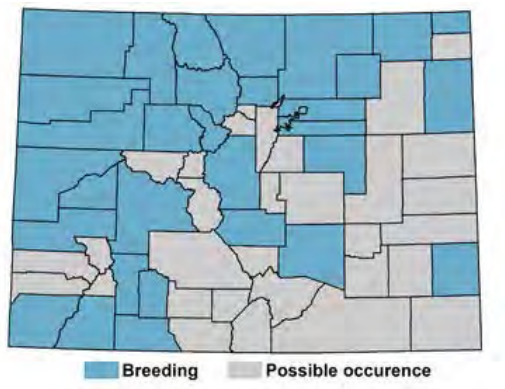
Bald Eagle (*Haliaeetus leucocephalus*)

General Description: The Bald Eagle is a raptor in the family Accipitridae. The Eagle uses a variety of habitat types mostly during the winter in the San Luis Valley that are near open water but prefer riparian areas along the Rio Grande and Conejos Rivers.

Physical characteristics: The Bald Eagle is a large bird of prey that has five unique plumages that correspond to a different age leading to adult hood with its characteristic white head and tail between 5 and 6 years of age. They have yellow feet and beak. Immature bald eagles have a brown head and tail plumage and variable amounts of white streaking throughout their plumage. The eagle is usually between 27 to 35 inches in length with a wing span of 71 to 89 in. The sexes are similar in plumage although the females are larger than the males.

Range and Conservation Status: During breeding, migration, and wintering this species is widely distributed throughout the United States; they winter throughout the United States from coast to coast. Although present in some portions of Colorado year round, this species is typically in the San Luis Valley only during the wintering/non-breeding season. Declines in the population of the Bald Eagle resulted from a variety of factors including being targeted by ranchers and hunters, especially during the twentieth century as they were perceived to be a threat to livestock. Native Americans trapped and killed the eagles for ceremonial purposes that required their feathers. Other factors include ingestion of plastics and lead which poisoned many birds. Pesticide and environmental contaminants through the 1960s decreased reproduction and survival and which was further complicated by the degradation of breeding and wintering habitat. The Bald Eagle was protected initially in 1940 under the Bald Eagle Protection Act and the southern (south of 40th parallel) in 1967 as Endangered under the Endangered Species

Preservation Act. Protection was expanded to all bald eagles in 1978 although it was listed as only Threatened in 5 northern states. By 1974 there was only a single breeding pair of Bald Eagles in Colorado. The species was down listed to Threatened in 1995 and was completely delisted in 2007. This species is listed as a Tier 2 species of Greatest Conservation need in the 2016 Colorado State Wildlife Action Plan, is a USFS and BLM Sensitive species, and on the watch list for Partners in Flight. The Colorado Breeding Bird Atlas indicates that the eagle may be susceptible to climate changes and urban development that further reduces habitat, increases fragmentation, and encroaches on breeding sites.



North America map used by permission from Cornell Lab of Ornithology's Birds of North America Online (http:/bna.birds.cornell.edu/bna). Colorado map based on Andrews and Righter (1992), Kingery (1998), COBBAII (2015), and CFO (2015).

Communication: Bald Eagles often chatter with 6 to 9 notes of 'kwit kwit' to a ki-ki'. Often use a 'peal' call as a threat vocalization when something or someone approaches the nest or to fend off an attack.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Bald Eagles forage on a variety of prey but prefer fish with small mammals being a major source of food in the winter. Hunts from perches or while soaring and often will take prey from other species in addition to foraging on carrion. In general they are opportunistic feeders.
- Wintering: Arrives in the SLV in December and over-winters through March. Tends to wander in search of suitable habitat and prey.
- Breeding system: Rarely in the SLV during this season. Monogamous and thought to mate for life. Begins breeding at 5-7 years old. Courtship and pairing begins in fall and continues until spring migration; most females are paired when they arrive on breeding areas.
- Nesting: Builds large nests in usually the largest tree in an area with available large limbs for perching and nest site. Nest is composed of sticks and may take from 4 days to 3 months to build. Only produces one brood per season. Lay from 1 - 3 eggs per nest but 2 is most common. 35 days to incubate with the female doing a majority but the male may participate. Asynchronous hatching over period of several days, typically 2 days if two eggs. The first young to hatch has a significant advantage over its sibling.
- Brood period: Broods are cared for by both the male and female, April through August, with at least one of the parents consistently present until 4 weeks of age. At 5 to 6 weeks, the adults tend to roost in nearby trees at least half of the time. Male provides most of the food for the first two weeks with both parents feeding the young after that time. Young fledge at 8 to 12 weeks of age with up to half of

nest departures being unsuccessful. Parents will continue to feed young that are grounded but the young are much more prone to predation. Fledglings may continue to use nest for several weeks as a feeding platform.

- Post-breeding: Young and adults may be associated for up to 10 weeks after fledging. Young often follow adults to foraging sites but learn to hunt on their own rather than from adults.
- Non-breeding period: Bald eagles generally migrate alone, but often associate with other eagles at feeding and roost sites. Communal roosts are common.

Bald eagle SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water	Year-round (foraging)											
Short emergent	Year-round (foraging)											
Wet meadow	Year-round (foraging)											

Bald eagle SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water	Wintering											Wintering
Short emergent	Wintering											Wintering
Wet meadow	Wintering											Wintering

Habitat Requirements:

In the San Luis Valley, Bald Eagles use a variety of wetlands, upland, and open water habitats including the Rio Grande and Conejos Rivers, playa lakes, short and tall emergent wetlands, cottonwood forest galleries, and agricultural areas. Preferred habitats include perching sites adjacent to open water or agricultural fields. Agricultural lands that have not been disked in the fall but retain some stubble or waste grain that ducks and geese commonly forage on during the day in the winter are popular locations for eagles.

Occasionally the eagle may nest in the SLV. Bald eagles typically breed in forested areas near large water bodies or wooded riparian areas. Nest sites are documented in the upper Rio Grande drainage. Roost sites are large trees with accessible perches that are near foraging areas and provide protection from weather.

Key public areas for Eagles in the San Luis Valley: Alamosa National Wildlife Refuge, Baca NWR, Blanca Wetlands, McIntire/Simpson, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, Rio Grande SWA, Higel SWA, Coller SWA, Sego Springs SWA, Hot Creek SWA.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the creation and protection of habitats that promote open water habitats in the winter and agricultural activities that maintain residual cover and allow waste grain to remain over the winter e.g. crop fields are not disked in the fall. Protection of bald eagle nest and roost sites from human disturbance is important in maintaining local use.

Maintaining healthy, extensive riparian and wetland habitats is necessary to provide a food and habitat base for bald eagles.

- Work with agricultural landowners to leave some circles with residual vegetation in the fall to provide forage for waterfowl.
- Work with water users and administration to allow instream flows in rivers and creeks that maintain open water.
- Work with water users and administration to allow wetland managers to maintain some open water habitats through well use on public lands.

Monitoring Recommendations:

Continue to monitor bald eagles during the mid-winter eagle count, SLV wide and on the mid-winter aerial waterfowl survey. Known nest sites are recorded in a statewide nest database maintained by Colorado Parks and Wildlife. Periodic monitoring of nest and roost sites provides an index to local population status.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Colorado Parks and Wildlife. 2016. Bald Eagle. Colorado Parks and Wildlife - Wildlife Species Profiles. Denver, CO.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/baleag/introduction

Wheeler, B.K. and W.S. Clark. 1995. A Photographic Guide to North American Raptors. Princeton University Press, Princeton NJ.

Wickersham, J.L. 2016. Bald Eagle (*Haliaeetus leucocephalus*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp 172-173. Canada.

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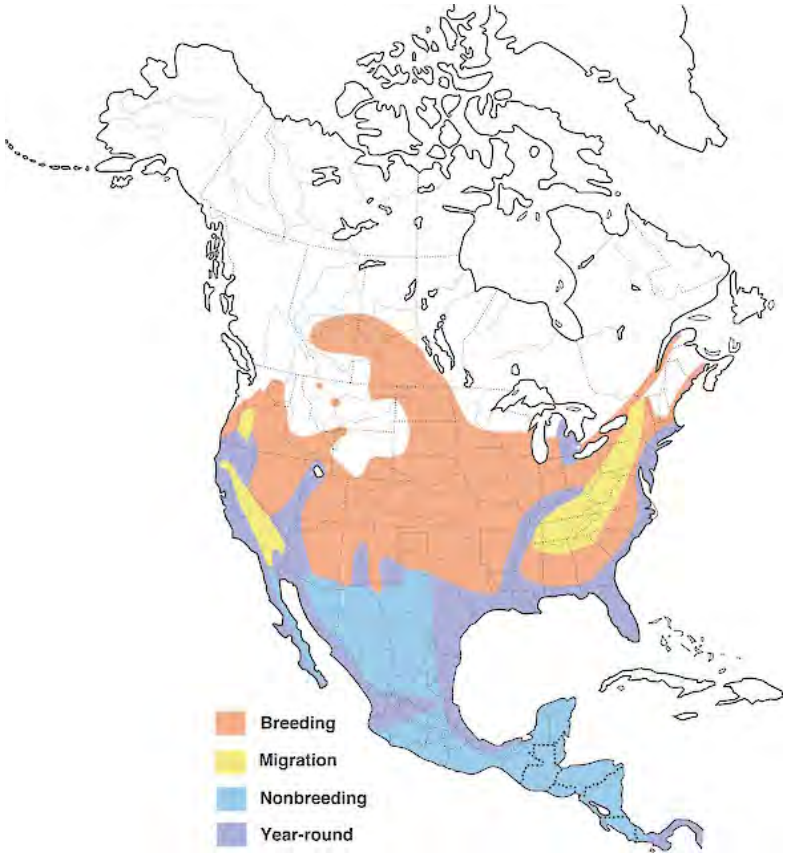
Black-crowned Night-Heron (*Nycticorax nycticorax*)

General Description: The black-crowned night-heron is a medium-sized heron in the family Ardeidae. Night-herons are widespread in the San Luis Valley during breeding and migration, where they use a variety of emergent wetland habitats.

Physical characteristics: Black-crowned night-herons are stocky herons with relatively short legs. The sexes have similar plumage, but males are slightly larger than females. Adults have a black cap and upper back; gray wings, rump and tail; and light gray to white underparts. The stout bill is black and the eyes are red. Their legs are yellow-green. Immature night-herons are brown and heavily spotted above and streaked below with white.

Range and Conservation Status: The black-crowned night-heron is one of the most widely distributed herons in the world. This species breeds across most of North America, and winters primarily in coastal and southern areas. In Colorado, breeding populations appear fairly stable, although large fluctuations in numbers at individual breeding colonies have occurred. Night-herons are susceptible to wetland habitat loss and degradation, pesticides and other contaminants, and human disturbance.



Communication: The most common call is a guttural *quock*, given in flight or when alarmed at colonies. A variety of harsh calls, plucks, and buzzes are used during courtship and at the nest.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Black-crowned night-herons forage opportunistically on a wide variety of aquatic and terrestrial invertebrates, fish, amphibians, reptiles, small mammals, and birds. Usually feeds from evening to early morning, but commonly forages diurnally during breeding, ambushing or actively stalking prey. Breeding adults defend feeding territories.
- Breeding system: Night-herons appear to be seasonally monogamous. Males select nest sites and display to attract females. Often nests in colonies with other night-herons and other wading birds such as the snowy egret and white-faced ibis in the SLV. Adults defend a small territory around the nest.
- Nesting: Late April through June. Night-herons have one nest per year, but pairs will re-nest if the first nest is lost. Clutch size is three to five eggs, laid at two-day intervals. On the floor of the San Luis Valley night-herons usually nest over water in tall emergent vegetation; elsewhere they nest in trees and on islands. Incubation is usually 21-26 days. Both parents incubate the eggs.
- Brood period: Late May to early August. Young are semi-altricial at hatch. Both parents feed and brood young. Young leave the nest at about five weeks, and can fly at about six weeks.
- Post-breeding: Young black-crowned night-herons can disperse long distances in any direction.

Black-crowned night heron SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Riparian				Migration					Migration			
				Pre-Breeding								
				Nesting								
					Brood Rearing							
								Post-Breeding				
Short Emergent				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Tall emergent				Migration					Migration			
				Pre-Breeding								
				Nesting								
					Brood Rearing							
								Post-Breeding				
Wet Meadow				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, black-crowned night-herons nest in tall, dense emergent vegetation in large semi-permanent marshes, often in mixed colonies with other wading birds. They use a wide variety of wetland and upland habitats for foraging.

Key public areas for night-herons in the San Luis Valley: Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, Rio Grande State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Nesting colonies require protection from disturbance. Drying or flooding during nesting can result in breeding failure. Good water quality and maintaining wetland productivity is important, particularly to maintain high-quality feeding areas.

From observations at Blanca Wetlands, to maintain high-quality breeding areas, manage for some late-successional cattail and bulrush communities and maintain those areas for years as site fidelity seems to be important.

Monitoring Recommendations:

Colonial nesting wading birds have historically been monitored in the San Luis Valley. Accurate counts of breeding numbers may be difficult while minimizing observer disturbance of colonies. Measures of productivity on colonies would be informative, and information on habitat variables and their correlation with colony activity and success is needed.

Map known breeding colonies of night-herons, survey and characterize habitat attributes during the non-breeding season, determine if birds may opportunistically move to sites during non-breeding season which have high prey bases, e.g. these herons have been observed in mid to late summer in large numbers on the Rio Grande SWA coinciding with large numbers of tadpoles that year.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Hothem, R. L., B. E. Brussee, and W. E. Davis Jr. 2010. Black-crowned Night-Heron (*Nycticorax nycticorax*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/bcnher DOI: 10.2173/bna.74

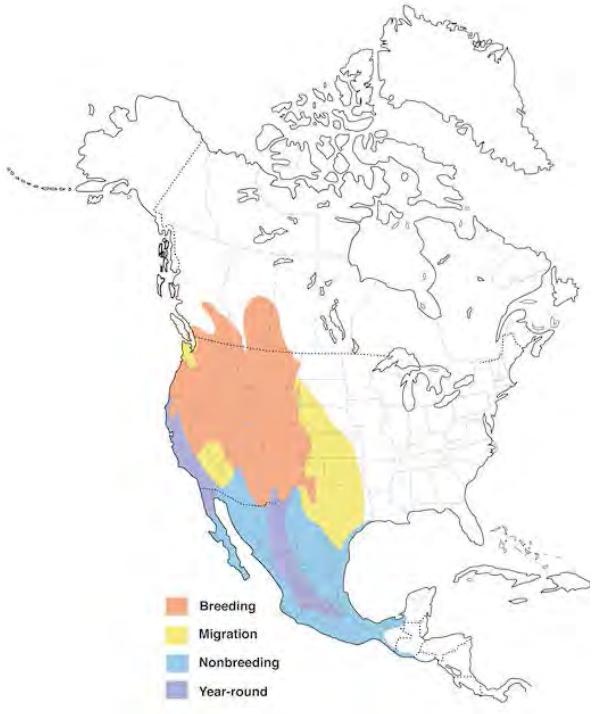
Hundertmark, C. A., and K. M. Potter. 2016. Black-crowned night-heron (*Nycticorax nycticorax*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 160-161. Colorado Bird Atlas Partnership.

Cinnamon teal (*Anas cyanoptera*)

General Description: The cinnamon teal is a small dabbling duck in the family Anatidae. In the San Luis Valley it uses a wide variety of wetlands, and nests on the ground near or over water.

Physical characteristics: Both sexes have bright blue upper wing patches. Males in breeding plumage are unmistakable, with bright rust or chestnut plumage on head, neck, and underparts; a red eye; dark gray or black bill; and orange-yellow legs and feet. Females are mostly brown on upperparts and buff with brown streaks on underparts with dull brownish yellow legs and a slaty gray bill.

Range and Conservation Status: During breeding and migration, cinnamon teal are widely distributed throughout the Great Basin and Intermountain West; they winter primarily in coastal areas and the interior of Mexico. The cinnamon teal is currently not threatened or of concern but loss of wetlands limits suitable habitat, and local populations are detrimentally impacted by heavy metals and other water quality issues. The Breeding Bird Survey shows no statistical trends in North America. Cinnamon teal are common and widespread throughout the San Luis Valley during migration and breeding. The teal is a CPW Wetlands Program Tier 1 priority species.



Communication: Vocalizes infrequently compared with other dabbling ducks. Male uses a low-pitched *karr karr karr* during aggression and courtship displays. Female performs a soft, rattling *rrrr* as bill moves upward during courtship. Decrescendo call of female is infrequent consisting of a weak *gack-gack-ga-ga*.

Life history characteristics:

- Diet and foraging behavior: Cinnamon teal are omnivorous, feeding on seeds, aquatic vegetation, aquatic and semi-terrestrial insects, snails, and zooplankton. Pre-breeding females and ducklings consume a higher proportion of animal foods. Cinnamon teal use a variety of feeding methods but primarily forage at or near the water surface or in substrate at shallow (<6 inches) water depths.
- Breeding system: Seasonally monogamous. Pair formation begins on wintering areas and continues through spring migration and after arrival on breeding areas.
- Nesting: Late April through July. Cinnamon teal have one nest per year, but pairs will re-nest if the first nest is lost. Clutch size is 4-16, with an average of about 9; laying interval is about one egg per day. Cinnamon teal nest over water or on the ground close to water, in a well-concealed nest formed from herbaceous vegetation and down feathers. Incubation is usually 21-25 days. Only females incubate the eggs.
- Brood period: Late May through August. Chicks leave the nest within 24 hours of hatching, and are led by the female to nearby habitats with shallow, open water and emergent vegetation for feeding and cover. Young cinnamon teal can fly about seven weeks after hatch.
- Post-breeding: After females begin incubating, males form small flocks and move to wetlands with dense emergent vegetation to molt. Groups of teal stage on wetlands in late summer before moving rapidly south to wintering areas.

Cinnamon teal SLV habitat, timing, and life cycle event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water			Migration						Migration			
			Pre-Breeding									
						Brood Rearing						
								Post-Breeding				
Playa			Migration							Migration		
			Pre-Breeding									
						Brood Rearing						
								Post-Breeding				
Short Emergent			Migration							Migration		
			Pre-Breeding									
				Nesting								
						Brood Rearing						
								Post-Breeding				
Tall Emergent			Migration							Migration		
			Pre-Breeding									
				Nesting								
						Brood Rearing						
								Post-Breeding				
Wet Meadow			Migration							Migration		
			Pre-Breeding									
				Nesting								
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, cinnamon teal use a variety of wetlands, including alkali playas, temporarily flooded saltgrass flats, wet meadows and pastures, and emergent vegetation and open water in seasonal and semi-permanent wetlands and permanent water bodies. They commonly nest in relatively short, dense herbaceous vegetation, but also construct over-water nests in tall emergent habitats.

Key public areas for cinnamon teal in the San Luis Valley: Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, San Luis Lakes State Wildlife Area, and Rio Grande State Wildlife Area.

Management Recommendations:

Complexes of different freshwater and alkaline wetland types in close proximity benefit cinnamon teal by providing a variety of habitat structure, water depths, and food types necessary to meet annual cycle needs. Large fluctuations in water levels (drying or flooding) during nesting can jeopardize nest success.

- Water availability is limited in February and March prior to the surface and groundwater irrigation rules and regulations presumptive start date of April 1, therefore public lands with groundwater wildlife adjudications are extremely important.
- Promoting winter sheet ice in late fall, where available, may help provide some early spring habitat.

Monitoring Recommendations:

Except for the closely related blue-winged teal, cinnamon teal are readily distinguished from other duck species during standardized waterfowl counts. In recent years an effort has been made to band cinnamon teal on Monte Vista National Wildlife Refuge in late summer. Most cinnamon teal have left the San Luis Valley by the time hunting seasons begin, so they do not show up in the harvest.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Gammonley, J. H. 2012. Cinnamon Teal (*Anas cyanoptera*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/cintea DOI: 10.2173/bna.209

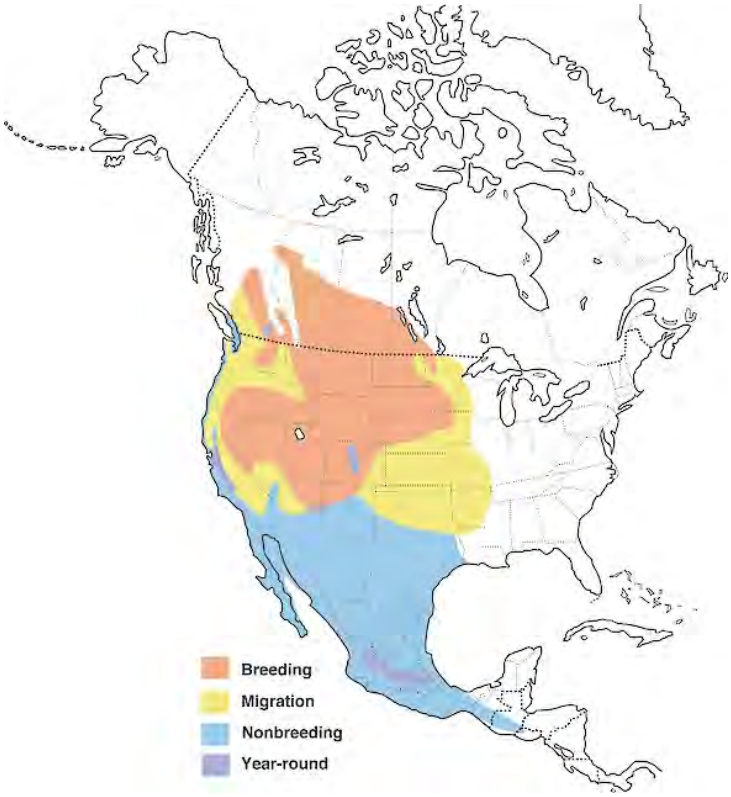
Gammonley, J. H. 2016. Cinnamon teal (*Anas cyanoptera*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 82-83. Colorado Bird Atlas Partnership.

Eared grebe (*Podiceps nigricollis*)

General Description: The eared grebe is a small colonial-nesting waterbird in the family Podicipedidae. This distinctive species breeds and migrates through the San Luis Valley, using large marshes with emergent and submerged vegetation.

Physical characteristics: Adult eared grebes in breeding plumage have a black head, neck, breast, and upperparts; cinnamon brown sides and flanks; white belly; and bright gold tufts of elongated feathers behind the eyes. In non-breeding plumage the upperparts are blackish, underparts are white, and the sides, and front of the neck are gray. Juveniles are similar to nonbreeding adults but with a brownish tinge on the back and neck. The dark, thin bill usually appears slightly upturned. The legs are dark. The iris is bright red in adults, orange in non-breeders (1-2 years old), and tan in juveniles.

Range and Conservation Status: Eared grebes breed locally over a large area of the Great Basin and basins of the Intermountain West in southern Canada and the United States. This grebe winters primarily in the Gulf of California and Salton Sea, with scattered numbers along the Pacific and Gulf coasts and throughout Mexico. Eared grebes are regular breeders and migrants in the San Luis Valley. Eared grebe populations appear to be stable.



