Draft Environmental Assessment and Land Protection Plan

San Luis Valley Conservation Area

Colorado and New Mexico

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Prepared by

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In accordance with the National Environmental Policy Act and U.S. Fish and Wildlife Service policy, an environmental assessment and land protection plan have been prepared to analyze the effects of establishing the San Luis Valley Conservation Area in southern Colorado and northern New Mexico.

- The environmental assessment analyzes the environmental effects of establishing the San Luis Valley Conservation Area.
- The San Luis Valley Conservation Area land protection plan describes the priorities for acquiring 530,000 acres in conservation easements and a limited amount of fee-title within the project boundary.

Both documents, which stand alone, are contained within this volume.

Note: Information contained in the maps within these documents is approximate and does not represent a legal survey. Ownership information may not be complete.

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Abbreviations

BLM	Bureau of Land Management
CCP	Comprehensive Conservation Plan
CWCB	Colorado Water Conservation Board
EA	Environmental Assessment
LPP	Land Protection Plan
NEPA	National Environmental Policy Act
NAWCA	North American Wetland Conservation Act
NRCS	Natural Resource Conservation Service
NWR	National Wildlife Refuge
SLVCA	San Luis Valley Conservation Area
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
WRP	Wetland Reserve Program

Environmental Assessment Chapter 1 — Purpose of and Need for Action

This Environmental Assessment (EA) documents the purpose of and the issues, alternatives, and analysis for the proposed San Luis Valley Conservation Area (SLVCA). The SLVCA would be located largely in southern Colorado, but a small portion (less than 10 percent) would be in northern New Mexico. Section 1 provides background information and describes the conditions that led to the U.S. Fish and Wildlife Service (Service or USFWS) proposal to create the SLVCA for the protection of important wetland and upland habitats, primarily through conservation easements with willing landowners.

Introduction

The proposed SLVCA is a landscape-level strategic habitat conservation initiative within the Southern Rockies Landscape Conservation Cooperative. The SLVCA would encompass the headwaters and upper portions of the Rio Grande in southern Colorado and a small part of northern New Mexico. The San Luis Valley is a large intermountain valley bounded by the San Juan and Sangre de Cristo mountain ranges, whose rain shadows create high desert conditions in the region. However, the complex hydrology of the valley as well as the snowmelt runoff from the mountains have created a variety of dynamic wetlands and riparian corridors on the valley floor. These wetland areas support a diverse assemblage of plants and wildlife, including habitat for many trust species such as the southwestern willow flycatcher, western snowy plover, numerous species of migrating and nesting waterfowl, and 95 percent of the Rocky Mountain population of greater sandhill crane.

Anthropogenic [human-caused] practices such as agriculture have resulted in substantial changes to the hydrology of the San Luis Valley. These effects have been exacerbated in recent years by a changing climate and lower precipitation amounts. Surface and ground water diversions have significantly changed the amounts and timing of flows in most valley streams. In addition, ground water use has exceeded recharge rates in large portions of the valley. These factors, plus the impact of chronic drought, have resulted in a substantial loss of wetland habitat. Many of the remaining wetlands and their associated wildlife are maintained either as an accidental byproduct of agricultural water use or as an intentional habitat type through active manipulation such as irrigation with surface- and groundwater and the construction of dikes and ditches.

The remaining wetlands, and the low human population density associated with the largely agricultural economy of the valley, have resulted in the San Luis Valley's maintaining a significant portion of its biological value, particularly for migratory birds. However, rising agricultural costs, including those resulting from the recent requirement to augment surface flows to offset the impacts of ground water use, have led to an unsettled agricultural economy. The potential for farmers and ranchers to sell water rights from their lands or even convert current land use practices from agricultural to residential, industrial, or municipal uses will continue to grow and threaten the biological integrity of the San Luis Valley.

Proposed Action

The Service proposes to create the 5.2-million-acre SLVCA to conserve vital wildlife habitats and migration corridors through voluntary conservation easements and a limited amount of fee-title acquisition. The SLVCA acquisitions will focus on the protection of wetlands, riparian corridors, and certain uplands in the valley through the purchase of up to 500,000 acres of conservation easements. Up to an additional 30,000 acres of fee-title acquisition from willing sellers has been proposed and was approved as part of the Preliminary Project Proposal for this project. However, the present intent is to use fee-title acquisition only in limited circumstances to simplify the management of existing units of the National Wildlife Refuge System and when conservation objectives of those existing refuges clearly cannot be met using easements alone (e.g., acquisition of surface water rights for augmentation).

The lands protected via easement would remain in private ownership. These lands could continue to be grazed, hayed, farmed, or otherwise managed in accordance with current practices. However, subdivision and development would be restricted, subject to stipulations agreed upon by the landowner and the Service. Furthermore, exercise of water rights

associated with these lands could be changed only if the proposed changes would be beneficial to wildlife.

Unlike some other conservation areas of the National Wildlife Refuge System, in which objectives and the setting of priorities are largely based on modeling for one species or a guild of species, the SLVCA is intended to meet all the objectives of a complex geographic, ecological, and political environment. It therefore has a diverse range of goals:

- conserve, restore, enhance, and protect wetland and riparian habitat, an important breeding and foraging resource in the high mountain desert for migratory shorebirds, waterfowl, and neotropical passerine birds
- support the recovery and protection of threatened and endangered species that occur in the SLVCA, and reduce the likelihood of future listings under the Endangered Species Act by prioritizing key habitat for listed species and species that are candidates for listing
- protect the integrity of these habitats by preventing fragmentation and off-parcel sale of surface water
- conserve working landscapes based on ranching and farming activities that support a viable agricultural industry
- promote ecological resiliency and adaptive capacity by connecting together the existing network of public and private conservation lands
- protect, restore, or, when necessary, emulate the historic hydrologic regime of the valley to ensure the presence of wildlife habitat

The Service will phase in implementation of the overall project. We anticipate focusing first on the southern Sangre de Cristo mountains, with conservation on the valley floor to follow. During this comment period we want to hear from all interested parties and partners to ensure we understand and consider any concerns or comments about the acquisition of easements in these areas. A Habitat Conservation Plan for the southwestern willow flycatcher is currently in development by local governments and pertains to the valley floor. This and considerations about the actual easement language as it relates to water use and rights may take longer to resolve. These issues are less likely to be concerns in the southern Sangre de Cristo mountains. Therefore, we anticipate that, if the overall plan is approved, we will focus our initial implementation efforts there.

Decisions to Be Made

Based on the analysis provided in this draft EA and following public comment and revision, the Regional Director of the Service will make two decisions:

1. Determine whether the Service should establish the SLVCA, in accordance with its land protection planning policy.
2. If yes, determine whether the selected alternative will have a significant impact on the quality of the human environment. This decision is required by the National Environmental Policy Act (NEPA). If the quality of the human environment would not be affected, a "finding of no significant impact" will be signed and will be made available to the public. If the preferred alternative would have a significant impact, an environmental impact statement will be prepared to further address those impacts.

Issues Identified and Selected for Analysis

The Service solicited comments about the SLVCA from the public through direct mailings, news releases, public meetings, and direct contacts.

- On March 15, 2011, the Service opened a scoping period for the general public with the publication of a notice of intent in the Federal Register (FR Doc. 2011-5924). The notice of intent notified the public of the Service's intention to begin the co-planning and NEPA review for the Comprehensive Conservation Plan (CCP) and Land Protection Plan (LPP) for the San Luis Valley National Wildlife Refuge Complex.
- Public scoping meetings were held on March 29, 2011, in Alamosa, Colorado; March 30, 2011, in Monte Vista, Colorado; and March 31, 2011, in Moffat, Colorado. The scoping meetings were attended by approximately 50 people, many of whom provided input for the scoping process. Additionally, 14 written comments were received from organizations and members of the public.
- A press event and public meeting was held at Adams State College in Alamosa, Colorado, on January 4, 2012, at which the Secretary of the Interior, Ken Salazar, organized the presentation of several complementary initiatives for the San Luis Valley and Sangre de Cristo Mountains. One of these initiatives was landscape scale conservation, which the Director of the Service presented as being embodied by the SLVCA. Questions were answered

and comments taken at a breakout session following the main meeting.

The project's planning Web site <http://www.fws.gov/alamosa/planning> was established in early March 2011. The site provides information about meetings and downloadable versions of public documents. Individuals can also sign up to be on the project mailing list through the Web site.

During scoping, the CCP and LPP were still being planned simultaneously. However, the two plans have since been separated and the LPP process has been moved up to take advantage of conservation opportunities that may not exist in the future. As such, many of the issues identified during scoping are not specific or relevant to the LPP. The applicable topics and issues identified during the scoping process and during internal conversations among the SLVCA planning team are:

- The SLVCA must protect the wildlife habitat, specifically wetlands, riparian corridors, grasslands, and shrublands, of the San Luis Valley, while also maintaining the rural agricultural aesthetic that defines the region.
- What role can the conservation area play in protecting listed species and species of concern?
- How will the SLVCA affect water use in the valley?
- The SLVCA should not negatively affect private property rights in the valley.
- Develop partnerships for land protection.
- How will the public be able to use lands protected under the SLVCA?
- Ensure that the SLVCA planning process incorporates the importance of protecting cultural resources.
- How will the SLVCA increase the capacity to adapt to climate change on the existing refuges and habitat throughout the valley?
- The plan should account for air, soil, sound, and visibility effects.

Related Actions and Activities

The San Luis Valley contains many public lands and private protected areas, some of which are contiguous with other protected areas and some of which are isolated. As illustrated in Figure 1, several existing State, Federal, and private land trust programs promote the conservation of habitats in the SLVCA.

San Luis Valley National Wildlife Refuge Complex (Service)

The San Luis Valley National Wildlife Refuge Complex includes three existing units: the Alamosa, Baca, and Monte Vista National Wildlife Refuges (NWRs). These refuges were established for different purposes, as described in Section 1.1 of the LPP in this volume, and protect 12,026 acres, 92,500 acres, and 14,800 acres, respectively. All three refuges currently contain a variety of habitats, with a special emphasis on wetlands and riparian systems. Management practices include vegetation manipulation and the artificial movement of water. Limited water availability presents significant challenges, particularly given a changing climate and new State of Colorado requirements for ground water augmentation. A secondary goal of the SLVCA is to help restore the hydrology of the San Luis Valley both on and off existing refuges to help ameliorate some of this problem.

U.S. Forest Service (USFS)

The San Isabel and Rio Grande National Forests border the SLVCA to the north, east, and west. These forests contain nearly 3 million acres of public lands in the Sangre de Cristo, Saguache, and San Juan mountains. The forests contain habitat ranging from pinyon-juniper savanna up to alpine tundra and scree fields at elevations over 14,000 feet. Much of this is designated wilderness area. These national forests are important habitat for Federal trust species, including Canada lynx and Rio Grande cutthroat trout, and for non-listed but climate-change-imperiled species, such as American pika and white-tailed ptarmigan.

Bureau of Land Management (BLM)

Much of the land between the National Forest boundaries and the largely private valley floor is administered by the BLM as the San Luis Resource Area. The BLM is actively working to restore the historic playa wetlands in the South San Luis Lakes and Blanca Wetlands areas, the latter of which they have designated as an Area of Critical Ecological Concern. These intermittent wetlands are particularly important for migratory shorebirds, some of which nest in the valley, and are also a priority habitat for the Service.

National Park Service (NPS)

Bordering Baca NWR is the Great Sand Dunes National Park and Preserve (NPP). Together these comanaged NPS units protect approximately 150,000 acres, from valley floor rabbitbrush scrub and the tallest sand dunes in North America to peaks over 13,000 feet in the Sangre de Cristo Mountains.

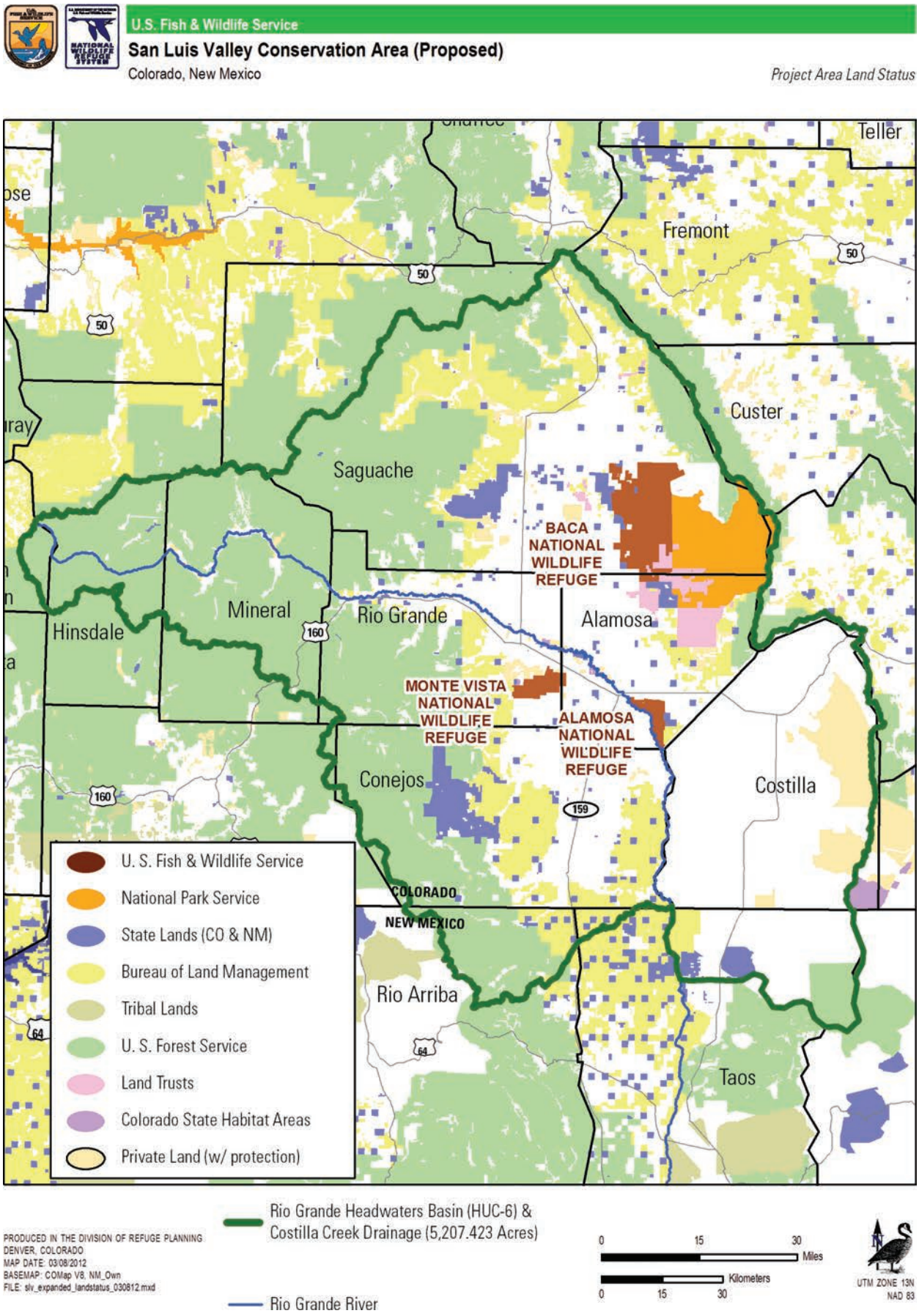


Figure 1. The SLVCA will be part of a broader network of public and private conservation lands.

Natural Resources Conservation Service (NRCS)

The NRCS actively works in the valley through its Wetlands Reserve Program, a voluntary easement program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. They do not own land in fee title, but rather provide technical and financial support to help landowners with their wetland restoration efforts.

State of Colorado

The State of Colorado owns thousands of acres throughout the project area, and also administers State Wildlife Areas and State Habitat Areas on many private lands. There are several school sections, managed by the State Land Board to provide revenue for K-12 education in the State. Some of these State Land Board parcels, such as La Jara Reservoir, allow recreational use as part of the Public Access program with Colorado Parks and Wildlife. There are a handful of regionally important wetlands and riparian corridors managed as State Wildlife Areas, including Russel Lakes; San Luis Lakes; and Rio Grande, Higel, and Hot Creek State Wildlife Areas. South of Baca NWR and west of Great Sand Dunes NPP is San Luis Lakes State Park, which provides important habitat for migratory birds as well as opportunities for wildlife-dependent recreation and watersports.

Land Trusts

Tens of thousands of acres are protected in either fee title or easement programs funded and/or administered by several conservation and land trust organizations, including but not limited to the Wetlands America Trust, The Nature Conservancy, the Rocky Mountain Elk Foundation, the Colorado Open Lands, the American Farmland Trust, Ducks Unlimited, the Rio Grande Headwaters Land Trust, and the Colorado Cattleman's Agricultural Land Trust. These organizations have many different objectives; some focus on the preservation of undeveloped agricultural land to provide resources for the future, some are interested in protecting specific wildlife resources such as wetlands, and some have cultural or recreational objectives. The efforts of each of these organizations complement each other as well as those being undertaken by public agencies, including the Service. The locations of easements on private land are largely confidential, but there are some important land trust properties held in fee title as well, such as The Nature Conservancy's Medano-Zapata Ranch, which borders Baca NWR and Great Sand Dunes NPP. This property is a 103,000-acre working ranch and is home to a herd of 2,500 bison that are managed to mimic natural grazing patterns in the high desert shrub and grasslands.

National Wildlife Refuge System and Authorities

The SLVCA will be part of the National Wildlife Refuge System, whose mission is "…to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Improvement Act of 1997). National wildlife refuges provide important habitat for native plants and many species of mammals, birds, fish, insects, amphibians, and reptiles. They also play a vital role in conserving threatened and endangered species. Refuges offer a wide variety of wildlife-dependent recreational opportunities, and many have visitor centers, wildlife trails, and environmental education programs.

Conservation of additional wildlife habitat in the SLVCA would be consistent with the following policies and management plans:

- Migratory Bird Treaty Act (1918)
- Migratory Bird Hunting and Conservation Stamp Act (1934)
- U.S. Fish and Wildlife Act (1956)
- Bald and Golden Eagle Protection Act (1962)
- Land and Water Conservation Fund Act (1965)
- Endangered Species Act (1973)
- Migratory Non-Game Birds of Management Concern in the U.S. (2002)
- Alamosa-Monte Vista National Wildlife Refuge Complex Comprehensive Conservation Plan (2003)
- Baca National Wildlife Refuge Conceptual Management Plan (2005)

The acquisition authorities for the proposed easements and property acquisition are the U.S. Fish and Wildlife Act of 1956 (16 U.S.C. 742a-j) and the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended. Land would be acquired with the use of the Land and Water Conservation Fund, which is derived primarily from oil and gas leases on the Outer Continental Shelf, motorboat fuel taxes, and the sale of surplus Federal property. The Service could also purchase land interest through the use of duck stamp revenue from the Migratory Bird Hunting and Conservation Stamp Act of 1934. There could also be additional money to acquire lands, water, and interests for fish and wildlife conservation purposes as identified by Congress or donations from nonprofit organizations. Any acquisition from willing sellers would be subject to available funding.

Chapter 2 — Alternatives

This chapter describes the two alternatives identified for this project:

- no-action alternative
- proposed action, giving the Service the authority to create the SLVCA

These alternatives were developed according to NEPA §102(2)(E) requirements to "study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternatives uses of available resources." The alternatives consider the effects of a conservation easement program with limited fee-title acquisition within the project area boundary identified in this EA.

In addition, alternatives that were eliminated from detailed study are briefly discussed.

Alternative A (No Action)

Under the no-action alternative, the areas outside of existing protected areas would largely remain in private ownership and subject to changes in land use or habitat type. Some additional protection is likely because of ongoing conservation easement initiatives in the San Luis Valley by public entities such as the NRCS and nongovernmental organizations such as the Colorado Cattleman's Agricultural Land Trust and the Rio Grande Headwaters Trust.

Alternative B (Proposed Action)

Under the proposed action, the Service would establish the SLVCA in southern Colorado and northern New Mexico. The project boundary encompasses approximately 5.2 million acres. Within this boundary, the Service would strategically acquire from willing sellers perpetual conservation easements on up to 500,000 acres and potentially acquire fee-title on up to 30,000 acres.

Conservation easements are both a cost-effective and politically effective means of land protection. They stem from the "bundle of rights" concept of land ownership (Merenlender et al. 2004), wherein, like severed surface and mineral rights for a given parcel, a portion of the land title is severed and transferred to a land trust or public agency for conservation purposes. They are quite popular for a variety of reasons. Because they allow the property owner to continue using the land, subject to agreed-upon stipulations, they protect working landscapes, which is a priority of the America's Great Outdoors initiative. Perpetual conservation easements provide a one-time source of income to the seller or a tax incentive to the donor, and can even be an estate planning tool (Engel 2007). In many cases, they can meet the conservation objectives of the Service without our incurring the costs associated with managing fee-title land; furthermore, the land remains on the county tax rolls. In the SLVCA, the Service seeks to protect up to 500,000 acres through conservation easements.

In instances where boundary adjustment or additional acquisition would simplify the management of or better meet the objectives of existing refuges (e.g. acquiring surface water rights for augmentation), the Service will consider the acquisition of up to 30,000 acres in fee title.

Potential easements or fee-title lands will be prioritized based on wildlife needs in the project area, which include areas of wetland, riparian, montane forest, and upland habitats. The Service may also investigate the possibility of acquiring properties with water rights whose protection may benefit habitat elsewhere in the valley. The LPP in the second part of this volume describes these priorities in detail.

Nothing in this alternative would preclude the subdivision of the SLVCA into separate management units to simplify the administration of easements and fee-title lands acquired as part of the SLVCA if deemed necessary by the Service.

Alternatives Considered but Eliminated from Further Analysis

Voluntary Landowner Zoning or County Zoning

Under this alternative, landowners would voluntarily petition their county commissioners to create a zoning district to direct the types of development that can occur in an area. An example of citizen-initiated zoning is when landowners would petition the county government to zone an area as agricultural, precluding certain types of nonagricultural development, such as residential subdivision or construction of a solar energy facility. However, zoning decisions are easily changed and thus do not ensure perpetual habitat protection. Also, agricultural zoning would be inadequate because water has become an increasingly expensive and limiting resource and it thus would not in itself stop continued conversion from flood-irrigated vegetation to less biologically diverse cultivated crops. This conversion has often been accompanied by the replacement of flood irrigation practices with center-pivot irrigation. Although center-pivot irrigation offers on-site water efficiency, it results in land cover that is far less suitable to wildlife than native vegetation or even flood-irrigated agriculture. Because of these reasons, this alternative was not investigated further.

Management by Others

A substantial portion of the SLVCA (some 44 percent) is under public ownership already; current land managers include the Colorado Parks and Wildlife, the Colorado State Land Board, the BLM, the NPS, the USFS, and the Service. Additional land is conserved in fee title by The Nature Conservancy, and conservation easements are held by Ducks Unlimited, Rio Grande Headwaters Trust, the NRCS, and the Colorado Parks and Wildlife, among others. There are active conservation initiatives underway by these organizations, but none has the scope necessary to achieve the conservation objectives of the SLVCA, nor do other organizations have the same wildlife habitat objectives.

Fee-Title Acquisition Only

Much of the publicly owned land mentioned in the previous section has been managed for conservation purposes for decades; indeed, Great Sand Dunes NPP was originally established in 1932 as a National Monument. Fee-title ownership allows the strongest protection for the habitat and allows the greatest flexibility for adaptive management in response to new data or changing conditions. However, acquisition of new public land on the scale of the SLVCA is politically untenable and, given the low appropriation of Land and Water Conservation Fund monies, it is also financially unrealistic. For these reasons as well as the expense of managing additional public lands, it is the Service's policy to acquire the minimum interest necessary to reach conservation objectives.