Communication: Eared grebes are mostly silent outside the breeding season and in flight, but give a variety of mostly high-pitched, trilling courtship, aggressive, and alarm calls during the breeding season. These grebes have a set of distinctive, ritualized displays used to communicate during courtship and with other pairs at the boundaries of territories.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Eared grebes feed principally on aquatic invertebrates (crustaceans and insects), as well as mollusks, small fish, and amphibians. They feed in open wetlands and lakes, by diving to glean prey from the bottom substrate as well as from the water column and pecking from the water surface. Eared grebes are solitary foragers during breeding and migration, but often forage in groups to pursue prey on wintering areas.
- Migration: Eared grebes migrate nocturnally. Immediately after breeding most adults move to molting and staging areas on large saline lakes in the Great Basin. Juveniles arrive soon after, and after molting eared grebes move quickly to wintering areas. In spring, eared grebes begin arriving on breeding areas by April or May.
- Breeding system: Seasonally monogamous. Courtship and pairing apparently occurs immediately after arrival on breeding sites.
- Nesting: Late May through July. Eared grebes have one nest per year. Clutch size is 1-8, usually three or four eggs. Both pair members build a floating platform of vegetation, anchored to emergent stems or floating mats of submergent vegetation, away from shore and usually at water depths of >1 meter. Pairs defend their platform, but large colonies can form on suitable marshes. Incubation is usually 20-23 days. Both parents incubate the eggs.
- Brood period: June through August. The pre-cocial young can move shortly after hatching, but the parents brood them on their backs and feed them for the first week. By about three weeks young are independent.
- Post-breeding: Eared grebes are extremely gregarious, migrating together to staging areas in large numbers.

Eared grebe SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration				Migration				
				Pre-Breeding								
				Nesting								
					Brood Rearing							
						Post-breeding						
Short Emergent				Migration				Migration				
				Pre-Breeding								
				Nesting								
					Brood Rearing							
						Post-breeding						
Tall emergent				Migration				Migration				
				Pre-Breeding								
				Nesting								
					Brood Rearing							
						Post-breeding						

Habitat Requirements:

In the San Luis Valley, eared grebes use larger semi-permanent marshes with interspersed tall emergent vegetation, submergent aquatic vegetation, and good water quality. They also feed along alkaline shorelines.

Key public areas for eared grebes in the San Luis Valley: Blanca Wetlands, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Large, productive semi-permanent and permanent wetlands along with playa lakes are important to maintaining breeding colonies of eared grebes. Water management should avoid excessive flooding or drying of these wetlands during the breeding period. Multiple emergent marshes with open water should be maintained throughout the San Luis Valley to allow independent management, and colonies can move from year to year to wetlands with good conditions. Disturbance to breeding colonies should be minimized.

- Permanent playa lakes should be drawndown periodically in order to reduce salts through volatilization and to help reduce any invasive fish such as carp that reduce light penetration to the bottom of the lake and reduce plant growth

Monitoring Recommendations:

Many colonial nesting marsh birds have been historically monitored in Colorado. Accurate counts of breeding numbers may be difficult while minimizing observer disturbance of colonies. Measures of productivity on colonies would be informative, and information on habitat variables and their correlation with colony activity and success is needed.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Cullen, S. A., J. R. Jehl Jr., and G. L. Nuechterlein. 1999. Eared Grebe (*Podiceps nigricollis*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/eargre DOI: 10.2173/bna.433

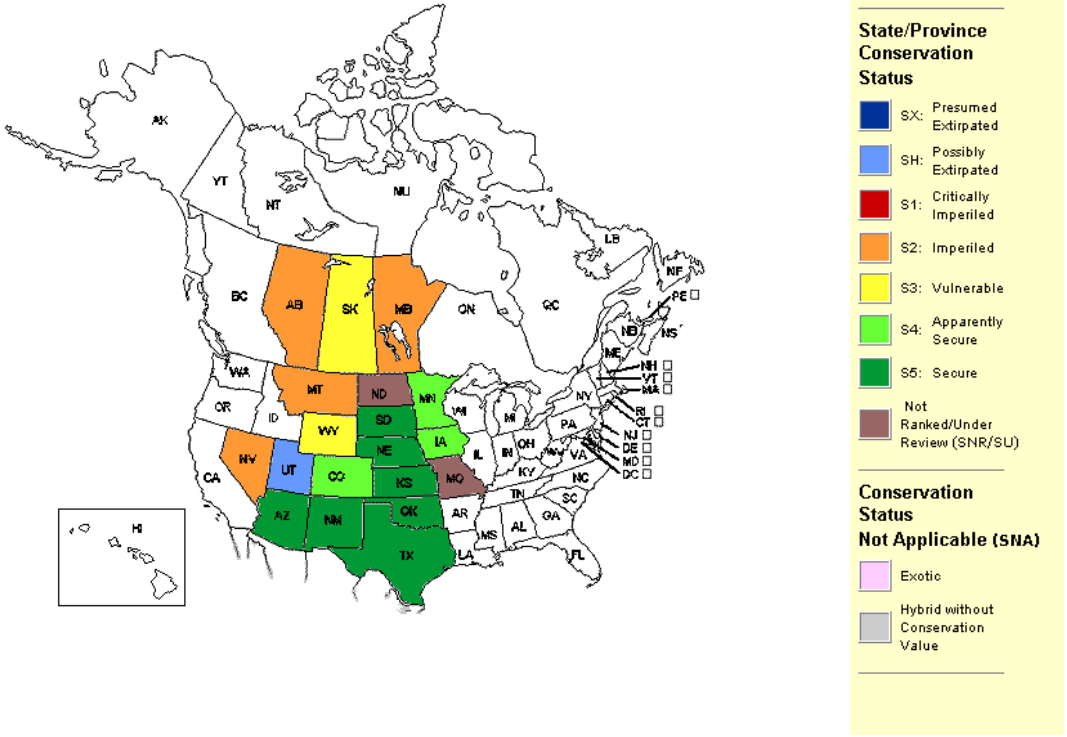
Hundertmark, C. A., and D. L. Nelson. 2016. Eared grebe (*Podiceps nigricollis*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 138-139. Colorado Bird Atlas Partnership.

Great Plains Toad (*Anaxyrus cognatus*)

General Description: The Great Plains toad (GPTO) is in the Bufonidae (toad) family and is common in open spaces characterized by broad grasslands in the arid southwest adjacent to breeding sites in temporary or seasonal wetlands, is nocturnal and spends most of its time burrowed underground.

Physical Characteristics: Great plains toads (*Anaxyrus cognatus*) vary in color from green to brown to grey with paired dark brown blotches defined by narrow borders along their sides and a white or creamy color belly. The adult GPTO male is slightly smaller than the female from 4.5 to 10 cm. Generally, in the SLV, females the populations seem to be of small size than in other locations with females only reaching about 8 cm. The toad's backs are covered by tubercles or 'warts' that are less than 1mm in diameter. Some toads have a light mid dorsal stripe and a small but well developed cranial crest. Breeding male GPTO have a black vocal sac that is sausage shaped when expanded. Tadpoles are blackish but become a lighter mottled brown or gray.

Range and Conservation Status: The GPTO is common throughout mid and western North America with populations in the San Luis Valley and eastern Colorado. They occur at elevations ranging from sea level to 8,000 feet. The toads are not currently listed as threatened or of concern but may be in the future given continued habitat fragmentation and the use of pesticides and herbicides that are not well tolerated.



Communication: The males have distinctive breeding calls that is a metallic-sounding trill.

Life History Characteristics:

- Diet: GPTO adults are nocturnal insectivores that prefer arthropods commonly known as insects, spiders, crustaceans, etc. Larvae (tadpoles) are herbivores that eat organic matter, algae, and plant tissue. Newly metamorphed toads eat all day for the first month of growth.
- Hibernation: Toads spend a large amount of time underground by backing into the ground creating burrows over the winter and during dry conditions throughout the rest of the year. They are not freeze tolerant and burrow below the frost line.
- Breeding: GPTO usually begin breeding during or after spring rains from April to June and requires air temperatures of 15° C or greater. The males use mating calls and congregate in large masses to attract females, who initiate copulations through physical contact at which point the male tenaciously holds onto her. Females are attracted to males with a higher call rate regardless of size or other attributes. Each female lays a dark egg mass up to 20,000 eggs about 2 days after copulation that are attached to debris near the bottom of the water. Eggs begin metamorphoses about 6 weeks after they are laid. Females extrude one egg mass at one type during the breeding season. Toads are 2 years old in the SLV when they become sexually mature.
- Young: Larvae (tadpoles) emerge and metamorphose into toads within 2 weeks.
- Dispersal: GPTO may move several hundred meters between breeding sites and over-wintering areas. These toads often stay at the same calling site on any individual night and may stay at the same location over several nights. After the breeding season toads will move to their over-wintering areas which typically includes sequences of moving short distances to forage, burrowing for several days, and then moving on to another forage location.

Great Plains Toad SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grasslands							Dispersal					
Open Water				Breeding								
						Larvae and Metamorphosis						
Short Emergent				Breeding								
						Larvae and Metamorphosis						
Wet Meadow	Hibernation							Hibernation				
				Breeding								
						Larvae and Metamorphosis						
							Dispersal					

Habitat Requirements:

Typical habitats for Great Plains toads in the San Luis Valley include temporary or seasonal wetlands, irrigated agricultural fields, juxtaposed to grasslands that allow for burrowing. GPTO burrow in the mud, gravel, sand or similar substrates. Usually GPTO

are found at the water's edge or in shallow water. Known predators to GPTO include various game fish, bullfrogs, and western terrestrial garter snake.

Requirements:

- Shallow wetlands that are seasonal or temporary that allow the toads to burrow into the ground for long periods of time.
- Good water quality.
- Limited presence of known exotic, aquatic predators: bullfrog, game fishes, and tiger salamanders.

Key public areas for the toad in the San Luis Valley: Blanca Wetlands Management Area, San Luis Lakes SWA, Higel SWA, Rio Grande SWA, Russell Lakes SWA, Baca National Wildlife Refuge, Monte Vista National Wildlife Refuge, Alamosa National Wildlife Refuge, and Great Sand Dunes National Park.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the creation and protection of habitats that favor toad reproduction and limit or prohibit successful breeding by bullfrogs and predatory fishes. Additional methods to enhance toad habitat are listed below:

- Periodic dewatering or drawdowns of wetlands in summer, after toads have metamorphosed, can be beneficial to prevent and decrease predators such as bullfrogs and fish. This will generally be accomplished though natural water discharge or dry down.

- Avoid producing breeding habitat in areas where wetlands dry up before larvae have metamorphosed.

- Manage for harvest of predators that are game species: bullfrogs and fish.

Monitoring Recommendations:

Monitoring strategies depend upon the season and the life stage of the toad that is being studied. The GPTO is primarily nocturnal during the breeding season, therefore strategies should be correlated to night call surveys during this time. Visual surveys may be conducted outside of the breeding season, along open areas of shorelines, in the morning that target adult frogs.

References:

AmphibiaWeb. 2019. <http://amphibiaweb.org> University of California, Berkeley, CA, USA. Accessed 30 Apr 2019.

NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: April 30, 2019)

Citation for Amphibian Range Maps of the Western Hemisphere:
IUCN, Conservation International, and NatureServe. 2004. Global Amphibian Assessment. IUCN, Conservation International, and NatureServe, Washington, DC and Arlington, Virginia, USA.

Acknowledgement Statement for Amphibian Range Maps of the Western Hemisphere:
"Data developed as part of the Global Amphibian Assessment and provided by IUCN-World Conservation Union, Conservation International and NatureServe."

Sullivan, B. 1983. Sexual selection and mating system variation in the Great Plains toad (*Bufo cognatus* Say) and Woodhouse's toad (*Bufo woodhousei austrailis* Shannon and Lowe). Arizona State University, PhD Dissertation.

Lewis's Woodpecker (*Melanerpes lewis*)

General Description: The Lewis's Woodpecker is a distinctive woodpecker, at a distance it is often confused with a crow because of it's medium size (26-28 cm) and dark in color. The species is named in honor of Meriwether Lewis for his observations on this species in July of 1805 during the Lewis and Clark expedition.

Physical characteristics:
This bird's unique plumage easily distinguishes it from other woodpeckers. Sexes are similar. Plumage is greenish black head, back, wings and tail; a prominent silver grey collar; a pink or salmon lower breast and belly; and a dark red face. Juvenile plumage is distinctly different and more drab than adults but highly variable; overall dark and more brownish black dorsally and lacking gray, red and pink on the front.

Range and Conservation Status:
The Lewis's Woodpecker is locally distributed within its range, it is a species with sporadic occurrence, known to disappear and reappear from breeding sites. This species is limited to western North America and is present year round in much of Colorado. This species' range matches the distribution of Ponderosa Pine (*Pinus ponderosa)* forests however range expansions have occurred into riparian habitat.

This species is a Tier 2 species on the Colorado State Wildlife Action Plan (SWAP), it is a US Forest Service Species of Concern, a USFWS bird of conservation concern, has a declining population trend noted in the SWAP, and in BBS data (2.8% decrease). The Colorado Breeding Bird Atlas showed a 47% decrease in priority blocks between Atlas I and Atlas II. Likely causes of the decline include fire suppression in Ponderosa Pine which decreases the open space the species needs to forage and old cottonwood dominated riparian forests with little regeneration.

Communication: Unlike other woodpeckers this species does not call regularly and drumming is limited during the breeding season. Their vocal array includes single note *churr* calls from males during courtship, *chatter* calls, a descending series of short squeaks mostly from males during breeding season, and alarm notes which are simple squeak notes uttered singly or in bursts, *yick* in the male and *yick-ick* in the female.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Opportunistic, diet varies with seasons. Preys on flying insects during summer breeding season; fall and winter diet is primarily acorns, other nuts, grain and fruit cached in mast stores. Unlike most woodpeckers, Lewis's Woodpeckers do not excavate insects from trees, instead they are aerial insectivores, fly-catching over streams, ponds, and wet meadows; they also glean from tree trunks, starting at the base of a tree and working up and out to smaller branches.
- Breeding system: Monogamous, some evidence of long-term permanent pairing probably linked to nest-site fidelity.
- Nesting: Beginning in mid-April, rarely excavates a nest so dependent on natural cavities, only one brood per season, clutch size 5-9 eggs, incubation 14-16 days by both male and female.
- Brood period: Fledging in 28-34 days, male and female care for young, male broods at night, young leave the nest several days before flying. In foothills of Colorado young fledge from June 30 to July 21.
- Post-breeding: After fledging, young remain with adults in nomadic flocks until adults establish winter territories.

Lewis's Woodpecker SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian	Wintering										Wintering	
				Nesting								
					Brood Rearing							
							Post-Breeding					
River	Wintering										Wintering	
				Nesting								
					Brood Rearing							
							Post-Breeding					
Shrubland	Wintering										Wintering	
Wet Meadow				Foraging								
					Brood Rearing							
							Post-Breeding					

Habitat Requirements:

In the San Luis Valley, important habitat includes riparian areas with cottonwood galleries adjacent to upland habitat of pinyon-juniper and or ponderosa pine as well as associated wetland areas for insect hatches.

Key public areas for Lewis's Woodpecker in the San Luis Valley: Great Sand Dunes National Park, Baca National Wildlife Refuge, Coller SWA, and Hot Creek SWA.

Management Recommendations:
Conservation in the San Luis Valley of Colorado is probably best accomplished through the protection and expansion of riparian forests. This species requires old decaying cottonwood for nest cavities and storage of mast. Drought, overgrazing, and changes in flooding regimes have reduced regeneration of cottonwood habitat. Riparian habitat associated with pinon-juniper and ponderosa pine uplands would be especially important to protect.

- Providing a variety of structure, age class, and dense riparian cottonwood and willow forests with a large percentage of 'edge' habitat.
- Maintain consistent surface water conditions adjacent to riparian forests through the breeding season.
- Promote regeneration of cottonwood and willow on conserved lands with willing landowners by incorporating management practices that prevent cattle grazing in the riparian area until trees can withstand some browse (5 to 7 years), prevent mowing and haying of newly established trees.
- Work with private landowners to improve riparian health

Monitoring Recommendations:
Target appropriate habitat for expanded monitoring efforts. The patchy distribution of this species means that they could easily be missed if monitoring efforts are not targeted.

References:
Ortega, Joseph P. 2016. Lewis's Woodpecker (*Melanerpes lewis*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp 288-289. Colorado Bird Atlas Partnership.

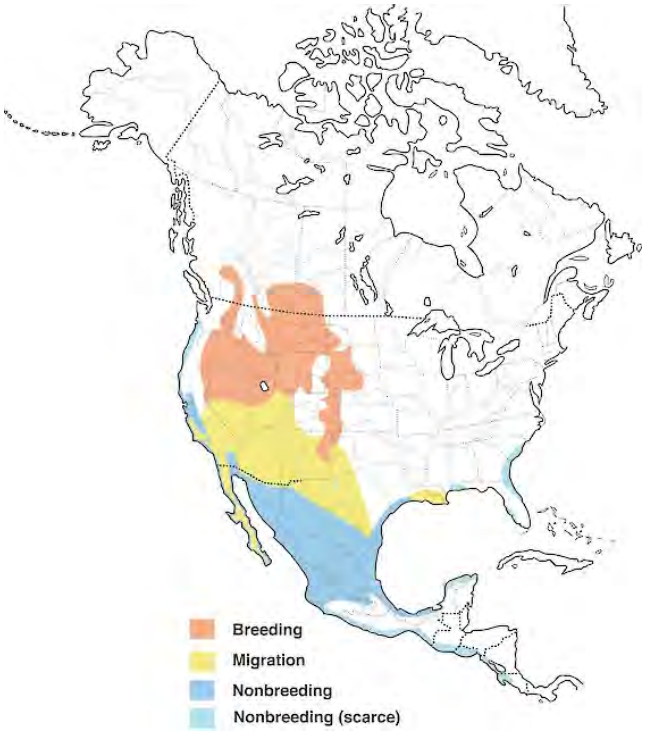
Vierling, Kerri T., Victoria A. Saab and Bret W. Tobalske.(2013).Lewis's Woodpecker (*Melanerpes lewis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/lewwoo
DOI: 10.2173/bna.284

Long-billed curlew (*Numineus americanus*)

General Description: The long-billed curlew, the largest North American shorebird, is a member of the family Scolopacidae. Primarily a grassland bird, curlews are uncommon in the San Luis Valley, where they use wet meadows, short emergent wetlands, and shorelines of open wetlands, lakes, and reservoirs during migration.

Physical characteristics: The long-billed curlew is a large, long-legged shorebird with a very long, decurved bill. Plumage is buff colored with heavy dark brown and cinnamon streaking. The legs and feet are dull gray. The bill is gray brown, fading to pinkish at base. Females have a longer bill than males.

Range and Conservation Status: Long-billed curlews breed in shortgrass and mixed grass habitats of the Great Basin, Great Plains, and intermountain basins of the western United States and southwestern Canada. They winter primarily in coastal and inland habitats in California, Texas, Louisiana, and Mexico. Listed as highly imperiled in the U.S. Shorebird Conservation Plan, due to relatively low overall population size and declining trends in some parts of the range. Long-billed curlews are uncommon to rare breeders in Colorado, primarily on the eastern plains, and are occasionally observed during migration in the San Luis Valley. The Colorado SWAP (2016) has listed the bird as a Tier 2 species of concern, is a Colorado State Species of Concern, and is a Sensitive Species for the BLM, USFS, and USFWS.



Communication: a distinctive two-note *curluoo* call is given commonly on the ground and in flight; a longer, multi-note *curluoo* call is commonly given on the ground during

social interactions outside the nesting period. A variety of other whistles and soft guttural calls are used, primarily during the breeding season.

Life history characteristics:

- Diet and foraging behavior: Long-billed curlews are carnivorous, feeding primarily on terrestrial and aquatic invertebrates, as well as some small vertebrates. They use their long, decurved bill to probe for underground prey, and also peck at the surface or from vegetation. In wetlands, curlews appear to prefer sparsely vegetated habitats flooded <5 cm.
- Breeding system: Seasonally monogamous. Many curlews do not breed until they are two or three years old. Some pair formation occurs during spring migration. Paired and unpaired males establish territories on breeding areas, and unpaired males perform aerial courtship displays to attract mates.
- Spring migration: Long-billed curlews move through the San Luis Valley February through April, with greatest numbers in April. They often move as pairs or solitary individuals, but also in small groups.
- Fall migration: Curlews move through the San Luis Valley from June to September, with greatest numbers in September. Small flocks often move quickly through the area. Specific information on migration routes and timing are unavailable.

Long-billed curlew SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grassland		Migration				Migration						
Open water		Migration				Migration						
Playa		Migration				Migration						
Short emergent		Migration				Migration						
Wet meadow		Migration				Migration						

Habitat Requirements:

Long-billed curlews are grassland birds and use extensive meadows and fields along with shallow freshwater and alkaline wetlands within these upland habitats. They also use open shorelines of lakes.

Key public areas for the curlew in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Baca National Wildlife Refuge, Blanca Wetlands, Russell Lakes State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Practices that promote plant and invertebrate abundance and diversity in upland (e.g., grazing) and wetland (e.g., seasonal draw-downs) habitats can be beneficial. Curlews do not tolerate high levels of human disturbance so where possible, minimize disturbance in suitable habitat during their peak months, April and September.

Provide large expanses of short, mixed grass prairies especially during the migratory months of April and September if possible.

Conversion of suitable habitat to agriculture, energy development, and other uses pose a threat to curlews therefore preservation of open grasslands is critical to this species during their migration.

Monitoring Recommendations:

Because long-billed curlews are relatively rare and sparsely distributed in the San Luis Valley, monitoring of the quantity and quality of suitable habitat available to curlews may be most beneficial.

Conducting coordinated bird surveys specifically for this species valley-wide during April and September may aide in understanding the extent of the population using the SLV and also which habitats are being selected for during migration.

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Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

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Kibbe, D. P. 2016. Long-billed curlew (*Numenius americanus*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 216-217. Colorado Bird Atlas Partnership.

Mallard (*Anas platyrhynchos*)

General Description: The mallard is a well-known, large dabbling duck in the family Anatidae. They are abundant and widely distributed throughout North America and use wetland and agricultural habitats in the San Luis Valley throughout the year.

Physical characteristics: Mallards are strongly sexually dimorphic. The adult male in breeding plumage has a dark-green head, narrow white neck-ring, chestnut-brown breast, brownish-gray upperparts, grayish underparts, black rump and undertail coverts, white outer tail feathers and strongly recurved black central tail feathers. The bill is yellow to olive and the legs and feet are red. The female has a broken streaky pattern of buff, white, gray, or black on brown feathers, white outer tail feathers, and a pale mottled belly and undertail coverts. The bill is orange and variably splotched with black; the legs and feet are orange. Juveniles and males during post-breeding molt have plumage similar to females. In both sexes the upper wing has an iridescent blue to violet speculum bordered by white.

Range and Conservation Status: The mallard is abundant and widespread, breeding throughout most of North America and wintering throughout the United States. It is the most common breeding duck in the San Luis Valley, and if open water is available small numbers remain through the winter. The mallard is also the most heavily harvested duck in North America and Colorado, and has been the focus of most duck habitat management, monitoring, and research. The mallard is a CPW Wetlands Program Tier 1 priority species and is a high priority species for the North American Wetlands Conservation Act.