Conservation Easements Only

Conservation easements can be used to achieve conservation objectives while preserving working landscapes, such as farms and ranches. They are more cost effective, socially acceptable, and politically popular than acquiring fee-title land, and often promote the preservation of the unfragmented, quality habitat we seek to protect. However, there may be circumstances in which the Service's goals may not be met with an easement-only conservation area, particularly in circumstances where acquisitions would serve to enhance the management efficiency of existing national wildlife refuges or to secure water rights to benefit wildlife on existing refuges.

Chapter 3 — Affected Environment

This chapter describes the biological, cultural, and socioeconomic resources of the SLVCA that could be affected by the no-action alternative (alternative A) and the proposed action (alternative B). The SLVCA consists of 5.2 million acres within the Southern Rockies and Arizona/New Mexico Plateau ecoregions (U.S. Environmental Protection Agency 2011). The project encompasses significant portions of seven counties in southern Colorado as well as small parts of two counties in northern New Mexico. Just over 50 percent of the total project area is publicly owned; however, the distribution of public/private ownership is uneven, with over 90 percent of Mineral County administered by the USFS, but less than 1 percent of Costilla County in State or Federal ownership. The project boundary is defined by the headwaters hydrologic unit (HUC 6) of the Rio Grande.

Because of the nearly 7,000 feet in elevation change across the project area, the SLVCA contains a diverse array of plant communities, ranging from rabbitbrush scrub and playa wetlands on the valley floor to alpine tundra and scree fields on the peaks of the surrounding mountains. As described in detail in this chapter, the habitats of the valley and surrounding mountains are crucial to the breeding and migration of migratory birds, and provide important opportunities for persistence or reintroduction of populations of imperiled species that are protected under the Endangered Species Act.

Physical Environment

Geology

The San Luis Valley is part of the much larger Rio Grande Rift Zone, which extends from southern New Mexico northward through the San Luis and Upper Arkansas valleys to its northern termination near Leadville, Colorado (McCalpin 1996). The San Luis Valley is bordered on the east by the linear Sangre de Cristo Mountains, which were created by extensive block faulting during the Laramide Orogeny. The north-northwest portion of the valley is bordered by the southernmost reach of the Sawatch Mountains. The west side of the valley is flanked by the San Juan Mountains, the result of extensive Tertiary-aged volcanism. In sharp contrast to the steeply rising mountains on the eastern side of the valley floor, the Oligocene volcanic rocks of the San Juan Mountains dip gently eastward into the valley floor, where they are interbedded with valley-fill deposits. Valley-fill deposits consist of sedimentary rocks that inter-finger with volcanic deposits. Quaternary deposits include pediments along the mountain fronts, alluvium, and sand dunes (USFWS 2011).

Minerals

Sand and gravel are the major mineral commodities mined in the vicinity of the San Luis Valley. Rock, sand, and gravel mines are scattered throughout the valley, but are concentrated around the cities of Alamosa and Monte Vista and the town of Del Norte, Colorado. No coal mining permits are active in the SLVCA (Colorado Division of Reclamation, Mining, and Safety 2012). Other minerals that are mined in the area include gold, silver, peat, and limestone. There is also nascent oil and gas exploration in the valley (USFWS 2011).

Water and Hydrology

Surface Water

The SLVCA contains the upper headwaters of the Rio Grande watershed (Figure 2). Because of its position in a high-mountain desert, the valley floor receives little precipitation, and most surface and ground water is a result of runoff from the surrounding mountains. There are numerous perennial and intermittent drainages that descend from the Sangre de Cristo and San Juan Mountains. Some of the larger waterways include the Conejos, San Antonio, and Rio Grande rivers.

A portion of the northern valley, known as the Closed Basin or Sump, does not contribute water to the Rio Grande. The Closed Basin may have formed in the middle Pleistocene when the lake that filled the valley began to dry up, resulting in an environment of swamps and organic-rich sediments. Mayo et al. (2006; as cited in USFWS 2011) refer to the Closed Basin of Pleistocene time as the "ancestral sump." Currently, the Closed Basin covers approximately 2,940 square miles in the northern part of the valley and is separated from the rest of the valley by a low alluvial fan. The Closed Basin is composed of the San Luis and Saguache creek drainage basins. Water enters the Closed Basin through precipitation and snowmelt from the 4,700 square miles of watershed in the surrounding

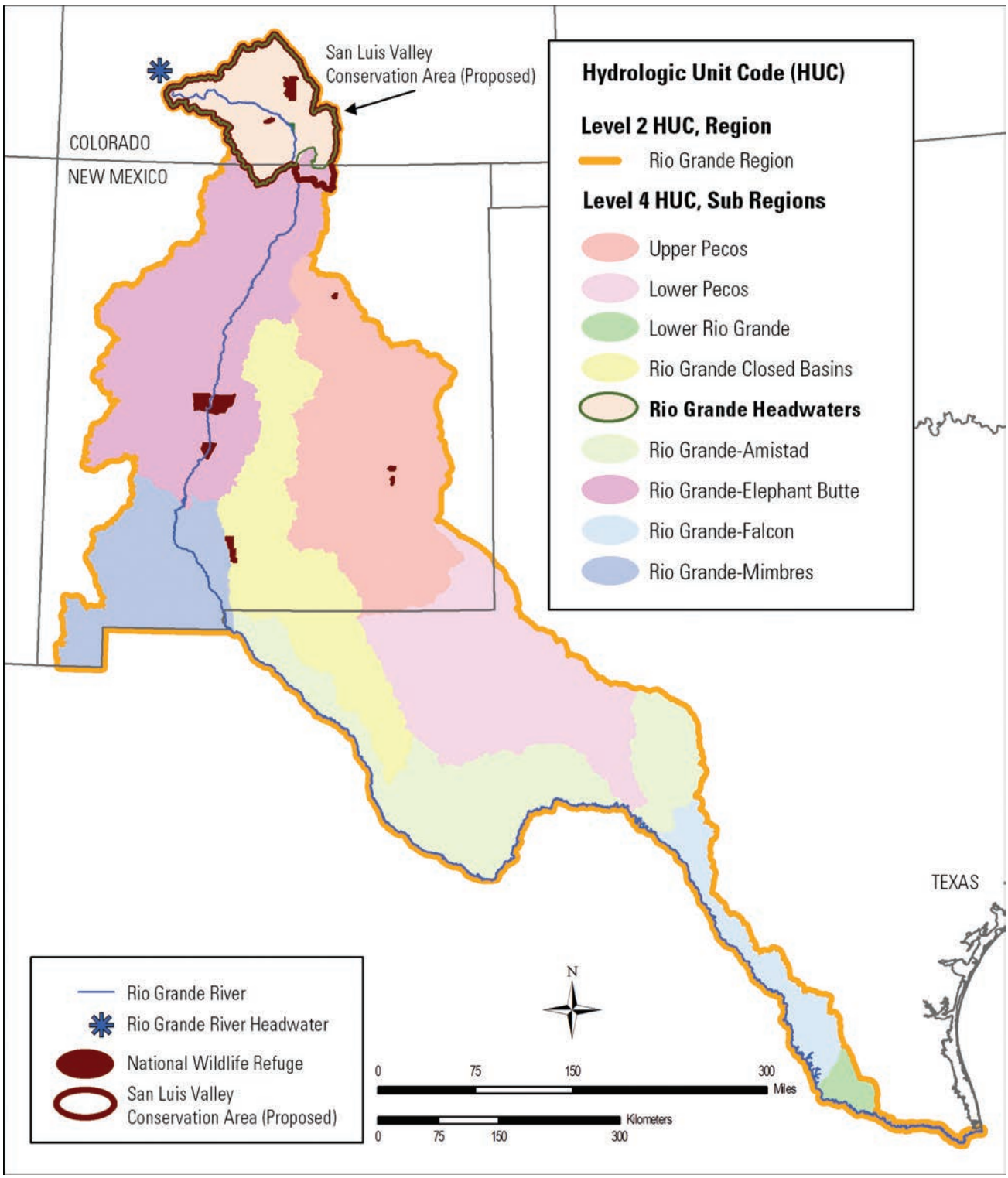


Figure 2. The SLVCA captures the upper headwaters of the Rio Grande, the fourth longest river in the United States.

mountains. Water exits primarily through evapotranspiration. Approximately 7,000 miles of stream channels and ditches flow through the valley. Surface water flows into San Luis Creek, which flows generally to the south. There is no outlet, so water is impounded in San Luis Lake and associated lakes in an area south of the Baca NWR (USFWS 2011).

Groundwater

The project area is in the San Luis Valley portion of the Rio Grande Aquifer System. The San Luis Valley is the northernmost portion of the aquifer system that stretches from Saguache County, Colorado, to West Texas (Robson and Banta 1995). The San Luis Valley is estimated to contain more than 2 billion acre-feet of ground water in storage, with more than 140 million acre-feet estimated to be recoverable. The principal use of groundwater is agricultural (USFWS 2012).

The thick basin-fill deposits in the San Luis Valley consist of interbedded clay, silt, sand, gravel, and volcanic rock. These form many separate aquifer systems, which are generally grouped into two major aquifers, a shallow unconfined aquifer and a deep confined aquifer, though the lines between these features are not absolute. Combined, these two aquifer systems are contained in valley-fill that can be as much as 30,000 feet thick (Brendle 2002). The unconfined aquifer is separated, but not totally disconnected, from the confined aquifer by clay layers and lava flows. The unconfined aquifer is recharged through infiltration of precipitation, irrigation water, runoff, and upward seepage of ground water from the confining bed. Discharge from the unconfined aquifer is from ground water withdrawals, ground water flow to the south, discharge to streams or drains, and evapotranspiration. Water levels in the unconfined aquifer respond to local climatic events and fall or rise with the availability of precipitation. Wells drilled into the deep confined aquifer are artesian and are buffered from climatic conditions. The confined aquifer is recharged from precipitation and snowmelt in the high San Juan Mountains and Sangre de Cristo Mountains. Discharge from the confined aquifer is from ground water withdrawals, ground water flow to the south, and upward leakage through the confining bed (USFWS 2012).

A third aquifer system covers approximately 3,000 square miles in the Closed Basin in the northern part of the valley. This aquifer system has no natural surface water drain. The U.S. Bureau of Reclamation's Closed Basin Project extracts ground water from the sump. The water levels in the unconfined aquifer in the Closed Basin are declining and ground water withdrawal is exceeding recharge (Rio Grande Water Conservation District 2012). Ground water from the Closed Basin Project is carried in the Closed Basin Canal, which starts in the central San Luis Valley, passes south through Baca NWR, and ends at the Rio Grande on Alamosa NWR land. Salvaged Closed Basin ground water helps Colorado meet its interstate compact with New Mexico and Texas (USFWS 2012).

Climate

The climate of the San Luis Valley is consistent with its high mountain desert setting, with substantial 24-hour temperature swings due to cold air drainage from the surrounding mountains. This cold air also creates winter overnight temperatures that are often much lower than at many other places at similar elevations and latitudes. The mid-January high averages 34°F while the low averages -2°F, and the mid-July high averages 83°F while the low averages 37°F.

Precipitation in the valley is strongly influenced by the surrounding mountains. The windward side of the mountain ranges, particularly the San Juan Mountains, receives a substantial amount of orographic precipitation, which is caused when air masses rise and subsequently cool, dumping their precipitation at higher elevations. This results in a marked rain shadow effect on the lee side of the mountains, with annual precipitation in Alamosa averaging 7.25 inches per year (National Weather Service 2012).

Biological Environment

Plant Communities

The vegetation across the project area varies greatly, depending on hydrology, slope, aspect, and elevation. See Figure 3 for an overview of general landcover. The San Luis Valley's hydrology is strongly influenced by the surface runoff and ground water flows from the surrounding mountains. This hydrology has created a network of riparian corridors and wetlands that break up large expanses of associated desert and upland habitats across a 7,000-foot elevation gradient, resulting in high plant diversity. The six Colorado counties that constitute the majority of the project area (Saguache, Mineral, Rio Grande, Costilla, Conejos, and Alamosa) contain 1,132 species of plants (Appendix B; Colorado State University Herbarium 2012), which is more than a third of the total plant species present in Colorado.

Wetlands

Wet Meadows. Wet meadow habitat is naturally present in the San Luis Valley in areas that have shallow water tables and areas that are periodically shallowly inundated early in the growing season. Wet meadows are the most widespread wetland type in the San Luis Valley. Dominant plants include Baltic rush, hair grass, and sedges. Most of the naturally occurring wet meadows have been modified by changes in water use, but in some areas wet meadows have also expanded due

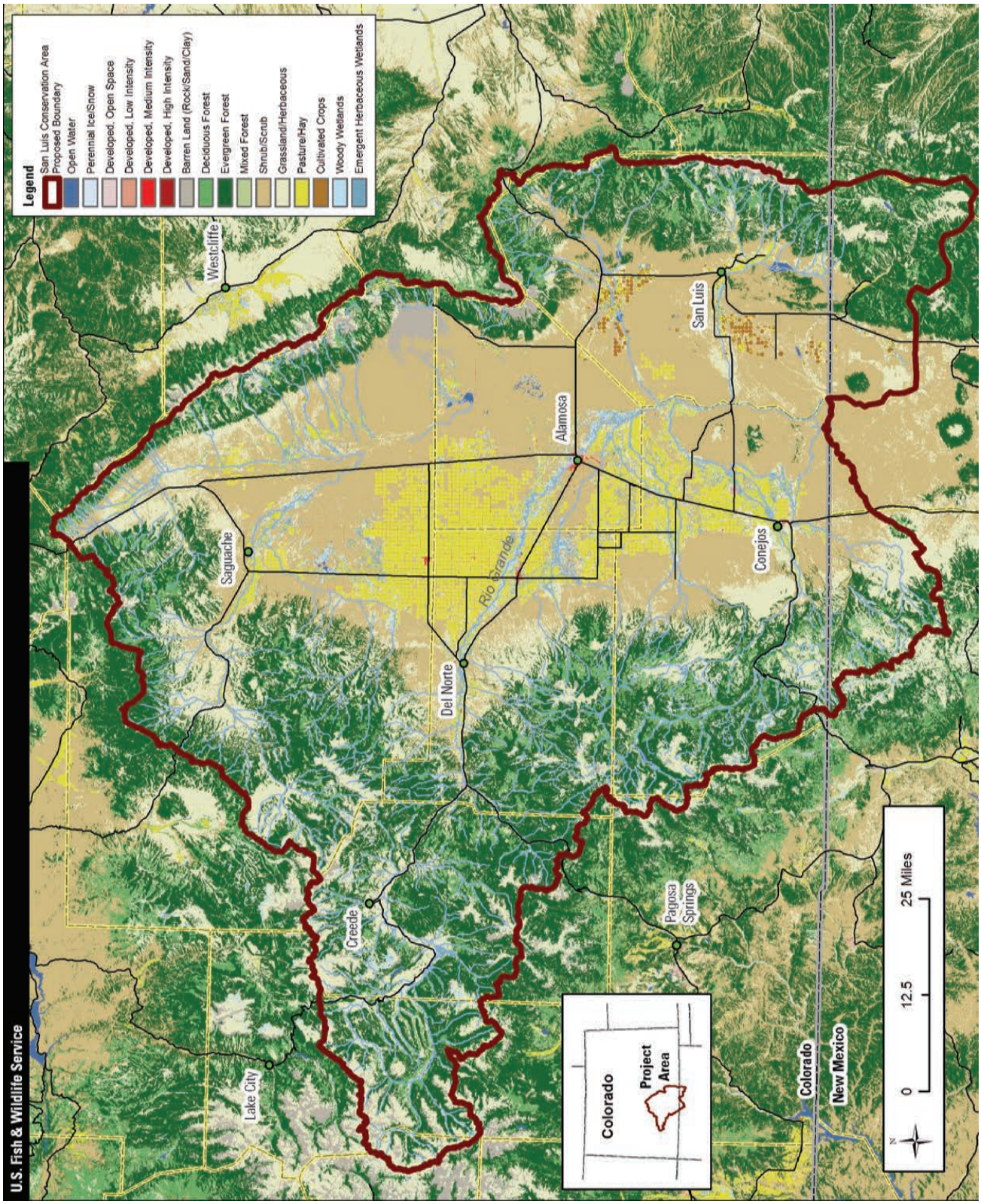


Figure 3. An overview of the basic land cover and vegetation in the SLVCA.

to artificial irrigation for hay fields and cattle grazing. These agricultural uses, while not without their own problems, do create habitat for a variety of wildlife (USFWS 2005).

The combination of plant structure and density coupled with water depth and duration creates rich habitat diversity within each larger area of wet meadow. This richness of habitat creates tremendous foraging and nesting opportunities for a variety of bird species. Among these are numerous species of waterfowl as well as sora, Virginia rail, white-faced ibis, American avocet, Wilson's snipe, and Wilson's phalarope. Wet meadows provide critical roosting and foraging areas for the Rocky Mountain population of greater sandhill cranes, which migrate through the valley in the spring and fall. Wet meadows also provide habitat for a variety of regionally rare or unusual amphibian species, such as northern leopard frog and Plains spadefoot toad (USFWS 2005). Also present in this habitat, particularly in areas of alkali soils, is the somewhat rare slender spiderflower, which once had a wide range in the southern Rocky Mountains but now occurs almost exclusively in the San Luis Valley.

Playa Wetlands. Playa wetlands form in areas where streams flow into closed basins, in areas where seasonally high water tables result in surface discharge or capillary flow from aquifers, or both (Rocchio 2005). In the San Luis Valley, playa wetlands are found both in the closed basin at the termini of San Luis and Saguache Creeks on and near the Baca NWR, and in and around the Blanca Wetlands, which are managed by BLM. These wetlands are ephemeral or temporary, and since the water regime of the valley has been altered by human activity, they may remain dry in years of below average precipitation. The ephemeral nature of these wetlands adds to their uniqueness and their high productivity when inundated. During wet years, playas fill with rainfall during thunderstorms and with runoff from spring snowmelt in the surrounding mountains, and then slowly dry until the next wet season. This flooding and drying cycle provides for the nutrient cycling conditions ideal for invertebrates such as tadpole shrimp, which is a valuable food resource for wildlife, particularly migratory shorebirds. In particularly wet years, these wetlands are some of the most productive wetlands in the valley (Cooper and Severn 1992, as cited in USFWS 2005). Greasewood and rubber rabbitbrush with an understory of saltgrass and western wheatgrass typically surround pans that are bare or vegetated with saltgrass. Barren salt flats may be a component of playa wetland systems and can be important to foraging and nesting shorebirds (USFWS 2005).

Seasonal and Semipermanent Wetlands. Seasonal and semipermanent wetlands have hydrologic regimes that allow for the persistence of water throughout the growing season. Water in these areas is often deeper than 1 foot. Semipermanent wetlands may have substantial areas of open water with aquatic vegetation beds, and are often fringed by tall emergent vegetation (Figure 4). Tall emergent wetlands can also be seasonal and are typically dominated by bulrush and cattails.

Figure 4. Dozens of species of migratory waterbirds forage and/or nest in seasonal and temporary wetlands.

Swimming birds, including grebes, coots, and waterfowl, as well as aerial species such as swallows and terns, use open water areas of these wetlands for foraging. Emergent vegetation provides breeding habitat for diving and dabbling ducks, Canada geese, American bitterns, snowy and cattle egrets, black-crowned night herons, white-faced ibis, and marsh passerines such as marsh wrens, common yellowthroats, and yellow-headed blackbirds. Northern harriers and short-eared owls will also nest in residual patches of tall emergent vegetation. Tall emergent wetlands with a high density of sedges and a shallow seasonal water regime host rails and provide nesting sites for dabbling ducks.

Riparian Habitats

Riparian habitat includes trees, shrubs, and other streamside vegetation and is associated with intermittent and perennial waterways (Figure 5). This community may flood every year. Its historic extent on the valley floor has been reduced due to surface water diversion. Woody riparian habitat is sensitive to excessive grazing, which limits regeneration of the dominant willows and narrowleaf cottonwood trees. Shrubs that contribute to the structural diversity of riparian habitat include red-osier dogwood and greasewood.

These shrublands and forests provide important stopover habitat for migratory passerines, as well as nesting habitat for species such as Lewis' woodpecker, willow flycatcher, and possibly yellow-billed cuckoo. In addition, the shade and stream bank stabilization provided by riparian vegetation is important in maintaining temperature and water quality in streams and rivers for species such as the endemic Rio Grande cutthroat trout, Rio Grande chub, and Rio Grande sucker.

Upland Vegetation

Semi-desert Shrublands and Grasslands. Shrublands are the most common natural vegetation on the San Luis Valley floor. Many of the plants within these communities are drought resistant and tolerant of high soil salinity. These shrublands are characterized by an open to moderately dense assemblage of rubber rabbitbrush, greasewood, fourwing saltbush, shadscale, and winterfat. Also present in these communities are yucca, cactus, and various grasses. At slightly higher elevations than these, rabbitbrush shrublands are desert scrub and shrub-steppe habitats that have a significant cover of big sagebrush and/or sand sagebrush and that intergrade with the pinyon-juniper woodlands above. Grasses in these areas include Indian ricegrass, alkali sacaton, western wheat grass, and blue grama.

Bird diversity and density tend to be relatively low in semi-desert shrublands due to structural and floristic simplicity (Wiens and Rotenberry 1981). Species common to this habitat include the horned lark, mourning dove, western meadowlark, and loggerhead shrike. Upland grassland habitats have the potential to support grassland-dependent species such as burrowing owl, long-billed curlew, and a variety of sparrows. The sagebrush-dominated habitats are also home to

Figure 5. The riparian corridors of the San Luis Valley serve as wildlife corridors and provide nesting habitat for the endangered southwestern willow flycatcher.

the declining sage thrasher and the Endangered Species Act candidate Gunnison sage-grouse.

Montane Forests. Above the semi-desert shrubland, the vegetation transitions into pinyon-juniper woodland. This open-canopy forest is dominated by pinyon pines and junipers, with an understory consisting of shrubs and grasses. According to the Colorado Natural Heritage Program, this woodland's threat status is "fair" and its protection status is "poor-fair." Pinyon-juniper woodland is particularly threatened by the spread of invasive grasses that increase its susceptibility to fire (Colorado Natural Heritage Program and The Nature Conservancy 2008). Much of the existing pinyon-juniper woodland in the San Luis Valley is managed by BLM, though there are extensive stands on private lands in Costilla County. Pinyon jays are obligate nesters in the pinyon-juniper woodlands; although their population is stable in Colorado, they are effective indicators of forest health and are therefore a priority species for Partners in Flight throughout the intermountain west (Colorado Partners in Flight 2000). Other pinyon-juniper associated species include black-throated gray warbler and juniper titmouse.

As the elevation increases, the forest becomes a mixed conifer forest, sometimes with an aspen component, and finally becomes a subalpine spruce-fir forest. The vast majority of land at the higher elevations is under the management of the USFS, with the exception of areas of Costilla County, where it is largely part of a handful of large private ranches. These forests are home to a number of bird species, including olive-sided flycatcher, yellow warbler, and mountain chickadee. These higher elevation forests also provide habitat and migration corridors for a number of important large mammals such as elk, black bear, and the threatened Canada lynx.

Wildlife

The diverse mix of wetland, riparian, shrubland, and forest habitats throughout the SLVCA provide for the habitat needs of many assemblages of reptiles and amphibians, aquatic species, birds, and mammals, including several species of special concern. Appendix B lists the wildlife species found in the San Luis Valley and surrounding mountains.

Amphibians and Reptiles

The San Luis Valley is a cold desert, so it supports only a limited number of reptiles and amphibians. The large areas of semi-desert shrubland and the scattered wetlands and riparian areas are home to a handful of snakes and lizards as well as the snapping turtle. The arid nature of the region restricts amphibians largely to wetlands and riparian corridors; these areas provide habitat for tiger salamander and seven species of frogs, toads, and spadefoot toads. Among the latter group is the boreal toad, a high-elevation toad that appears to have declined substantially due to infection by Batrachochytrium dendrobatadis, a pathogenic fungus. This species is State listed as endangered by both Colorado and New Mexico (Colorado Parks and Wildlife 2012).