Communication: Mallards are more vocal than most ducks. Male and female vocalizations differ; females have a greater variety of calls and give the familiar loud quacking call (Decrescendo Call) most commonly associated with this species. Males commonly give a

quiet, raspy *rab* call. Most female calls are maternal calls, while most male calls are given during courtship and agonistic displays.

Life history characteristics:

- Diet: The mallard is an omnivorous, generalist feeder. During the breeding season, females eat mostly animal foods, particularly aquatic invertebrates and earthworms. Outside the breeding period plant foods dominate the diet, and mallards commonly feed in grain fields. In wetlands they typically feed at shallow (<20 cm) water depths, and use a variety of feeding methods, including tipping up, dabbling, and surface pecking.
- Breeding system: Seasonally monogamous. Pair formation occurs mainly on wintering areas but continues through spring migration and after arrival on breeding areas.
- Nesting: Late April through June. Mallards have one nest per year, but pairs will re-nest if the first nest is lost. Average clutch size is 8 eggs; laying interval is about one egg per day. Mallards nest over water or on the ground, usually close to water, in a well-concealed nest formed from herbaceous vegetation and down feathers. The incubation period averages 28 days, ranging from 23-30 days. Only females incubate the eggs.
- Brood period: Late May through August. Young leave the nest within 24 hours of hatching, and are led by the female to nearby habitats with shallow, open water and emergent vegetation for feeding and cover. Young mallard can fly 8-10 weeks after hatch.
- Post-breeding: After females begin incubating, males form small flocks and move to wetlands with dense emergent vegetation to molt. Groups of mallards stage on wetlands in late summer before moving toward wintering areas.
- Winter: Mallards will often only move as far south as needed to find suitable resources. Flocks roost in open water where they can find thermal cover, and feed in warm water seeps, rivers, open reservoirs, and grain fields.

Mallard SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop (grain)	Winter											Winter
		Migration								Migration		
Grassland				Nesting								
Open water	Winter											Winter
		Migration								Migration		
			Pre-Breeding									
					Brood Rearing							
							Post-Breeding					
Playa		Migration								Migration		
			Pre-Breeding									
					Brood Rearing							
							Post-Breeding					
Short Emergent		Migration								Migration		
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					
Tall Emergent		Migration								Migration		
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					
Wet Meadow		Migration								Migration		
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					

Habitat Requirements:

In the San Luis Valley, mallards use virtually all wetland habitats, but primarily focus on shallow, freshwater seasonal and semi-permanent habitats and wet meadows during pre-breeding and breeding, grain fields during fall through early spring, and open water habitats (rivers, reservoirs, sloughs) during winter.

Key public areas for mallards in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Blanca Wetlands, McIntire/Simpson, Russell Lakes State Wildlife Area, Rio Grande State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Complexes of different freshwater and alkaline wetland types in close proximity benefit mallards by providing a variety of habitat structure, water depths, and food types necessary to meet annual life cycle needs. Large fluctuations in water levels (drying or flooding) during nesting can jeopardize nest success. Grain fields in close proximity to wetland complexes and winter roost sites provide beneficial feeding opportunities during the non-breeding period.

- Water availability is limited in February and March prior to the surface and groundwater irrigation rules and regulations presumptive start date of April 1, therefore public lands with groundwater wildlife adjudications are extremely important.

- Promoting winter sheet ice in late fall, where available, may help provide some early spring habitat.

Monitoring Recommendations:

Mallards are readily distinguished from other duck species during standardized waterfowl counts. They have been well-studied in the San Luis Valley, but response to specific habitat treatments and landscape-scale habitat conditions needs further study.

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Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

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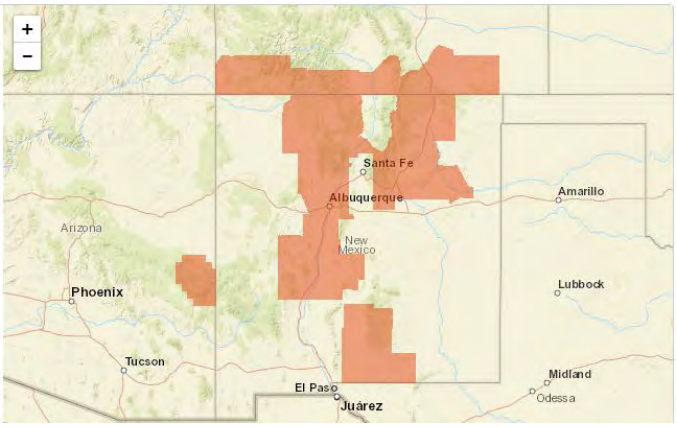
New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*)

General Description: The New Mexico Meadow jumping mouse is a unique subspecies of meadow jumping mouse. Jumping mice are rarely found more than a few feet (1.8 meters) from running water. They are named for their incredible jumping ability, capable of jumping up to a meter in distance. They are also unique for their hibernation needs, sleeping for 7 to 9 months of every year, depending on elevation.

Physical characteristics: A long tailed mouse with large feet. Both the tail and feet aid in jumping and swimming. The jumping mouse is grayish-brown on the back, yellowish-brown on the sides and white underneath. Total length is 7.4 to 10 inches (187 to 255 mm) with an extremely long, bicolored tail 5.1 inches (130.6 mm) in length and back feet that measure 1.2 inches (30.6 mm).

Range and Conservation Status: Endemic to New Mexico, Arizona, and a small area of southern Colorado. This species is naturally rare and spread across isolated population areas as their habitat needs are riparian areas in arid locations, which make up less than 1% of landmass in the southwest.



USFWS Critical Habitat for New Mexico Jumping Mouse.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Fruit, seeds, grasses, and forbs, insects, snails, slugs. Territory size can be up to 300 feet along stream bank.
- Breeding system: Little is known about breeding strategies specific to this subspecies but *Zapus* mice generally have 1 liter of 2 to 7 young produced after a

17-21 day gestation. Young are full developed and weened after 4 weeks. Female provides all care of young.

New Mexico Meadow Jumping Mouse habitat, timing, event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian	Hibernation								Hibernation			
						Breeding						

Habitat Requirements:
This species only utilizes two habitat types: persistent emergent herbaceous wetlands (beaked sedge and reed canarygrass alliances) and scrub-shrub riparian wetlands (willow and alder along perennial streams). This species has not been documented in the San Luis Valley but there are many areas where these habitat types can be found.

Key public areas in the San Luis Valley: Not known.

Management Recommendations:
Overgrazing is a major issue for this species as tall vegetation in riparian areas provide this species with both the cover and food resources it needs for survival.

Monitoring Recommendations:
In the SLV nobody even wants to look for this species for fear that they may find one.

References:

WildEarth Gardians, New Mexico Meadow Jumping Mouse. https://wildearthguardians.org/wildlife-conservation/endangered-species-list/mammals/new-mexico-meadow-jumping-mouse/

Pictures from webiste:
United States Department of Agriculture, Forest Service Southwestern Region New Mexico Meadow Jumping Mouse Home page:
https://www.fs.usda.gov/detail/r3/home/?cid=stelprd3809040

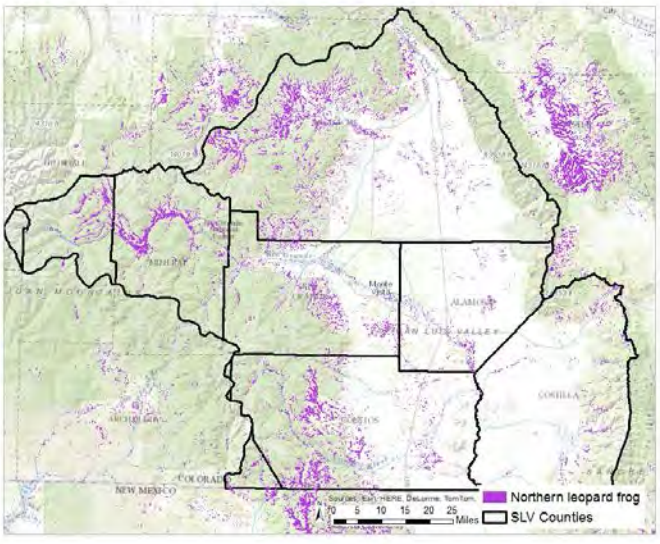
Map from U.S. Fish and Wildlife Service Environmental Conservation Online System:
https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A0BX#lifeHistory

Northern Leopard Frog (*Lithobates pipiens*)

General Description: The Northern leopard frog (NLFR) is in the Ranidae (true frog) family and is a semi-aquatic amphibian living in wetlands, rivers, and lakes.

Physical Characteristics: Northern leopard frogs (*Lithobates* [=*Rana*] *pipiens*) are green or brown frogs with two to three irregular rows of dark spots running vertically along their back (dorsum), which is characterized by two conspicuous dorsolateral ridges (or skin folds) bordering the rows of spots. The adult Northern leopard frog (*Lithobates pipiens*) is medium in size, averaging 3-4 inches long. Upper body coloration can be green or brown and have large dark irregular spots (usually rounded or oval) covering smooth, moist skin. The skin contains glands that secrete mucus to keep from drying out, and also has glands that secrete poisons strong enough to help them escape from their predators but not harmful to humans. During the breeding season, mature male NLFR have expanded vocal sacs that extend above front legs on each side and enlarged 'thumbs' (first digit) to assist in clasping females.

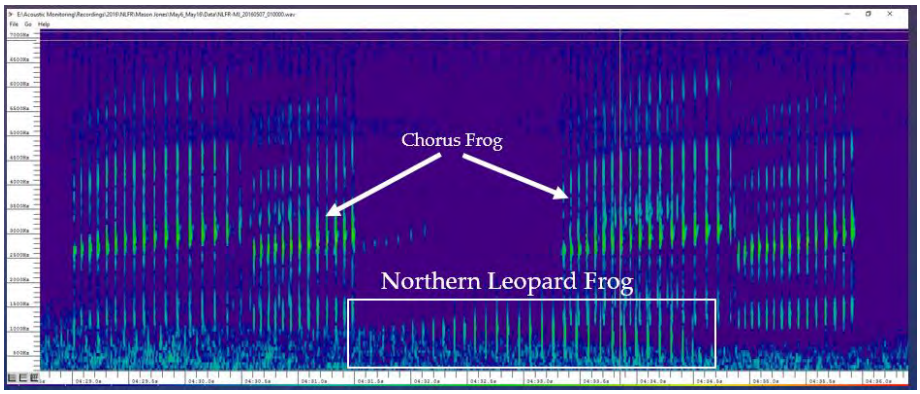
Range and Conservation Status: The NLFR is common throughout North America, inhabiting twenty-six states and much of Canada. The NLFR occurs throughout much of Colorado, excluding most of the southeastern and east-central portions of the state and specifically the Republican River drainage. They occur at elevations ranging from 3,500 feet to above 9,000 feet but are now rare or extirpated from many areas, especially mountainous regions. The Northern Leopard frog is a Colorado state species of special concern and a Tier 1 species in the recently updated Colorado State Wildlife Action Plan.



Population declines across North America have been associated with the chytrid

fungus, red-leg disease (*Aeromonas hydrophila*), habitat fragmentation and degradation, and the introduction of predatory species such as the bullfrog (*Lithobates catesbeianus*).

Communication: The males have distinctive breeding calls described as snores and chuckles. A prolonged snore may last 2 or 3 seconds that is then followed by a series of 2 to 3 chuckles although each may be made independent of the other. The figure below shows a sonogram of what the 'snore' sound looks like by a northern leopard frog in comparison to the sound that chorus frogs make. Although there is some overlap, the NLFR call is at a lower frequency than the chorus frog.



Life History Characteristics:

- Diet: Adults feed largely on invertebrates, snails, and smaller vertebrates such as chorus frogs. The diets of larvae differ from those of adult, with the young consuming plant material, such as algae, as well as microscopic animals.
- Hibernation: During winter, northern leopard frogs hibernate at the bottom of bodies of water and emerge in March-April.
- Breeding: The males use mating calls to attract females and establish territories. Copulation generally occurs between March to June. The females release eggs while swimming and the male, who attaches himself to the female with specialized thumbs, fertilizes the eggs. The egg masses are attached to vegetation just below the water surface in relatively warm shallow water typically 3-10 inches deep. Each female lays a dark egg mass up to 3,000 eggs, which hatch 10-20 days after fertilization.
- Young: Larvae (tadpoles) emerge and metamorphose into frogs throughout summer. Sexual maturity is reached in two or three years.
- Dispersal: Leopard frogs have been documented moving as far as 1.8 miles within a year. They tend to travel from water during mild wet weather or in search of suitable water sources. After they metamorphose from tadpoles, the young adults often disperse from their breeding areas and spend time in adjacent drier habitats for at least portions of the day.

Northern Leopard Frog SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water	Hibernation										Hibernation	
				Breeding								
						Larvae and Metamorphosis						
								Dispersal				
River								Dispersal				
Short Emergent				Breeding								
						Larvae and Metamorphosis						
Tall Emergent	Hibernation										Hibernation	
				Breeding								
						Larvae and Metamorphosis						
Wet Meadow								Dispersal				

Habitat Requirements:

Typical habitats for northern leopard frogs in Colorado's lowland areas (below 8,000 feet) include wet meadows, marshes, shallow wetlands, beaver ponds, depressional wetlands, deepwater wetlands, reservoirs, irrigation ditches, and along the banks of streams and rivers. Usually NLFR are found at the water's edge or in shallow water. Vegetation cover in the form of aquatic or emergent vegetation, or shoreline vegetation is essential to protect them from predation. However, recent studies have shown that newly morphed adults may prefer wetland areas that have some vegetation along the edge of the water but allows for easy access from and to the water. For example, tall emergent vegetation that has been mowed to 4 to 6 inches in height may be preferred to a site that has dense, residual tall emergent vegetation along the bank that impedes movement. Egg laying sites generally need mats of algae, or dense underwater vegetation to attach the eggs and shelter from predators. Known predators to NLFR include pied-billed grebes, tiger salamanders, various game fish, great blue herons, egrets, black-crowned night herons, bullfrogs, and western terrestrial garter snake. NLFR hibernate in the mud, gravel, sand or similar substrate under a body of water such as a permanent wetland or stream. Depth of water covering a hibernating frog is generally 33 inches or greater. However, active frogs have been found throughout the winter in pools formed by warm artesian wells in the San Luis Valley.

Requirements:

- Shallow, quiet areas of semi-permanent bodies of water, or in seasonally flooded areas that are adjacent to or contiguous with permanent wetlands or streams. An interspersion of these wetlands types is desired.
- Good water quality.
- Over wintering areas that do not freeze solid for winter hibernacula.
- Presence of vegetation in the shallows or edges of the wetland that allow for some protection but is not so dense as to impede movement out or back into the water.
- Areas of quiet, warm (53º-73ºF), shallow (3-10" deep), vegetated conditions within the wetland for egg laying.
- Limited presence of known exotic, aquatic predators: bullfrog, game fishes, and tiger salamanders.

Key public areas for the leopard frog in the San Luis Valley: Higel SWA, Rio Grande SWA, Monte Vista National Wildlife Refuge, and the Alamosa National Wildlife Refuge.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the creation and protection of habitats that favor leopard frog reproduction and limit or prohibit successful breeding by bullfrogs and exotic predatory fishes. Additional methods to enhance northern leopard frog habitat are listed below:

- Periodic dewatering or drawdowns of wetlands in late summer to early fall, after leopard frogs have metamorphosed, can be beneficial to prevent and decrease predators such as bullfrogs. This will generally be accomplished through natural water discharge or dry down.
- Avoid producing breeding habitat in areas where wetlands dry up before larvae have metamorphosed (mid-August).
- Manage for harvest of predators that are game species: bullfrogs and fish.
- Set back succession periodically in areas adjacent to breeding NLFR wetlands, for example, mow tall emergent to edge of wetlands in patches that allow NLFR to easily disperse after metamorphosis.

Monitoring Recommendations:

Monitoring strategies depend upon the season and the life stage of the frog that is being studied. The NLFR is primarily nocturnal during the breeding season, therefore strategies should be focused on night call surveys during this time. Visual surveys may be conducted outside of the breeding season, along open areas of shorelines, in the morning that target adult frogs. Frogs are most active at water temperatures between 18 and 24° C, air temperatures between 22 to 25° C, during times of light to intermittent precipitation, calm winds, and dropping barometric pressure. Call surveys may have the lowest cost but may not be the best method or have equal effectiveness depending on objectives and location. Also, call surveys will only be reflective of the breeding population. Other types of surveys such as line transects along the transition line between the water and vegetation would be appropriate to determine some level of recruitment. The following table shows habitat conditions, season, and type of survey that should be used.

Life Cycle Event	Habitat	Season	Type of Survey	Specific Monitoring technique
Breeding	Permanent, Semi-permanent, seasonal wetlands	Spring - Summer (April - June)	Visual, Auditory	Acoustic, Night call surveys
Larvae and Metamorphosis	Permanent, Semi-permanent, seasonal wetlands	Summer (June-Aug)	Visual	Drift fence/pitfall trap and egg mass counts
Dispersal	Seasonal wetlands, wet meadows, grasslands	Summer (August)	Visual	Quadrats; Transects; drift fence/pitfall trap
Over-wintering	Permanent wetlands, rivers	Fall (Sept-Oct)	Visual	Quadrats; Transects; drift fence/pitfall trap

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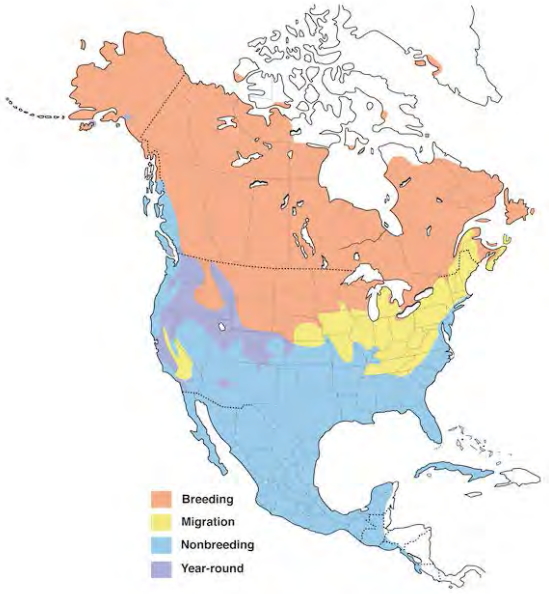
Northern pintail (*Anas acuta*)

General Description: The northern pintail is a medium-sized dabbling duck in the family Anatidae.

Physical characteristics: Both sexes are distinguished from other dabbling ducks by their slim profile, long, narrow neck, and pointed tail. Pintails have sexually dimorphic plumage. The male in breeding plumage is readily distinguished by a combination of chocolate brown head, white neck and underparts, very long central tail feathers, and a black bill with bluish stripes. Brownish females are distinguished from other female ducks by slender proportions, pointed tail, mottled dull brown or bronze (rarely with some green) speculum, and mottled to spotted dark gray to black bill. The legs and feet of both sexes are bluish gray.

Range and Conservation Status: In North America, pintails breed over a large range in Alaska, Canada, and the northern prairie states. Large numbers winter in California, Texas, and Louisiana. This species is widely distributed and highly mobile. Continental breeding numbers declined during the 1980s through the 2000s, but appears to have stabilized and in recent years the population has seen increases. Results of the Colorado Breeding Bird Atlas suggest that the pintail breeding distribution has declined in recent decades. Relatively few pintails breed in the San Luis Valley, but the species is present from spring through fall. The pintail is a CPW Wetlands Program Tier 1 priority species and is a high priority species for the North American Wetlands Conservation Act.



Communication: The most common call of adult males is a *whee*, a wheezy whistle-like sound, given throughout the year. During courtship, males give a high-pitched Burp Call, *ee hee*, followed by a loud, trilled whistle. The most common call of adult females is a short, low *kuk*, given singly or in series, heard throughout the year in many situations. Extended bouts of quacking are given by the female before and during the egg-laying period.

Life history characteristics:

- Diet and foraging behavior: Northern pintails eat agricultural grains (rice, wheat, corn, barley), moist-soil and aquatic plant seeds, pond weeds, aquatic insects, crustaceans, worms, and snails. During breeding, they forage primarily in shallow water depths in temporary, seasonal, and semi-permanent wetlands with open water and short emergent vegetation. During migration (February to early April and August to November) they forage in crop fields, and supplement energy-rich grain food sources with wetland foods.
- Breeding system: Seasonally monogamous. Pair formation begins on wintering areas and continues through spring migration and after arrival on breeding areas.
- Nesting: April to June. Northern pintails have one nest per year, but pairs will re-nest if the first nest is lost early. Clutch size is 3-12, with an average of 6 or 7. Pintails nest on the ground in residual short grasses or other plants, in a well-concealed nest formed from herbaceous vegetation and down feathers. Pintails often nest far from the nearest water. Incubation is usually 22-24 days. Only females incubate the eggs.
- Brood period: Late May through July. Young leave the nest within 24 hours of hatching, and are led by the female to nearby habitats with shallow, open water and emergent vegetation for feeding and cover. Young pintails can fly about six weeks after hatch.
- Post-breeding: After females begin incubating, males move to wetlands with dense emergent vegetation to molt. Groups of pintails stage on wetlands in late summer before moving rapidly south to wintering areas.

Northern pintail SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop (grain)		Migration						Migration				
Grassland				Nesting								
Open water		Migration						Migration				
			Pre-Breeding									
					Brood Rearing							
							Post-Breeding					
Playa		Migration						Migration				
			Pre-Breeding									
					Brood Rearing							
							Post-Breeding					
Short Emergent		Migration						Migration				
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					
Wet Meadow		Migration						Migration				
			Pre-Breeding									
				Nesting								
					Brood Rearing							
							Post-Breeding					

Habitat Requirements:

In the San Luis Valley, northern pintails use a variety of wetlands, including alkali playas, temporarily flooded saltgrass flats, wet meadows and pastures, and emergent vegetation and open water in seasonal and semi-permanent wetlands. Numbers are typically highest during spring migration, when flocks roost and feed on wetlands and fly to nearby crop fields to feed on small grains.

Key public areas for northern pintails in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, and Blanca Wetlands.

Management Recommendations:

Complexes of different freshwater and alkaline wetland types in close proximity to each other and to grain fields benefit northern pintails by providing a variety of habitat structure, water depths, and food types necessary to meet annual cycle needs.

- Water availability is limited in February and March prior to the surface and groundwater irrigation rules and regulations presumptive start date of April 1, therefore public lands with groundwater wildlife adjudications are extremely important.
- Promoting winter sheet ice in late fall, where available, may help provide some early spring habitat.

Monitoring Recommendations:

Northern pintails are readily distinguished from other duck species during standardized waterfowl counts. Monitoring of the distribution and hydrology of temporary and seasonal wetlands, as well as the distribution of pastures and grain fields, would be informative.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Clark, R. G., J. P. Fleskes, K. L. Guyn, D. A. Haukos, J. E. Austin, and M. R. Miller. 2014. Northern Pintail (*Anas acuta*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/norpin DOI: 10.2173/bna.163

Goldthwait, M. 2016. Northern pintail (*Anas acuta*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 86-87. Colorado Bird Atlas Partnership.

River Otter (*Lontra canadensis*)

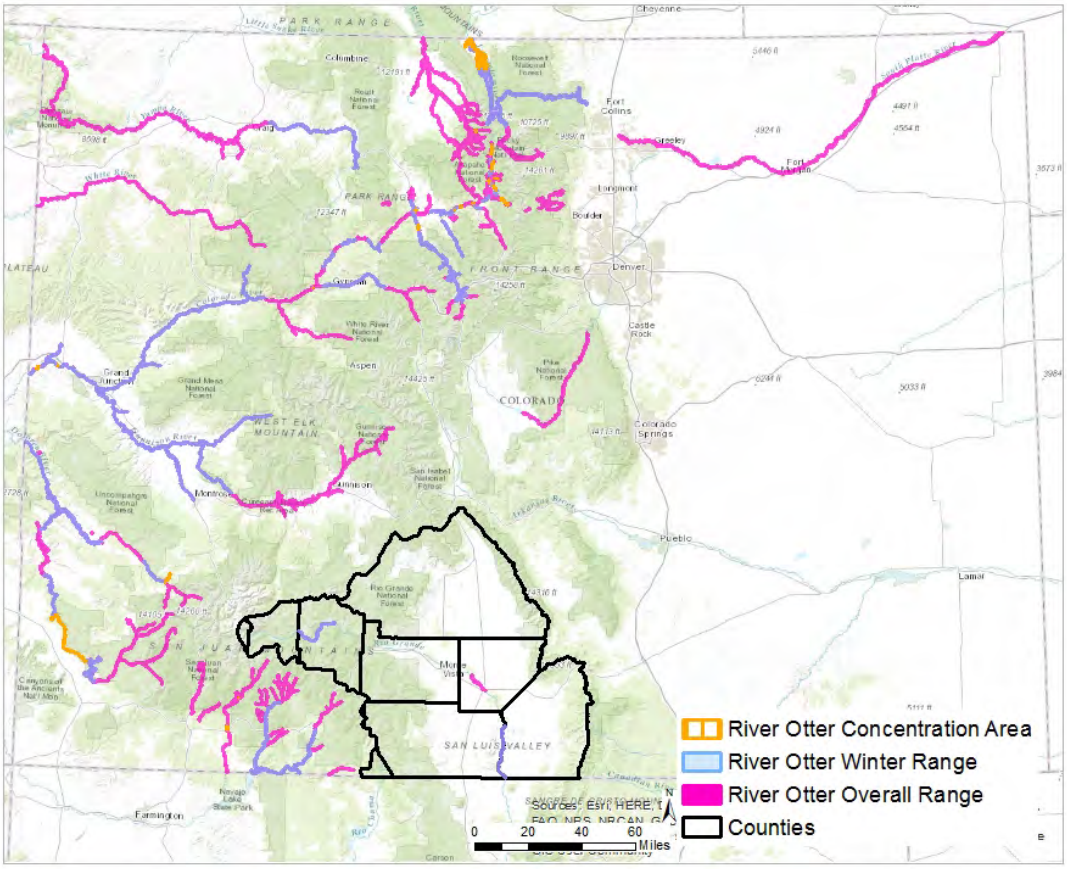
General Description: The River Otter is in the Mustelidae (weasel) family and is a semi-aquatic mammal living in wetlands, rivers, and lakes.

Physical characteristics: The River Otter is characterized by a flat head, small ears and eyes, and a long and sleek body with short, stout legs. They have webbed toes with non-retractable claws and a tail that is a 1/3 of their body length and tapered. Otters vary in length from 38 to 44 inches (including tail) and weigh 11 to 30 lbs with males typically larger than females. Their fur is short, thick, water-repellent, and varies in color from black to light brown with some graying of the tips as they age. They are darker dorsally than ventrally with silvery chins. Otters have an acute sense of smell and hearing but are near-sighted and commonly use their paws as they are highly sensitive to touch. These mammals are great swimmers and have adapted physically to their environment. For example they have decreased lung lobulation (their right lung has 4 lobes while the left has 2) along with a shortened trachea that allows for an increase in air exchange and lung ventilation when diving. They have developed specialized teeth that include sharp canines and carnassials that inflict lethal bites to prey and crush hard mollusk shells.

Behavioral characteristics: Otters are mostly nocturnal or crepuscular although they become more diurnal during the winter. They are renowned for their playful nature which includes wrestling and chasing, important for learning survival skills. They frequently dry themselves to uphold insulative quality of fur by rubbing and rolling on grass, bareground, and logs, thus it is common for them to have special locations where this occurs.

Communication: Otters communicate in several ways such as scent marking with feces, urine and possibly anal sac secretions along with musk from scent glands that may be secreted when they are frightened. They have several vocalizations that express different needs to the group. They often bark or growl when they are bothered, offer a shrill whistle when they are in pain, produce a low purring grunt when playing with other otters, make an explosive snort as an alarm call over long distances, and most commonly make a low frequency chuckling when among their own group.

Range and Conservation Status: The River Otter exists throughout North America although its range is less extensive now than historically. The otter occurs in Colorado but its population is fairly unknown in the San Luis Valley (see map). Typically otters



have been observed in late winter and early spring along the Rio Grande from Creede to the stateline. Monitoring efforts in 2017 suggest that there is year-round use of the Rio Grande Natural Area (south of Alamosa to the Stateline). Factors in the decline of the population since the late 1800s include pollution, poor water quality from mine waste, urbanization, and overharvest. River otters are highly susceptible to pollutants as they can accumulate high levels through their prey. Locations of otters exist back to the late 1800s and early 1900s but are not extensive. Reports in 1908 of river otters in Colorado include specimens from the Grande River and records of occurrences from other drainages. Only unsubstantiated reports occur after 1908. In 1975 the Colorado Wildlife Commission designated the otter as a 'state endangered species'. Increases in populations since then are mainly due to re-introductions. Between 1976 and 1991, 114 to 122 otters were re-introduced in 5 locations in CO with populations established along several rivers and reservoirs (Cheesman Reservoir, Gunnison River, Piedra River, Rocky

Mountain National Park, and Dolores River). In addition, Utah Department of Wildlife Resources released 67 otters in the Green River near the boundary with Colorado. These otters made their way into Colorado on the Green and Yampa Rivers. In 2003 the otter was downlisted to Threatened as a result of these successful reintroductions. A recovery plan was developed and outlines the threshold for de-listing and 3 self-sustaining populations meet the following criteria: 1. Occupancy of a minimum of 74.6 miles of contiguous stream, 2. River otter sign is present in each 5 km section of the stream in each survey year, 3. Surveys conducted 5, 10, 15 years after reintroduction indicate population persistence on those stream reaches, and 4. There have been documented sightings of otters on at least 3 connected tributaries or an additional 12.4 miles of the recovery stream outside the initial 74.6. Specifically, otters traveled 70 miles via river to Grand Junction and over 200 miles to the Colorado River in Utah. After 12 years of monitoring the Upper Colorado population in the Rocky Mountain National Park they have determined that the otters in that location are transient and use of the system is ephemeral due to water conditions, however, other locations have high fidelity to sites. Currently the otter is a USFS region 2 sensitive species, a management indicator species on the San Juan National Forest, a Tier 1 Threatened species for the State of Colorado, and has a CNHP rank of vulnerable/apparently secure (S3S4).

Life History Characteristics:

- Breeding: Polygamous; reproduce at 2 yrs of age; kits born after 12 month gestation, 10 month delay of implantation following copulation.
- Den (holt) sites: They do not make their own den site but use another animals like an old beaver lodge, rock formations, or cavities under trees with openings to the river; usually within about 10 ft of water; entrance leads to nest chamber lined with leaves, grass, hair, etc.; sites usually contain scat, tracks, slides and rolling places nearby.
- Slides: 8 inches wide, sometimes 60 ft long to open water, 18 to 20 inches apart on snow, ice, and mud.
- Young: Kits are born April to May; 1 to 5 kits but usually 1 to 3; emerge 6 to 8 weeks after birth; weaned at 12 weeks and mother provides food for them until they are over 9 months old. Males do not help with young but the group may stay together until the following spring when the young leave to find their own territory; young learn to swim at about 2 months when they leave the den.
- Diet: Opportunistic feeder but mainly piscivorous predator; Rocky Mountain National Park populations ate mostly Catostomidae (sucker) and Salmonidae (salmon and trout) fish species and crayfish; diet varies by season with crayfish being dominant in the summer; usually ambush prey, may cooperate while fishing; they will eat small fish in the water but bigger ones from the shore; eat the head first.
- Latrine sites: Sites are terrestrial communication centers where otters scent mark with scat, urine, and glandular secretions; may change seasonally and

annually and are related to hydrology of the river; use of latrine sites may be facilitated by maternal instruction, creating high fidelity to that site.

River Otter SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian	Wintering										Wintering	
				Denning								
	Kit Rearing				Kit Rearing							
		Dispersal							Dispersal			
Open Water	Wintering										Wintering	
				Denning								
	Kit Rearing				Kit Rearing							
		Dispersal							Dispersal			

Habitat Requirements:

Otters may be negatively affected by disturbance such as human interactions or degradation of riparian habitat due to agricultural activities and urban development. Otters have been shown to be positively correlated with beaver activities e.g. beaver activity often creates suitable habitat conditions. Wetlands adjacent to streams and rivers provide favorable food and shelter for otters that avoid disturbance and human interactions. Otters require cover including willows (shrubs) and an herbaceous layer. They can travel 26 miles in a day although they average 1.5 to 3 miles per day and travel less overall in the winter. Food habits and prey selection are dependent upon detectability and mobility of prey, habitat availability for prey, water depth and temperature, and seasonal changes in prey supply and distribution. They typically require access to open water year round. During the winter, open water may be limited so they will seek out bank areas along shores of permanent water that allow for cavities for the den and then access to water beneath the ice. They have a general territory size of 1 per 3 to 4 km (1.8 to 2.4 miles).

Key public areas for river otters in the San Luis Valley: Coller SWA, Higel SWA, Rio Grande SWA, Sego Springs SWA, Alamosa National Wildlife Refuge, McIntire/Simpson, and BLM and state lands along the lower Rio Grande to the Colorado/New Mexico stateline.

Management Recommendations:

Management for the river otter should include a variety of habitat types adjacent to one another. Because of their sensitivity to pollution, efforts to provide clean water and remove pollutants from reaching the area is a high priority. Specifically, actions to improve and maintain suitable otter habitat include:

- Dependable open water or access to water under the ice in the winter
- Stable water conditions through the summer
- Healthy fish populations such as suckers and trout; crayfish
- Good water quality
- Multiple stand structures juxtaposed to rivers and wetlands including willows, other shrubs, and herbaceous layers
- Monitor habitat and populations

Monitoring Recommendations:

Sign surveys have been used in the past in Colorado which provide a qualitative assessment of presence and overall distribution of populations. However, attempting to use this method to determine abundance is not always accurate. As well, during the winter, otters may remain in old beaver lodges for long periods of time without surfacing and leaving any sign. Watershed scale monitoring appears to be the most meaningful with different monitoring methods used dependent upon the season, eg track surveys in the winter and occupancy surveys done in early spring along the river corridors and adjacent wetlands.

References:

Ben-David, M. 2013. Population Survey for River Otters in the Rocky Mountain National Park: A progress report for 2012 National Park Service, Rocky Mountain National Park. River Otter Journal, Vol XXI, No II, Fall-Winter, Pp: 1-4.

Ben-David, M. J.K. Herreman, and J. Boyd. 2003. Population Survey for River Otters in the Rocky Mountain National Park: A Progress Report for 2003. University of Wyoming.

Berg, J.K. 1999. Final Report of the River Otter Research Project on the Upper Colorado River Basin in and adjacent to Rocky Mountain National Park, Colorado.

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Boyle, S. 2006. North American River Otter (Lontra Canadensis): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region, species Conservation Project.

Carpenter, S.K., N. Mateus-Pinilla, K. Monick, and M.L. Green. 2013. Evaluating the Relationship between River Otters and River Otter Latrines. River Otter Journal, Vol XXI, No II, Fall-Winter, Pp: 12-15.

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Halbrook, R.S., A. Woolf, G.F. Bubert, Jr., S. Ross, and W.E. Braselton. 1996. Contaminant concentrations in Illinois mink and otter. Ecotoxicology 5:103-114.

Loree' Harvey Personal Communication 2017

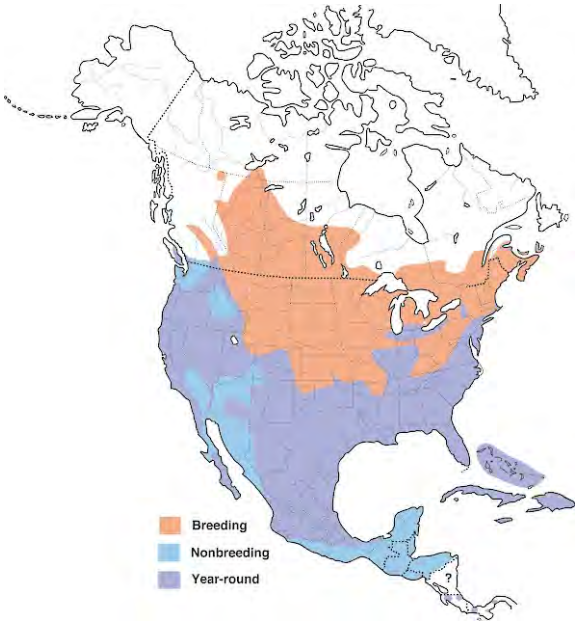
New Mexico Game and Fish. 2006. Feasibility Study: Potential for Restoration of River Otters in New Mexico. NM Dept of Game and Fish Conservation Services Division, Santa Fe, NM.

Pied-billed grebe (*Podilymbus podiceps*)

General Description: The pied-billed grebe is a small diving bird in the family Podicipedidae. It is widely distributed across North America and breeds and migrates through the San Luis Valley, primarily using freshwater semi-permanent and permanent wetlands with extensive stands of tall emergent and open water with submergent vegetation.

Physical characteristics: The sexes of pied-billed grebes have similar plumage throughout the year, but males are larger with heavier bills. Adults in breeding plumage have dark brownish upperparts and grayish buff sides of the neck and flanks. The underparts are whitish. They have a black throat patch with a whitish outline. The short, slightly hooked bill is bluish white with a distinct black vertical bar. The eye is dark brown in all ages. The legs and feet are slate gray. In nonbreeding plumage, the throat is pale, and the sides of the neck and flanks are reddish brown. The bill is flesh-colored and lacking black markings. The juvenile plumage is similar to non-breeding adults.

Range and Conservation Status: Pied-billed grebes breed throughout most of North America, including the Intermountain West. In many areas they remain on breeding sites throughout the year if suitable habitat remains available but in the San Luis Valley they are not present during the winter. Pied-billed grebes are considered common and fairly stable but are susceptible to wetland habitat loss at local and regional scales.



Communication: Pied-billed grebes are highly vocal with a variable repertoire. Common calls include a series of *kuk* notes, starting slowly and softly, increasing in speed and volume, repeated 4–12 times before changing to 4 to >20 *kaow* notes, or a high-pitched *kuk* alternated with a lower-pitched *kow* note. This is sometimes followed by long drawn-out *kaooo* notes separated by 1–5 "gulping" *gow* notes, described as a donkey's braying, repeated ≤15 times. Both sexes vocalize. They call throughout the year, but more frequently during breeding. Courtship displays are not as elaborate as in other grebes.

Life history characteristics:

- Diet and foraging behavior: Pied-billed grebes are carnivorous, feeding on a wide variety of fish, crustaceans, and aquatic insects. They feed primarily by diving, but occasionally capture food items at or near the water surface.
- Breeding system: Pied-billed grebes appear to be seasonally monogamous. Pair formation may occur during migration or after arrival on breeding areas; some pairs may stay together for extended periods. These grebes are highly territorial during the breeding period.
- Nesting: April to July. Pied-billed grebes may have one nest per year, but pairs will re-nest if the first nest is lost, and occasionally produce a second clutch after hatching of the first brood. Clutch size is variable, ranging from 2-11. Pied-billed grebes build nest platforms over water usually >1 m deep; nest is constructed of emergent and decaying vegetation, and usually anchored to tall emergent stems. Incubation is usually 23-27 days. Both sexes incubate the eggs.
- Brood period: May through August. Young are semi-precocial, and are fed and brooded (carried on the backs) of both adults for the first week after hatching. Subsequently, chicks begin capturing prey themselves, and stay with parents for variable lengths of time. Young pied-billed grebes are capable of flight 35-37 days after hatch.
- Post-breeding: Pairs may maintain territories after breeding. Small groups of grebes may loosely associate during the post-breeding period. Little is known about pre-migration movements.

Pied-billed grebe SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water			Migration						Migration			
			Pre-Breeding									
				Nesting								
					Brood Rearing							
						Post-breeding						
Short Emergent			Migration						Migration			
			Pre-Breeding									
				Nesting								
					Brood Rearing							
						Post-breeding						
Tall emergent			Migration						Migration			
			Pre-Breeding									
				Nesting								
					Brood Rearing							
						Post-breeding						

Habitat Requirements:

In the San Luis Valley, pied-billed grebes use open water, tall emergent, and short emergent habitats in seasonal, semi-permanent, and permanent wetlands.

Key public areas for pied-billed grebes in the San Luis Valley: Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Rio Grande State Wildlife Area, Russell Lakes State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Productive freshwater wetlands with good interspersion of open water and emergent habitat, and healthy stands of submergent aquatic vegetation are beneficial for pied-billed grebes. Excessive drying or flooding of wetlands during the breeding period can be detrimental.

Monitoring Recommendations:

Though somewhat secretive, presence of pied-billed grebes on wetlands can usually be detected. Call playback methods are an effective monitoring method for this species. Monitoring of habitat quantity and quality, including hydrologic dynamics of semi-permanent wetlands in the San Luis Valley, in relation to occupancy by pied-billed grebes would be informative.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Blackwood Miller, J., and K. M. Potter. 2016 Pied-billed grebe (*Podilymbus podiceps*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 136-137. Colorado Bird Atlas Partnership.

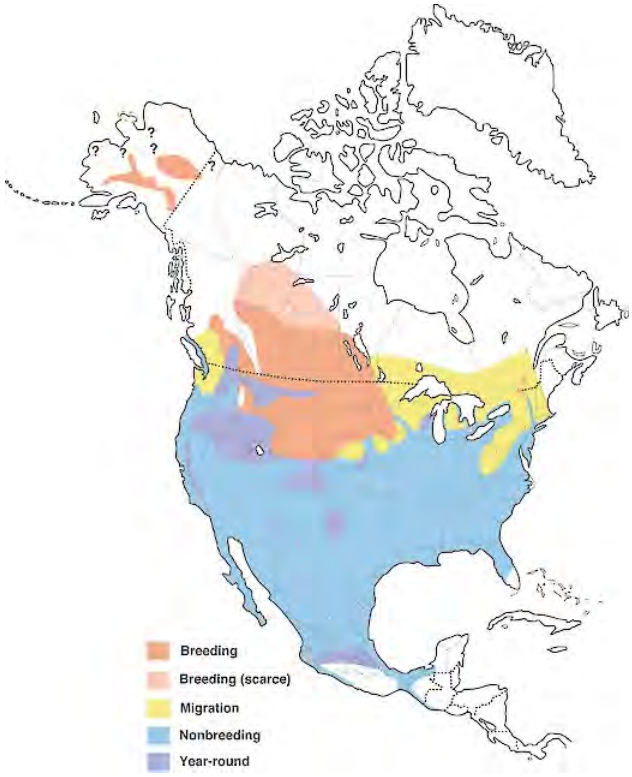
Muller, M. J., and R. W. Storer. 1999. Pied-billed Grebe (*Podilymbus podiceps*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/pibgre DOI: 10.2173/bna.410

Redhead (*Aythya americana*)

General Description: The redhead is a medium-sized diving duck in the family Anatidae.

Physical characteristics: Adult redheads are sexually dimorphic. The adult male in breeding plumage has a rufous head and neck, black breast, gray body, black hindquarters, yellowish eye, and blue-gray bill with black tip and white sub-terminal band. Females in all plumages are entirely plain brown with a whitish belly, gray wings, whitish chin and eye-ring, a dark eye, and bill similar to male. The male has a short post-breeding plumage that resembles the female, but with a dull reddish head and yellowish eye. The legs and feet of both sexes are gray.

Range and Conservation Status: Redheads breed throughout most of the western United States and Canada, including throughout the Intermountain West. They winter mainly along the Gulf Coast. The continental breeding population is increasing and well above the objective set in the North American Waterfowl Management Plan. Breeding populations of redheads appear stable throughout Colorado including in the San Luis Valley, but local populations can fluctuate greatly based on habitat conditions. The redhead is a priority species for the North American Wetlands Conservation Act.



Communication: Males make a wheezy *whee-ough* call, particularly during spring courtship. Females emit a soft, repeated *err* sound during courtship, and also makes a deeper, guttural *kurr-kurr-kurr* most often during breeding season, especially when making threat displays or while hunting for a suitable nest site. May produce loud *squak* when taking flight. Redheads have ritualized courtship and aggression displays.

Life history characteristics:

- Diet and foraging behavior: The redhead diet is dominated by vegetative parts and tubers of submerged aquatic plants, but also includes seeds, and especially during breeding, aquatic invertebrates. They feed in productive open water and short emergent habitats, as well as playas. Redheads often forage in relatively shallow water depths (<20 cm). They use a variety of feeding methods, including diving, tipping up, dabbling, and surface pecking.
- Breeding system: Seasonally monogamous. Pair formation begins on wintering areas and continues through spring migration and after arrival on breeding areas.
- Nesting: May through July. Redheads have one nest per year, but pairs will re-nest if the first nest is lost. Clutch size is 7-8 eggs, but most nests have more eggs because females commonly parasitize nests of other redheads and other duck species. The female constructs a nest over water, usually in deeper (>1 m) portions of semi-permanent and permanent water with interspersion of open water and tall emergent vegetation. Incubation is usually 22-28 days. Only females incubate the eggs.
- Brood period: June through early September. Young leave the nest within 1-2 of hatching, and stay close to the female for brooding, and to find food and cover. Females regularly leave broods before the ducklings have fledged. Young redheads can fly about 8-10 weeks after hatch.
- Post-breeding: After breeding, males, unsuccessful females, and later, successful females congregate on molting wetlands, often moving away from breeding sites. This species is gregarious and travels in large groups during the post-breeding and fall migration periods. Fledged young can move extensively before fall migration.

Redhead SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water			Migration						Migration			
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Playa			Migration						Migration			
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Short Emergent			Migration						Migration			
				Pre-Breeding								
						Nesting						
						Brood Rearing						
								Post-Breeding				
Tall Emergent			Migration						Migration			
				Pre-Breeding								
						Nesting						
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, redheads use a variety of wetlands, including alkali playas, emergent vegetation and open water in seasonal and semi-permanent wetlands and permanent water bodies.

Key public areas for redheads in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, Rio Grande SWA, and Blanca Wetlands.