Fish and Aquatic Species

The project area contains the headwaters of the Rio Grande. The Rio Grande and its tributaries, the streams of the San Luis Closed Basin, and the valley's marshes are home to several native fish as well as a range of introduced species. Most of the challenges faced by these aquatic species are a direct result of anthropogenic changes to the hydrology of the valley, not the least of which are water diversions. These impacts have been magnified by persistent drought conditions since the 1990s. The SLVCA easement program will assist in the conservation of these species by ensuring that water use is tied to the land on which the easement is purchased.

The Rio Grande chub is thought to have once been the most common fish throughout the Rio Grande drainage and in the San Luis Closed Basin, but it has been extirpated in much of its range, including from the main stem of the Rio Grande. The Rio Grande chub is now found in several small streams in the San Luis Valley, including Crestone Creek on Baca NWR. The Colorado Natural Heritage Program considers the Rio Grande chub to be an S1 (critically imperiled) species. It is thought to have declined due to habitat fragmentation by impoundments for diversions, habitat destruction due to poor land use practices, and predation by, and competition with, introduced fish species (Rees et al. 2005a).

The Rio Grande sucker had a historic range similar to that of the Rio Grande chub, and faces similar threats. It appears to have been particularly hard hit by competition with the introduced white sucker. At one point, the Rio Grande sucker was reduced to a single population in Hot Creek in Conejos County, Colorado, but it has since been reintroduced to several additional streams. It is considered a State endangered fish in Colorado (Rees et al. 2005b).

In historical times, Rio Grande cutthroat trout (Figure 6) were found in large numbers in the main stem of the Rio Grande and its major tributaries, such as the Conejos River; one account from the Conejos River in 1877 states that "fishing was so successful… our catch amounted to over a hundred pounds by mid-afternoon," which the fishermen shipped off to a restaurant in Denver (Sanford 1933). At present, the native trout are restricted to high-elevation streams descending from the San Juan and Sangre de Cristo Mountains. The Rio Grande cutthroat trout occupies approximately 10 percent of its historic range. Threats to the species include competition and hybridization with, and predation by, introduced trout; reduction in habitat quality due to water diversions and other

hydrological changes; and changes in stream temperature due to human water use and global climate change.[1] It is currently a candidate species under the Federal Endangered Species Act; a decision on whether to list the species is due in 2014.

Figure 6. The Rio Grande cutthroat trout, once found throughout the Rio Grande and Pecos River watersheds, is now only found in scattered cold water, high elevation streams .

Some 57 species of non-native fish have been introduced to the San Luis Valley, either as naturalized aquarium fish, escaped aquaculture species, or intentionally introduced sport fish. The latter category includes rainbow, golden, brook, and brown trout; northern pike; bluegill; pumpkinseed; yellow bullhead; common carp; large and small mouth bass; blue, flathead, and channel catfish; walleye; and yellow perch. Non-game species such as white suckers, Mozambique tilapia, grass carp, American eel, and even neotropical tetras and armored catfish have become naturalized in the Rio Grande drainage as well (USGS 2012).

Birds

The wetlands, riparian corridors, uplands, and forests of the SLVCA provide habitat for at least 274 species of birds. Some of these birds are year-round residents, but many migrate through the valley on their way to and from wintering and breeding grounds while others come to the valley to breed or spend the winter. Among the migratory species are neotropical migrants that winter in Central and South America and breed in North America. Riparian corridors and forests are particularly important to these species. Cordilleran flycatchers breed in forested areas of the SLVCA, including cottonwood riparian forest. These gallery riparian forests are also thought to host a limited number of yellow-billed cuckoos, a Federal candidate for listing as endangered. Olive-sided flycatchers breed in the coniferous forests of the mountains surrounding the valley. The southwestern willow flycatcher (shown in Figure 7), a subspecies of the more widespread willow flycatcher, breeds in shrub riparian and tree riparian with a willow understory; the southwestern willow flycatcher is federally and State listed as endangered. Examples of other neotropical migrants in the SLVCA include two species of phoebe, several additional flycatchers, western tanager, gray catbird, Bullock's oriole, and many species of warblers.

Figure 7. The endangered southwestern willow flycatcher nests in the willows along the Rio Grande and its tributaries .

Passerines are not the only migrants to make use of the area. Black-necked stilts and American avocets are shorebirds that migrate from winter ranges in Mexico and Central and South America to breed in the wetlands of the San Luis Valley. At least 25 other species of shorebirds use these wetlands as either stopover or breeding habitat. Six of these shorebirds, including the snowy plover, which breeds in the playa wetlands of the Closed Basin, are either focal species for the USFWS Migratory Bird Program and/or are USFWS Region 6 Birds of Conservation Concern. Given the scarcity of water in high desert and mountain environments, it is perhaps not surprising that the San Luis Valley

1 *76 Federal Register No. 207, Wednesday, October 26, 2011. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions. 66403*

is regionally important to both resident and migrant waterbirds. The marshes of the valley support 27 species of waterfowl. Approximately 30 percent of the cinnamon teal that summer in Colorado breed in the valley (S. Johnson, USFWS Migratory Birds, personal communication 2012). The secretive American bittern breeds in the valley, and has experienced population declines throughout its range, likely due to wetland disturbance. The white-faced ibis breeds in wet meadows and makes extensive use of natural and agricultural habitats in the valley. Nearly the entire Rocky Mountain population of sandhill cranes uses the San Luis Valley as migratory stopover habitat, particularly on and around the Monte Vista NWR, where they are the focus of an annual crane festival and a draw for thousands of tourists every year (Figure 8). Rookeries of great blue herons, snowy egrets, and black-crowned night-herons are also present. Conservation of wet meadow, playa, and emergent wetland habitat is crucial for these species.

The San Luis Valley hosts an array of diurnal raptors and owls throughout the year. Prairie falcons are common year-round residents and use uplands extensively for feeding and resting. The trees and snags along waterways are nesting sites for great horned and long-eared owls, red-tailed hawks, American kestrels, and Swainson's hawks (USFWS 2011). The latter species is a bird of conservation concern in USFWS Region 6 and is known to be sensitive to habitat fragmentation. Northern harriers and short-eared owls nest in wet meadows and emergent wetlands. These two species as well as ferruginous hawks, rough-legged hawks, and golden and bald eagles overwinter in the valley, where they forage for small mammals and other prey in riparian areas, uplands, and short-emergent wetlands where cover is abundant (USFWS 2011). The higher elevation portions of the project area are home to the northern goshawk, a generalist predator of rodents and birds that inhabits the montane forests of the surrounding mountains. It is probable that the forested canyons above the valley floor provide habitat for the Mexican spotted owl; this species is both State (Colorado) and federally listed as threatened, although no designated critical habitat for the species occurs in the project area.

The San Luis Valley is also in the eastern corner of the sagebrush region of the Intermountain West (Pitkin and Quattrini 2010) and, as such, has some strongly sagebrush-associated or sagebrush-obligate bird species, meaning that these species have life history needs

Figure 8. The wetlands and fields of the SLVCA are an important stopover habitat for migrating sandhill cranes.

that cannot be met in other habitats. The Gunnison sage-grouse has a small population at the north end of the San Luis Valley (D. Reinkensmeyer, personal communication with M. Dixon, February 2012). This species is currently a candidate for listing under the Federal Endangered Species Act and is a species of special concern in Colorado. Gunnison sage-grouse likely had much broader distribution than they do at present (Schroeder et al. 2004), and the Colorado Parks and Wildlife has identified that some of this former range is still potential habitat for the species (Gunnison Sage-Grouse Rangewide Steering Committee 2005). This potential range is mostly in Conejos and Costilla Counties, Colorado, but since the area of potential habitat crosses the State border, there is also some potential habitat in Rio Arriba and Taos Counties, New Mexico. Sage sparrows have similar habitat associations, preferring sagebrush-dominated habitats with open to closed canopies (Williams et al. 2011). Sage thrasher is another denizen of the upland shrub habitats of the valley, including sagebrush and rabbitbrush scrub. It is a USFWS Migratory Bird focal species and a USFWS Region 6 species of concern. It is thought that the primary reasons for the decline of Gunnison sage-grouse are the loss and fragmentation of sagebrush habitat (Oyler-McCance et al. 2001), so this species is likely to benefit from the protection of remaining potential habitat that the proposed action would provide. Given the overlap in habitat needs of sage grouse and other sagebrush obligates (Rowland et al. 2006), species like sage thrasher and sage sparrow would likely benefit from conservation of sagebrush and steppe habitat as well.

Mammals

The arid uplands, wetlands, and stream and river corridors of the SLVCA provide habitat for large game species, including pronghorn, elk, and mule deer. The higher elevations hold Rocky Mountain bighorn sheep. American bison were once an important component of both the San Luis Valley ecosystem and the socioeconomic system of the Ute and Pueblo peoples; however, the last bison were extirpated from the San Luis Valley by 1870 (Colville 1995). The Nature Conservancy currently manages a bison herd on their Medano-Zapata Ranch as a means of simulating natural grazing regimes; however, their stated goal is to introduce a free-ranging genetically pure bison herd of at least 3,000 animals to the valley by 2015 (The Nature Conservancy 2008). These megafauna provide opportunities for hunting and wildlife viewing, but are not without controversy. Perceived overpopulation of elk, in particular, is contentious among farmers and ranchers in the valley, who are concerned about the crop damage and competition for forage between elk and cattle. The elk herd on the east side of the valley (Figure 9) has been estimated to number approximately 5,000 animals (R. Rivale, Wildlife Biologist – CPW, personal communication, cited in USFWS 2005). A recent study of elk carrying capacity in the Great Sand Dunes ecosystem found that, under current management practices, the carrying capacity of the region should be 6,104 elk (Wockner et al. 2010). Development of plans for elk management in the valley is ongoing.

Small mammals in the SLVCA are those typical of the greater southern Rockies ecosystem. Riparian areas and marshes provide resources for beaver and common muskrat. Forested areas are home to North

USFWS

Figure 9. The semi-desert shrublands and adjoining Sangre de Cristo Mountains near Baca NWR are home to thousands of elk.

American porcupine and snowshoe hare. Uplands contain other rabbits, such as white-tailed jackrabbits and mountain cottontails, as well as the Ord's kangaroo rat. In the highest reaches of the project area, primarily above the tree line, are the charismatic American pika and the vocal and inquisitive yellow-bellied marmot. Of conservation concern is the Gunnison's prairie dog, which inhabits the valley floor. This species has suffered a sharp decline for reasons that include human persecution and outbreaks of plague. It is a candidate for Federal Endangered Species Act protection, and a listing decision will be made following a genetic re-evaluation of its taxonomic status.[2]

The aforementioned species serve as prey for several predator species in the project area. Black bear is a generalist omnivore whose flexibility makes it common in many habitat types in the valley. Coyote is often found hunting small mammals and occasionally larger prey throughout the study area. Similarly, both mountain lion and bobcat are quite catholic in their habitat needs, though the mountain lion has much larger home ranges and tends to specialize in hunting ungulates, whereas the bobcat is more opportunistic. In contrast to those two cats, the State endangered and federally threatened Canada lynx is largely a specialist predator of snowshoe hare; in the SLVCA, it is primarily found in the spruce-fir forests of the Sangre de Cristo and San Juan Mountains, where its preferred prey are found.

The grizzly bear once roamed the mountains of the area but was extirpated from Colorado in the early 20th century; the San Luis Valley grizzlies are remembered now as the mascot of Adams State College in Alamosa, Colorado. Similarly, the gray wolf historically hunted the San Luis Valley and surrounding mountains, but was extirpated from Colorado by 1945 (though it is still State and federally listed as endangered in Colorado). A mounting body of research demonstrates the potential ecological benefits of natural or human-facilitated reintroduction of wolves, particularly on vegetation adversely affected by unnaturally high elk browsing (Ripple and Beschta 2012). However, this possibility was received with opposition by some local ranchers and some members of the big game hunting community during scoping meetings for the CCP for the San Luis Valley NWR Complex in 2012; reintroduction will be discussed as part of one alternative during the NEPA review for the CCP.

Finally, the SLVCA is home to nine species of bats. All are insectivorous and hunt primarily by capturing insects in flight. The hoary bat and silver-haired bat are solitary tree-roosting bats that are present in the San Luis Valley during the summer and migrate to warmer climates during the winter. The presence of mature cottonwood riparian forests likely maintains their presence on the valley floor. The migratory Mexican free-tailed bat has an exceptionally large summer colony of approximately 100,000 individuals (Freeman and Wunder 1988) in the historic Orient Mine in the northern San Luis Valley. The remaining species are either resident or regionally migratory hibernators.

2 *Federal Register 76, No. 207. October 26, 2011. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions. 66389*

Cultural Resources

On the hottest days it is cool in the shade, and on the very coldest days it is comfortable in the sunshine.

—Geologist C.E. Siebenthal, describing the San Luis Valley in 1910

Humans have inhabited the San Luis Valley for over 12,000 years. Their uses of the land reflect both the traditions of those who moved to the valley and local adaptations. The following summary of the prehistory and history of the valley provides an overview of some of the major themes and events that illustrate the human interaction with the land (Figure 10). There is an abundance of prehistoric evidence as well as early historical accounts, records, photographs, and local histories for the valley. This synopsis provides only a glimpse into the resources and information available with an emphasis on environmental references.

Meg Van Ness/USFWS

Figure 10. The ranching heritage of the San Luis Valley extends back into the 17th century, as evidenced by the national historic register listed Trujillo Homestead on Baca NWR .

Prehistory

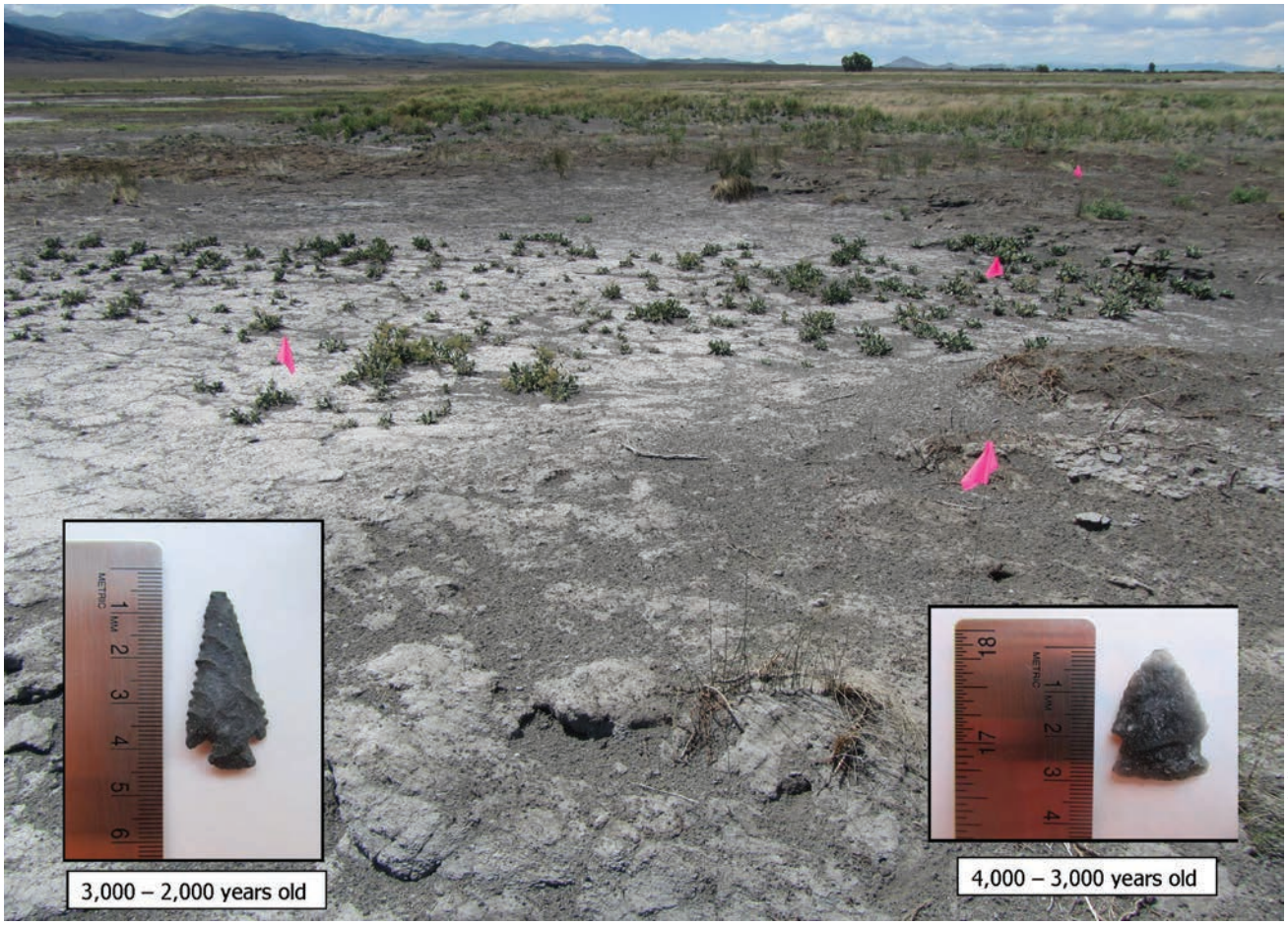
Paleo-Indian Stage

Current archaeological evidence indicates that the earliest humans, called the paleo-Indians, migrated to the region near the close of the last Ice Age approximately 12,000 years ago. These people had a highly mobile lifestyle that depended on the hunting of large, now-extinct mammals, including mammoths and a huge ancient bison. The hallmark of most paleo-Indian sites are the beautiful but deadly spear points that were launched with the aid of a simple yet expertly engineered spear-thrower called an atlatl. These projectile points are generally recovered as isolated occurrences or in association with animal kills, butchering sites, or small temporary camps. Although the timing of this stage varies throughout the region and is constantly being refined as additional data become available, the stage generally lasted until about 7,500 years ago.

Information from the Colorado Office of Archaeology and Historic Preservation indicates that 62 paleo-Indian resources have been identified in the proposed SLVCA. These sites are often located near wetlands and along the shorelines of ancient lakes, reflecting the use of abundant floral and faunal resources available in these locations. Several paleo-Indian sites in the valley and surrounding mountains have been excavated, including the high altitude Black Mountain Site (5HN55) located at 10,000 feet in the San Juan Mountains south of Lake City on the western edge of the proposed SLVCA. This campsite dates from approximately 10,000 to 7,000 years ago and has yielded a variety of stone tools suggesting animal procurement and processing (Jodry 1999a).

Several paleo-Indian sites on the valley floor have been excavated and provide an extensive record of the early occupations (Figure 11). Three of these sites, the Cattle Guard site (5Al101), the Linger site (5AL91), and the Zapata site (5AL90), are located just south of Great Sand Dunes NPP and represent camps with an abundance of bison bone and associated stone tools (Cassells 1997, Jodry 1999a). The Reddin site (5SH77) near the town of Hooper yielded nearly 500 paleo-Indian artifacts suggesting a variety of activities and uses (Cassells 1997, Jodry 1999a).

Climatic fluctuations during the Holocene Epoch (which started about 12,000 years ago and has continued to the present) are often reflected in the archaeological record. Pollen remains, faunal assemblages, and geomorphological deposits suggest periods of significant



Meg Van Ness/USFWS

Figure 11. The San Luis Valley contains archaeological sites extending thousands of years into prehistory.

and rather abrupt vegetation changes and variations in the amount of moisture (Jodry 1999b, Martorano 1999a). Bison remains associated with archaeological sites on the Southern Plains also indicate oscillations in bison numbers in response to climatic conditions (Creel et al. 1990). Although additional research is needed and archaeologists' ability to recover and interpret the prehistoric record is continually improving, these preliminary studies are an intriguing look into the evidence for and the consequences of long-term climatic change.

Archaic Stage

There was a gradual but definite shift in the pattern of human use of the region that began about 7,500 years ago and continued until approximately 1,500 years ago. The changes were the result of a combination of regional climatic fluctuations and an increasing population coupled with technological innovation and regional influences. Although the Archaic stage is better represented in the archaeological record than the preceding paleo-Indian stage, the identification and interpretation of the remains continues to be expanded and refined. Evidence of a greater diversity of tools and the use of a larger variety of plants and animals than during the preceding paleo-Indian stage is found on many sites.

There have been 618 Archaic stage resources recorded in the Colorado portion of the study area. As with the earlier inhabitants, the Archaic peoples made extensive use of the valley's wetland resources and occupied the rockshelters and several high-altitude locations found in the surrounding mountains. Speaking of Archaic sites in the northeastern portion of the valley, Hoefer states: "Most of the Closed Basin archaeological sites are open camps containing debitage and fire-cracked rock scatters, approximately half of which contain ground stone implements such as metate fragments or manos. Many of these sites are located around seasonal wetland marshes and lakes" (Hoefer 1999).

The use of the atlatl with spear points continued and basketry, cloth, and cordage came into use. Although still very mobile, the population increasingly made short-term use of small groupings of structures with storage features. Former hunting blinds and other rock structures are fairly common but often difficult to interpret. Archaic Stage rock art is scattered throughout the region and the influences of surrounding regions, particularly the Plains and the Great Basin, are identifiable at several sites.

Late Prehistoric Stage

Beginning approximately 1,500 years ago, several innovations greatly influenced life in the valley (Martorano 1999b). Although these changes were adopted at different rates and degrees throughout the area, the advent of pottery and the bow and arrow coupled with a larger and more sedentary population defines the period until approximately 600 years ago. Early archaeological research in the valley identified numerous regional influences, with several sites exhibiting pueblo-inspired attributes (Renaud 1942). In 1694, Don Diego de Vargas documented his visit to the valley, thus providing an early historical written account and ushering in the historic period.

The 442 Late Prehistoric resources in the Office of Archaeology and Historic Preservation database are listed under a variety of designations for this stage, but all date to about the same time period. The distribution of Late Prehistoric sites in the valley reinforces the trend of intensive use of wetland habitats (Martorano 1999b). This is not surprising as the available resources—both floral and faunal—would have continued to be abundant in these areas. Site types include camps, stone tool scatters, rock art, rock alignments and enclosures, and quarries where the lithic material for stone tools was collected.

Protohistoric Stage

By the late 1600s, Spanish incursions into the valley were beginning to affect the lives of the native populations. The Utes, who, based on archaeological evidence, came to the valley sometime after A.D. 1100 (Reed 1994) and were the most prevalent occupants of the valley, quickly acquired horses and other trade items. Although numerous other Native American groups probably visited or traveled through the valley, the Comanche, Apache, Navajo, Arapaho, Cheyenne, and several northern Pueblos also had a significant if not sustained presence (Martorano 1999c).

The 59 recorded Office of Archaeology and Historic Preservation sites from this stage include the traditional stone tools and ceramics mixed with utilized and/or flaked glass, trade beads, and metal projectile points. Wickiups (conical timbered structures) and trees with peeled bark (indicating the harvesting of the edible cambium layer) were common, as is rock art with motifs and depictions of post-contact goods.

Early History

The Historic period for the valley began with the reoccurring contact of the Native Peoples with people of European decent and ended in the mid-twentieth century. This interaction generally followed many years of occasional contact, often for the exchange of trade goods. The narrative below briefly summarizes some of the major historic influences, patterns, and themes in the region.