Management Recommendations:

Complexes of different freshwater and alkaline wetland types in close proximity benefit redheads by providing a variety of habitat structure, water depths, and food types necessary to meet annual cycle needs. Large semi-permanent wetlands with good interspersion of tall emergent vegetation and open water with productive stands of submergent vegetation are beneficial for breeding redheads. Large fluctuations in water levels (drying or flooding) during nesting can jeopardize nest success.

- Water availability is limited in February and March prior to the surface and groundwater irrigation rules and regulations presumptive start date of April 1, therefore public lands with groundwater wildlife adjudications are extremely important.
- Promoting winter sheet ice in late fall, where available, may help provide some early spring habitat.

Monitoring Recommendations:

Redheads are readily distinguished from other duck species during standardized waterfowl counts. Monitoring of semi-permanent wetland habitat conditions (hydrology, vegetation composition and cover) would be informative.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Floyd, T. 2016. Redhead (*Aythya americana*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 92-93. Colorado Bird Atlas Partnership.

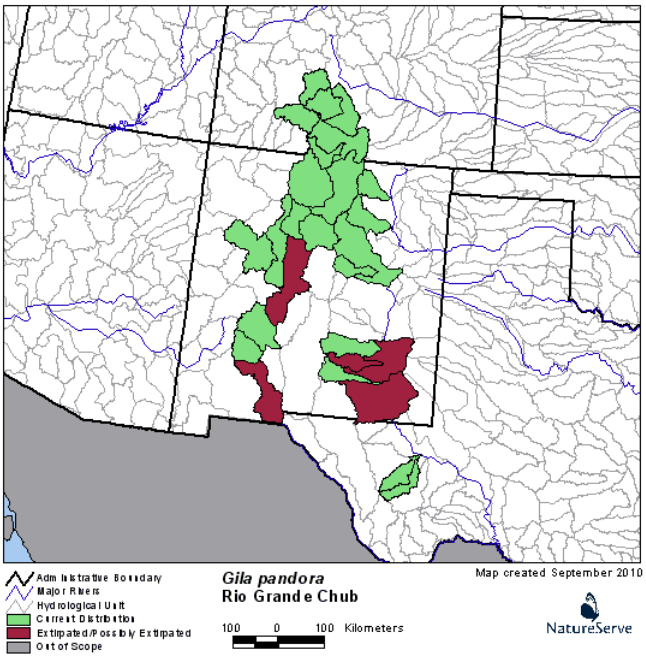
Woodin, M. C., and T. C. Michot. 2002. Redhead (*Aythya americana*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/redhea DOI: 10.2173/bna.695

Rio Grande Chub (*Gila pandora*)

General Description: The Rio Grande Chub (RGCH) is in the Cyprinidae (minnow) family and is commonly found in headwaters of flowing rivers and creeks and associated with undercut banks and aquatic vegetation.

Physical Characteristics: The Rio Grande chub (*Gila pandora*) are light brown fish with a lateral line, 8 rays on the dorsal and anal fins, a rounded and blunt snout, 2 dusky stripes along the sides, and a slightly subterminal mouth that extends to the front of the large eye. The adult chub average about 11 cm in length with females typically larger than males. During spawning season, the caudal peduncle, anal fins, and caudal fins of adult male have more pronounced tubercles than females.

Range and Conservation Status: The RGCH occurs in the Upper Rio Grande and Pecos River systems in Colorado and New Mexico and an isolated population in the Davis Mountains of Texas. A population in the Canadian River basin of New Mexico was recently considered introduced. They have been introduced to Dome Lake in the Gunnison National Forest. They occur at elevations ranging to 10,500 feet. Populations have been in decline due to changes in river flows due to water diversions, irrigation, and other projects that impact connectivity of habitats, water quality, and habitat degradation. Invasive and non-native species such as trout have also impacted populations through competition and predation.



Range and Conservation Status – Colorado and the San Luis Valley: Recent monitoring efforts by the Colorado Parks and Wildlife have shown that some populations still exist in the mainstem of the Rio Grande in the San Luis Valley but may be more prevalent in tributaries. Isolated populations are more susceptible to catastrophic events that could extinguish the entire population. The Rio Grande Chub is a Colorado state species of special concern, a Region 2 US Forest Service sensitive species, has a Natural Heritage Program global rank of G3 (vulnerable), and a state rank of S1 (critically imperiled) in Colorado.

Colorado Reintroduction locations:
Rio San Antonio, San Luis Creek, and Rock Creek (CPW 2016)

Life History characteristics:

The RGCH evolved along with the Rio Grande cutthroat trout (RGCT) and the Rio Grande sucker (RGSU) that provided a balance within the ecosystem promoting survival of all three species within the community. Each species fit a specific niche with the RGCT being a top predator of fish and insects, the RGCH diet consisting of insects and plants, and the RGSU being a benthic feeder eating algae and insects.

- Diet: The RGCH is an omnivore that feeds within the middle water column on zooplankton, aquatic insects, small fish, vegetation, and some detritus.
- Spawning: Occurs in spring and early summer although if conditions are suitable it may extend into the fall. Spawning occurs in riffle habitat of streams with no care after egg laying from the parents.
- Young: Juveniles may require beds of aquatic macrophytes and cover from over-hanging vegetation or undercut banks.

Rio Grande Chub SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open Water	Year Round Foraging											
					Spawning/Recruitment							

Habitat Requirements:

Typical habitats for Rio Grande chub in the Upper Rio Grande headwaters, tributaries, and other streams and creeks in the San Luis Valley of Colorado include flowing water in rivers and creeks with access to undercut banks, aquatic vegetation, and floating debris.

Requirements:

- Cool, flowing water usually in headwaters of rivers and creeks.
- Undercut banks, over-hanging vegetation on the banks.
- Sand is most common substrate.

Key public areas for trout in the San Luis Valley: Rio Grande and Conjeos Rivers and tributaries, creeks in the San Juan and Sangre de Cristo mountain ranges.

Management Recommendations:
Similar to the Rio Grande Cutthroat Trout, a rang-wide conservation team has been established for the RGCH (and Rio Grande Sucker). A conservation agreement is being drafted by state, federal, tribal, and other stakeholders which will expedite and coordinate the implementation of conservation measures and provide a framework for the long-term conservation of the species.

Conservation in the Upper Rio Grande of Colorado is probably best accomplished through the creation and protection of habitats that promote natural river dynamics, decrease anthropogenic disturbances such as increased sedimentation, and the removal of non-native fish species. Specific recommendations include:

- Riparian fencing that prevents cattle from eroding river banks and decreasing water quality by increasing sedimentation.
- Maintaining instream flows during the irrigation season.
- Removal of non-native fish species
- Increase public awareness for conservation of the species

Monitoring Recommendations:

Monitoring strategies should be centered around providing information pertaining to life history data such as specific habitat requirements for the species during different times of the year. Techniques that incorporate capturing the fish and documenting distribution in relation to habitat types would be useful. Recurring surveys to determine distribution and abundance to determine movement of the species is needed. Population trends and recruitment estimates in areas managed on all streams is also needed.

References:

Colorado Parks and Wildlife. 2016. 2016 Aquatic Conservation Inventory Report – Southwest Region. Gunnison, CO. 78 pp.

Rees, D.E., R.J. Carr, and W.J. Miller. 2005. Rio Grande Chub (Gila pandora): A Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

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Rio Grande Cutthroat trout (*Oncorhynchus clarkii virginalis*)

General Description: The Rio Grande Cutthroat Trout (RGCT) is a subspecies of the cutthroat trout and in the Salmonidae (salmon) family found in high elevation streams and lakes of the Rio Grande.

Physical Characteristics: Rio Grande Cutthroat Trout (*Oncorhynchus clarki virginalis*) have a characteristic red to orange slash in the throat folds beneath their jaw and irregular shaped spots concentrated behind the dorsal fin along with small less numerous spots above the lateral line anterior to the dorsal fin and minute or absent basibranchial teeth.

Range and Conservation Status: The RGCT occurs in the Rio Grande, Canadian, and Pecos systems in Colorado and New Mexico. There are about 13 genetically pure and protected populations of more than 2,500 individuals and over 200 other populations that are threatened in some way, for example, due to non-native species competition and hybridization. Trout populations have been in decline due to whirling disease, fire, along with changes in river flows due to water diversions, irrigation, and other projects that impact connectivity of habitats, water quality, and habitat degradation resulting from livestock use of riparian areas that denude banks and increase sedimentation. Currently only 11% of historic range contains populations of this trout. Invasive and non-native species of trout have also impacted populations through competition, predation, and hybridization. The Rio Grande Cutthroat Trout is a Colorado a Tier 1 state species of special concern, a Region 2 US Forest Service Species of Conservation Concern, and has a Natural Heritage Program global rank of G4T3 (Species is Vulnerable). The RGCT was considered 'warranted' for Federal listing in 2008 but was removed from consideration in 2014. Distribution and status of Rio Grande cutthroat trout conservation populations and secure conservation populations are shown below (a subset of the conservation populations: based on 2012 database from the 2013 CPW Conservation Strategy).

GMU	# of Conservation Populations	# of Secure Conservation Populations
Canadian	11	4
Caballo	0	0
Lower Rio Grande	62	24
Pecos	12	7
Rio Grande Headwaters	42	18
Range-wide Total	**127**	**53**

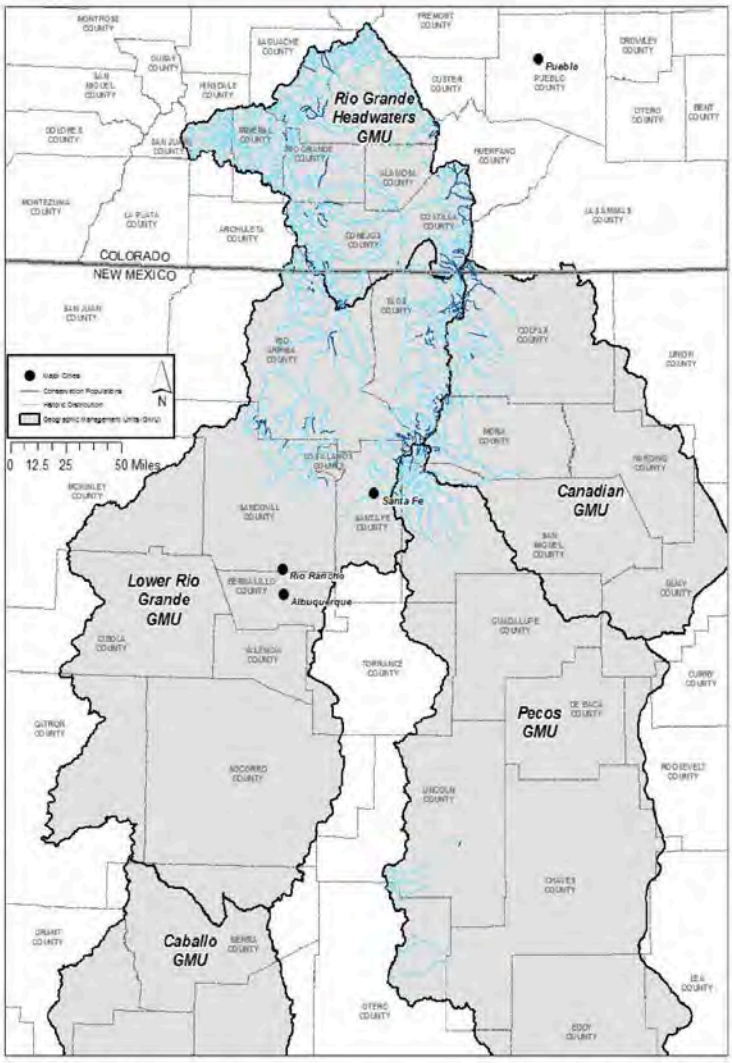

Figure 1. Presumed historical and current ranges of conservation populations of Rio Grande cutthroat trout. Map courtesy of New Mexico Department of Game and Fish and US Fish and Wildlife Service.

Life History characteristics:

The RGCT evolved along with the Rio Grande sucker (RGSU) and the Rio Grande chub (RGCH) that provided a balance within the ecosystem promoting survival of all three species within the community. Each species filled a specific niche with the RGCT being a top predator of fish and insects, the RGCH diet consisting of insects and plants, and the RGSU being a benthic feeder eating algae and insects.

- Diet: The RGCT is an opportunistic feeder that eats aquatic invertebrates and terrestrial insects that may fall in the water with small fish becoming more important as they grow/age.
- Spawning: Occurs in spring as highwater flows decline, Mid-May through Mid-June dependent upon temperature, day length, and runoff. RGCT have the ability to hybridize with Rainbow Trout and all other cutthroat trout subspecies. Egg production dependent on female size and may vary from 100 to 400 eggs in beds of sorted oxygenated gravel.
- Young: Juveniles require mean daily temperatures of 46°F in July in order to survive and reach sexual maturity. Development and growth is temperature dependent in time to gain weight by winter.
- Adults: Males are sexually mature at 2 years and females at 3 years of age.

Rio Grande Cutthroat trout SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open Water	Year Round Foraging											
					Spawning/Recruitment							

Habitat Requirements:

Typical habitats for Rio Grande Cutthroat Trout in the Rio Grande, tributaries, and other streams and creeks in the San Luis Valley of Colorado include headwaters of rivers and creeks with access to nursery, spawning, and refugium habitats. These habitat areas, in relation to current conditions, typically are restricted to 5 miles or less of a particular stream reach.

Requirements:

- Clear, cold streams (sometimes in lakes) with pools associated with cover and riffles for foraging.
- Spawning habitat consisting of clean gravel (little or no fine sediment).
- Nursery habitat characterized by low water velocity, cover, and slightly warmer temperatures.
- Refugium habitat of deep pools that don't freeze in the winter and are persistent through periods of drought.

Key public areas for trout in the San Luis Valley: Rio Grande and high elevation tributaries above 9,000 feet from the Colorado state line in the south, north to Saguache along the Continental Divide, and west to the Sangre de Cristo Mountains.

Reintroduction:
Many reintroduction efforts have been attempted for RGCT in Colorado, including several that have contributed to the current number of current conservation populations. The most recent attempt being the Roaring Fork, a tributary of Goose Creek in the headwaters of the Rio Grande and Weminuche Wilderness. The removal of non-native brook trout occurred in 2015 and 2016, with the planned reintroduction of RGCT in 2017 or 2018, pending final surveys to document to complete removal of brook trout. Future RGCT reintroduction efforts are being planned for Sand Creek within the Great Sand Dunes National Park and Preserve.

Management Recommendations:

Continuation of the implementation of the Conservation Agreement for Rio Grande Cutthroat Trout (RGCT 2013) is an important measure for the long-term conservation of the species. Many conservation activities for the species occurred in both Colorado and New Mexico prior to the initial Conservation Agreement in 2003 but the coordinated effort has led to collaboration between federal, state, and local stakeholders conserving the species.

Conservation in the Rio Grande of Colorado is probably best accomplished through the creation and protection of habitats that promote natural river dynamics, decrease anthropogenic disturbances such as increased sedimentation, and the removal of non-native fish species or the creation of barriers that prevent those species from interacting with RGCT populations. Specific recommendations include:

- Riparian fencing that prevents cattle from eroding river banks and decreasing water quality by increasing sedimentation.
- Maintaining instream flows during the irrigation season.
- Removal of non-native fish species such as rainbow, brook, and brown trout
- Creation of fish barriers to separate populations
- Utilize natural features such as waterfalls with suitable habitat conditions upstream for reintroductions.
- River restoration projects that reduce sediment loads and increase diversity of habitats such as pools and riffles.

Monitoring Recommendations:

Monitoring strategies should be centered around determining the effects of restoration and management strategies and changes in temperature within different stream reaches in relation to climate change and overall effect on the population.

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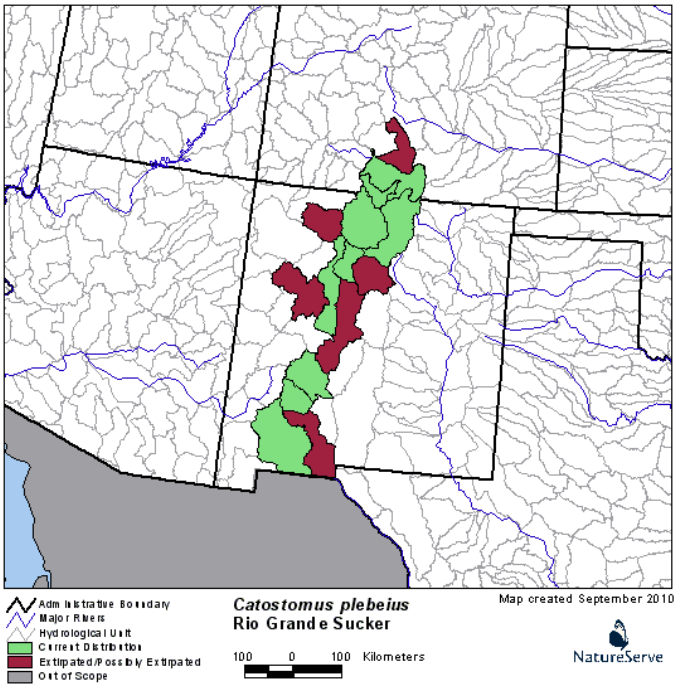
Rio Grande Sucker (*Catostomus plebeius*)

General Description: The Rio Grande sucker (RGSU) is in the Catostomidae (sucker) family commonly found living in headwaters of flowing rivers and creeks and associated with undercut banks and aquatic vegetation.

Physical Characteristics: Rio Grande suckers (*Catostomus plebeius*) are light brown fish with a lateral line, 8 rays on the dorsal and anal fins, a rounded and blunt snout, 2 dusky stripes along the sides, and a slightly subterminal mouth that extends to the front of the large eye. The adult suckers average about 16 cm in length with females typically larger than males. The caudal peduncle, anal fins, and caudal fins of adult male have more pronounced tubercles than females during spawning season.

Range and Conservation Status: The RGSU is an endemic species to the Rio Grande Basin, historically occurring in the Upper and Middle Rio Grande systems in Colorado and New Mexico to Mexico. The fish have been introduced in a few other locations, for example the Platte River in Colorado. They occur rarely above elevations of 9,000 feet. Populations have been in decline due to changes in river flows due to water diversions, irrigation, and other projects that impact connectivity of habitats, water quality, and habitat degradation. Invasive and non-native species such as brown trout and the white sucker (*Catostomus commersonii*) have also impacted populations through competition and predation. Declines in RGSU populations have coincided with increases in the populations of the white sucker since the 1930s in the Upper Rio Grande basin of Colorado. These two species overlap in habitat use and in prey base, specifically invertebrates.



Range and Conservation Status - Rangewide – Colorado and the San Luis Valley: By 1994 only one known population existed in

Colorado's Rio Grande Basin, in Hot Creek in the San Juan Mountains. Additional populations are now known from San Luis Creek and Rock Creek. In 2005, an additional historic population was discovered in Crestone Creek on the Baca National Wildlife Refuge. Re-introduction efforts have occurred throughout the Rio Grande Basin by Colorado Parks and Wildlife. Recent monitoring efforts by the Colorado Parks and Wildlife have shown that transplanted populations have subsisted in the mainstem of the Rio Grande in the San Luis Valley but may be more prevalent in tributaries. The Rio Grande Sucker is a Colorado state endangered species and was petitioned for federal listing in 2014.

Current Colorado Locations:

Middle Fork Carnero Creek

Rio Grande Sucker have been stocked in to Middle Fork Carnero Creek on the Rio Grande National Forest since 1998. Along with a population of Rio Grande Cutthroat Trout, RGSU persist in this system, although RGSU per mile and size have declined since 2000. Limiting factors including non-natives (white sucker), sedimentation, and grazing impacts are thought to limit success. The only fish captured during the most recent sampling were most likely from the 2016 sampling event (CPW 2016).

Lake Fork Conejos River

The Lake Fork of the Conejos River has been an important water for Rio Grande Sucker and Rio Grande Cutthroat Trout management for a number of years. In addition to Rio Grande Cutthroat being restored there, RGSU have been stocked in 2005, 2007, 2015, 2016 and 2017. Both a constructed barrier (above Rock Lake) and a natural barrier (Rock Lake) protect these populations from non-native intrusion. Rio Grande Sucker were accidentally stocked below the barriers in 2015, with recent surveys indicating their persistence both above and below the barriers. The presence of young-of-year RGSU has been documented, albeit slow, indicating that reproduction is taking place.

San Luis Creek

7,000 Rio Grande Sucker were stocked in San Luis Creek in 2016. Recent monitoring indicated multiple age classes of RGS, and as they had not been documented in the creek before, they likely originated from Rock Creek and have persisted since 2000 after the droughts of 2002 and 2012. Non-native trout (Brown Trout) continue to utilize this reach of San Luis Creek.

Rock Creek

In 2000, 128 adult RGS were stocked into Rock Creek and in July 2016 an additional 4,000 age-1 individuals were released. Recent surveys indicated continued presence of RGS, with several age classes. The continued presence of RGS in Rock Creek indicates that the water can support RGS.

The following streams have also had reintroductions of Rio Grande suckers (check with CPW on status): Cascade Creek, Osier Creek, North Fork Carnero Creek, Medano Creek, San Francisco Creek, Big Springs Creek

Life History Characteristics:

The RGSU evolved along with the Rio Grande cutthroat trout (RGCT) and the Rio Grande chub (RGCH) which together provided a balance within the ecosystem promoting survival of all three species within the community. Each species filled a specific niche with the RGCT being a top predator of fish and insects, the RGCH diet consisting of insects and plants, and the RGSU being a benthic feeder eating algae and insects.

- Diet: The RGSU is benthic lithophil feeder that eats periphyton algae and insects, primarily invertebrates.
- Spawning: Occurs in spring and is initiated by declines in peak stream flows and/or when water temperatures are between 7 to 10° C. May have a second spawning event in fall. Spawns over medium sized gravel.
- Young: Juveniles may require beds of aquatic macrophytes and cover from over-hanging vegetation or undercut banks.

Rio Grande Sucker SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open Water	Year Round Foraging											
					Spawning/Recruitment							

Habitat Requirements:

Typical habitats for Rio Grande sucker in the Upper Rio Grande headwaters, tributaries, and other streams and creeks in the San Luis Valley of Colorado include flowing water in rivers and creeks with gravel/cobble/rubble substrates. The RGSU may also occur in habitats adjacent to these including backwater sloughs and beaver ponds.

Requirements:

- Cool, flowing water usually in mid-elevation rivers and creeks.
- Undercut banks, over-hanging vegetation on the banks.
- Gravel is most common substrate rangewide, although large amounts of sand substrate is found at both historic populations at Hot Creek State Wildlife Area and Crestone Creek on the Baca National Wildlife Refuge.
- Low gradient (<3.2 percent) stream reaches appear to be preferred

Key public areas for RGSU in the San Luis Valley: Rio Grande and tributaries below 9,000 feet throughout the San Luis Valley, Colorado. Two native, historic populations occur at Hot Creek State Wildlife Area and in Crestone Creek on the Baca National Wildlife Refuge. Re-introduced populations occur in many areas on the Rio Grande National Forest.

Management Recommendations:

Similar to the Rio Grande Cutthroat Trout, a rang-wide conservation team has been established for the RGSU (and Rio Grande Chub). A conservation agreement is being drafted by state, federal, tribal, and other stakeholders which will expedite and coordinate the implementation of conservation measures and provide a framework for the long-term conservation of the species.

Conservation in the Upper Rio Grande of Colorado is probably best accomplished through the creation and protection of habitats that promote natural river dynamics, decrease anthropogenic disturbances such as increased sedimentation, and the removal of non-native fish species. Specific recommendations include:

- Riparian fencing that prevents cattle from eroding river banks and decreasing water quality by increasing sedimentation.
- Maintaining instream flows during the irrigation season.
- Removal of non-native fish species
- Allow high water scouring events to create or maintain the gravel/cobble substrates.
- Increase public awareness for the conservation of the species

Monitoring Recommendations:

Monitoring strategies should be centered around providing information pertaining to life history data such as specific habitat requirements for the species during different times of the year. Monitoring populations that have been reintroduced into isolated locations can provide an opportunity to fill data gaps regarding the ecology of this species. Monitoring the size and health of these populations may also provide insight into cause-effect relationships with the primary threats to this species. This additional information will be helpful for the future development of specific conservation strategies. On-going efforts using pit tags to determine movement of the species in Crestone Creek will expand knowledge in that drainage; additional studies in other locations would also be useful. Population trends and recruitment estimates in areas managed on all streams is also needed.

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Greater sandhill crane (*Antigone canadensis tabida*)

General Description: The greater sandhill crane is a large, long-legged and long-necked bird in the family Gruidae. Virtually the entire population of Rocky Mountain greater sandhill cranes migrate through and stage in the San Luis Valley during the spring and fall.

Physical characteristics: Plumage is grey or rust-colored. A red forehead is present in all but first-year birds. Sexes are similar, but males are slightly larger.

Range and Conservation Status: Sandhill cranes are widely distributed throughout North America. The Rocky Mountain Population of greater sandhill cranes is comprised of about 20,000 cranes that breed in Idaho, Montana, Wyoming, Utah, and northern Colorado, and winter in New Mexico, Arizona, and Mexico. Most of these cranes move through Colorado during spring and fall migration, and spend 1-2 months in the San Luis Valley during each migration, September-November and February-April. Several thousand cranes (primarily lesser sandhill cranes *A. c. canadensis*) from the Mid-Continent Population of sandhill cranes also migrate through the San Luis Valley. Rocky Mountain Population sandhill cranes are hunted throughout their range except in Colorado. The population is stable and is carefully monitored. Loss of wetland and associated upland habitat throughout the range is a conservation concern as are new regulations related to irrigation practices in the SLV that restrict water use before April 1 annually. The species is also listed as a Tier I priority species for the state of Colorado and is a Colorado State Species of Concern.

Communication: Sandhill cranes are well-known for their loud, rattling calls. There are a variety of variations of this characteristic call, which are used to communicate between mated pairs, family groups, or flocks. Sandhill cranes are most vocal around

sunrise and sunset, and as they arrive and depart feeding and roosting areas. During migration, cranes often fly at very high elevations, and their calls can often be heard before the cranes are seen. Sandhill cranes have elaborate courtship "dance" displays and a variety of displays used to signal alert or aggression.

Life history characteristics:

- Diet and foraging behavior: Sandhill cranes are omnivorous and eat a wide variety of plant materials, invertebrates, and small vertebrates. They feed at the surface or by probing into the ground of uplands and shallow wetlands. In the San Luis Valley cranes forage extensively in agricultural fields near roost areas, where they consume small grains and potatoes, usually during morning and evening feeding periods.
- Breeding system: Pairs are socially monogamous, usually with life-long pair bonds. Most cranes do not pair and nest until they are 5-7 years old.
- Spring migration: Sandhill cranes move through the San Luis Valley February through April, with greatest numbers in March. Acquisition of lipid reserves in the San Luis Valley prior to arrival on breeding areas is considered important to subsequent breeding success.
- Fall migration: Sandhill cranes move through the San Luis Valley from late August through early November. Flocks consist of family groups as well as non-breeding cranes; family groups tend to stay on the edges of flocks.

Sandhill crane SLV habitat, timing, and life cycle event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop		Migration							Migration			
Grassland		Migration							Migration			
Open water		Migration							Migration			
Riparian		Migration							Migration			
Short emergent		Migration							Migration			
Wet meadow		Migration							Migration			

Habitat Requirements:

Because sandhill cranes use the San Luis Valley during migration, their habitat requirements are relatively simple. Cranes require undisturbed roost sites and loafing areas; these are usually characterized by open, shallow water with no vegetation or short vegetation. Cranes also require foraging habitats where they can easily obtain energy and other nutritional requirements. They feed in wetlands on or near roost and loafing sites, and also move to croplands where they can feed on high-carbohydrate foods.

Key public areas for cranes in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Baca National Wildlife Refuge, Blanca Wetlands, Russell Lakes State Wildlife Area, Rio Grande State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Productive, undisturbed wetland roost and loafing areas must be available throughout the San Luis Valley to provide cranes with access to nearby crop fields. Farming practices that allow waste grain to be available for foraging cranes, especially in spring, should be encouraged. Given changes in water administration and agricultural crop practices the following needs should be considered:

- Water availability is limited in February and March prior to the surface and groundwater irrigation rules and regulations presumptive start date of April 1, therefore public lands with groundwater wildlife adjudications are extremely important.
- Due to changes in water management, barley and other grains may not be as prevalent, in addition, fall disking of fields that leave bare dirt rather than stubble and waste grain may affect available foraging areas; discussion with local farmers in close proximity to public areas managed to provide crane roosting should be encouraged.
- Promoting winter sheet ice in late fall, where available, may help provide some early spring habitat.

Monitoring Recommendations:

Sandhill cranes are easily observed. Separating greater sandhill cranes from the lesser subspecies within flocks, and identifying family groups and juveniles during the fall, can be accomplished where flocks can be closely observed. The annual recruitment survey for Rocky Mountain Population sandhill cranes is conducted in the San Luis Valley. Monitoring of the distribution and seasonal availability of suitable wetland habitat, and changes in crop distribution and tillage practices, would be informative.

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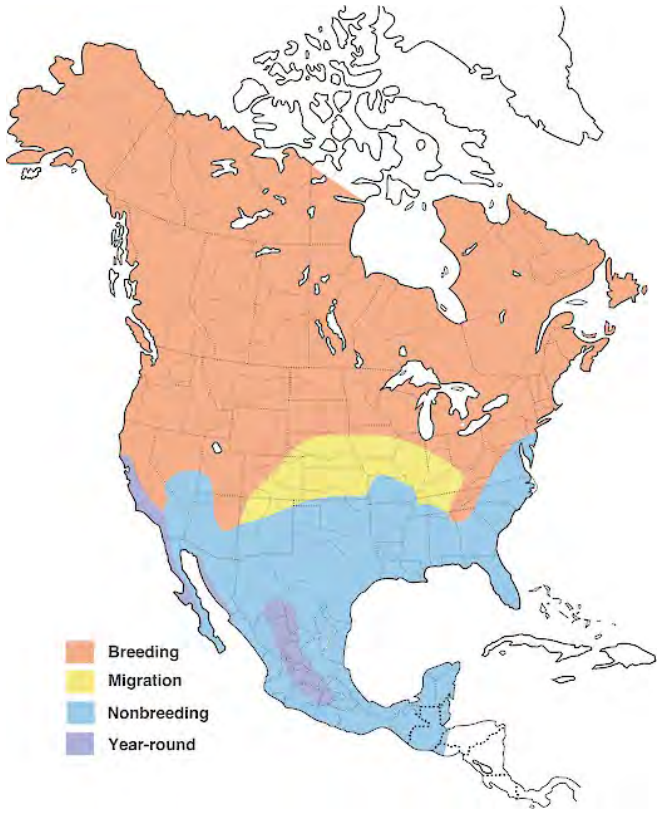
Savannah Sparrow (*Passerculus sandwichensis*)

General Description: The Savannah sparrow is a member of the Emberizidae family. It is a small, secretive sparrow that favors open wet areas.

Physical characteristics:
The Savannah sparrow is a small, crisply streaked sparrow, sexes are similar and there is high variability geographically across the species range. The breast is finely streaked, with a small bill, a short notched tail, and a white belly. The most distinguishing feature is a yellow wash on the lores and pale median crown-stripe. Juvenile plumage is similar but with heavier breast streaking, crown stripe and yellow lore area are less diffuse.

Range and Conservation Status:
This is a very wide ranging species across North and Central America. All populations migrate except the coastal California population and resident Mexico populations. In Colorado this species is found during the breeding season in mountainous areas of the state in association with wet riparian areas, irrigated hay fields, and short emergent wetlands.



Breeding Bird Survey data indicate significant declining trends for this species in the US and Canada but in Colorado and across the West, populations appear to be more stable.

Communication: The song of the Savannah Sparrow is very distinctive and very helpful in identifying this small secretive species. The song is short, usually with 3 high pitched introductory notes, followed by buzzy insect like trill slurs. Call notes are a dry, high pitched *chip*.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Mostly adult and larval insects, spiders, seeds and fruits but occasionally insect eggs and small mollusks.
- Breeding system: Monogamous and polygamous. Pairs that have bred together before readily breed together in subsequent seasons but do not migrate together.
- Nesting: Beginning in mid-May to late July, the female alone constructs a cup like nest on the ground in 2-3 days, can be double brooded but not confirmed in Colorado. Clutch size 2-6 eggs, incubation 9-15 days usually by female only.
- Brood period: Female does most of the brood rearing, both parents feed young, females capable of raising young unaided by male. Fledging in 8-12 days, young capable of flight in 13-15 days.
- Post-breeding: Immatures congregate into loose flocks, initially 3-8 individuals eventually increasing to more than 100. Flocks wander 0.5 to 1km and delay migration until 2-3 months post fledging.

Savannah Sparrow SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian				Migration					Migration			
				Pre-Breeding								
				Nesting								
						Brood Rearing						
								Post-Breeding				
Short Emergent				Migration					Migration			
				Pre-Breeding								
				Nesting								
						Brood Rearing						
								Post-Breeding				
Wet Meadow				Migration					Migration			
				Pre-Breeding								
				Nesting								
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, savannah sparrows use a variety of wetlands, including temporarily flooded saltgrass, seasonally flooded pastures, irrigated hay fields, short emergent wetlands, and wet streamside meadows. In all these wetland types, savannah sparrows prefer low, dense vegetated areas for foraging, nesting, and resting.

Key public areas for savannah sparrow in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Baca National Wildlife Refuge, Blanca Wetlands, Russell Lakes State Wildlife Area, Higel State Wildlife Area, San Luis Lakes State Wildlife Area, and Rio Grande State Wildlife Area.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the protection and expansion of short emergent wetlands and riparian wet meadows.

Intensive grazing and frequency or timing of mowing/haying regimes will negatively impact nest success for this species. This species reliance on wet areas means that it is susceptible to habitat limitations due to drought.

Monitoring Recommendations:
Understanding impacts to this species under drought conditions is important with future climate changes. This species often nests with Wilson's phalarope in short emergent habitat so there is potential for combined monitoring for these species during the breeding season. Monitoring efforts during the breeding season may be important over time to track changes in abundance of this species in different climactic conditions.

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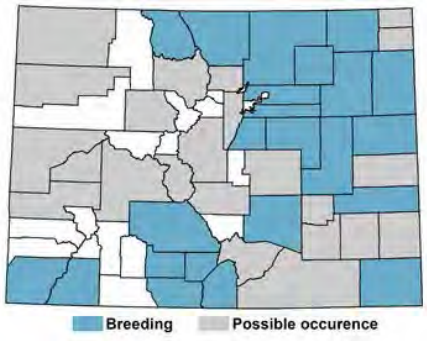
DOI: 10.2173/bna.45

Short-eared Owl (*Asio flammeus*)

General Description: The Short-eared owl is a raptor in the family Strigidae. This owl uses a variety of habitat types in the non-breeding season in the San Luis Valley including wetlands and grasslands.

Physical characteristics: The Short-eared owl is a medium sized owl with short ear tufts that are not always visible. The owls are usually between 13.3 to 16.5 in in length with a wing span of 10.5 to 12.3 in. The sexes are fairly similar although the females may sometimes have darker plumage and the males may be slightly larger than females. They are generally mottled brown and buff colored dorsally and whitish to rust colored ventrally with some streaking. The face is large with a round ruff. Their facial disk is gray/white with black orbits, yellow eyes and a black bill.

Range and Conservation Status: During breeding, migration, and wintering this species is widely distributed throughout the United States; they winter primarily in the southern half of the United States, Mexico, and Central America. This species is typically in the San Luis Valley during the wintering/non-breeding season. The Short-eared owl has declined in Colorado in the past few decades as a result of loss of large areas of wetlands juxtaposed to grasslands along with habitat fragmentation and subsequent declines in small mammal populations. This species is listed as a Tier 2 species in the 2016 Colorado State Wildlife Action Plan and on the watch list for Partners in Flight. The Colorado Breeding Bird Atlas indicates that there are declines regionally in this species population but globally the species is not of concern.



North America map used by permission from Cornell Lab of Ornithology's Birds of North America Online (http:/bna.birds.cornell.edu/bna). Colorado map based on Andrews and Righter (1992), Kingery (1998), COBBAII (2015), and CFO (2015).

Communication: Short-eared Owls have a wide range of sounds including a song of '*hoo-hoo's* during male displays and have an intraspecific '*keee-ow'* during the winter that may be directed at any type of intruder.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Short-eared owls feed primarily on small mammals and specifically voles but will prey on small birds. The owls hunt day and night by hovering or coursing. In the winter season they are mostly crepuscular hunters. The owl uses hearing, vision, and flight adaptations to forage.
- Wintering: Nomadic with little known as to its migratory patterns to wintering grounds. Tends to wander in search of suitable habitat and prey.
- Breeding system: Rarely in the SLV during this season but if present pair formation occurs before breeding in March and April. Seasonally monogamous. The owl may be a colonial nester if suitable habitat is available. May attempt a second brood within the same season.
- Nesting: Ground-nesting, usually in dry areas with cover less than 0.5 m in height, may re-nest over nest from previous year. Nest is scraped together and lined with grass and feathers. Lay anywhere from 8 - 17 eggs per nest. About 24 to 29 days incubating by the female. Asynchronous hatching over period of about 12 days. Males feed incubating female.
- Brood period: Broods are semi-altricial and nidicolous. Young begin asynchronously dispersing from the nest on foot (before flight capable) 14 to 17 days after hatching and may move up to 55 meters from the nest while dispersing. The male brings the food to the female to feed to the young.
- Post-breeding: After breeding, young owls my form communal family groups and roost together. Unknown if the adults participate in this group.

Short-eared owl SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grasslands	Wintering		Migration					Migration		Wintering		
Short emergent	Wintering		Migration					Migration		Wintering		
Shrublands	Wintering		Migration					Migration		Wintering		
Wet meadow	Wintering		Migration					Migration		Wintering		

Habitat Requirements:

In the San Luis Valley, Short-eared owls use a variety of wetlands, including alkali playas and marshes, grasslands, shrublands, and agricultural areas. Preferred habitats include wetland and grasslands in close association that support large populations of small mammals such as voles. Agricultural lands may be used with birds preferring ungrazed meadows and grasslands that support prey populations. The owls prefer densely vegetated areas of at least 100 ha.

Key public lands for owls in the San Luis Valley: Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Baca National Wildlife Refuge, and Russell Lakes State Wildlife Area.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the creation and protection of habitats that favor large expanses of grasslands and wetlands that have retained a large portion of their structure and cover over the winter, e.g. have not been grazed or cut in the fall and have standing vegetation through the winter.

- Large, contiguous complexes of wetlands and grasslands that have residual vegetation in the winter.
- Work with agricultural ranchers with large wet meadows and grasslands to leave some residual vegetation in the fall to provide habitat for this species.
- Rare occurrences of nesting could be supported by providing large contiguous grasslands with little to no flooding in late March and early April.

Monitoring Recommendations:

Very little is known about the short-eared owl presence throughout its life cycle in the SLV. Winter crepuscular monitoring that would target owls hunting before nightfall may provide valuable information about where this species may be using habitat across the SLV. Between the 1st and 2nd edition of the Colorado Bird Atlas, observations of the owl in the SLV went from 7 to 0, respectively.

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Ortega, C.P. 2016. Short-eared owl (*Asio flammeus*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp 266-267. Canada.

North America map used by permission from Cornell Lab of Ornithology's Birds of North America Online (http:/bna.birds.cornell.edu/bna). Colorado map based on Andrews and Righter (1992), Kingery (1998), COBBAII (2015), and CFO (2015).

Snowy egret (*Egretta thula*)

General Description: The snowy egret is a medium-sized heron in the family Ardeidae. In the San Luis Valley, snowy egrets usually nest in tall emergent vegetation in semi-permanent wetlands, in mixed colonies with black-crowned night herons, and white-faced ibis.

Physical characteristics: The plumage of the snowy egret is entirely white, with bright yellow feet and bare skin around the eyes, and dark black legs and bill. In immature snowy egrets and nonbreeding adults, the feet and lower legs are a duller greenish yellow. Breeding adults have long, wispy feathers on the breast, back of the neck, and back.

Range and Conservation Status: The snowy egret breeds on inland and coastal wetlands across the United States, Mexico, the Caribbean, Central and South America. In the U.S., winters mainly along the coasts. Numbers of breeding snowy egrets in the San Luis Valley have varied widely over time.

Communication: Snowy egrets are not commonly vocal except when flushed or during aggressive or courtship interactions on breeding sites. A variety of low- and high-pitched, raspy calls are used.

Life history activities in the San Luis Valley:

- <u>Diet and foraging behavior:</u> Snowy egrets forage opportunistically on a wide variety of aquatic and terrestrial invertebrates, fish, amphibians, reptiles, small mammals, and birds. They forage in a wide variety of habitats and use a vast array of tactics to capture prey. During breeding, snowy egrets forage primarily in morning and

evening hours. Snowy egrets often feed in groups and around other wetland birds.

- Breeding system: Snowy egrets appear to be seasonally monogamous, but may be promiscuous in some situations. Pairing occurs at nest sites, with males displaying to attract females. This species often nests in mixed colonies with other egrets and other wading birds such as black-crowned night heron and white-face ibis. Adults defend a small territory around the nest.
- Nesting: April through June. Snowy egrets have one nest per year, but pairs will re-nest if the first nest is lost early. Clutch size is three to five eggs, laid at two-day intervals. In the San Luis Valley snowy egrets usually nest over water in tall emergent vegetation; elsewhere they nest in trees and on islands. The incubation period averages 20-24 days. Both parents incubate the eggs.
- Brood period: Late May to early August. Young are semi-altricial at hatch. Both parents feed and brood young. Young leave the nest at about 10 days. Most young leave the nesting colony by about 7-8 weeks.
- Post-breeding: Snowy egrets are highly social, often feeding and roosting in groups. Snowy egrets can make large movements in any direction after the breeding period and before fall migration. Most egrets leave the San Luis Valley by the end of September, but some may stay later in the fall.

Snowy egret SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Riparian				Migration					Migration			
				Pre-Breeding								
				Nesting								
					Brood Rearing							
								Post-Breeding				
Short Emergent				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Tall emergent				Migration					Migration			
				Pre-Breeding								
				Nesting								
					Brood Rearing							
								Post-Breeding				
Wet Meadow				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, snowy egrets nest in tall, dense emergent vegetation in large semi-permanent and permanent marshes or playa lakes, often in mixed colonies with other wading birds. They use a wide variety of wetland habitats for foraging.

Key public areas for the egret in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Baca National Wildlife Refuge, Blanca Wetlands, Russell Lakes State Wildlife Area, San Luis Lakes State Wildlife Area, and Rio Grande State Wildlife Area.

Management Recommendations:

Nesting areas require protection from disturbance. Drying or flooding during nesting can result in breeding failure. Drying of areas could lead to higher rates of predation by mammals. Good water quality and maintaining wetland productivity is important, particularly to maintain high-quality feeding areas.

Monitoring Recommendations:

Colonial nesting wading birds have historically been monitored in the San Luis Valley typically with flight count methods. Accurate counts of breeding numbers may be difficult while minimizing observer disturbance of colonies. Measures of productivity on colonies would be informative, and information on habitat variables and their correlation with colony activity and success is needed. Monitoring of movements and use between areas, especially if a key breeding location is unavailable in certain years would be helpful in managing areas collectively across the SLV.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Brown, A., and R. A. Ryder. 2016. Snowy egret (*Egretta thula*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 154-155. Colorado Bird Atlas Partnership.

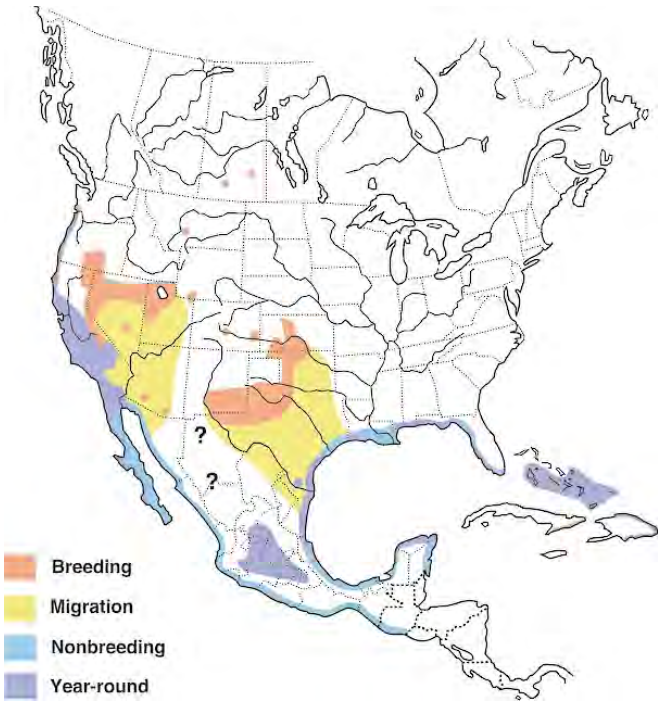
Parsons, K. C., and T. L. Master. 2000. Snowy Egret (*Egretta thula*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/snoegr DOI: 10.2173/bna.489

Western snowy plover (*Charadrius nivosus*)

General Description: The western snowy plover is a small shorebird in the family Charadriidae. In the San Luis Valley, snowy plovers nest and forage around sparsely vegetated alkaline wetlands.

Physical characteristics: Plumage of snowy plovers is pale brown on upperparts and white on underparts. Adult males in breeding plumage have black patches on the crown, behind the eye, and on the sides of the neck. In females these patches are usually dark brown. In nonbreeding plumage is paler and the sexes are indistinguishable. Juveniles have no forehead patch and feathers on upper parts are edged with pale brown. The short bill is black and legs and feet are dull gray to black.