Early Exploration and Trade

> *"...I take and seize one, two, and three times, one, two, and three times, one, two, and three times, and all those which I can and ought, the Royal tenancy and possession, actual, civil,*

> *and criminal, at this aforesaid River of the North, without excepting anything and without any limitation, with the meadows, glens, and their pastures and watering places. And I take this aforesaid possession, and I seize upon it, in the voice and name of the other lands, towns, cities, villas, castles, and strong houses and dwellings, which are now founded in the said kingdoms and provinces of New Mexico, and those neighboring to them, and shall in future time be founded in them, with their mountains, glens, watering places, and all its Indian natives..."*
>
> —Capitán Gaspar Pérez de Villagrá in *La Historia de la Nuevo Mexico, 1610*

With these bold words in 1598, Spain claimed all lands, structures, and people along the Rio Grande—including the San Luis Valley—forever. This followed several years of sporadic Spanish incursions into northern New Mexico and southern Colorado, which ushered in several decades of trade, conflict, and settlement. Many Spanish traveled along the Northern Branch of the Spanish Trail, which had both western and eastern routes through the valley. Although the Spanish relinquished ownership of the valley in 1821, their influence survives as a vital part of the landscape and people today.

There are numerous explorers and settlers who left a legacy of journals, maps, and other accounts of their time in the San Luis Valley. These documents offer a wide variety of historic and environmental information. The examples summarized below provide a glimpse into the types of information and insight available in these early accounts.

Don Diego de Vargas: 1694. The 1694 journal of Don Diego de Vargas survives as the earliest written account of the San Luis Valley. The journal is a wealth of information concerning the native peoples, topography, and environment (Colville 1995). After leaving Santa Fe, De Vargas followed the North Branch of the Spanish Trail northward, travelling east of the Rio Grande, and entering the valley just southeast of Ute Mountain. From there he continued north, crossing what would become the New Mexico/Colorado State line and paralleling the western side of San Pedro Mesa before heading west along Culebra Creek. When he reached the Rio Grande, he turned south and crossed the river about five miles south of the confluence. His return trip to Santa Fe took him along the Rio San Antonito on the west side of the Rio Grande, exiting the valley on the west side of San Antonio Mountain (Colville 1995).

His six days in the valley included contact, trade, and occasional skirmishes with the Utes and confrontations with Taos Puebloans. He also documented large herds of bison and some "very large deer." This reference is the earliest known historical account of bison in the Valley (Colville 1995), the last being a brief mention of bison by Juan Bautista Silva along the Rio San Antonio south of present day Antonito in the spring of 1859 (Kessler 1998). During de Vargas's travels, the use of sign language and smoke signals for communication is well documented, as is the need to be near water during mid-summer.

Notable features of the de Vargas journal include the advantageous yet temporary alliance of de Vargas' men with the Utes and Apaches to combat a mutual enemy: the Comanche. As he traveled along the west side of the valley, de Vargas refers to the San Juan Mountains by their early Spanish name: Sierra de la Grulla, or Mountains of the Cranes. And, in an interesting meteorological observation, de Vargas states on August 24 that: "From the beginning of the march we suffered from bitter cold"—this during a month that now has an average daytime high temperature in the upper 70s.

Juan Bautista de Anza: 1779. Eighty-five years later in 1779, Juan Bautista de Anza, the Governor and Military Commander of New Mexico, left Santa Fe and headed north to quell the Comanche raids that were devastating Spanish settlements in the region. Traveling by night to avoid detection, de Anza followed the North Branch of the Spanish Trail along the eastern foothills of the San Juan Mountains, crossed Poncha Pass, and then headed east to the plains near Pikes Peak. From there he headed south along the foothills, through the areas that would become Colorado Springs and Pueblo, where he fought several victorious battles with the Comanche. He concluded his campaign by crossing back into the valley at Sangre de Cristo Pass (which is also known as La Veta Pass) and taking the eastern route of the North Branch of the Spanish trail back to Santa Fe (Kessler 1998). He initially entered the valley on August 19, 1779, and by September 4 of that year he had reentered the valley near Fort Garland on his return trip to Santa Fe.

Zebulon Montgomery Pike: 1807. Unlike the earlier Spanish explorers, Captain Zebulon Montgomery Pike entered the San Luis Valley from the east, having traveled west from St. Louis across Missouri, Kansas, and the plains of Colorado. Pike's mission was to map and describe the southern portions of the newly acquired Louisiana Purchase. On January 27, 1807, he and most of his men (except five that were left along the trail because they were unable to walk on their frozen feet) crossed the Sangre de Cristo Mountains and entered the valley near the Great Sand Dunes (Carter 1978, Hart and Hulbert 2006, Ubbelohde et al. 2001). Pike built a simple stockade near where the current town of Sanford is located and stayed there until February 26, when Spanish officials took him prisoner and escorted him down to Santa Fe because

"...it was necessary his Excellency should receive an explanation of my business on his frontier..." (Zebulon Pike, Thursday, February 26, 1807).

Although Pike's journal in the days preceding the ascent into the valley often mentions seeing "a gang of buffalo," including in the Wet Valley, there is no mention of buffalo after he enters the San Luis Valley. In contrast, deer are often mentioned in the valley and goose was a part of at least one meal. Pike grew fond of the Valley and concluded that "...it was at the same time one of the most sublime and beautiful prospects ever presented to the eyes of man" (Zebulon Pike, Thursday, February 5, 1807).

Jacob Fowler: 1821 to 1822. The journal of Jacob Fowler, which dates from 1821 to 1822 and which *The New York Times* referred to as "quaint and interesting" (*The New York Times* 1898), is a wealth of information concerning the environment and the interactions between the various peoples who occupied the valley (Coues 1965). *The New York Times* further describes the journal—just published by noted ornithologist Elliott Coues—as "…a notable contribution to our knowledge of early adventure and pioneering in the Great West. His style is straightforward and his wonderful power of observation has made the narrative very attractive."

Fowler was a fur trader who left Fort Smith, Arkansas, in September 1821 and entered the valley via La Veta Pass on February 4, 1822. For the next 3 months, he traveled between Taos and the central portion of the valley, going as far north as near where Fort Garland would be later established. Many animals are noted in the valley, including beaver, elk, deer, bear, antelope, otter, big-horned sheep, wild horses, geese, ducks, and a wolf. Although great herds of "buffelow" were noted as the party crossed the Plains, and as far west as the Wet Valley, there is no mention of them once they reach the San Luis Valley. As with the references to animals, the descriptions of plants, particularly the distribution (or lack thereof) of cottonwoods and willows along specific creeks, is frequent and often detailed. These descriptions are mixed with wonderful accounts of life in the numerous small Spanish settlements that dotted the landscape and interactions with the native peoples.

Fowler recorded an exceptionally astute observation while crossing the southern portion of the Valley on February 18, 1822:

> *I Have no doubt but the River from the Head of those Rocks up for about one Hundred miles has once been a lake of about from forty to fifty miles Wide and about two Hundred feet deep – and that the running and dashing of the Watter Has Woren a Way the Rocks So as to form the present Chanel.*

With this, Robert Fowler had speculated about some of the complex geological processes that formed the Valley—processes that were studied and confirmed a hundred years later.

Numerous other explorers and settlers visited the valley and left behind journals of varying detail (Hart and Hulbert 2006, Kessler 1998, Preuss 1958, Richmond 1990, Sanchez 1997). Among these are:

- George Frederick Ruxton, 1846
- John C. Fremont, 1848 to 1849
- Charles Preuss, 1848 to 1849 (traveling with Fremont)
- Gwinn Harris Heap, 1853
- John Williams Gunnison, 1853
- John Heinrich Schiel, 1853 (traveling with Gunnison)
- Randolph Barnes Marcy, 1858
- William Wing Loring, 1858
- Juan Bautista Silva, 1859

Political Boundaries, Land Grants, and Public Lands

The San Luis Valley has endured many changes in governance over the last 300 years. Following nearly 12,000 years of sovereignty by various Native Americans, the control (or at least the declared control) and political boundaries of the region shifted continually until Colorado and New Mexico obtained statehood. The brief timeline below summarizes some of these changes in "ownership" of the San Luis Valley:

1598 Don Juan de Onate claims the San Luis Valley and surrounding areas for Spain.

1763 The Treaty of Paris at the end of the French and Indian War divides much of the North American interior between Spain and France. The San Luis Valley is considered Spanish territory.

1803 The Louisiana Purchase is negotiated between the United States and France but the western boundaries are not clarified and remain ambiguous.

1819 The U.S. negotiates the Adams-Onis Treaty with Spain to clarify the boundaries of the Louisiana Purchase. The San Luis Valley remains part of Spain's New Mexico Territory.

1821 Mexican War of Independence (1810 to 1821). The valley becomes a part of the new nation of Mexico.

1836 The Republic of Texas achieves independence from Mexico. Texas claims the land in the valley east and north of the Rio Grande. Mexico does not recognize the Republic, disputes this boundary, and continues to claim the entire valley.

1837 The United States recognizes the Republic of Texas, including the San Luis Valley.
1845 The United States annexes Texas, including the San Luis Valley, and Texas achieves statehood.
1848 Following the Mexican-American War (1846 to 1848), the Treaty of Guadalupe Hidalgo establishes the present Mexico–United States border except for the later 1853 Gadsden Purchase (southern Arizona and southern New Mexico).
1850 Amid much controversy over the admittance of free versus slave States, and as a result of the Compromise of 1850, Texas surrenders its claim to New Mexico, and the New Mexico Territory, including the San Luis Valley generally south of the Rio Grande (38th parallel), is established.
1854 The Kansas Territory, which includes the northern part of the San Luis Valley (above the 38th parallel), is established out of previously unorganized lands of the Louisiana Purchases.
1861 The Colorado Territory is created by the Colorado Organic Act with the same boundaries that would later become the State of Colorado.
1876 Colorado becomes a State.
1912 New Mexico becomes a State.

Beginning in 1833, numerous Mexican land grants were issued in the valley as a direct result of the political turmoil noted above and the desire for Mexico City to maintain control over the distant northern borderlands of their newly independent nation. These land grants were intended to encourage Mexican settlement in the borderlands, thereby dissuading any thoughts of Texas independence and discouraging encroachment by American fur traders.

The first grants consisted of numerous small parcels along the Conejos River in Colorado in 1833 (Athearn 1985). These small grants were ineffective in establishing permanent settlement, but the much larger 1842 Conejos Grant proved to have more success in persuading the founding of farms and towns. This grant covered over 2.5 million acres and included all of what would become the Colorado counties of Conejos and Rio Grande with parts of the counties of Mineral, Saguache, and Alamosa. As with other Mexican land grants in the valley, the grants were considered invalid following the Mexican-American War. The Court of Private Land Claims in 1900 ruled against the grantees and negated the claim (Colorado State Archives 2001).

The Sangre de Cristo grant included all of what is now Costilla County and extended a short distance into the current State of New Mexico. The grant consisted of 1 million acres and was originally awarded to two Mexican nationals in 1844, but following their deaths during the Pueblo Revolt of 1847, the land was sold to Charles (Carlos) Beaubien. Unlike the Conejos Grant, Beaubien's claim to the land was upheld by the courts in 1860. The land was later sold to William Gilpin (Colorado's first territorial governor) in 1864. Large tracts of the grant have been sold to various developers and disputes over the rights of local people to use the land have continued through 2009 (The Center for Grant Studies 2003, *The Pueblo Chieftain* 2009).

The Baca Land Grant in the San Luis Valley was the result of a land dispute. The Baca grants, of which there are five, were granted to the heirs of Luis Maria Baca in replacement for his 1825 grant near Las Vegas, New Mexico, which was also claimed by Juan de Dios Maiese in 1835. These conflicting claims came to light when the U.S. took control of the lands in the mid 1840s. The Baca claim was settled in 1860 and patented in 1903, when the Baca heirs were given five parcels of land: two in New Mexico, two in Arizona, and one in the San Luis Valley—Baca #4. In various configurations and sizes, the Baca #4 lands have changed hands many times over the ensuing hundred years, with a large portion established as the Baca National Wildlife Refuge in 2000.

Slightly under half of the SLVCA is publically owned. This includes large portions of the Rio Grande and the Pike-San Isabel National Forests in Colorado, with small sections of the Carson National Forest in New Mexico. The National Forest system was established at the turn of the 20th century as the American public became alarmed at the destruction of forests by timber and mining interests. The BLM was established in 1946 as a result of combining several agencies and policies into one bureau and currently owns large parcels of land in the area, primarily in the western and northern parts of the valley floor. Great Sand Dunes NPP was initially established as a National Monument in 1932 and was expanded to include many upland parcels in 2004. Three national wildlife refuges, Monte Vista (1953), Alamosa (1962), and Baca (2000), were established to protect wetland habitat for migratory birds along the central flyway. Additional lands are owned by the Bureau of Reclamation and the State of Colorado.

Native Peoples

The post-contact history of Native Americans in the San Luis Valley involves both cooperation and conflict and ends with the establishment of reservations outside of the valley. Although several Native American tribes are currently represented in the valley, today they comprise less than 1 percent of the current population.

The Utes consist of several bands and at the time of contact were the primary Native American inhabitants

of much of Utah, central and western Colorado, and parts of northern New Mexico. Increased settlement after the United States gained possession of the valley in 1848 and the surrounding Gold Rush of 1859 brought new people to the valley and ushered in several decades of escalating pressure to remove the Utes (Ellis 1996). Fort Massachusetts (1852 to 1858) and Fort Garland (1858 to 1883) were established in the valley primarily to protect settlers from Ute attacks. The 1863 and 1868 treaties between the United States and the Utes gave portions of Colorado, including the San Luis Valley, to the United States. Over the next four decades, a series of treaties and agreements continued to reduce Ute lands and relocate the Ute peoples, with the eventual establishment of three reservations in southwestern Colorado and northern Utah by the early years of the 20th century.

Numerous other Native Americans visited or lived in the valley, including the Apache, Arapaho, Cheyenne, Comanche, Kiowa, and Navajo (NPS 2011). Early historical accounts frequently mention various members of pueblos along the Rio Grande coming north into the central San Luis Valley to hunt bison, causing occasional confrontations with the Utes (Carson 1998, Colville 1995). The first Pueblo revolt of 1680, a response to the expanding Spanish control in northern New Mexico, effectively ceased Spanish rule in the region until Don Diego de Vargas reestablished control over the pueblos in 1692 and 1696. The Taos Pueblo rebelled against the occupation of U.S. troops during the Mexican-American War in 1847, but the rebellion was soon repelled, effectively ending major conflicts in the region.

Settlement

Settlement of the San Luis Valley reflects cultural, economic, and political influences as well as creative adaptation to a unique environment. Following the 1610 establishment of Santa Fe as the capital of the New Mexico province, explorers and traders slowly made their way north into the central San Luis Valley. Jacob Fowler encountered several small Spanish settlements during his travels north of Taos and into southern Colorado in 1821 and 1822 (Coues 1965).

The Catholic Church, which was a primary influence during the initial exploration of the region, continued to play a major role in the establishment of settlements and in the day-to-day lives of the majority of the inhabitants. Members of various church orders were often part of the early explorations, such as the 22 Franciscans who accompanied de Onate during his 1598 exploration and settlement in northern New Mexico (Athearn 1989). The church was instrumental not only in matters of faith, but also as educators, trade coordinators, keepers of public records, and builders of comparatively grand architecture. On the other hand, the oppressive condemnation and suppression of the Native American religious practices were a major contributor to the unrest that led to the Pueblo Revolt of 1680 and the destruction of several missions. Nonetheless, the Catholic church began the 18th century as one of the few institutions in the area to prosper, and soon missions were established throughout the region (Athearn 1989). The journals of a Jesuit order near Conejos from 1871 to1875 reveal days full of baptisms, marriages, deaths, prayers, attending to the sick, and rituals, with a persistent concern for obtaining basic supplies (Stoller and Steele 1982).

In her 1997 book on the San Luis Valley, Olibama Lopez-Tushar describes the first attempted settlement of the valley as that of George Gold (Gould) near the town of Costilla in 1848 (Lopez-Tushar 1997. This settlement was found to be in trespass of the lands held by the Sangre de Cristo Grant and Gold was evicted prior to establishing a colony, although the town of San Luis de Culebra was established on the land grant 3 years later (Athearn 1985, Wyckoff 1999). The establishment of towns on the land grants was encouraged and within a few years the towns of San Pedro, San Acacio, Chama, and San Francisco were on the Sangre de Cristo Grant and the towns of Conejos, Guadelupe, Ortiz, and Magote were on the Conejos Grant.

Early settlements in the valley were established based on the traditional pattern of the Spanish plaza with homes, churches, and public buildings clustered around a central square and long narrow fields radiating out around the buildings and fronting a nearby creek—sometimes referred to as cordillera or plaza farming (Colville 1995). The extensive systems of early irrigation canals and water control structures supported small grain fields and gardens, some of which are still in use today. Several large canals and their associated laterals, including the Travelers Canal, the Empire Canal, and the Monte Vista Canal, were built in the 1880s in response to the increasing demand for the valley's beans, corn, grains, and other vegetables. The extensive irrigation in the valley was recognized early as a source of future problems as noted by Major John Wesley Powell in his 1890 testimony before the Senate Special Committee on Irrigation and Reclamation of Arid Lands:

> *Passing into New Mexico, then, the water that practically heads in the high mountains of Colorado is largely, almost wholly, cut off from the Rio Grande, so that no portion of the water that heads in these mountains where there is great precipitation will cross the line into New Mexico (in the dry season). In a dry season, nothing can be raised in the lower region and sometimes the dry seasons come two or three together. (Siebenthal 1910)*

The mining boom in the surrounding mountains in 1859, the completion of the Denver & Rio Grande Railroad over the Sangre de Cristo Mountains and into the valley in 1877, and a vigorous advertising effort by land speculators led to a slow but steady increase in population in the latter half of the 19th century. Prior to the discovery of gold in 1859, the valley was the home of Colorado's largest non-Native American population, and by 1870 the population of Conejos, Costilla, and Saguache Counties is estimated to have been approximately 5,000 (Wyckoff 1999). Speculators capitalized on the increasing number of immigrants heading west from the eastern United States and Europe, as is illustrated by the description of the valley in a 1884 promotional brochure:

> *Society is very good. The intelligence of average western people is far above those of the eastern States. Under the duck or buckskin coat of many a miner, farmer or stockman of Colorado is concealed diplomas from the best colleges of the east and Europe.*
>
> *The climate is almost perfect. Extremes of heat or cold are unknown, and the land is one of almost perpetual sunshine by day, and cloudless skies at night. The healthfulness of the country is notorious, sickness almost unknown. No malaria, no cyclones, no deluges, and when the orchards of small fruits, apples, cherries and plums, and groves of shade trees are planted, the country will be as fruitful and beautiful as the land of Italy. (The Republican Publishing Company 1884)*

By the early 1870s, the effect of hunting and development was already taking a toll on Colorado's wildlife. In 1872, the Colorado Territorial Governor Edward N. Cook passed the first game laws to protect certain birds, buffalo, deer, elk, and bighorn sheep (Colville 1995). His words sounded the alarm that the wildlife needed protection:

> *I desire to say a word in favor of protecting our game—birds, beasts, and fishes—all of which are being wastefully destroyed…and unless some law is passed…the buffalo, elk, deer antelope and trout will soon become extinct, and Colorado will be robbed of the many attractions she today possesses.*

Summary of Known Historic Resources

Information concerning the recorded resources in the Colorado portion of the SLVCA is summarized from data obtained from the Colorado Office of Archaeology and Historic Preservation in February 2012. Similar trends can be extrapolated for the New Mexico portion of the area. The Office of Archaeology and Historic Preservation data represent the efforts of hundreds of agencies, organizations, and individuals to document and study the past. The counts include sites, buildings, structures, and isolated finds; however, an individual resource may have many of these elements and may represent more than one time-period (multi-component) and therefore may be counted more than once. It is also important to note that the distribution of the known resources often indicates where modern activities have mandated cultural resource surveys and may also potentially indicate recorder bias as much as actual prehistoric or historic settlement or use patterns.

A total of 6,490 cultural resource sites or properties have been recorded in the Colorado portion of the proposed SLVCA. Another 2,740 isolated artifacts or features have also been recorded in this area. These resources include 4,719 prehistoric components, 4,091 historic components, 62 components lacking a temporal designation, and 3 paleontological locations, with some resources representing multiple components.

Nearly 20 percent of the prehistoric components are lithic scatters. These locations consist of stone tools and/or the remains associated with stone tool manufacture. Camps, which are lithic scatters in association with the remains of a campfire, are only slightly less common and have been recorded at approximately 19 percent of the sites. The third most frequent prehistoric site type, representing 4 percent of the sites, is architectural, and generally consist of stone circles or alignments. Other relatively frequent site types found in the valley but never consisting of more than 1 percent include peeled trees, rock art, and human burials. Over half of the prehistoric components on sites in the valley have not been classified into a particular type.

The 4,091 historic components include standing buildings or structures and/or historic archaeological deposits. Many of these are homes, commercial buildings, or public buildings within the towns in the valley, with 100 or more each recorded in Alamosa, San Luis, and Monte Vista. Rural sites with historical components often include water control structures (111 recorded), cabins or homesteads (68 recorded), roads or trails (62 recorded), and railroad-related features (28 recorded). The 1,635 historical archaeology components include both isolated rubbish scatters and small features in addition to artifacts or deposits associated with a building or structure.

Two resources in the valley have been designated as National Historic Landmarks. These include Pike's Stockade (5CN75) from 1808 and the Pedro Trujillo Homestead (5AL706) from the late 19th century. Approximately 100 cultural resources in the valley are listed on the National or State Register of Historic Places. Another 435 resources are officially eligible to be listed on the National or State Registers but have yet to be formally nominated.

Socioeconomic Environment

Socioeconomic Profile

Population

The SLVCA spans nine counties: Alamosa County, Conejos County, Costilla County, Hinsdale County, Mineral County, Rio Grande County, and Saguache County in Colorado and Rio Arriba County and Taos County in New Mexico. Table 1 lists population statistics for these counties. The nine-county region has a population of roughly 120,000 people (U.S. Census Bureau 2010a). Over the past decade, population growth in the region has been slow, and the region has experienced some out-migration. Slow growth may be the result of increasing unemployment, decreasing nonresidential construction, and declining prices of key agriculture commodities (such as barley, alfalfa, and potatoes in 2009) (Colorado Legislative Council Staff 2011). From 2000 to 2010, the nine-county region experienced a 2 percent increase in population, representing slow growth relative to the statewide figures for Colorado (which had a 17 percent increase from 2000 levels) and New Mexico (which had a 13 percent increase from 2000 levels). Of the seven Colorado counties in the nine-county region, the greatest in-migration was experienced in Hinsdale County (7 percent increase from 2000 levels), and in New Mexico, Taos County (10 percent increase from 2000 levels) experienced the largest increase in population. Five of the nine counties in the region (Conejos, Rio Arriba, Rio Grande, Costilla, and Mineral Counties) experienced negative growth during these years, with the greatest out-migration occurring in Mineral County (14 percent decrease from 2000 levels) (U.S. Census Bureau 2010a).

Population growth in the nine-county region is expected to continue at a slow pace over the next decade. From 2010 to 2025, the population of the local area is projected to increase by 14 percent, indicating slow growth compared to the projected statewide figures for Colorado (which has a projected 26 percent increase) and New Mexico (which has a projected 19 percent increase) (Colorado Department of Local Affairs 2002, University of New Mexico 2002). Within the nine-county region, the greatest projected increases in population are expected to occur in the counties of Hinsdale (26 percent), Alamosa (25 percent), and Saguache (18 percent). The smallest projected increases are anticipated in the counties of Rio Grande (7 percent) and Costilla (8 percent) (Colorado Department of Local Affairs 2002, University of New Mexico 2002).

Race, Ethnicity, and Education

Hispanic and Latino residents (57 percent of the total population) represent the largest ethnicity in the nine-county region. The prevalence of this ethnic group is due to the presence of two large Hispanic communities in the local area. The region is home to a large population of White residents who identify themselves as being of the Hispanic or Latino ethnicity. This is particularly true in Alamosa, Conejos, Costilla, Saguache, Rio Arriba, and Taos Counties, where, collectively, White Hispanics represent 32 percent of the countywide population on average (U.S. Census Bureau 2010a). The occurrence of this race-ethnicity pairing in the San Luis Valley may be due to residents of Hispano heritage (i.e., descendants from Spaniards) (Sangre de Cristo National Heritage Area 2012). Hispanics of Mexican descent also represent a substantial

Table 1. Population statistics for the counties in Colorado and New Mexico that contain the San Luis Valley Conservation Area (SLVCA).

	Residents (2010)	*Persons per square mile (2010)*	*Percentage population change (2000–2010)*	*Percentage population change (2010–2025)†*
Colorado	5,029,196	48.5	17%	26%
Alamosa County	15,445	21.4	3%	25%
Conejos County	8,256	6.4	-2%	10%
Costilla County	3,524	2.9	-4%	8%
Hinsdale County	843	0.8	7%	26%
Mineral County	712	0.8	-14%	16%
Rio Grande County	11,982	13.1	-3%	7%
Saguache County	6,108	1.9	3%	18%
New Mexico	2,059,179	17.0	13%	19%
Rio Arriba County	40,246	6.9	-2%	11%
Taos County	32,937	15.0	10%	17%

Sources: U.S. Census Bureau 2010a and †Colorado Department of Local Affairs 2002, University of New Mexico 2002

share of the population in Alamosa (26 percent), Conejos (22 percent), Costilla (34 percent), Rio Grande (25 percent), Saguache (27 percent), and Rio Arriba (21 percent) Counties (U.S. Census Bureau 2010a).

Whites (including Whites of Hispanic and Latino origin) represent the largest race in the nine-county region (66 percent of the total population). Mineral County, Colorado, has the largest representation of White residents (97 percent of the population), and Rio Arriba County has the smallest representation of White residents (52 percent of the population) in the region. Native Americans and Alaska Natives account for 8 percent of the total population of the region, with the greatest population of Native Americans located in Rio Arriba County (16 percent of the population). Collectively, Black or African American residents, Asians, and Native Hawaiians and other Pacific Islanders account for about 1 percent of the total population of the region (U.S. Census Bureau 2010a).

Table 2 shows the percent of the population that has obtained a bachelor's degree or higher within each of the SLVCA States and counties. Of the two States, Colorado has the highest percentage of individuals with a bachelor's degree or higher (36 percent of the population), followed by New Mexico (26 percent) (U.S. Census Bureau 2010a). However, among the Colorado counties in the local area, only Hinsdale County reported more county residents with at least a bachelor's degree (42 percent of the countywide population) than the State average (36 percent of the statewide population). In New Mexico, the same is true of the educational attainment in Taos County (30 percent of the countywide population with a bachelor's degree or higher) relative to the State average (26 percent) (U.S. Census Bureau 2010a).

Regional Economy, Employment, and Income

Table 2 also shows median household income and poverty rates for each of the SLVCA States and counties. Among the two States, Colorado had the highest median household income in 2010 ($56,456 per year), followed by New Mexico ($43,820 per year) (U.S. Census Bureau 2010b). At a statewide level, New Mexico had the highest poverty rate at 18.4 percent, and Colorado had the lowest at 12.2 percent. However, the San Luis Valley is one of the most impoverished regions of Colorado with Costilla, Saguache, and Alamosa Counties representing the first, second, and third highest poverty levels statewide. Within the nine-county region, Hinsdale County, Colorado, had the highest median household income ($74,659 per year) and the lowest poverty rate (3.7 percent). Costilla County, Colorado, had the lowest median household income ($24,388 per year) and the highest poverty rate (28.4 percent). With the exceptions of Hinsdale and Mineral Counties in Colorado and Taos County in New Mexico, all of the counties in the nine-county region had poverty levels above the statewide average, with Costilla and Alamosa Counties having poverty rates nearly twice Colorado's average. (U.S. Census Bureau 2010b).

Table 3 shows the percent of employment by sector within the nine-county region. The combined nine-county region had a total employment of more than 62,000 individuals in 2009 (U.S. Department of Commerce 2009). The highest percentage of total employment in 2009 was in public administration (18

Table 2. Income, education, unemployment, and poverty rates for counties in Colorado and New Mexico that contain the San Luis Valley Conservation Area (SLVCA).

	Median household income (average 2006-2010)†	*Bachelor's degree or higher†*	*Percentage unemployed‡*		*Percentage of individuals below poverty (average 2006-2010)†*
			2008	*2011*	
Colorado	$56,456	36%	4.8%	7.9%	12%
Alamosa County	$35,935	27%	5.2%	7.5%	24%
Conejos County	$33,627	19%	7.3%	9.5%	18%
Costilla County	$24,388	14%	7.7%	12.4%	28%
Hinsdale County	$74,659	42%	3.4%	6.1%	4%
Mineral County	$53,438	39%	5.4%	7.3%	8%
Rio Grande County	$39,871	19%	5.6%	7.8%	17%
Saguache County	$30,430	19%	7.2%	9.9%	24%
New Mexico	$43,820	26%	4.5%	6.6%	18%
Rio Arriba County	$41,437	16%	5.4%	8.9%	20%
Taos County	$35,441	30%	5.5%	10.4%	17%

Sources: †U.S. Census Bureau 2010b and ‡ Bureau of Labor Statistics 2011a, Bureau of Labor Statistics 2011b, Bureau of Labor Statistics 2008

Table 3. Percentage employment by sector for counties in Colorado and New Mexico that contain the San Luis Valley Conservation Area (SLVCA)

Employment sectors	*Percentage of nine-county region employed*
Total employment in 2009[a]	62,121
Agriculture, forestry, fishing, hunting, and mining	11%
Arts, entertainment, recreation, and accommodation and food services	11%
Construction	6%
Educational services, health care, and social assistance	8%
Finance and insurance, real estate, rental, and leasing	6%
Information	1%
Manufacturing	2%
Other services, except public administration	4%
Professional, scientific, management, administrative, and waste-management services	5%
Public administration	18%
Retail trade	10%
Transportation and warehousing, and utilities	2%
Wholesale trade	2%

Source: U.S. Department of Commerce 2009
[a]Not every sector category for every county was fully disclosed due to confidentiality requirements; the table reflects the best and most accurate information available

percent of total local employment), the second highest was in the arts, entertainment, recreation, and accommodation and food services (11 percent), and the third highest was in agriculture, forestry, fishing, hunting, and mining (11 percent) (U.S. Department of Commerce 2009).

Agriculture, Recreation, and Tourism

Agriculture is a prominent industry in the San Luis Valley (Figure 12). Crops grown in the valley include alfalfa, native grass hay, wheat, barley, sorghum, canola, spinach, lettuce, carrots, and potatoes (Colorado Division of Wildlife 2010). Agriculture, forestry, fishing, hunting, and mining accounted for roughly 11 percent of the total jobs in the region in 2009 (U.S. Census Bureau 2009). The total number of agricultural jobs in the local area increased from about 3,700 jobs in 1970 to 4,446 in 2009 (U.S. Department of Commerce 2010a). Costilla County, Colorado, had the largest percentage of employment in agriculture (22 percent), and Mineral County, Colorado, had the smallest (2 percent) (U.S. Department of Commerce 2010a, U.S. Department of Commerce 2010b [data complied using EPS-HDT]). Approximately 29 percent of the land in the nine-county region is in agriculture, with Rio Arriba, New Mexico, having the largest percentage of land in agriculture (39 percent) and Hinsdale County, Colorado, having the smallest (less than 1 percent of total land in agriculture) (U.S. Department of Agriculture, 2009 [data complied using EPS-HDT]).

Tourism is a cornerstone of the local economy, and the tourism industry in the San Luis Valley shows strong development potential. With a diverse collection of natural and heritage assets, the local tourism industry is able to cater to a variety of recreationalists, including outdoor recreationalists; visitors to the Great Sand Dunes NPP; resort tourists; vacation and second home owners; eco-tourists; heritage, arts, and cultural tourists; and visitors who pass through the area on their way to other regional attractions (Center for Rural Entrepreneurship 2008). According to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, approximately 3.1 million residents participated in wildlife-associated recreation activities in Colorado and New Mexico in 2006 (USFWS 2008). It was estimated that residents and visitors combined spent $3.8 billion on wildlife-associated recreational activities in 2006 in the two States combined, with Colorado accounting for approximately 79 percent of this spending. Among participants, wildlife watching was the most frequently reported activity, followed by fishing and hunting. In Colorado, 82 percent of individuals' surveyed watched wildlife, 30 percent fished, and 12 percent hunted, while in New Mexico, 83 percent watched wildlife, 26 percent fished, and 10 percent hunted (USFWS 2008).

Land Use and Ownership Changes Surrounding the Refuge

Current Land Use

The San Luis Valley is a large intermountain basin covering approximately 3,200 square miles of land in southern Colorado and northern New Mexico. The

USFWS

Figure 12. Agriculture practices such as haying and grazing are a primary component of the economy in the San Luis Valley, and often provide habitat for wildlife as well

valley is bordered by the Sangre de Cristo Mountains to the east and northeast, the San Juan and La Garita Mountains to the west and northwest, and the Taos Plateau to the south. Snowmelt from the mountains on the valley's periphery is responsible for most of the area's stream flow in the associated watershed, including the Rio Grande and Conejos Rivers (Emery no date). The valley floor is primarily grassland and shrubland, while the hills surrounding the valley are forested. Collectively, grasslands (40 percent of all land cover in the nine-county region), forests (30 percent), and shrublands (22 percent) account for most of the land cover in the local area (NASA 2006 [data complied using EPS-HDT]). Approximately 56 percent (2,944,353 acres) of the project area is in private ownership. The remaining acres are protected and managed by the Service, the USFS, the BLM, the National Park Service, and the State of Colorado. The majority of the private land and wetland habitat occurs on the valley floor, creating one of the largest intermountain valleys in the world (USFWS 2010a).

The nine-county region is relatively rural, and population densities in the San Luis Valley are among the lowest in Colorado. Only 2 percent of land cover in the local area is urban (NASA 2006 [data complied using EPS-HDT]), U.S. Census Bureau 2010a). Major municipalities in the region include Alamosa, San Luis, Saguache, Crestone, and Del Norte. Alamosa is home to Adams State College and had 8,780 residents in 2010, making it the largest municipality in the local area; San Luis is a historic community with Hispano heritage; Saguache is a ranching community that serves as the county seat of Saguache County; Crestone is a historic mining town at the base of the Sangre de Cristo Mountains in the northern end of the valley and is home to several spiritual centers that attract a large spiritual community from many different religious and ideological backgrounds; and Del Norte is the county seat for Rio Grande County (U.S. Census Bureau 2010a, Colorado Tourism Office 2012).

Changes in Land Use

The SLVCA contains a rich diversity of trust species and habitat types, including some of the nation's most dynamic wetlands. The proposed project area supports more than 1,300 species of vascular plants, 95 percent of the Rocky Mountain population of greater sandhill cranes, isolated waterfowl nesting densities exceeding 1,500 nests per square mile, and populations of priority species such as the southwestern willow flycatcher, western snowy plover, white-faced ibis, and mallard (USFWS 2010a). The SLVCA is the southernmost significant waterbird production area in the central flyway and is the most important waterfowl production area in Colorado. According to Partners in Flight, riparian habitats in the region support the highest bird diversity of any western habitat type (USFWS 2010a).

Historically, land use remained unchanged in the San Luis Valley until the early 1800s, when Euro-American settlement began to alter the pristine landscape (USFWS 2010a). During this period, livestock grazing, farming, and water development began to affect

ecosystem processes such as the natural hydrological regime. Since then, nearly 50 percent of Colorado's wetlands have been lost (Dahl 1990, 2000).

The highest-remaining concentration of wetlands in Colorado occurs in the San Luis Valley and protection of every remaining wetland acre is a high priority (USFWS 2010a). Manipulation of the natural hydrological cycle in the San Luis Valley for agricultural purposes has resulted in the loss of significant wetland habitat (USFWS 2010a). Most of the remaining wetlands in the SLVCA occur on private ranch and farm land and are reliant on the water diverted out of rivers and creeks or from artesian wells to maintain their value to wetland-dependent wildlife (USFWS 2010a).

Development pressure started to increase during the 1990s and early 2000s as land prices and agricultural operation costs in the SLVCA began to rise. To continue ranching operations, many rural landowners were forced to sell portions of their property for housing and commercial development, creating additional fragmentation and loss of critical wildlife habitat, including riparian habitat, in the SLVCA (USFWS 2010a). As agricultural lands are subdivided, the resulting fragmentation can affect habitat use for a wide array of waterfowl, shorebirds, colonial waterbirds, and songbird species. Many of these species require specific habitat conditions for successful reproduction and building energy reserves for breeding and migration (USFWS 2010a). As habitats are lost, the spatial juxtaposition of available habitat is altered, disrupting wildlife movement, dispersal, and migration patterns. In addition to the direct loss of wildlife habitat from fragmentation, the water rights associated with these properties are often sold with the property, resulting in not only the loss of wetland habitat and wetland functions on the subdivided property, but also on adjoining lands as the water is redistributed off of the property (USFWS 2010a). Maintaining the current connectedness of the wetland complex through permanent protection would limit the risk for species movement patterns to be disrupted due to fragmentation and would also maintain important migration corridors and linkages between seasonal ranges necessary to meet the life-history requirements for many wildlife species (USFWS 2010a).

Due to the small agriculture-based human population in the area, however, the landscape has not been altered to the same extent as many other western regions with more rapid population growth (USFWS 2010). In recent years, the downturn in the national and regional economy has slowed growth and development pressures in the SLVCA. As explained previously, the overall population in the SLVCA increased by only 2 percent between 2000 and 2010. The largest increase in population growth occurred in Hinsdale County (7 percent increase from 2000 levels) and Taos County (10 percent increase from 2000 levels), while five of the nine counties in the region (Conejos, Rio Arriba, Rio Grande, Costilla, and Mineral Counties) experienced negative growth during these years (U.S. Census Bureau 2010a). From 2010 to 2025, the population in the SLVCA is projected to increase by 16 percent, indicating slower growth relative to the projected State-level increases of 26 percent for Colorado and 18 percent for New Mexico (Colorado Department of Local Affairs 2002, University of New Mexico 2002). However, the population is projected to increase at rates similar to the Colorado State average in Hinsdale County (26 percent increase) and Alamosa County (25 percent increase), and above the New Mexico State average in Taos County (21 percent increase).

In 2000, the American Farmland Trust identified 4.9 million acres of prime ranchlands in Colorado and 2.6 million acres in New Mexico as being vulnerable to low-density development by the year 2020. Within the Rocky Mountain region (which includes 263 counties in Idaho, Montana, Wyoming, Utah, Colorado, Arizona, and New Mexico), Saguache County, Colorado, and Rio Arriba County, New Mexico, ranked in the top 25 counties for acres of strategic ranchland at risk (American Farmland Trust 2000). While population densities are still low in these counties, development has been occurring within sensitive riparian areas in the valley floor. Taking additional steps to conserve wildlife habitat in the San Luis Valley now, while land prices are still affordable and irreplaceable habitat has not been lost, may be appropriate. Protecting this land from development is the only way to ensure the long-term resiliency of the ecosystem and maintain viable wildlife populations and habitats in the face of climate change and other threats (USFWS 2010a).

Water quantity, quality, and use issues are major threats to the sustainability of wetland and riparian habitats in the SLVCA. Changes in water quality and quantity have adverse effects on the function of the wetland complex located in the valley floor. There are, for example, growing concerns about the impacts of new contaminants, such as endocrine-disrupting chemicals, that can affect water quality on both private and public lands (USFWS 2010a).

Ground water usage, especially artesian well development, started during the early 1900s. The result has been the construction of over 7,000 wells and development of one of the world's largest concentrations of center pivot irrigation systems, many of which depend solely upon ground water. As a consequence, water users and regulators have acknowledged that annual ground water use chronically exceeds recharge. Because legal and political circumstances, new ground water rules are currently being developed by the Colorado Division of Water Resources and may soon be applied to water users in the San Luis Valley (USFWS 2010a).

Once the new ground water rules are implemented, ground water users will be responsible for eliminating

injury to senior water rights through a formal augmentation planning process with the State (USFWS 2010a). In most cases, this will require ground water users to acquire, and in many cases, remove senior water rights from other properties to augment their well use.

These circumstances threaten healthy riparian systems along the Rio Grande, Conejos, and Alamosa rivers, where senior water rights are currently used in the floodplain. The evolving economic and regulatory environment in the SLVCA will likely result in the acquisition of some of these water rights to augment distant wells, moving water out of the floodplain and degrading migratory bird habitat (USFWS 2010a). Additionally, this will increase the State's difficulty in managing water in the Rio Grande and administering the Rio Grande Compact. For these reasons, the Rio Grande Water Conservation District and other water users in the San Luis Valley will support the SLVCA in acquiring conservation easements along these rivers (USFWS 2010a).

Energy development is also an emerging threat to wildlife in the SLVCA. Colorado is among the most promising sources of solar energy nationwide, and the San Luis Valley receives more direct solar radiation than any other part of the State (National Renewable Energy Laboratory 2007a, National Renewable Energy Laboratory 2007b). Interest in the development of the solar energy industry in the San Luis Valley continues to expand, especially since Colorado State legislation requires that 30 percent of large utilities' electricity come from renewable sources by 2020 (Galbraith 2010). Prospective solar development in the local area is supported by Federal initiatives and funding from the U.S. Department of Energy (U.S. Department of Energy 2011, Jaffe 2011). The growth of the solar industry in the local area, however, is dependent on the ability of solar producers to obtain power purchase agreements from the Public Service Company of Colorado and may also be dependent on the future provision of transmission lines out of the valley (Colorado Department of Local Affairs 2011). Other nonrenewable (oil and gas) and renewable (wind) forms of energy development occur to a lesser extent in the SLVCA than many western States (USFWS 2010a).

SLVCA LAND CONSERVATION EFFORTS

Land protection is a relatively new practice in the San Luis Valley, as most conservation easements have been completed within the last 10 years. However, during this short time frame, more than 232,000 acres of land have been protected, which suggests that public support for land protection in the SLVCA is strong (USFWS 2010a). In fact, there are so many landowners interested in entering into conservation easements that organizations like the Rio Grande Headwaters Land Trust, The Nature Conservancy, Ducks Unlimited, and the NRCS cannot handle the demand, either for time or funding (USFWS 2010a). Citizens of the San Luis Valley understand that the rural lifestyle and wildlife habitat is what makes this area unique and have voiced their concern over the loss of these values. They recognize that conservation easements are a tool to keep both ranches and wildlife habitat intact (USFWS 2010a).

The Service plans to conserve approximately 530,000 acres to protect the remaining expanses of wildlife habitat in the SLVCA. This would be accomplished primarily through the purchase of conservation easements by the Service on a voluntary basis from private landowners. Other Federal, State, and nongovernmental partners may assist in acquiring conservation easements or fee-title to a lesser extent. On a limited basis, fee-title acquisition may be used by the Service to protect wetlands such as the Alamosa Marshes on the valley floor of the SLVCA. Acquisition of these lands will occur over a period assumed to range from 15 to 20 years, but based on past acquisition rates, could reasonably be expected to occur over a longer period, possibly up to 100 years.

Conservation Easements

One of the Service's high-priority objectives is to guide residential and commercial development away from high-priority conservation areas by securing appropriate conservation easements. The SLVCA will focus on the protection of wetland habitat types and associated uplands on private land within the valley floor through acquisition of conservation easements from willing sellers (USFWS 2010a). Conservation easements leave land in private ownership, protecting private property rights, while providing the Service with a cost-effective conservation strategy that enables the conservation of large blocks of habitat. Within the SLVCA, the Service proposes to purchase conservation easements to protect up to 500,000 acres of significant wildlife habitat to maintain wildlife populations, plant communities, and ecosystem processes in perpetuity (USFWS 2010a).

A conservation easement is a voluntary legal agreement entered into between a landowner and a conservation entity. Conservation easements are binding in perpetuity; the landowner reserves the right to sell or bequeath the property, but the easement and its associated restrictions remain with the property forever. Owners of land that does not contain a conservation easement have a set of rights associated with their land. For example, landowners have the right to run cattle, grow crops, harvest trees, build structures, and subdivide and sell their land. Under a conservation easement, landowners maintain ownership of their property, but transfer some of their ownership rights to the conservation entity. The most common

right transferred under a conservation easement is the right to develop or subdivide the land.

Conservation easements in the SLVCA may require the transfer of additional rights. A conservation easement on a parcel of land may have restrictions for all types of human development, such as surface disturbance from solar, mineral, or wind energy development, and may include restrictions to ensure maintenance of historic water use patterns that benefit wildlife. Protecting critical water sources on private land will be a key objective within the SLVCA, and easement agreements may include restrictions on the sale or diversion of water from the land.

Wetland habitat is common in the SLVCA on private lands in areas where ranchers irrigate and use habitat for native hay meadows and pastureland for livestock. Protection of wetland habitat types will ensure proper drying and flooding cycles while maintaining historic water use patterns in wetland basins that are beneficial to wildlife.

In most cases, a conservation easement acquired for wetland values will be associated with appurtenant irrigation water rights that have resulted in desirable wildlife habitat. Doing anything less may often result in separation of water use from the land, reducing the easement's value to trust wildlife species. Water laws are sensitive to State requirements; therefore, water issues will need to be addressed individually for each easement. In all cases, the terms of a conservation easement must be mutually agreed upon by the landowner and the easement holder. Conservation easements acquired from private landowners would not affect their property rights beyond those purchased through conservation easement.

Subsurface rights are often severed from the surface rights of a parcel of land. Conservation easements apply only to surface rights; therefore, the mineral interest may be extracted at any time by the person who holds the qualified mineral right (Byers and Ponte 2005). For this reason, the Service is unlikely to enter into a conservation easement agreement for a parcel of land that has a viable subsurface mineral interest. Exceptions may be made if the parcel has high habitat value and the probability of mineral extraction is low.

Fee-title Purchases

Within the SLVCA, the Service proposes to purchase limited property in fee-title at fair market value to protect up to 30,000 acres of significant wildlife habitat and maintain wildlife populations, plant communities, and ecosystem processes in perpetuity (USFWS 2010a). Under fee-title purchases, full ownership of the land, including the underlying title, is transferred to another party. This gives the new owner maximum interest in the purchased land and allows the new owner to manage the land in any manner that is consistent with local, State, and Federal laws. For fee-title acquisitions, the Service intends to evaluate the purchase of water rights with each property.

The primary fee-title acquisition component of the SLVCA is expansion of the Alamosa National Wildlife Refuge western boundary to include wetlands identified during the 1874, 1875, and 1877 Wheeler expedition as the Alamosa Marshes (U.S. Army Corps of Engineers 1878). The acquisition area includes the confluences of Alamosa River, Rock Creek, and La Jara Creek with the Rio Grande. The area still provides one of the largest intact wetland complexes in the San Luis Valley. That said, the acquisition of fee-title will be considered only in circumstances where the Service's conservation objectives could not be met with conservation easements.

Water Law

Colorado

Colorado is divided into seven water divisions determined by watershed boundaries. Each division has a Water Court and a division engineer who administers water rights by priority. The Rio Grande is in Division 3.

Water rights in Colorado are subject to the prior appropriation doctrine; the first entity to claim the water right has the first right to use the full amount of water they claimed for beneficial use. The prior appropriation doctrine allows State officials to properly manage and distribute water according to the decreed priority dates. There are four elements of a water right under the prior appropriation doctrine: intent, diversion, beneficial use, and priority. An applicant must demonstrate that there is intent to use the water, construct the diversion works, put the water to beneficial use, and establish a priority date. In Colorado, every water right must be adjudicated through the Water Court. There are now legal avenues to use water for beneficial use without a diversion, such as instream flows.

If there is not enough water to satisfy all water right holders in a particular stream, the State may shut off junior rights as necessary to ensure that senior water right holders receive their full appropriation. The Rio Grande basin in Colorado is considered over-appropriated.