Range and Conservation Status: Snowy plovers breed along the Pacific Coast, the Great Basin, in several Intermountain basins (including the San Luis Valley), the southern High Plains, the eastern Gulf Coast, several Caribbean Islands, and Central Mexico. They winter primarily along the Pacific and Gulf coasts and at several large inland basins. In Colorado, snowy plovers breed in the San Luis Valley and along the Arkansas River corridor in the southeastern part of the state. Breeding populations of snowy plovers are subject to considerable variation over time and space. Blanca Wetlands, a SLV key area for the species, consistently supports one of the largest breeding populations in the State. Adult snowy plover numbers have widely fluctuated on the site from a high of 141 in 2007 to a low of 27 in 2014. Currently, the population is stable at about 37 adults. The Colorado State Wildlife Action Plan (SWAP) 2016 has listed the bird as a Tier 2 species of concern, a Colorado State species of concern and the BLM and USFS consider it a Sensitive Species.



Communication: Snowy plovers give short *purrt*, *towheet*, and *churr* calls during courtship, agonistic, and alarm encounters.

Life history characteristics:

- Diet and foraging behavior: Snowy plovers feed on aquatic and terrestrial invertebrates, particularly insects. They forage visually by gleaning or by probing in substrate. Snowy plovers mainly feed in alkaline or freshwater habitats with little or no vegetation. Most feeding is in 1-2 cm of water and wet mudflats, but occasionally in dry playas.
- Breeding system: Snowy plovers have a flexible breeding system usually characterized by polyandry, in which females desert males during incubation or after hatch and may form a new pair and produce a second clutch. The extent of polyandry depends on the sex ratio in the local population, length of the breeding season, and success of early nest attempts.
- Nesting: April through July. Clutch size is usually 3 per nest laid about every other day. Snowy plovers nest on the ground in open habitats. Males produce a scrape in the ground and both sexes add bits of debris to the nest bowl. The incubation period is variable and usually around 23-28 days. Both sexes incubate the eggs.
- Brood period: Late May through August. Snowy plover chicks are precocial and leave the nest within 24 hours of hatching but still need to be insulated by a parent. They are led by the parents to nearby habitats with shallow, open water and emergent vegetation for feeding and cover. Parents usually stay with young until they can fly (28-33 days after hatch), but females may leave young early.
- Post-breeding: Fall departure begins in mid-July and can extend into September. There is no available information on post-breeding movements or migratory behavior.

Snowy Plover SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Playa			Migration					Migration				
				Pre-Breeding								
				Nesting								
					Brood Rearing							
							Post Breeding					
Wet Meadow			Migration					Migration				
				Pre-Breeding								
				Nesting								
					Brood Rearing							
							Post Breeding					

Habitat Requirements:

In the San Luis Valley, snowy plovers use playas, alkali shorelines of lakes, and saltgrass habitats in close proximity to abundant macroinvertebrate prey. They forage and nest in sparsely vegetated or unvegetated areas on moist shoreline or in water < 1-2 cm.

Key public areas for snowy plovers in the San Luis Valley: Blanca Wetlands. Historically nested at San Luis Lakes.

At Blanca Wetlands, snowy plovers prefer microhabitat with raised topography, white unvegetated soils, and some surrounding structure for nest site selection.

Management Recommendations:

Ephemeral or seasonal, shallow flooding of preferred habitats is important for stimulating high production and concentrations of invertebrate foods. Excessive flooding during the breeding period should be avoided. At Blanca Wetlands, this species seems very sensitive to amounts of white shoreline and water levels. It can be challenging to provide playa conditions that are neither too dry nor too full because of this habitat's quick and extreme response to climatic conditions, such as snow pack during spring or high evaporative rates in summer. Local numbers can vary greatly over time in relation to drought cycles.

Additional considerations for snowy plovers are listed below:

- Complexes comprised of alkaline playas with little or no vegetation and abundant, easily accessible, insect prey with moist soil or water up to 1-2cm.
- Where possible, maximize white shorelines to provide camouflage for birds, chicks, and eggs.
- In areas with the ability to alter hydrologic conditions and water quality parameters, careful management to promote salinity levels that limit vegetative growth is beneficial to this species.
- In areas of consistent and concentrated shorebird use, consider efforts to minimize disturbance during breeding.
- Avoid causing deep tracks/depressions of any kind in snowy plover breeding habitat as these depressions may trap chicks (e.g. ATV/vehicle ruts or deep foot prints)
- Encourage playa wetland development where possible to expand snowy plover habitat.

Monitoring Recommendations:

Snowy plovers appear to be limited in numbers and distribution in the San Luis Valley. Additional monitoring is necessary to define the extent and occurrence of snowy plovers during breeding and migration. For example, a snowy plover has been detected on Alta Lake in the south end of the SLV and on San Luis Lakes State Wildlife Area during general bird surveys.

Continued monitoring on Blanca Wetlands and expanding efforts at other sites with suitable and/or potential habitat is needed to evaluate population trends and determine reproductive success. Tracking of habitat conditions and use over time on known and potential breeding areas is needed.

As new populations are found, initiate annual monitoring to determine trends.

Coordinate survey efforts using USFWS international protocols as currently being used on Blanca Wetlands to standardize monitoring efforts.

Continue and expand intensive nest reproductive success studies similar to those initiated on Blanca Wetlands.

Continue and expand the understanding of water quality influences on macroinvertebrate biomass and timing to maximize availability for the species.

References:

Andrews, R. and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

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Nelson, D. L. 2016. Snowy plover (*Charadrius nivosus*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 202-203. Colorado Bird Atlas Partnership.

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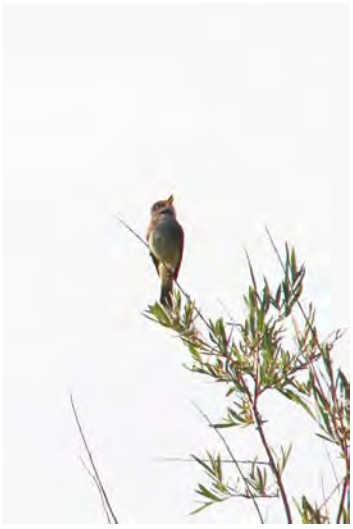
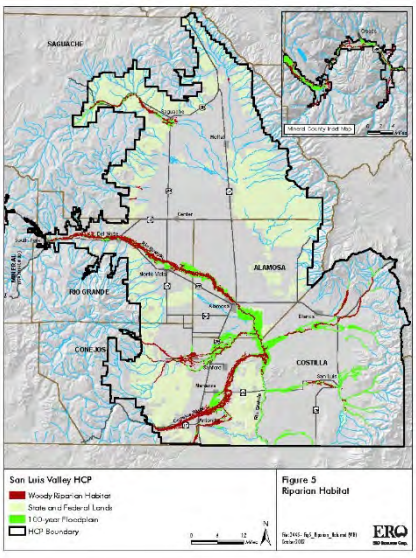
Southwestern willow flycatcher (*Empidonax traillii extimus*)



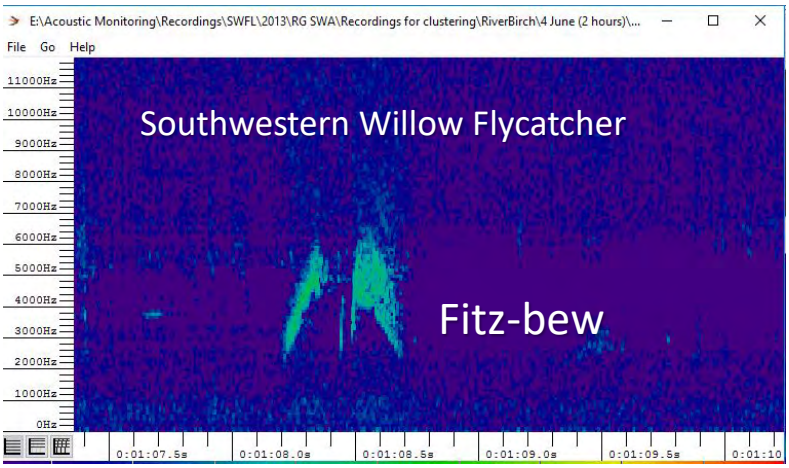
General Description: The Southwestern willow flycatcher is a small, endangered flycatcher in the family Tyrannidae. The flycatcher occupies riparian cottonwood and willow galleries below 8,500 feet in the San Luis Valley of Colorado.

Physical Characteristics: The Southwestern willow flycatcher is approximately 6 inches in length and is similar in appearance to many other flycatchers, but easily distinguished by its distinctive song. Plumage is brownish-olive to gray-green with a whitish throat, pale olive breast, yellowish belly, has two dirty or dingy white wing bars and a weak eye ring. Commonly flicks tail upward while perched.

Range and Conservation Status: The southwestern willow flycatcher is distributed throughout the southwestern United States, Central America, and northern South America. The San Luis Valley (SLV) lies at the northern edge of this species geographic and altitudinal range and is present in the SLV during the migration and breeding season. This bird typically occupies riparian deciduous forests up to 8,500 feet in elevation, specifically along the Rio Grande and Conejos Rivers although there is documentation of the bird along smaller creeks in the SLV such as Hot Creek, La Jara Creek, and La Garita Creek. The flycatcher has declined due to a loss of appropriate riparian habitat that is closely linked to changes in irrigation practices, changes in stream and river flows, channelization of the river, agricultural activities, urban development, and introduction of invasive tree species. This species was listed as federally endangered in 1995 by the U.S. Fish and Wildlife Service. A Recovery Plan was completed in 2002 and updated in 2010 for this species. In addition, a Habitat Conservation Plan was completed for the six counties in the SLV in 2012. Critical habitat was designated in 2013 on the Alamosa National Wildlife Refuge, BLM's McIntire/Simpson property, and 12.7 miles of the Rio Grande within BLM's Rio Grande Natural Area. The species is also listed as a Tier I priority species for the state of Colorado, is State Threatened, and a USFWS Bird of Conservation Concern.



Communication: Flycatchers, almost always males, have a distinctive '*fitz-bew'* call that is their primary song. Males may sing continuously for hours or all day, sometimes punctuated by a '*whitt*' call. The '*whitt*' call is often used by nesting pairs on a territory and may be used as a contact call between males and females. This call may be the primary call when pairs have active nests but is difficult to distinguish from similar calls by the yellow-breasted chat.



Life History Characteristics:

- Diet and foraging behavior: Southwestern willow flycatchers are exclusively insectivores preying on a wide range of insects including small leafhoppers (Homoptera), dragonflies (Odonata), bugs (Hemiptera), bees and wasps (Hymenoptera), and flies (Diptera). The flycatcher feeds by perching in an open location in a tree and performing aerial hawking and gleaning within open areas in the habitat, tree canopies, or on the edge of the forest.
- Breeding system: The flycatcher returns to its breeding territory in May with breeding beginning in the SLV around June 1st when the trees begin to leaf out. Many flycatchers return to the same drainage if not the same area to breed year after year but may move on to other areas if reproductive success or habitat declined the previous year.
- Nesting: Nests consist of an open cup in the fork of a tree branch supported by other small branches. Flycatchers lay 3 to 4 eggs and will re-nest if the first attempt is unsuccessful. Incubation periods average about 12-13 days after the last egg is laid.
- Brood period: The young stay in the nest 12-15 days and stay close to each other for the following 3-5 days. Both the male and female parents typically continue to feed the young for about 2 weeks after fledging.
- Post-breeding: Disperse and begin migrating south in late August through September. Dispersal of first year flycatchers is usually more extensive than for adult birds.

Southwestern willow flycatcher SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian					Migration			Migration				
					Pre-Breeding							
						Nesting						
						Brood Rearing						
								Post-Breeding				
Short Emergent					Migration			Migration				
					Pre-Breeding							
						Nesting						
						Brood Rearing						
								Post-Breeding				
Wet Meadow					Migration			Migration				
					Pre-Breeding							
						Nesting						
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, Southwestern willow flycatchers use riparian areas primarily along the Rio Grande and Conejos Rivers although the birds have been documented on Hot Creek, La Jara Creek, and La Garita Creek. Flycatchers need dense willow and/or cottonwood stands with multiple age classes and structure greater than 3 meters tall adjacent to surface water present through July. At McIntire/Simpson, tall residual meadow grasses seem instrumental in promoting higher prey abundance. Most breeding territories require willow and cottonwood habitat patches to be greater than 10 m in width although linear strips in a riparian area may be utilized for migration. Males require habitat that provides perches for defending territories.

Key public areas for flycatchers in the San Luis Valley: Rio Grande SWA, Higel SWA, Hot Creek, and Sego Springs SWA, Alamosa National Wildlife Refuge, McIntire/Simpson Parcels, Rio Grande Natural Area, and other state and BLM properties on the Rio Grande, Conejos River, La Garita Creek, and La Jara Creek.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished with development and implementation of riparian management strategies and conservation of lands that protect river and stream reaches in areas that commonly support this species. Specific recommendations include:

- Providing a variety of structure, age class, and dense riparian cottonwood and willow forests with a large percentage of 'edge' habitat.
- Maintain consistent surface water conditions adjacent to riparian forests through the breeding season.
- Promote regeneration of cottonwood and willow on conserved lands with willing landowners by incorporating management practices that prevent cattle grazing in the riparian area until trees can withstand some browse (5 to 7 years), prevent

mowing and haying of newly established trees and shrubs. Where possible, minimize grazing and haying to maintain residual grasses.

- Work with private landowners to improve riparian health
- Maintain residual vegetation, including tall grasses, rushes and sedges, interspersed within the willow and cottonwood riparian habitat
- In patches where willow is predominantly dead and surveys are showing no occupancy of habitat, consider treating portions of decadent willow to stimulate regrowth through mowing or prescribed fire
- Where possible, use irrigation water rights to promote hydrologic conditions that mimic natural conditions to improve riparian suitable habitat (overbank flows, raised groundwater levels, standing water later in the season, etc.)
- Regulate non-native invasive species presence in suitable and potential habitat
- Where possible, reduce human presence/disturbance within occupied habitat particularly during the breeding season
- Where necessary, construct exclosures to promote habitat regeneration and recovery
- Improve connectivity of habitat through targeted conservation easements in critical locations

Monitoring Recommendations:

Official survey protocols have been established for the flycatcher, which are based on call-playback surveys during the breeding season by certified personnel. There are three pre-defined survey periods beginning May 15th and ending July 17th. Given the late start to the growing season in the SLV, the USFWS has allowed surveyors to begin the first survey June 1st and conduct two surveys before June 24th. Monitoring of the southwestern willow flycatcher on public lands occurs roughly every three years during the breeding season. Little is known of the extent of the population on private lands. Monitoring of private lands with willing landowners with conservation easements would be extremely useful in determining the actual population status in the SLV. Advances in acoustic monitoring offer a new tool that could be utilized to determine presence/absence where questions exist for potential development or habitat projects.

Because playback surveys can be disrupting during breeding season, avoid oversurveying and/or using the recording in areas of occupied habitat where birds are already vocalizing.

When doing species surveys, record habitat variables, such as presence of standing water, distance to standing water, and height of residual vegetation to better quantify these habitat characteristics in relation to species presence/absence.

Quantify the amount of suitable habitat on the key areas periodically and coordinate habitat treatments to maximize available habitat.

References:

Species Profile: Southwestern willow flycatcher (*Empidonax traillii extimus*). ECOS – Environmental Conservation Online System. U.S. Fish and Wildlife Service https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B094

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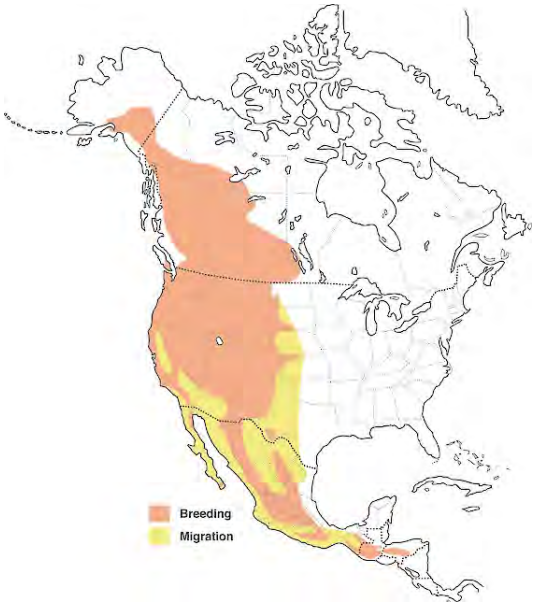
Western Wood-Pewee (*Contopus sordidulus*)

General Description: The Western wood-pewee is a small flycatcher in the family Tyrannidae. The pewee occupies riparian and pine woodlands in western North and Central America.

Physical characteristics: The Western wood-pewee is approximately 14-16 cm in length and is similar to many other flycatchers, distinguished by its small size, plumage pattern, and distinctive song. They have uniform dark grayish brown upperparts with dull whitish to dusky breast and flank underparts. Fairly difficult to separate eastern wood-pewee's from the western species by plumage. The females are generally smaller than the males. The birds are a dark grayish color with a lighter, browner head.

Range and Conservation Status: During breeding, migration, and wintering, pewees are distributed throughout the western United States, Mexico, and Central America. This species is present in the San Luis Valley during the breeding season. This bird typically occupies riparian deciduous forests and ponderosa pine woodlands up to 3000 m in elevation. The Second Colorado Bird Atlas indicates that although the species may be declining elsewhere, the population is stable and may be increasing in Colorado. This trend may be due to changes in forest management that promote suitable habitat conditions such as forest thinning.



Communication: Male sings a 'dawn song' of '*peee-pip-pip'* alternating with '*peee-er*' near the nest before sunrise. The common '*bzew*' call is given at night and used to communicate with a mate and in nest defense.

Life history activities in the San Luis Valley:

- <u>Diet and foraging behavior:</u> Western wood-pewees diet is composed entirely of flying insects, such as flies, ants, bees, wasps, and beetles. The pewee feeds by perching in an open location in a tree up to 25 m or in the upper 25% of the canopy and swooping down in short distances to catch and eat its prey.

- Breeding system: The pewee returns to its breeding territory in mid-May and begins courtship and pair bonding.
- Nesting: Nests consist of an open cup made from twigs, and other plant and tree material placed on the top of horizontal branches about 24 m above the ground. Pewees lay 2 to 4 eggs and raise a single brood. Parents aggressively defend nest sites and therefore have little parasitism. Incubation periods average about 15 days.
- Brood period: The young stay in the nest about 16 days. The young fledge and after about 3 days leave the area.
- Post-breeding: Disperse and begin migrating south in late August through September.

Western-wood pewee SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian					Migration			Migration				
					Pre-Breeding							
					Nesting							
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, Western wood-pewees use riparian areas, forest edges with snags, open canopies, and woodlands up to 3,000 m in elevation. The Second Colorado Bird Atlas indicates that the pewees were documented throughout the SLV including on the Rio Grande State Wildlife Area. The pewee needs migration, breeding, and brood-rearing habitats in the SLV.

Key public areas for pewees in the San Luis Valley: Hot Creek SWA, Coller SWA, Higel SWA, Rio Grande SWA, Sego Springs SWA, Alamosa National Wildlife Refuge, Baca National Wildlife Refuge, McIntire/Simpson, and Great Sand Dunes National Park.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished with development and implementation of riparian management strategies that protect river and stream reaches in areas that commonly support this species. Specific recommendations include:

- Providing a variety of structure and age classes of riparian deciduous trees, mainly cottonwood and willow with a large percentage of 'edge' habitat.
- Providing multi-structural and age class woodlands up to 3,000 m in elevation
- Continue current forest management techniques that have improved habitat conditions for the pewee such as forest thinning and protection of dead snags or trees with dead tops or exposed branches for singing posts and foraging perches.

Monitoring Recommendations:

This species is a good indicator of riparian health. Monitoring of this species with respect to fire, forest thinning, and riparian management would help provide and promote suitable habitat conditions.

References:

Bemis, C. and J.D. Rising. 1999. Western wood-pewee (*Contopus sordidulus*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; https://birdsna.org/Species-Account/bna/species/wewpew/introduction

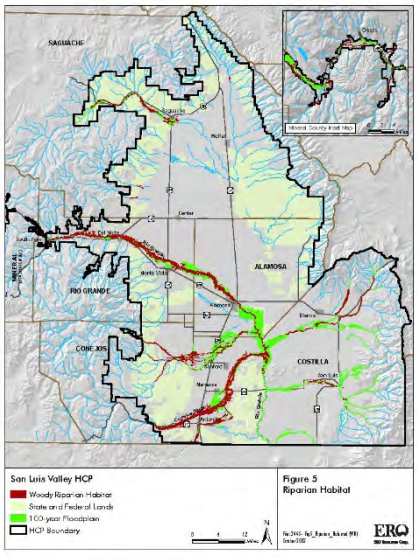
Swanson, H. and B. Baker. 2016. Western wood-pewee (*Contopus sordidulus*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp 316-317. Colorado Bird Atlas Partnership.

Western Yellow-billed Cuckoo (*Coccyzus americanus*)

General Description: The Western yellow-billed cuckoo is a large, long, secretive bird in the family Cuculidae that is federally threatened. The cuckoo occupies dense riparian cottonwood and willow galleries in the San Luis Valley of Colorado.

Physical Characteristics: The Yellow-billed cuckoo is approximately 12 inches in length. Plumage is dorsally brown with a whitish belly, yellow eye ring, and a blackish face mask. The outer wings are a rufous color, seen in flight. When perched, the long tail has distinctive wide white bands with black between on the underside. The bill is slightly down-curved and yellow with some black on the top.

Range and Conservation Status: The western sub-species of the Yellow-billed cuckoo is distributed from southern British Columbia, throughout the western United States, to its wintering range in South America. The San Luis Valley (SLV) lies at the eastern edge of this species' geographic and altitudinal range. The yellow-billed cuckoo is present in the SLV during the migration and breeding seasons. This bird typically occupies riparian deciduous forests, specifically along the Rio Grande and Conejos Rivers. The western cuckoo population has been in decline since the 1940's and has been extirpated from its northern breeding grounds. These declines are due to a loss of riparian habitat that is closely linked to changes in irrigation practices, changes in stream and river flows, channelization of the river, agricultural activities, urban development, and introduction of invasive tree species. This species has been documented in only a few locations throughout the SLV: McIntire/Simpson, Rio Grande and Higel State Wildlife Areas, and one area west of Monte Vista along the Rio Grande. This species was listed as federally threatened in 2014 by the U.S. Fish and Wildlife Service. A Habitat Conservation Plan was completed for the six counties in the SLV in 2012 that includes this species. Critical habitat has been proposed in the SLV but has not yet been designated. The species is also listed as a Tier I priority species for the state of Colorado, is State Threatened, a USFS Sensitive species, and a USFWS Bird of Conservation Concern.



Communication: Cuckoos are secretive and call infrequently, perhaps once per hour. The contact call consists of a '*kuk*' call that may or may not incorporate a '*kowlp*' call. The '*coo*' call is most often given by the female and may be given softly by both parents to nestlings. The '*knocker*' call is an alarm call given by both the male and female usually in association with a threat in the area of the nest or fledglings and continues until the threat is gone.

Life History Characteristics:

- Diet and foraging behavior: Yellow-billed cuckoos prefer caterpillars but eat a variety of other arthropods such as cicadas, katydids, and grasshoppers along with small lizards, frogs, spiders, and other insects. The cuckoo feeds by perching in a secluded area of the forest, visually detecting prey, that it then goes after in nearby habitats comprised of short structured vegetation.
- Breeding system: The cuckoo returns to its breeding territory from late May through early July with breeding beginning in the SLV in late June and early July. Many cuckoos return to the same drainage if not the same area to breed year after year but may move on to other areas if reproductive success declined, habitat conditions worsened, or excessive disturbance occurred on the site.
- Nesting: Nests are well concealed and built by both the male and female in dense vegetation. Eggs may be laid as late as September. Double broods are common in other locations, with even a few instances of triple broods being observed. Cuckoos lay up to 4 eggs, with eggs being laid every other day. Incubation periods average about 9-11 days. The male incubates the eggs at night and alternates with the female during the day.
- Brood period: The young fledge after about 5-8 days from hatching. Both the male and female care for the nestlings with the male primarily caring for fledglings.
- Post-breeding: The birds disperse and begin migrating south in late September through November.

Yellow billed cuckoo SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian					Migration				Migration			
					Pre-Breeding							
						Nesting						
							Brood Rearing					
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, Yellow-billed cuckoos use riparian areas primarily along the Rio Grande and Conejos Rivers. Specifically, cuckoos need fairly large willow and cottonwood forest stands of at least 50 acres, although some breeding cuckoos have been documented in much smaller and fragmented stands in Colorado. New breeding

locations have been found in restored sites with 2 year old willow/cottonwood stands. Most breeding territories contain a canopy, noticeable sub-canopy, and an understory of mixed species. Average home ranges vary from 48 to 104 acres depending on a wide range of factors. Research has shown the birds to be highly mobile and adaptive to climatic conditions. Studies in California have shown large fluctuations in the population from year to year within breeding habitat.

Key potential public areas for cuckoos in the San Luis Valley: Rio Grande SWA, Higel SWA, McIntire/Simpson Management Area, Alamosa National Wildlife Refuge, and Sego Springs SWA.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished with development and implementation of riparian management strategies and conservation of lands that protect river and stream reaches in areas that commonly support this species. Specific recommendations include:

- Providing a variety of structure, age class, and dense riparian cottonwood and willow forests.
- Maintain consistent surface water conditions adjacent to riparian forests through the breeding season.
- Promote regeneration of cottonwood and willow on conserved lands with willing landowners by incorporating management practices that prevent cattle grazing in the riparian area until trees can withstand some browse (5 to 7 years), prevent mowing and haying of newly established trees.
- Work with private landowners to improve riparian health
- This species appears to have high site fidelity, and to be sensitive to human disturbance, based on observations at the McIntire/Simpson property. If breeding is suspected, consider area closures during breeding season if possible.

Monitoring Recommendations:

Official survey protocols have been established for the cuckoo which are based on call-playback surveys during the breeding season by certified personnel. Monitoring of the Yellow-billed cuckoo on public lands has not been consistent across areas or years during the breeding season in the SLV. Due to its secretive nature and rare call frequency, little is known of the extent of the population on public and private lands throughout the SLV. Monitoring of public lands along with private lands with willing landowners with conservation easements would be extremely useful in determining the actual population status in the SLV. Advances in acoustic monitoring offer a new tool that could be utilized to determine presence/absence where questions exist for potential development or habitat projects.

References:

Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (*Coccyzus americanus*); Final Rule. Federal Register Vol. 79 No. 192, 50 CFR Part 17.

Halterman, M.D., M.J. Johnson, J.A. Holmes and S.A. Laymon. 2015. A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo: U.S. Fish and Wildlife Techniques and Methods, 45 p.

Species Profile: Yellow-billed cuckoo (*Coccyzus americanus*). ECOS – Environmental Conservation Online System. U.S. Fish and Wildlife Service https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B06R

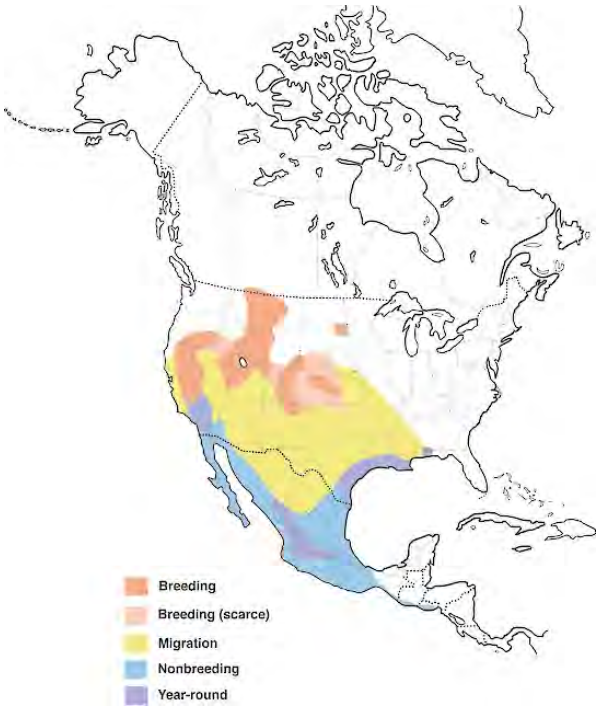
San Luis Valley Regional Habitat Conservation Plan. 2012. ERO Resources Corporation, Denver, CO.

White-faced ibis (*Plegadis chihi*)

General Description: The white-faced ibis is a medium-sized wading bird in the family Threskiornithidae. Ibis nest colonially in dense, tall emergent vegetation in semi-permanent and permanent wetlands, and forage in hayfields, pastures, wet meadows, and shallow wetlands with short emergent vegetation.

Physical characteristics: White-faced ibis have a long neck, long legs, and a long, decurved bill. In breeding plumage, the head, neck, upper back, wings, and undersides are dark red with a metallic green and bronze sheen on the body and a purplish tint on the wings. Bare facial skin becomes reddish purple, and white feathers separate the forehead from face, extending completely around back of eye. The eye is reddish brown, and the bill, legs, and feet are bright pink; during the non-breeding period the bill, legs, and feet are olive gray, the white face feathers are absent, and the plumage is duller overall.

Range and Conservation Status: White-faced ibis breed locally across much of the western United States, western Gulf Coast, Mexico, and South America. They winter primarily in coastal Louisiana and Texas, and into Mexico, as well as in southern California and Arizona. The Colorado SWAP (2016) has listed the bird as a Tier 2 species of concern and the BLM considers it a Sensitive Species.



Communication: The males have a distinctive breeding call that is a nasal '*waaaah*' that is rapidly pulsed for 1 to 4 seconds.

Life history characteristics:

- Diet and foraging behavior: White-faced ibis are carnivorous, consuming primarily aquatic and terrestrial invertebrates, earthworms, and crustaceans. They feed mainly in shallow water

and wet soils in seasonal wetlands, wet meadows, and alfalfa fields. Ibis feed by pecking or probing. They often feed in large groups, flying out from nesting colonies to feed in nearby meadows and agricultural fields.

- Breeding system: Little is known, but white-faced ibis apparently are seasonally monogamous. They form pairs and select nest sites shortly after arrival on breeding areas. Both pair members participate in nest construction, incubation, and rearing of young, and defending the territory immediately around the nest.
- Nesting: Late April through July. White-faced ibis have one nest per year, but pairs will re-nest if the first nest is lost early. Clutch size is 2-5, usually three or four; eggs are usually laid every other day. White-faced ibis nest over water, and construct a nest in tall emergent vegetation. Incubation is about 20 days. Both sexes incubate the eggs.
- Brood period: Late May through August. Chicks are altricial at hatch and remain in nest for the first week. Adults brood and shade the young. Young ibis leave the colony by 6-7 weeks and are largely independent by 8 weeks after hatch.
- Post-breeding: Juveniles flock separately from adults in late summer prior to migration. After breeding, ibis will wander in any direction before migration. White-faced ibis are very gregarious, moving in flocks to forage and roost.

White-faced ibis SLV habitat, timing, and life cycle event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Short Emergent				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				
Tall emergent				Migration					Migration			
				Pre-Breeding								
				Nesting								
					Brood Rearing							
								Post-Breeding				
Wet Meadow				Migration					Migration			
				Pre-Breeding								
					Brood Rearing							
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, white-faced ibis are dependent upon large semi-permanent and permanent wetlands and playa lakes with stands of tall emergent vegetation for nesting habitat and roosting areas. Ibis use a variety of habitats for foraging habitat, including short emergent, wet meadow, shorelines and shallow open water portions of lakes and wetlands, and agricultural fields (primarily alfalfa).

Key public areas for white-faced ibis in the San Luis Valley: Alamosa National Wildlife Refuge, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, Blanca Wetlands, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Extensive, productive feeding areas must be available in proximity to nesting sites in order for white-faced ibis to breed successfully. Wetlands that support nesting colonies should have stable water conditions during breeding, and avoid excessive drying or flooding. Disturbance at nesting colonies should be minimized.

Monitoring Recommendations:

Colonial nesting wading birds have historically been monitored in the San Luis Valley with the flight count method. Accurate counts of breeding numbers may be difficult while minimizing observer disturbance of colonies. Measures of productivity on colonies would be informative, and information on habitat variables (including foraging habitat) and their correlation with colony activity and success is needed. Monitoring of movements and use between areas, especially if a key breeding location is unavailable in certain years would be helpful in managing areas collectively across the SLV.

References:

Andrews, R. and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Colorado's 2016 State Wildlife Action Plan. Colorado Parks and Wildlife.

Hundertmark, C. A., and R. A. Ryder. 2016. White-faced ibis (*Plegadis chihi*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 162-163. Colorado Bird Atlas Partnership.

Ryder, R. A. and D. E. Manry. 1994. White-faced Ibis (*Plegadis chihi*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/whfibi DOI: 10.2173/bna.130

Wilson's phalarope (*Phalaropus tricolor*)

General Description: The Wilson's phalarope is a small shorebird in the family Scolopacidae. It breeds and migrates through the San Luis Valley, where it primarily uses shallow, freshwater, and alkaline wetlands.

Physical characteristics: Wilson's phalarope females are larger and more brightly colored than males. Breeding females have a bluish gray forehead and crown, a black streak through the eye and down the sides of the neck to the upper back, white cheeks, buffy throat, gray wings and back with chestnut patches, gray tail, and white underparts and rump. Breeding males have less coloration than females. The non-breeding plumage of both sexes is pale gray above with white underparts and rump. The bill and legs are grayish to black in breeding adults, while non-breeding adults and juveniles have yellow legs.

Range and Conservation Status: Wilson's phalarope breed throughout southern Canada and the western intermountain region and northern prairies of the United States, and winters in South America. Although the North American range of Wilson's phalarope has expanded in recent decades, the Second Colorado Breeding Bird Atlas suggests population declines in Colorado. Wilson's phalaropes have been documented breeding throughout the San Luis Valley.

Communication: Wilson's phalaropes have several short, low, nasal calls used during courtship and aggressive encounters among individuals.

Life history characteristics:

- Diet and foraging behavior: Wilson's phalaropes feed primarily on small aquatic invertebrates, particularly insects and crustaceans, as well as some terrestrial invertebrates. They feed in open water and short emergent habitats, wet meadows, playas, along shorelines of wetlands, and to a lesser extent in upland areas near water. Phalaropes forage mostly visually, but also probe in bottom sediments. They use a variety of capture techniques, depending on water depth and prey type. Phalaropes are known for spinning while swimming to stir up prey from the water column. They are social and usually feed in flocks or loose groups throughout the year.

- Breeding system: Courtship begins during spring migration and continues on arrival at breeding areas. Wilson's phalaropes have a female-access polyandry breeding system. Females usually compete for males on breeding areas. Pair bonds usually last through clutch completion but may continue into incubation, some females may pair again and produce another clutch of eggs.
- Nesting: May through mid-July. Most clutches have 4 eggs. Nests are placed within 100 meters of water, well-concealed in herbaceous vegetation. Females lay eggs in a bare scrape on the ground, and males line the nest and conceal the eggs with vegetation. Incubation period averages 23 days, and ranges from 18-27 days. Only males incubate the eggs.
- Brood period: June through August. Chicks are precocial and leave the nest within 24 hours of hatching. The male broods the young, and quickly moves them to nearby wetlands for food and cover. Age of flight and independence of young is unknown.
- Post-breeding: Females depart breeding areas and begin moving to staging areas by mid-June, followed by adult males about two weeks later, and juveniles arrive last. Many Wilson's phalaropes stage at western hypersaline lakes (e.g., Great Salt Lake, Utah and Mono Lake, California), where abundant food enables rapid molt and fattening before migrating to South American wintering areas.

Wilson's phalarope SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open water				Migration								
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Playa				Migration								
				Pre-Breeding								
						Brood Rearing						
								Post-Breeding				
Short Emergent				Migration								
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				
Wet Meadow				Migration								
				Pre-Breeding								
					Nesting							
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, Wilson's phalaropes use a variety of wetlands. For breeding, they select either short-emergent vegetation, wet meadows, or temporarily flooded salt grass. Other habitat requirements include open water, alkali playas, and salt flats for brood rearing, foraging, and migratory purposes. High invertebrate production is important in these habitats.

Key public areas for Wilson's phalaropes in the San Luis Valley: Alamosa National Wildlife Refuge, Blanca Wetlands, Monte Vista National Wildlife Refuge, Russell Lakes State Wildlife Area, and San Luis Lakes State Wildlife Area.

Management Recommendations:

Complexes of different freshwater and alkaline wetland types in close proximity benefit Wilson's phalaropes by providing a variety of habitat structure, water depths, and food types necessary to meet annual cycle needs. Manage for stable water conditions as changes in hydrology (drying or flooding) during nesting can negatively affect nest success.

Monitoring Recommendations:

Wilson's phalaropes are often inconspicuous but can readily be distinguished from other shorebirds during standardized counts. Tracking of wetland hydrology and quantitative or qualitative measures of suitable habitat and invertebrate production would be useful in assessing habitat conditions for these birds.

Coordinate surveys across ownership boundaries to document habitat use to better understand movement patterns and timing across the landscape. This could also help distinguish breeding versus migratory populations in the SLV.

References:

Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History.

Colwell, M. A., and J. R. Jehl Jr. 1994. Wilson's Phalarope (*Phalaropus tricolor*). *In* P. G. Rodewald, editor. The Birds of North America. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/wilpha DOI: 10.2173/bna.83

Kibbe, D. P. 2016. Wilson's phalarope (*Phalaropus tricolor*). *In* L.E. Wickersham, editor. The Second Colorado Breeding Bird Atlas, Pp. 220-221. Colorado Bird Atlas Partnership.

Woodhouse's Toad (*Anaxyrus woodhoussii*)

General Description: The Woodhouse's toad (WOTO) is in the Bufonidae (toad) family and is mostly nocturnal, common in floodplain wetlands, irrigation ditches, or agricultural fields.

Physical Characteristics: Woodhouse's toad (*Anaxyrus woodhousii*) vary in color from yellowish brown to gray or olive with a light stripe down the middle of the back and an asymmetrical pattern of dark spots with some warts. The adult WOTO may reach 5 inches in length with males being smaller than females. Breeding male WOTO have a dark throat and dark patches on the inner surface of the first and second toes of the front feet. The vocal sac is spherical and elongated when expanded.

Range and Conservation Status: The WOTO is common throughout western North America occurring at elevations ranging from sea level to 8,000 feet. The Woodhouse's toad is currently not threatened or of concern but given limited water resources, urban sprawl, and changes from flood irrigation to other methods, habitat required by this species may be in decline. Other population declines may be related to pesticide/herbicide use.

Communication: The males have distinctive breeding call that is a nasal 'waaaah' that is rapidly pulsed for 1 to 4 seconds.

Life History Characteristics:

- Diet: WOTO adults are nocturnal insectivores that prefer arthropods commonly known as insects, spiders, crustaceans, etc. Larvae (tadpoles) are herbivores that eat organic matter, algae, and plant tissue. Newly metamorphed toads eat all day for the first month of growth.
- Hibernation: Toads spend a large amount of time underground by backing/burrowing into the ground during the winter and during the summer in dry conditions. They are not freeze tolerant and burrow below the frost line.
- Breeding: Breeding occurs during and after rainstorms. The males use mating calls and congregate in large masses to attract females, defending their territories. Females have been positively correlated to the rate of calling by a male rather than size of male. Each female lays a long gelatinous strand of on average 20,000 eggs that may become tangled in submerged vegetation. Males are 1 to 2 years old and females are 2 to 3 years old before becoming sexually mature.

- Young: Larvae (tadpoles) are generally brown or dark gray with light mottling or dense gold flecking. Depending on conditions, they emerge and metamorphose into toads from 4 to 7 weeks after the eggs were laid.
- Dispersal: WOTO may move locally, short distances between breeding pools and during non-breeding times to terrestrial habitats for over-wintering.

Woodhouse's Toad SLV habitat, timing, and event												
Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grasslands				Dispersal								
	Hibernation											
Open Water					Breeding							
						Larvae and Metamorphosis						
Short Emergent					Breeding							
						Larvae and Metamorphosis						
Tall Emergent					Breeding							
						Larvae and Metamorphosis						

Habitat Requirements:

Typical habitats for Woodhouse's toads throughout their range include floodplains and wetlands with deep soils for burrowing and irrigated agricultural lands. Most toads seem to prefer sandy substrates near rivers, creeks, or irrigation ditches. Breeding habitat is primarily in standing water associated with a variety of wetland types. Known predators to WOTO include pied-billed grebes, tiger salamanders, various game fish, great blue herons, egrets, black-crowned night herons, bullfrogs, and western terrestrial garter snake. WOTO burrow in the mud, gravel, sand or similar substrate.

Requirements:

- Standing water in wetlands such as marshes, lakes, backwater sloughs.
- Good water quality.
- Limited presence of known exotic, aquatic predators: bullfrog, game fishes, and tiger salamanders.

Key public areas for the toad in the San Luis Valley: Blanca Wetlands Management Area, San Luis Lakes SWA, Higel SWA, Rio Grande SWA, Baca National Wildlife Refuge, Monte Vista National Wildlife Refuge, Alamosa National Wildlife Refuge, and Great Sand Dunes National Park.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished through the creation and protection of habitats that favor toad reproduction and limit or prohibit successful breeding by bullfrogs and predatory fish. Additional methods to enhance Woodhouse's toad habitat are listed below:

- Management of shallow, seasonal or temporary wetlands that are maintained for at least 8 weeks in order to make sure that toads have time to breed, lay eggs, and metamorphose into toads.

- Avoid producing breeding habitat in areas where wetlands dry up before larvae have metamorphosed (mid-August).

- Manage for harvest of predators that are game species: bullfrogs and fish.

- Set back succession periodically in areas adjacent to breeding WOTO wetlands, for example, maintain some adjacent grasslands.

Monitoring Recommendations:

Monitoring strategies for the WOTO should primarily occur during the breeding season, therefore strategies should be correlated to crepuscular and night call surveys during this time. Visual surveys may be conducted outside of the breeding season, along open areas of shorelines or in wetlands for tadpoles or newly metamorphed toads.

References:

AmphibiaWeb. 2019. <http://amphibiaweb.org> University of California, Berkeley, CA, USA. Accessed 30 Apr 2019.

NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: April 30, 2019). http://explorer.natureserve.org/servlet/NatureServe?searchName=Anaxyrus+woodhoussii

http://cpw.state.co.us/learn/Pages/SpeciesProfiles.aspx

Simon, M. 2014. Life History Account for Woodhouse's Toad. California Wildlife Habitat Relationships System

Sullivan, B. 1983. Sexual selection and mating system variation in the Great Plains toad (*Bufo woodhousii* Say) and Woodhouse's toad (*Bufo woodhousei austrailis* Shannon and Lowe). Arizona State University, PhD Dissertation.

Yellow warbler (*Setophaga petechia*)

General Description: The Yellow warbler is a small warbler in the wood warbler family Parulidae. The warbler occupies riparian forest galleries throughout the San Luis Valley.

Physical characteristics: The Yellow warbler is approximately 5 inches in length with bright yellow plumage over most of its body. Wings are yellow-green to olive with yellow edged tertials and greater coverts. The warbler has a short tail with yellow spots. These warblers have some chestnut streaking on their breasts which is usually more pronounced in the males.

Range and Conservation Status: The Yellow warbler is present throughout the United States and Central America during some portion of their annual cycle. The San Luis Valley (SLV) provides habitat for the warbler during the migration and breeding seasons. This bird typically occupies riparian forest galleries and can be found along most river and creek drainages. There has been no discernible change to the general population in the United States but declines have been observed throughout the southwest. The warbler has declined in Colorado according to the Second Colorado Breeding Bird Atlas and Birds of North America due to a loss of riparian habitat that is closely linked to changes in irrigation practices, changes in stream and river flows, channelization of the river, agricultural activities, urban development, and introduction of invasive tree species.

Communication: Warblers, almost always males, have a distinctive 'sweet, sweet, sweet, I'm so sweet' call that is their primary song. However this song can be highly variable both within and between populations. A 'seet' is often given in response to threats, perhaps mostly to brown-headed cowbirds attempting to parasitize the nest.

Life history activities in the San Luis Valley:

- Diet and foraging behavior: Yellow warblers are insectivores that spend a majority of their time gleaning their prey from surface of leaves or twigs as they are perched. The warbler will occasionally but rarely sally or hover to forage for prey.
- Breeding system: The warbler returns to its breeding territory in April with breeding beginning in the SLV in May and continuing into July. Many warblers return to the same area to breed year after year.
- Nesting: Nests consist of an open cup built in the fork of a shrub or tree branch. Warblers lay 3 to 4 eggs and rarely re-nest. One egg is laid per day within 10 minutes of sunrise. Incubation periods average about 10-12 days after the last egg is laid. Nesting may extend into August.
- Brood period: The young stay in the nest 8-12 days. The fledglings stay with the adults for about 3 weeks after fledging.
- Post-breeding: Disperse and begin migrating south in late August through September.

Yellow warbler SLV habitat, timing, and event

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riparian				Migration					Migration			
					Pre-Breeding							
					Nesting							
						Brood Rearing						
								Post-Breeding				

Habitat Requirements:

In the San Luis Valley, Yellow warblers use riparian areas characterized as wet, deciduous thickets. Specifically warblers prefer dense willow or early successional habitats in both the breeding and migration seasons.

Key public areas for warblers in the San Luis Valley: Rio Grande SWA, Higel SWA, McIntire/Simpson Management Area, Alamosa National Wildlife Refuge, Hot Creek SWA, Sego Springs SWA, and USFS, BLM, and state lands on any creek or river.

Management Recommendations:

Conservation in the San Luis Valley of Colorado is probably best accomplished with development and implementation of riparian management strategies and conservation of lands that protect river and stream reaches in areas that commonly support this species. Specific recommendations include:

- Providing a variety of structure, age class, and dense riparian cottonwood and willow forests.
- Promote regeneration of cottonwood and willow on conserved lands with willing landowners by incorporating management practices that prevent cattle grazing in

the riparian area until trees can withstand some browse (5 to 7 years), prevent mowing and haying of newly established trees.

- Work with private landowners to improve riparian health.

Monitoring Recommendations:

Monitoring of breeding warblers along streams, rivers, and canals that have appropriate habitat eg dense willow or other shrubs/trees would help determine breeding success, rate of parasitism, and potential effects of parasitism on success.

References:

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