Ground water in Colorado is designated as either tributary or non-tributary. Tributary ground water is water contained in aquifers that have a direct hydraulic connection to surface water. The unconfined aquifer in the San Luis Valley is tributary ground water. Tributary ground water is treated administratively the same as a surface water diversion. The confined aquifer in the San Luis Valley is also considered tributary, though the hydraulic connection to the surface water system is poorly understood.

Water rights in Colorado can be transferred from one entity to another, but a change application must

be filed and approved by the State Engineer and the Water Court. The amount available for transfer is limited to the consumptive use portion of the right. Water rights in Colorado are considered real property and they may be bought or sold. A water right can be conveyed either as part of a piece of property or separate from a property, as long as that water right has been severed from the land by an approved application through the State engineer and the Water Court.

In 1973, the Colorado legislature passed Senate Bill 97, creating the State's Instream Flow Program. This program, one of the first of its kind, vested the Colorado Water Conservation Board (CWCB) with exclusive authority to protect streamflow through a reach of stream rather than just at a point, and to protect levels in natural lakes. Until this law was passed, all appropriations of water in Colorado were required to divert water from the natural stream.

Since 1973, Colorado clarified the CWCB's authority to acquire existing, decreed senior water rights on a voluntary basis from willing owners for instream flow uses. New appropriations are new, junior water rights claimed by the CWCB to preserve the natural environment. New appropriations are considered by the CWCB each year and are filed annually with the Water Court for adjudication. New appropriations are generally limited to the minimum amount necessary to fulfill the purpose of the instream flow.

New Mexico

New Mexico's water law is also based on the doctrine of prior appropriation. All waters in New Mexico are declared to be public and subject to appropriation for beneficial use. Apart from water rights acquired before 1907 and small-scale stockwatering (10 acre-feet or less), a permit from the State engineer is required to appropriate water, change the point of diversion, change the location of wells in declared basins, divert or store water, or change the place or purpose of water use. There is a new requirement in New Mexico that prior to obtaining a water right involving the use of public lands, the person seeking the right must prove that he or she actually has a permit to use the public lands.

The New Mexico groundwater code was enacted in 1931. Ground water procedures closely parallel those for surface water, with several important differences. A permit to drill a well and appropriate water is not required in areas outside of declared "underground-water basins." Within undergroundwater basins, however, use is regulated by the State engineer. The State engineer has the authority to establish these basins when regulation is necessary to protect prior appropriations, ensure that water is put to beneficial use, and maintain orderly development of the State's water resources. There are currently 33 declared undergroundwater basins throughout New Mexico.

Water rights in New Mexico can be transferred from one entity to another, but a change application must be filed and approved by the State engineer. Water rights in New Mexico are considered real property and they may be bought or sold. A water right can be conveyed as part of a piece of property or separate from a property, as long as that water right has been severed from the land by an approved application through the State engineer.

New Mexico has had adjudicated water rights since 1907. In an adjudication suit, each claimant has an opportunity to present evidence of water right to the court. The completion of adjudication results in a court decree outlining the priority, amount, purpose (determination of use), periods, and place of water use.

New Mexico's instream flow program is complex, unclear, and continually evolving. New Mexico does not have a legislated instream flow program, and instream flow is not a recognized beneficial use. Recent case law, however, has allowed the development of an instream flow program in New Mexico. In 1998, the New Mexico Attorney General issued a legal opinion concluding that the transfer of a consumptive water right to an instream flow right is allowable under State law. The legal opinion determined that instream uses such as recreation and fish and wildlife habitat are beneficial uses, and that transfers of existing water rights to instream flows are not expressly prohibited. Prior to this opinion, New Mexico was the only State that did not recognize instream flow as a beneficial use.

The 1998 Attorney General's opinion is limited to the transfer of existing water rights. The opinion notes that new appropriations of water for instream flow are not subject to this precedent. Although the opinion concludes that there are no legal barriers to the transfer of existing water rights to an instream flow right, the State engineer still has the responsibility for approving such a transfer. Although instream flow in itself is not recognized as a beneficial use, it appears that water can be dedicated to instream flow for the purpose of recreation or fish and wildlife habitat.

The Attorney General's opinion does not explicitly address the issue of ownership of instream flow rights. Since ownership of other types of water rights are not limited, it could be interpreted that instream flow rights could be held by a public or private entity. Current law is unclear and continues to develop.

Chapter 4 — Environmental Consequences

For alternatives A and B described in section 2, the following narrative documents the analysis of environmental effects expected to occur from implementing each of the alternatives.

Effects on the Physical Environment

The estimated effects of each alternative on mineral, soil, and water resources, and on the Service's ability to address climate change, are described below.

Alternative A (No Action)

Development and associated habitat loss could continue on lands outside of existing protected areas; in riparian areas, development may cause erosion and sedimentation that ultimately could adversely affect aquatic species like the Rio Grande cutthroat trout. Additionally, surface water rights will continue to be subject to sale, altering hydrology that currently benefits many wildlife species. Further land protection would be limited to the efforts of other agencies and organizations. The Service's role would be limited to programs such as Partners for Fish and Wildlife; no Land and Water Conservation Fund monies would be expended in the project area by the Service for further land protection outside of the immediate vicinity of existing refuge units. Important water-dependent wildlife habitat would remain vulnerable to reallocation of surface water off site or changes to how existing water rights are exercised.

Alternative B (Proposed Action)

The establishment of the SLVCA will primarily maintain current land use practices, and is therefore unlikely to substantially affect soil resources in the valley. There may be some reduction in erosion and sedimentation due to prevention of subdivision and development. The SLVCA wouldn't supersede existing mineral rights, and the program is therefore unlikely to affect mineral resources. The Service is unlikely to pursue acquisition of interests in lands with outstanding surface mineral leases or rights because the associated destruction of surface vegetation and need for reclamation would diminish the wildlife value of such land. Habitat that depends on continuation of current water use practices would be protected from degradation caused by the sale of surface water rights or substantial changes to water use. There could be a net benefit to aquifer recharge if any of water rights acquired by the Service through this plan were adjudicated for instream flow (M. Estep, personal communication to M. Dixon, March 2012).

Effects on the Biological Environment

This section describes the likely effects of the project on species and their habitats.

Alternative A (No Action)

The Service's Partners for Fish and Wildlife program would remain active within the project area, where it works cooperatively with landowners to voluntarily improve habitat on private land. Habitats would continue to be protected due to the ongoing efforts of agency partners and nongovernmental organizations, primarily through easements funded by private donations, the NRCS Wetland Reserve Program (WRP), and North American Wetlands Conservation Act (NAWCA) grants. These efforts are laudable and have conserved valuable habitat, particularly wetlands. However, they tend to under-represent non-wetland riparian forest and uplands such as sagebrush steppe, both of which are particularly important for federally listed species and candidates for listing in the project area. Further, the demand for both NAWCA and WRP funds is much higher than historically available funding. Also, unlike a Land and Water Conservation Fund easement program, NAWCA requires matching funds, which may or may not be available. Therefore, there would likely continue to be erosion of habitat quality and a decrease in ecological resiliency due to land cover changes and associated fragmentation, introduction of exotic species, and construction of man-made structures that are incompatible with habitat use by some wildlife.

Outright habitat loss due to conversion of land to other uses is perhaps the most obvious threat to wildlife in most areas. In the SLVCA, this can take the form of conversion from natural to agricultural land

cover, changes to irrigation regimes, and development of land for commercial or residential use. This habitat destruction, along with construction of associated infrastructure such as water diversion structures, can result in the fragmentation of habitat. The effects of fragmentation on wildlife have been intensively studied in ecology and wildlife biology (for a conceptual review, see Collinge 2009).

Both the loss and fragmentation of riparian habitat are real concerns in the SLVCA. Riparian areas are necessary for the maintenance of medium and large mammal diversity in agricultural landscapes (e.g. Hilty and Merenlender 2004), and for both breeding and stopover habitat for neotropical migratory songbirds in human-altered landscapes (Pennington, Hansel, and Blair 2008). Valley floor riparian areas provide nest habitat for the threatened southwestern willow flycatcher and the candidate yellow-billed cuckoo, and the slow but continued loss of this habitat under alternative A would have an impact not just on regional species diversity, but also on the potential persistence of imperiled species.

Besides providing habitat in and of themselves, riparian areas also serve as corridors for animal movement. Facilitating animal movement across complex mosaic landscapes is critical in a time of global environmental change. One of the greatest ecological threats of climate change is that species and varieties that are adapted to specific environmental conditions may die out because they are isolated from habitats that may have those conditions in the future (Loss et al. 2011). Under alternative A, there is continued risk of development in previously contiguous riparian corridors, as well as in unprotected areas along the Sangre de Cristo Mountains in Costilla County, Colorado, and northern Taos County, New Mexico, which could endanger the future existence of populations and species under future climate conditions. The latter area is also habitat for the Canada lynx which is federally listed as threatened; development of that region, which could occur under alternative A, may isolate lynx in the southern Sangre de Cristos from those in the rest of the Rocky Mountains.

Alternative B (Proposed Action)

Establishment of the SLVCA would enable the Service to permanently protect up to 530,000 acres of vital wildlife habitat, in addition to that already held in Alamosa, Baca, and Monte Vista NWRs. While there are several conservation initiatives by other government agencies and private land trusts underway in the project area, the SLVCA specifically targets habitat that is necessary for migration and/or breeding of Federal trust species, namely migratory birds and a handful of federally listed and candidate species. The conservation area should complement and enhance the ecological benefits of existing public and private conservation lands and habitat improvement programs by capturing habitats not included in these programs and by helping to link together the existing protected area.

The use of easements and limited fee-title to protect and buffer riparian habitats under alternative B would benefit both obligate riparian species like the southwestern willow flycatcher, bats like the Yuma myotis, and species that simply use the riparian areas as corridors to move from point to point, like bobcat and black bear. Of particular interest are the willow and cottonwood riparian forests along the Rio Grande, Conejos, and San Antonio Rivers, which are used by dozens of species of migratory songbirds. In the rivers and tributaries themselves, the use of easements could maintain conditions suitable for imperiled fish such as the Rio Grande cutthroat trout, Rio Grande chub, and Rio Grande sucker by preventing development of houses and roads, which can cause siltation and changes in water chemistry and temperature. Easements would also prevent conversion of shrub steppe near riparian areas to cropland, which can lead to increases in sediment, nitrogen loads, and temperatures in associated streams.

The presence of wetlands in the midst of a high-mountain desert provides an irreplaceable resource to regional, and in some cases continental, populations of breeding and migrating shorebirds, wading birds, and waterfowl. Water costs in the San Luis Valley are increasing due to restrictions on the use of ground water, and water is likely to become an increasingly complex issue due to projected changes in runoff timing and uncertainty regarding future precipitation trends (Ray et al. 2008). This may encourage landowners who have quality wetlands to change how they exercise their water rights, to the detriment of species that use those wetlands. The easements may include language restricting changes to existing beneficial uses of water, meaning that willing sellers would agree to maintain practices that are of value to wildlife. For example, water could not be sold off of the property where water rights were being exercised when the easement was purchased unless the new use was deemed more beneficial to wildlife. This could be especially important for the sandhill crane, since the vast majority of its Rocky Mountain population uses the marshes and wet meadows of the San Luis Valley as a stopover during spring and fall migrations (Drewien and Bizeau 1974). Many of these wetlands would not exist at present without current land use practices.

Sagebrush shrubland and steppe are not widespread in the project area, but are found in a ring above the desert scrubland and below the pinyon-juniper woodland in the far northern, southeast, and southwest portions of the valley. Much of this land is managed by the BLM. The largest areas of this vegetation in

the region are in Costilla County, Colorado, and these areas are almost entirely privately owned and not under conservation easements. Colorado Parks and Wildlife has identified that area as potential but unoccupied habitat for the Endangered Species Act candidate Gunnison sage-grouse. Sage-grouse, as well as other sagebrush obligates, are particularly sensitive to disturbance, especially the construction of vertical structures in their habitat, which could happen if homes and associated power lines were constructed. Much of that area has been subdivided into small parcels, but little real development has occurred to date outside of small towns and cities. Given those factors, and the lack of attention being given to that habitat type by conservation partners at present, land protection under alternative B is likely to play an important role in preventing modification of this important ecosystem. It is unknown if there will be future attempts to reintroduce Gunnison sage-grouse to that area, but certainly it would be unlikely to happen if the existing habitat were altered.

As discussed under alternative A, there are large unprotected areas along the spine of the Sangre de Cristo Mountains in Costilla County, Colorado, extending into Taos County, New Mexico. Alternative B would allow the Service to use its acquisition authority to complement efforts by private land trusts to protect this important wildlife corridor and Canada lynx habitat.

Effects on Cultural Resources

The estimated effects of each alternative on cultural resources are described below

Alternative A (No Action)

Some cultural resources could be adversely affected by activities such as development and road construction on lands outside of existing public and private conservation lands. While the rate of development is not rapid at present, the San Luis Valley is rich with millennia of human history, and much of the valley's history is poorly documented. There are legitimate concerns that important sites may be destroyed or irreparably disturbed in the absence of protection.

Alternative B (Proposed Action)

There is the potential for greater protection of cultural resources than under alternative A because the easement terms that prevent development of land in ways that could adversely affect wildlife could also prevent destruction of Native American, Hispano, and other historical American sites.

Effects on the Socioeconomic Environment

This section describes the estimated effects of the alternatives on land use, ecosystem services, land ownership, and the regional economy.

Alternative A (No Action)

Landownership patterns will continue to change in accordance with market forces, as will resulting modification of ecosystem services and changes in cost of public service delivery by local government. Landowner compensation through conservation easements would remain available through other Federal programs and the efforts of nongovernmental organizations.

Alternative B (Proposed Action)

Social and Economic Impacts of Conservation Easements and Fee-title Acquisitions

Conservation easements and fee-title acquisitions provide public benefits for local residents, communities, and governments. Easements and fee-title acquisitions also reshape future development patterns, affect property values, and inject new money into local communities. There are many dynamic variables at play when considering the social and economic effects of conservation easements and fee-title acquisitions, especially given that potential purchases may span decades. Due to future uncertainty surrounding such factors as the likelihood and timing of easements and acquisitions; the availability of Service funds to purchase lands; and population growth, land values, and agricultural commodity prices, the social and economic impacts of the easements and acquisitions cannot be quantified in this analysis. However, these impacts can be described qualitatively. This analysis discusses the following effects of conservation easements and fee-title acquisitions in the SLVCA:

- conservation values in the region
- benefits to local communities
- landowner compensation
- effects to local government net revenue

Table 4, located at the end of this section, provides a summary of the social and economic impacts of conservation easements and fee-title acquisitions in the SLVCA.

Conservation Value. Conservation easements and fee-title acquisitions can protect values associated with biodiversity and wildlife abundance, maintain aesthetic beauty, and protect social and culturally significant features of landscapes and livelihoods (Millennium Ecosystem Service Assessment 2005; Ehrlich and Ehrlich 1992; Daily 1997). Ecosystem services, such

as water purification, oxygen production, pollination, and waste breakdown, are also maintained for local residents through land preservation (Millennium Ecosystem Service Assessment 2005). The primary public benefit of Service conservation easements and fee-title acquisitions is enhanced and preserved wildlife habitat. As development stressors increase over time, many key off-refuge habitat areas may become less available due to conversion to non-wildlife habitat uses. Habitat preservation has been shown to stabilize and increase wildlife populations (Reynolds and others 2001). Conservation easements on private lands strengthen the resiliency of species habitat and provide opportunities for wildlife movement and adaptation for years to come.

Benefits to Local Communities. Although local residents may not be able to explicitly use or access land protected by conservation easements, protected lands act as a buffer that benefits residents through increased biodiversity, recreational quality, and hunting opportunities on publicly accessible wildlife refuges and on some private lands (Rissman et al. 2007). It is well documented that open space carries positive values to local residents and communities, as well as to passers-by (McConnell and Walls 2005). This is evidenced by the success of open space preservation ballot initiatives at the local, county, and State levels. Banzhaf et al. (2006) point out that between 1997 and 2004, over 75 percent of the more than 1,100 referenda on open space conservation that appeared on ballots across the United States passed, most by a wide margin.

It is also well documented that open space and protected natural areas can increase surrounding property values (see McConnell and Walls 2005 for a comprehensive review). The reciprocating value of open space on property values will vary depending on landscape characteristics and location attributes (for example, distance to the conserved area) (Kroger 2008). The permanence of the open space is also an influencing factor. Typically, open space that is permanently protected (such as refuge lands and lands protected with perpetual conservation easements) will generate a higher enhancement value to local properties than land that has the potential for future development (Geoghegan et al. 2003). Location and demographic factors in the region can also influence the relative level of property enhancement value. For instance, open space may generate larger amenity premiums for property in more urbanized areas and where median incomes are higher (Netusil et al. 2000), which isn't to say there isn't the chance for property values to increase substantially in rural areas as well (Vrooman 1978, Phillips 2000, Crompton 2001, Thorsnes 2002).

Conservation easement and fee-title purchases would also inject new money into the local economy. The sale of conservation easements and fee-title lands provides landowners with additional revenue. Some percentage of these funds may be spent in the local economy, including purchasing new real estate, consumer goods, or services in the local area. Conservation easements may also help maintain the character of a region by protecting a traditional and historic way of life and the associated working landscape. Land with historic commercial use, such as ranching, forestry, and farming, is often compatible with or beneficial to wildlife refuge objectives (Jordan et al. 2007, Rissman et al. 2007). Conservation easements provide financial benefits for landowners that may enable them to preserve the natural and historic value of their farm, ranch, and open space lands, and to pass this legacy on to their children and grandchildren. In addition to maintaining a cultural heritage, the preservation of farming and ranching operations can result in economic benefits to the local economy. Farmers' costs for equipment, supplies, and materials may be spent in the local economy, thus stimulating local businesses and supporting local employment. Farm workers will also spend their salaries in the local economy, thus supporting further local employment.

Lands acquired through fee-title purchases would be managed by the Service. These lands would be converted from farmland to managed wetlands, which could result in a loss of agricultural production income for farmers and the elimination of farming-related purchases. However, maintenance of large intact expanses of wetland habitat through fee-title acquisition would require active management by the Service and the associated purchase of new equipment and supplies to manage these lands for wildlife habitat. Acquisition of additional fee-title lands and conservation easements may also result in increased recreation-related spending by visitors.

Landowner Compensation. The Service proposes to buy conservation easements from willing sellers at fair market value. The fair market value of a conservation easement is determined through an appraisal process. An appraiser estimates how much the land would sell for unencumbered by the conservation easement (the "before" value) and how much the land would sell for with the conservation easement in place (the "after" value). The value of the conservation easement is equal to the before value minus the after value, or the difference in the fair market value of the property with and without the easement. Landowners may also choose to donate conservation easements to the Service. The donation of a conservation easement may qualify as a tax-deductible charitable donation, which may result in Federal income tax benefits. The sale of a conservation easement for less than its fair market value (called a "bargain sale") may also qualify for tax deductions. Landowners may be able to claim a charitable income-tax donation equal to the difference between the fair market value and the bargain sale price of their easement. Income from the sale of

a conservation easement may be taxable. Please note that the Service does not give tax advice. Landowners considering entering into a conservation agreement with the Service should consult a tax advisor or attorney for advice on how a conservation easement would affect their taxes and estate.

Conservation easements reduce the value of the encumbered property. A conservation easement will reduce the fair market value of an estate because the easement permanently removes some of the estate's development potential. The reduction in value depends on the potential development value of the land and the level of restriction agreed upon in the easement. In general, an easement on land located in an area with high development pressure will have a greater effect on the value of the land than an easement on land located in an area with low development pressure, and an easement that is more restrictive will have a greater effect on the value of the land than an easement that is less restrictive. The Service will purchase easements at their appraised fair market value; therefore, easements on lands with high development pressure will receive higher payments.

For fee-title acquisitions, land owners would be compensated for the fair market value of the land. Land owners would forfeit all rights of ownership and turn the property over to the Service.

Effects on Local Government Net Revenue. The effects of conservation easements and fee-title acquisitions on the net revenue of local government are complex and speculative; many variables are at play, and realizing the effects often requires time. Local governments collect revenue through intergovernmental transfers, property taxes, sales taxes, personal income taxes, and other charges, such as permitting. These revenues are then spent to provide community services such as fire and police services, schools, infrastructure, and public spaces. Conservation easements and fee-title purchases affect the location of future development, and therefore affect both future revenues and costs for local governments. The following sections describe the possible effects to local government revenues and costs. Overall, the SLVCA conservation easement program and limited fee-title purchases are expected to have negligible effects on local government net revenues (revenues minus costs).

Effects on Local Government Revenues. Property taxes constitute the largest source of local governments' own revenue (Urban Institute and Brookings Institution 2008), and are not expected to be substantially affected by conservation easements in the SLVCA. Property taxes are assessed based on the value of property. For most types of properties, county assessors use fair market value to determine property tax liabilities; however, agricultural land is often assessed differently. In many States, the assessed value of agricultural land is determined based on the productive value of the land rather than on the fair market value of the property. The fair market value of land is the amount that a property is estimated to sell for. This value includes both the productive value of the land and any speculative value associated with the possibility of developing the land. Conservation easements reduce the fair market value of property by removing the speculative value associated with possible development; however, conservation easements generally do not affect the productive value of agricultural land.

The SLVCA would include land in two States: Colorado and New Mexico. In both States, property taxes for agricultural land are assessed based on the productive value of the land or farm income[1] (Colorado Division of Property Taxation 2006; New Mexico Taxation and Revenue Department 2011). In the SLVCA, the majority of properties that will enter into conservation-easement agreements with the Service will be classified as agricultural land; thus, there will be little affect on the current property tax base for the nine-county area. Some of the lands in the SLVCA that will enter into easements are currently fallow and do not classify as agricultural lands. For these properties, assessors may assess the fair market value of the land based only on the uses permitted by the easement. This could result in a small reduction in property tax revenue in some counties within the region. The reduction in property taxes will be dependent on the percent of easement acres that are purchased on fallow land (versus agricultural land), and on the reduction in the market value of the fallow lands.

The purchase of fee-title lands at fair market value will reduce the amount of property tax revenue collected by local governments because the Service is exempt from taxation on its property holdings. Under Federal fee-title ownership, counties would qualify for reimbursement of some property tax revenue foregone under the Refuge Revenue Sharing Act (RRS) of 1935, which allows the Service to make annual payments to local governments in areas where fee-title purchases have removed land from the tax rolls. Under provisions of the RRS Act, local counties receive an annual payment for lands that have been purchased by full fee-title acquisition by the Service. Payments are based on the greater of 75 cents per acre or 0.75 percent of the fair market value. The exact amount of the annual payment depends on Congressional appropriations, which in recent years have tended to be substantially less than the amount required to fully fund the authorized level of payments. In fiscal year 2010, actual RRS payments were 22 percent of authorized levels.

1 Special rules and statues apply in each State to determine if land in agricultural production and land in conservation easements is eligible to be assessed as agricultural land.

Local government revenue associated with personal income is expected to remain relatively constant within the nine-county area. Conservation easements and fee-title acquisitions in the SLVCA would affect the location and distribution of development, but are not expected to change the rate or density of human population growth. Redistribution of population growth could affect the distribution of personal-income-related revenues across the counties, but is expected to have little effect on total revenues within the nine-county area. There would be a one-time increase in landowner income as the Service purchases the easement or land in fee-title. Fee-title purchases that result in the conversion of land out of agricultural production could reduce farmer income and expenditures on agricultural supplies purchased in the local area. However, these lands would be converted to wetland habitat, likely requiring habitat improvements and ongoing maintenance. These management activities would result in an increase in the amount of money spent on supplies purchased in the local area, as well as the potential for additional income for new Service employees.

Effects on Local Government Costs. Land protection through conservation easements and fee-title acquisition could result in a reduction in future expenditures for local governments and municipalities. New residential developments require local governments to provide services such as fire protection, police services, and schools, and to construct new infrastructure such as roads, parks, and water and electric-delivery systems. The costs to provide government services for new residential developments often exceed new revenues derived from the developments. This is especially true for rural residences, which tend to have higher costs for county governments and school districts than urban residences. In 2001, the American Farmland Trust found that, on average, the cost to provide community services to new residential developments was $1.15 for every $1.00 of revenue generated by those developments (American Farmland Trust, 2001; Coupal et al. 2002). A study conducted in Wyoming found that community service costs averaged $2.01 for every $1.00 of revenue for rural residential lands; in contrast, the average cost to provide services for lands under agricultural production averaged $0.54 for every $1.00 of revenue (Taylor and Coupal 2000).

Unavoidable Adverse Impacts

This section describes adverse effects which may be unavoidable when carrying out alternatives A and B.

ALTERNATIVE A (NO ACTION)

Loss of wetland, riparian, and upland vegetation and their associated habitat values would continue due to development of areas outside of those protected by partner agencies and land trusts.

ALTERNATIVE B (PROPOSED ACTION)

No direct or indirect unavoidable adverse impacts to the environment would result from the selection of alternative B. An easement and limited fee-title program would not result in adverse impacts on the physical or biological environment. The selection of an approved boundary for the SLVCA and concurrent authorization to go forward with an easement program would not, by itself, affect land ownership or value, or other aspects of the socioeconomic environment.

Irreversible and Irretrievable Commitment of Resources

Any commitments of resources that may be irreversible or irretrievable because of carrying out alternatives A or B are described below

ALTERNATIVE A (NO ACTION)

There would be no commitment of resources by the Service if alternative A were selected. The Service could still exercise its authority to acquire inholdings or for minor expansions of existing refuges, but would not be obligated to do so.

ALTERNATIVE B (PROPOSED ACTION)

The establishment of the SLVCA would not, of itself, constitute an irreversible or irretrievable commitment of resources. However, if interests in land were acquired through the use of Land and Water Conservation Fund or donations, the administration of the easement provisions would require an irreversible and irretrievable commitment of resources. The monitoring of easements would represent a minor increase in overall Service costs borne by the San Luis Valley NWR complex.

Short-Term versus Long-Term Productivity

Following is a discussion of short- and long-term effects.

ALTERNATIVE A (NO ACTION)

Continued efforts to conserve habitats would be ongoing through the efforts of Service activities like

Partners for Fish and Wildlife and the efforts of other agency and nonprofit partners. Important wetland and upland habitats would be expected to continue to be lost at current rates of conversion, which would have long-term negative implications on the maintenance of the ecological communities they support.

Alternative B (Proposed Action)

The Service would be authorized to purchase perpetual easements only from willing sellers, providing an immediate short-term economic benefit to landowners. This may provide capital for expansion of agricultural operations, or simply permit struggling operators to stay in business. This is particularly relevant given the changes to Colorado water law, which now require ground water users to purchase increasingly expensive surface water to minimize their impact on senior surface water users. This infusion of capital at an opportune time would likely have important long-term benefits to the economy of the San Luis Valley. The conservation of habitats under this program would also have important short- and long-term ecological benefits. The program would preserve habitat currently used by wildlife, including federally protected species. This would result in the preservation of the area's biodiversity, which is important for long-term ecosystem stability and function in arid environments (Maestre et al. 2012). By preventing fragmentation, particularly in wildlife corridors like riparian areas and along the Sangre de Cristo Mountains, the program would promote long-term ecological resiliency to habitat perturbations such as large wildfires and climate change.

Cumulative Impacts

As defined by NEPA regulations, a cumulative impact on the environment "results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 CFR 1508.7). The following describes the past, present, and reasonably foreseeable actions related to the proposed SLVCA. A discussion follows regarding the cumulative impacts of these actions in combination with the actions of alternatives A and B.

Past, Present, and Reasonably Foreseeable Future Actions

A number of private and public organizations have successfully implemented land protection programs in the San Luis Valley through negotiation of conservation easements with willing landowners. One specific example is a coalition of local governments, landowners, and nonprofit organizations that is working to conserve land as part of the mitigation strategy in the draft San Luis Valley Habitat Conservation Plan planned for release in June 2012. The Service assumes that these land protection efforts will likely continue in the foreseeable future.

The State of Colorado is implementing new laws regarding ground water augmentation, wherein landowners who use ground water for irrigation will have to purchase surface water rights to offset any adverse impacts on downstream users.

There is ongoing interest in the San Luis Valley for renewable energy development. There are small-scale commercial solar facilities currently deployed in the San Luis Valley, and the Department of Energy and the BLM are studying the impacts of additional facilities being developed on public land (BLM and DOE 2010). The BLM is currently reviewing the potential impacts of expanded geothermal leasing on public lands in the San Luis Valley (BLM 2012). The potential for increased energy production in the San Luis Valley has led to planning for the construction of a high-capacity transmission corridor through the valley, crossing the Sangre de Cristo Mountains at La Veta Pass. Planning for that power corridor has stalled; however, interest in building another corridor to promote energy reliability is ongoing.

Alternative A (No Action)

Under this alternative, there would be no cumulative impacts on the environment since the Service would not undertake any additional land protection measures.

Alternative B (Proposed Action)

The continuing land protection efforts of others, combined with the proposed action, may have non-linear, positive effects on wildlife populations. Since this alternative would focus on federally regulated species (i.e., priority migratory bird species and species listed or being considered for listing under the Endangered Species Act), implementation would result in accelerated protection of habitats for those species. The Service seeks to coordinate its land protection efforts by promoting active communication with conservation partners on land protection opportunities as they arise so that the organization whose program is most appropriate can seek the acquisition of a particular land interest. The public and private conservation entities in the San Luis Valley have a long-standing friendly relationship and view each other's conservation objectives as largely complementary. However, there are specific instances where potential conflict could arise without this communication, such as riparian habitat of the southwestern willow flycatcher. The Service does not intend to compromise the ability of local government to meet its mitigation targets in the San Luis Valley Habitat Conservation Plan. To this end, the Service would not undertake any acquisition of

southwestern willow flycatcher habitats along the Rio Grande or Conejos Rivers without discussing the opportunity with our conservation partners. The Service would defer to partners in all instances where they need to seek an interest in the land first.

The impacts of new Colorado water law on water availability and cost may be cumulative with the impacts of the Service's easements, which would include language restricting the sale of surface water rights from lands protected under this program. Because the easements would maintain current water use practices on lands where an interest is acquired, these impacts are unlikely to be significant.

The presence of a Service interest in land could preclude construction of commercial energy production or transmission infrastructure on that property if such activity is deemed to be incompatible with the purpose of the SLVCA; this would result in unknown effects due to potentially limiting where such facilities could be sited.

Any impacts of the proposed action that are cumulative with the actions of others will largely be determined by 1) the number of landowners willing to enter into easement agreements with the Service and 2) the amount of funding available for acquisition of these easements.

Table 4. Social and economic impacts of conservation easements and fee-title acquisitions.

	Social and economic impacts	
Issue	*Conservation easements*	*Fee-title acquisitions*
Conservation value	■ Migration corridors and habitat for deer, elk, moose, and migratory birds will be preserved.	■ Same as for easements plus the conservation value of fee-title lands may be greater than easement lands because the Service would have the ability to increase conservation value through projects on the land.
Affects to local communities	■ The public will enjoy increased biodiversity, recreational quality, and hunting opportunities on nearby publicly accessible refuges and some private lands. ■ Neighboring property values may increase. ■ Positive economic impacts may result from new landowner money injected into the local economy. ■ Traditional and historic ranching and farming landscapes will be preserved.	■ Same as for easements except traditional and historic ranching and farming landscapes may not be preserved. ■ Positive economic impacts may also result from increased Service habitat improvement expenditures injected into the local economy. ■ Possible increase in refuge visitation and associated impacts of visitor spending in the local economy. However, neighbors and other public may be affected by increased accesses to refuge lands.
Landowner compensation	■ Land owners will be compensated for the fair market value of the easement. ■ Easements will reduce the fair market value of the encumbered property. ■ Landowners maintain the majority of use rights, but forfeit their right to develop or subdivide the land. Other possible restrictions include development of vertical structures, or diversion or sale of water rights.	■ Land owners will be compensated for the fair market value of the land. ■ Land owners forfeit all rights of ownership and turn the property over to the Service.
Affects on local government net revenue	■ No changes to property tax revenues are expected for agricultural lands. ■ Property tax revenues from fallow lands will decrease. ■ Other government revenues, such as personal income tax, may be redistributed throughout the region. ■ Land protection through conservation easements could result in reduced future service costs for local governments and municipalities.	■ The Service does not pay property taxes on land they own; thus, county tax revenue would decline. ■ Lost property tax revenues are partially replaced with Refuge Revenue Sharing payments.

Chapter 5. — Coordination and Environmental Review

This chapter describes how the Service coordinated with others and conducted environmental reviews of various aspects of the project proposal and analysis. Additional coordination and review would be needed to carry out the proposed action, if selected.

Agency Coordination

The Service has discussed the proposed establishment of the SLVCA with other Federal (USFS, National Park Service, BLM, NRCS), State of Colorado (Colorado Parks and Wildlife, Colorado Water Conservation Board), local county governments, and regional (Rio Grande Water Conservation District) agencies through a series of meetings and correspondence. Tribes with an aboriginal interest in the San Luis Valley and surrounding mountains (Pueblo of Picuris, Cochiti Pueblo, Jemez Pueblo, Jicarilla Apache Nation, Navajo Nation, San Juan Pueblo, Pueblo of Acoma, Pueblo of Jemez, Pueblo of Laguna, Pueblo of Ildefonso, Pueblo of Santa Ana, Pueblo of Santa Clara, Pueblo of Taos, Pueblo of Zuni, Southern Ute Tribe, Uintah and Ouray Ute Indian Tribe, and Ute Mountain Ute Tribe) were invited to participate or formally consult in the planning process. The Service's Regional Archaeologist consulted with the State Historic Preservation Officer, and was intimately involved with the development of this EA.

A number of nongovernmental organizations that are active in and around the San Luis Valley were also consulted, including Colorado Cattleman's Agricultural Land Trust, Colorado Open Lands, The Nature Conservancy, Rio Grande Headwaters Trust, Orient Land Trust, and Colorado Water Trust.

The Service coordinated internally in the development of this EA as well. Region 6 Refuge planning staff and San Luis Valley NWR Complex staff conducted the analysis and prepared this document, as well as the LPP. An intra-service Endangered Species Act section 7 consultation has been initiated and will be included as an appendix in the final LPP/EA. Region 6 Migratory Birds staff guided the development of our focal species list, and both that office and staff from the Region 6 Fisheries office reviewed the document (See appendix A, List of Preparers and Reviewers).

Contaminants and Hazardous Waste

The Service is required to invest in healthy lands. At a minimum, a Level I pre-acquisition site assessment by the USFWS Ecological Services – Colorado Field Office or New Mexico Field Office, as appropriate, would be required prior to acquisition.

Through the SLVCA, the Service hopes to help ensure the viability of wildlife habitats in an uncertain future.

National Environmental Policy Act

The Service conducted this environmental analysis under the authority of and in compliance with NEPA, which requires an evaluation of reasonable alternatives that will meet stated objectives, and an assessment of the possible effects on the natural and human environment.

Environmental Assessment

This EA will be the basis for determining whether the implementation of the proposed action would constitute a major Federal action significantly affecting the quality of the natural and human environments. NEPA planning for this EA involved other government agencies and the public in the identification of issues and alternatives for the proposed project.

Distribution and Availability

The Service distributed the draft EA (with the associated draft LPP in the same volume) to the project mailing list, which includes Federal and State legislative delegations; tribes; Federal, State, and local agencies; nongovernmental organizations; and interested individuals. Copies can be requested from the USFWS Region 6 office. The documents are also available electronically on the Refuge Planning website.

Project Web site: <http://www.fws.gov/mountain-prairie/planning/lpp/index.html>

- Project email: <slvrefugesplanning@fws.gov>
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Land Protection Plan Chapter 1 — Introduction and Project Description

"In short, this view combined the sublime and beautiful: the great and lofty mountains covered with eternal snows, seemed to surround the luxuriant vale, crowned with perennial flowers, like a terrestrial paradise, shut out from the view of man."

– Captain Zebulon Pike, on a hill overlooking the San Luis Valley, February 5, 1807

Through the San Luis Valley Conservation Area (SLVCA), the U.S. Fish & Wildlife Service (Service) seeks to protect the remarkable ecological values of the high-mountain desert that were so eloquently described during Pike's Expedition to the southwest in the early 19th century. The SLVCA is a landscape-level strategic habitat conservation initiative within the boundaries of the Southern Rockies Landscape Conservation Cooperative. It encompasses the headwaters of the Rio Grande in southern Colorado and a small part of northern New Mexico.

The San Luis Valley is a large intermountain valley bounded by the San Juan and Sangre de Cristo Mountains, whose rain shadows result in high desert conditions. However, the complex hydrology of the valley and the snowmelt runoff from the mountains have created a variety of dynamic wetlands and riparian corridors on the valley floor, resulting in a diverse assemblage of plants and wildlife. The valley provides habitat for many trust species, including the southwestern willow flycatcher, western snowy plover, numerous species of migrating and nesting waterfowl, and 95 percent of the Rocky Mountain population of greater sandhill cranes.

Anthropogenic practices, primarily agriculture, have resulted in substantial changes to the hydrology of the San Luis Valley. Both reductions in surface flows due to diversions and lowering of the aquifer due to ground water extraction have resulted in a substantial loss of wetland habitat. Many of the remaining wetlands and their associated wildlife are maintained either accidentally as a product of agricultural water use or intentionally due to active manipulation such as irrigation with ground and surface water and the construction of dikes and ditches. The remaining wetlands and the low human population density associated with the largely agricultural economy of the valley have resulted in the San Luis Valley's maintaining a significant portion of its biological value, particularly for migratory birds. However, rising agricultural costs, including those resulting from the recent requirement to augment surface flows to offset the impacts of ground water use, have led to an unsettled agricultural economy. The potential for farmers and ranchers to sell water rights from their lands or even convert current land use practices from agricultural to residential, industrial, or municipal uses will continue to grow and threaten the biological integrity of the San Luis Valley.

The Service proposes to create the SLVCA to conserve a network of vital wildlife habitat through voluntary conservation easements and a limited amount of fee-title acquisition. An overview of the project area is provided in Figure 1. The SLVCA acquisitions will focus on the protection of wetlands and associated uplands in the valley through the use of up to 500,000 acres of conservation easements. Up to an additional 30,000 acres of fee-title acquisition from willing sellers has been proposed where such acquisition would benefit the management and objectives of the three existing refuges, but this tool would only be used when Service objectives could not be accomplished with conservation easements.

The Service will phase in implementation of the overall project. We anticipate focusing first on the southern Sangre de Cristo mountains, with conservation on the valley floor to follow. During this comment period we want to hear from all interested parties and partners to ensure we understand and consider any concerns or comments about the acquisition of easements in these areas. A Habitat Conservation Plan for the southwestern willow flycatcher is currently in development by local governments and pertains to the valley floor. This and considerations about the actual easement language as it relates to water use and rights may take longer to resolve. These issues are less likely to be concerns in the southern Sangre de Cristo mountains. Therefore, we anticipate that, if the overall plan is approved, we will focus our initial implementation efforts there.

Purpose of the SLVCA

The purpose of the SLVCA is to protect Federal trust species and other plants and wildlife of the San Luis Valley while ensuring the long-term function and

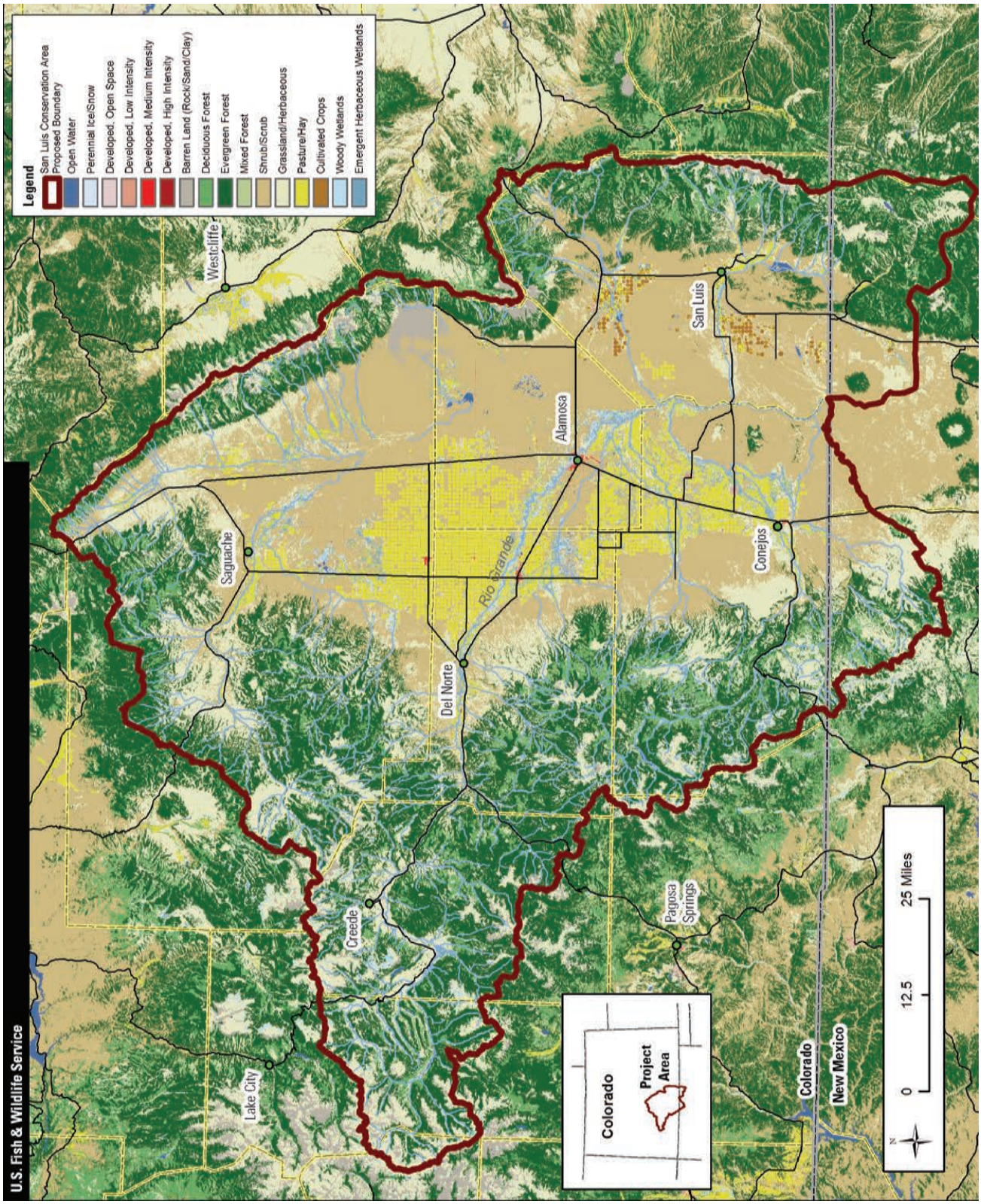

Figure 1. An overview of the general land cover of the SLVCA.

resilience of its diverse ecosystems. Acquisition and management of the SLVCA will focus on protecting riparian areas, wetlands, and key uplands that complement and connect existing protected areas and on maintaining and restoring the hydrology of the valley.

This purpose is in alignment with, but does not supersede, the vision and statutory purposes of the three existing refuges within the San Luis Valley National Wildlife Refuge (NWR) Complex, as described below.

San Luis Valley Refuge Complex

Vision:

> *The San Luis Valley Refuge Complex, set in a high expansive desert valley, is cradled between the snowcapped peaks of the San Juan and Sangre de Cristo Ranges. Mountain snowmelt feeds the Rio Grande, numerous streams, and a dynamic groundwater system, creating a diverse mix of playas, wet meadows, and willow and cottonwood riparian corridors that are in stark contrast with the surrounding arid landscape. As reflected by 12,000 years of human history in the valley, the refuge complex attracts many people. Visitors experience the ancient song of the sandhill crane, witness evening flights of thousands of waterfowl, and listen to bugling elk. Through ever changing conditions, the refuges support and foster a collaborative spirit between their neighbors and partners to conserve the valley's treasured resources.*

Alamosa and Monte Vista NWRs

Vision:

> *Lands of the Alamosa and Monte Vista National Wildlife Refuge Complex and those owned by our partners will be managed in a way that contributes to the migratory bird resource in the San Luis Valley to the greatest extent possible to benefit people of the valley and the United States. Management will emphasize protection, enhancement, restoration, and, where appropriate, creation of a variety of wetland and riparian habitats in this water-rich yet arid mountain valley. Local residents and visitors will view refuge lands with a sense of pride and value their relationships and accomplishments with the U.S. Fish & Wildlife Service.*

Purpose:

> *Alamosa and Monte Vista NWRs were established under the authority of the Migratory Bird Conservation Act "…for use as inviolate sanctuaries, or for any other management purpose, for migratory birds."*

Baca NWR

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.*

Issues Identified and Selected for Analysis

Please see discussion of Issues Identified and Selected for Analysis in Section 1.4 of the Environmental Assessment (EA) in this volume.

Public Review of and Comments on the Draft EA and LPP

To be populated following analysis of public comments on Draft EA/LPP

National Wildlife Refuge System and Authorities

Please see a discussion of the National Wildlife Refuge System and Authorities in Section 1.6 of the EA in this volume.

Related Actions and Activities

Please see a discussion of Related Actions and Activities in Section 1.5 of the EA in this volume.

Habitat Protection and the Easement Acquisition Process

Habitat protection will occur through the purchase of conservation easements and limited fee-title acquisition, where necessary and appropriate to meet the Service's conservation objectives. It is the Service's long-established policy to acquire the minimum interest in land from willing sellers to achieve habitat protection goals.

The acquisition authority for the SLVCA is the U.S. Fish and Wildlife Act of 1956 .[1] The Federal money used to acquire conservation easements will largely come from the Land and Water Conservation Fund, which is derived from oil and gas leases on the Outer Continental Shelf, motorboat fuel tax revenues, and the sale of surplus Federal property. There could be additional funds to acquire interests in habitat and water through direct congressional appropriations, donations, and the Federal Land Trust Facilitation Act if Congress votes to reauthorize that act.

Conservation Easements and Other Acquisitions

An easement is a conservation tool that is commonly employed to conserve natural resources, and has been extensively employed in the SLVCA project area by other organizations. Easements involve the acquisition of certain rights to the property, such the right to subdivide or alter irrigation practices so as to drain wetlands, while leaving the land title in the hands of the private property owner. Easements tend to be a cost-effective and socially acceptable means of habitat conservation. Many of the current land use practices, such as flood irrigation for haying and grazing, are consistent with wildlife resource protection, and the use of easements will help ensure a strong and vibrant rural lifestyle.

There may be circumstances in which management objectives cannot be achieved, such as small boundary adjustments to existing refuges or purchase of land appurtenant to a water right acquired for augmentation of refuge wells or to improve hydrology on existing refuge lands. In these cases, the Service would consider the limited use of fee-title acquisition, not to exceed 30,000 acres, as was described in the preliminary project proposal for the SLVCA.

1 *16 U.S.C. 742(a-j)*

Chapter 2 — Area Description and Resources

Please see a detailed description of the SLVCA area and the resources which could potentially be affected by its establishment in Chapter 3 of the EA in this volume.

Chapter 3 — Threats to and Status of Resources

Threats to Resources

The land cover of the San Luis Valley was largely unaltered, except by natural processes, until the 19th century, when human land use associated with settlers of European origin began to alter the landscape. During this period, livestock grazing, farming, and water development also began to affect ecosystem processes such as the historic hydrological regime. Since then, Colorado has lost nearly 50 percent of its wetlands (Dahl 1990, 2000). The highest remaining concentration of wetlands in Colorado occurs in the San Luis Valley, and their protection is a high conservation priority.

Development

Population growth, primarily exurban development, led to habitat fragmentation in the San Luis Valley in the latter part of the 20th and first part of the 21st centuries. The population of Colorado increased by nearly 17 percent between 2000 and 2010 (U.S. Census Bureau 2010a). During a period of particularly rapid population growth in the San Luis Valley from 1990 to 2003, the population of Mineral County increased by 57.9 percent and Saguache County increased by 45.2 percent. The absolute population numbers and densities are still low in those counties, but habitat loss and fragmentation due to residential and commercial development have been the greatest recent threat to trust species in the SLVCA. This rapid growth has tempered somewhat during the current economic downturn, with relatively stable populations in the counties of the San Luis Valley from 2000 to 2010 (U.S. Census Bureau 2010a). However, that same downturn, coupled with depressed agricultural markets and pending expensive changes to Colorado's ground water law, have forced many farmers and ranchers to subdivide their properties in order to continue operating. This proliferation of 5-, 10-, and 40-acre parcels that have appeared on the market is likely to exacerbate the ongoing impacts of exurban housing development on the habitats of the SLVCA.

Energy development is also an emerging threat to wildlife in the SLVCA. The impacts to wildlife populations from solar energy development are of particular concern in the San Luis Valley, as interest in industrial solar-electric generating facilities has increased during the last decade. In fact, one of the largest photovoltaic plants in the United States is in the San Luis Valley. Economically viable wind energy potential is generally quite low in most of the valley (Hanser 2010) and thus unlikely to be an issue in the near term. Hydrocarbon potential is low throughout the valley (Copeland et al. 2009), although some oil has been found during mineral exploration (Watkins et al. 1995). There is potential for further oil and gas exploration in this region, which the Service has determined is unlikely to have significant impacts on the living resources of the valley (USFWS 2011). Reviews of hydrocarbon development impacts on ground nesting birds (Naugle et al. 2011), ungulates (Hebblewhite 2011), and songbirds (Bayne and Dale 2011) have all found some evidence of mortality and/or behavior modification (such as avoidance of an area) associated with petroleum extraction. If commercially exploitable hydrocarbons are found during the planned exploration, petroleum extraction could be an additional threat to the living resources of the SLVCA.

Fragmentation

Changes in land cover due to exurban development, energy development, roads, and changes in agricultural land use (such as transition from flood irrigation to center-pivot irrigation) not only cause a loss of habitat, they also fragment the remaining habitat. There is a robust body of literature on the effects of habitat fragmentation, summarized eloquently by Collinge (2009). Countless manipulative and observational studies have shown that habitat area and connectivity among types of similar habitat are important for everything from soil decomposers (Rantalainen et al. 2005) to passerine birds (Telleria and Santos 1995). Corridors between fragments promote use of, and persistence in, those habitats by migratory birds (Haas 1995), large carnivores (Shepherd and Whittington 2006, Tremblay 2001), and ungulates (Tremblay 2001) that are native to the SLVCA. Perhaps the most obvious way to protect corridors throughout the SLVCA, while protecting valuable habitat at the same time, is to focus on the conservation of the riparian corridors and wetland complexes that cross and connect existing protected areas. This action would protect wildlife movement corridors for both seasonal migration and colonization following large-scale disturbance or environmental change.

Invasive species

Increased human disturbance associated with development has also been shown to negatively affect adjoining habitat due to the invasion and establishment of invasive plant species. Invasive plants can have numerous detrimental effects; besides displacing native vegetation, they can alter nutrient cycling and soil chemistry, modify hydrology, increase erosion, and change fire regimes (Dukes and Mooney 2004). Noxious weeds, such as tall whitetop, Canada thistle, and Russian knapweed, can have severe negative effects on wildlife habitat (such as reducing the quality of nesting and foraging areas) when these weed species begin to replace native vegetation. The San Luis Valley already has one of the densest concentrations of Russian knapweed in the State of Colorado (Goslee et al. 2003). Other invasive species that could threaten resources in the SLVCA include New Zealand mudsnail, quagga and zebra mussels, and Asian clam. Diseases such as white nose syndrome, chytrid fungus, whirling disease, and chronic wasting disease also threaten wildlife and fish in the San Luis Valley.

Water resources

In addition to the threats of the direct loss of habitat and fragmentation that accompany subdivision for exurban development, water rights associated with subdivided parcels are often sold with the property. This results in the loss of wetland habitat and wetland functions not only on the subdivided property, but also on adjoining lands as the water is redistributed off of the property, directly affecting wildlife populations that depend on the wetlands to complete their life cycle. As fragmentation increases, remaining habitats become geographically isolated and wildlife populations with limited dispersal abilities may potentially become genetically and spatially isolated. Existing wetland habitats are shown in Figure 2.

Another threat to the sustainability of wetland and riparian habitat in the SLVCA is the chronic overuse of ground water. Due to legal and political circumstances, new ground water rules have been developed by the Colorado Division of Water Resources and will be applied to water users in the San Luis Valley starting in May 2012. Ground water usage, especially artesian

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Figure 2. Water is a critical resource for breeding and migratory birds in the high desert. Many wetlands and riparian areas have been lost due to ground water pumping and surface water diversion.

well development, started during the early 1900s. The result has been construction of over 7,000 wells and development of one of the world's largest concentration of center pivot irrigation systems, many of which depend solely upon ground water. As a consequence, water users and regulators have acknowledged that annual ground water use chronically exceeds recharge. The SLVCA would contribute to protection of wetland and riparian habitat from degradation by maintaining current water management practices and the associated benefits to the plant community and ground water hydrology.

Cultural resources

The proposed SLVCA is considered an important area for cultural resources due to the abundance of cultural sites that date to almost 12,000 years ago that are located throughout the valley; however, much of the archaeological research associated with the San Luis Valley has been conducted on public lands, such as the Closed Basin, San Juan National Forest, and Great Sand Dunes National Park and Preserve (Jones 2000). Permanent protection of wildlife habitat on private land would benefit the preservation of cultural sites from future disturbance on all acquired lands.

Climate change

Climate change has quickly moved to the forefront of conservation challenges during the 21st century, and the Service has made it a high priority in conservation planning (USFWS 2010b). Mountain ecosystems in the western United States are expected to be especially sensitive to climate change. In fact, data indicate that numerous places in the Rocky Mountains have experienced three times the global average temperature increase over the past century. Measurements have shown that Colorado's temperature has increased by approximately 2˚F between 1977 and 2006 (Ray et al. 2008). The western United States has seen a shift toward earlier spring snowmelt (Karl et al 2009).

Wetland and riparian habitats, such as those found in the SLVCA, that are dependent on snow-melt from surrounding high mountain ecosystems would be expected to be more acutely affected than other ecosystems. The San Luis Valley is predicted to have a 10 to 20 percent reduction in runoff by mid-century compared to the 1900 to 1970 baseline (Karl et al. 2009). As with many areas across the west, it is difficult to predict what the specific effects of climate change may be in a given area, particularly due to the complex interplay between the timing of temperature change and precipitation. The Western Water Assessment predicted that Colorado's ecosystems will be affected by climate change in nine broad ways: increased frequency and severity of forest-insect interactions; increased frequency and severity of wildfires; changes in the hydrologic cycle that impact aquatic species, including reduction in overall stream flow, shift to earlier spring runoff, and warming of water temperatures; northward and upward shift in animal ranges, causing shifts in ecosystem composition; increased range and spread of wildlife pathogens; increase in tree mortality due to drought stress; increased risk of desertification in dryland ecosystems; and an overall reduction in biodiversity because of the above impacts (Averyt et al. 2011). We must be cognizant of the potential impacts that climate change may have on wetland, riparian, and upland habitat in the SLVCA.

The proposed SLVCA intends to maintain and restore habitat connectivity to promote a San Luis Valley ecosystem that will be robust in the face of climate change. Protection of large intact expanses of wetland habitat types where natural ecosystem processes can be sustained will help wetland-dependent species resist some of the impacts of a changing climate. Some of these may not be the same type of wetland in the future, but the use of hydrogeomorphic modeling to assess historic hydrology should allow us to predict where and what kind of wetlands will persist in a potentially warmer and more arid future. We will respond by targeting these habitats for acquisition in the SLVCA. Besides intrinsically providing habitat for wildlife, riparian areas also serve as corridors. As shown in Figure 3, protection of such corridors will preserve a network through which wildlife can recolonize or disperse following disturbance, making the ecosystem more resilient to short term change and increasing its adaptive capacity to long-term change.

Effects of the SLVCA on the Natural and Human Environment

For a thorough discussion of the effects of the proposed easement and limited fee-title acquisition program, see Section 4 of the EA in this volume.

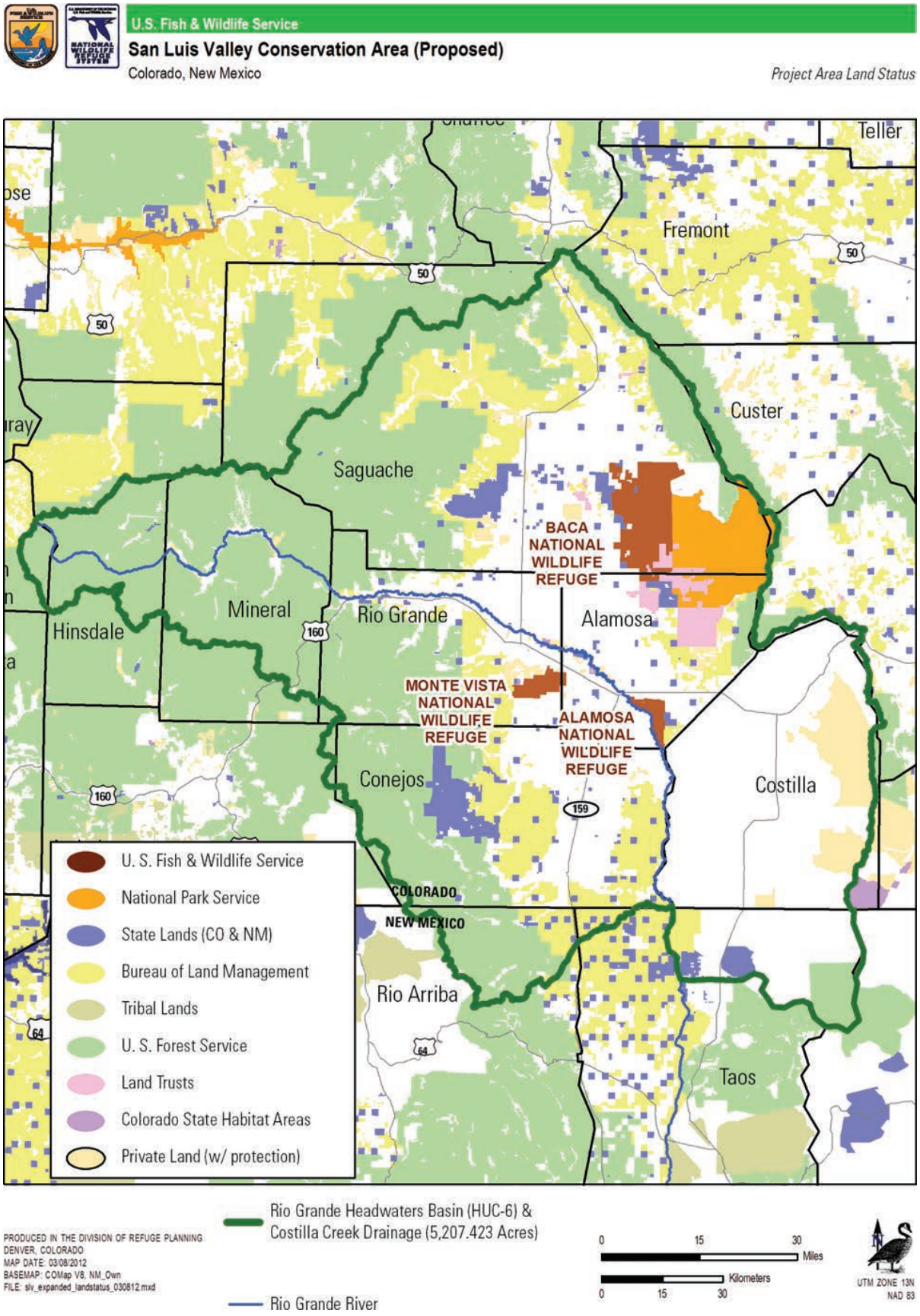

Figure 3. The SLVCA forms part of a broader network of public and private conservation lands, and by further networking these lands will contribute to the ability of the species and habitats of the Southern Rocky Mountains to adapt to climate change.

Chapter 4 — Project Implementation

Land Protection Options

No action

Under the no-action alternative, the areas outside of existing protected areas would largely remain in private ownership and subject to changes in land use and/or land cover. Some protection in addition to the SLVCA is likely because of ongoing conservation easement initiatives in the San Luis Valley by public entities such as NRCS and nongovernmental organizations such as The Nature Conservancy and Ducks Unlimited.

Conservation easements and limited fee-title acquisition (proposed action)

It is the Service's policy to acquire the minimum interest in a property necessary to accomplish its conservation objectives. It can be possible to achieve most of these objectives with conservation easements. The preservation of working landscapes such as farms and rangeland is more cost effective, socially acceptable, and politically popular than acquiring fee-title land, and it often promotes the preservation of unfragmented, quality habitat. Under the proposed action, the Service seeks to protect up to 500,000 acres through conservation easements In the SLVCA.

There are instances when the management and objectives of the existing three refuges in the San Luis Valley refuge complex may be simplified with small-scale acquisitions, but not with conservation easements. In such circumstances (e.g., boundary simplification or surface water rights acquisition for an existing refuge) the Service would consider up to a total of 30,000 acres of fee-title acquisition under the SLVCA.

As discussed throughout this document, the SLVCA is a large, landscape-scale approach to conserving a diverse array of important habitats. Each of these habitats is home to different Federal trust species, and each comes with its own management complications related to land use, water use, and other issues. Therefore, if necessary, the SLVCA could be subdivided into multiple management units that could be managed together or independently, based on the judgment of the Service. Natural features to define such management units would be the Closed Basin, the watersheds draining the southern Sangre de Cristo Mountains south of Blanca Peak to their confluence with the Rio Grande, and the watersheds of the remaining tributaries and main stem of the Rio Grande. Conceptual boundaries for these units are identified in Figure 4; however, actual boundaries would be established based upon the needs of refuge management.

Water use has an important influence on the persistence of habitat in the SLVCA, and the protection of that habitat may sometimes require easement stipulations regarding water use and sale of water rights, as detailed in Section 4.2.1. Crafting of the easement language may not be complete until after the SLVCA has been approved. In addition, the need to protect southwestern willow flycatcher habitat has led to a several-year effort by local governments to create the San Luis Valley Habitat Conservation Plan (HCP), a draft of which should be released mid-2012. The Service intends to defer its conservation partners in land protection as it relates to southwestern willow flycatcher habitat when necessary for them to meet their mitigation targets, but until the HCP is final, it would be difficult to ensure that the Service's conservation efforts do not conflict with those of partner organizations. While these issues do not directly affect the prioritization strategy for the SLVCA (detailed in section 4.3), they may influence how the Service implements its conservation delivery. Therefore, the Service's realty staff will focus initial efforts on the southern Sangre de Cristo Mountains and their drainages, where the aforementioned issues are not likely to be concerns.

Project Objectives and Actions

The Service seeks to establish the SLVCA in the San Luis Valley of central southern Colorado and northern New Mexico. The project area contains land in Hinsdale, Mineral, Rio Grande, Saguache, Conejos, Alamosa, and Costilla counties in Colorado, as well as a small portion of Rio Arriba and Taos counties in New Mexico. The SLVCA boundary approximates the headwaters and upper watershed of the upper Rio Grande. Within the project boundary, the Service will

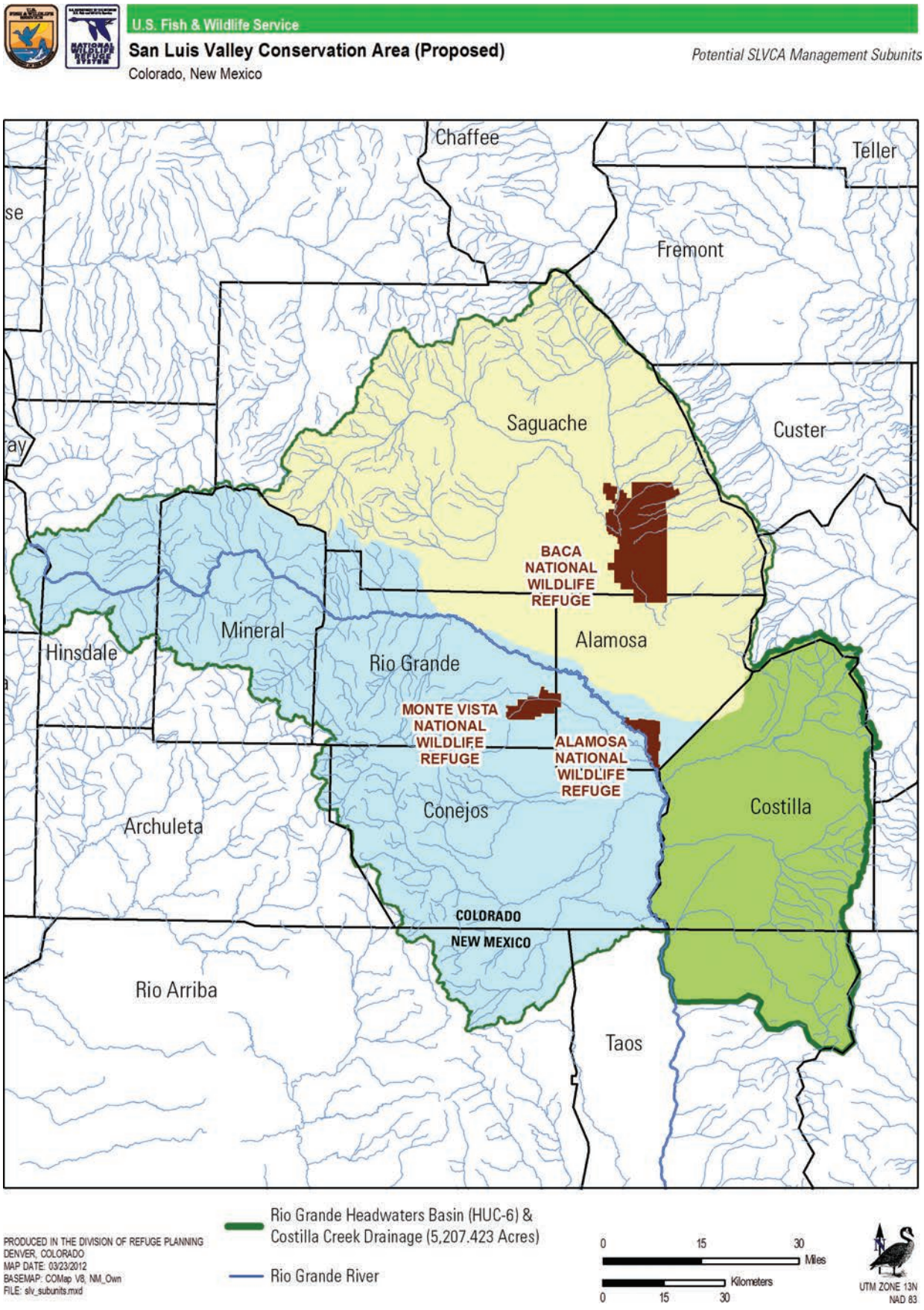

Figure 4. Potential management units of the SLVCA, with the Closed Basin in tan, the southern Sangre de Cristo Mountain watersheds in green, and the remaining Rio Grande watershed in blue..

strategically identify and acquire from willing sellers an appropriate interest in upland, wetland, and riparian habitats on privately owned lands.

The Service plans to buy or receive donated conservation easements or fee-title lands on those identified areas within the project boundaries. These easements and limited fee-title acquisitions will connect and expand existing lands under public and private conservation protection. Based upon the area of privately held priority habitat in the San Luis Valley, the objective of the SLVCA project is to protect 500,000 acres of uplands, wetlands, and riparian areas through easements and up to 30,000 acres through fee title.

Easement Terms and Requirements

The Service has successfully implemented easements in many projects, and existing language and guidelines would contribute substantially to the drafting of the SLVCA easement language. Given the Service's conservation goals in the SLVCA, the easements will be drafted with standard language to preclude subdivision and development and conversion of native vegetation to cropland, as well as to protect existing wetlands from being drained or filled.

In addition, because of the scarcity of water resources in the valley and impending changes to ground water law in the State of Colorado, there would be provisions regarding water use. The types of wetland and associated upland habitats in which we are interested are largely supported by current water use practices. Easements would include a stipulation that changes in water use cannot adversely affect the quality of habitats that we seek to protect in the easements, and that water rights currently owned for use on a property under an easement could not be sold or transferred for use on other properties unless such a transfer was deemed beneficial to wildlife.

The protection of riparian corridors is critically important in the SLVCA, particularly since much of this habitat has, or has the potential to have, the constituent elements of critical habitat for the southwestern willow flycatcher.[1] While easement language would not prescribe specific management practices on these lands, landowners with suitable or potentially suitable riparian habitat would be encouraged to work with the Partners for Fish and Wildlife program or the new Working Lands for Wildlife Program (NRCS 2012) to develop alternative strategies such as fencing of riparian corridors and off-river stock watering to prevent overgrazing of regenerating riparian vegetation.

Contaminants or Hazardous Materials

Level 1 pre-acquisition site assessments will be conducted on individual tracts before the purchase of any land interests. The Service's environmental contaminants specialists from the Ecological Services offices in Colorado and New Mexico will be contacted to ensure that policies and guidelines are followed before acquisition of conservation easements or fee title.

Acquisition Funding

The Service will acquire easements in the SLVCA primarily through Land and Water Conservation Fund monies. These monies are derived primarily through revenue generated from oil and gas leases on the Outer Continental Shelf, motorboat fuel taxes, and the sale of surplus Federal property. Monies in this fund are not derived from general taxes. While Land and Water Conservation Fund monies are intended for land and water conservation projects, funding is subject to annual appropriations by Congress for specific acquisition projects. If it is reauthorized by Congress, the Federal Land Trust Facilitation Act could also be used to fund specific acquisitions. This act is a law that allows the BLM to dispose of certain public lands in order to generate revenue for strategic conservation of habitat not currently in Federal trust.

The SLVCA project area includes several other government and nongovernmental organizations with overlapping conservation objectives. In the development of the SLVCA, we have prioritized land for acquisition by the Service, but our Land Protection Plan may also guide acquisitions for conservation by the NRCS (Wetland Reserve Program), The Nature Conservancy, Ducks Unlimited, and the Rio Grande Headwaters Land Trust, among others.

Protection Priorities

The Service, in consultation with internal divisions (Migratory Birds, Fisheries, Ecological Services), nongovernmental organization partners, Colorado Parks and Wildlife, and BLM, selected eight focal species whose habitat needs have driven the prioritization of the SLVCA. Each of these focal species represents a group of species that are vulnerable to the same threat processes (Lambeck 1997). The species selected were Canada lynx, Rio Grande cutthroat trout, willow flycatcher, Lewis' woodpecker, Wilson's phalarope, American bittern, Gunnison sage-grouse, and sage thrasher. All of these are Federal trust species and/or have State or regional conservation status, making them worthy of protection on their own; however, conserving habitat for these species will also protect habitat for other species with similar habitat requirements.

1 *FR 76(157), 50542-50629. Endangered and Threatened Wildlife and Plants; Designation of Revised Critical Habitat for Southwestern Willow Flycatcher. Agency: Fish and Wildlife Service. Action: Proposed Rule. August 15, 2011.*

Species-Habitat Mapping Methodology

Some of the chosen species, by virtue of their having special conservation status, had already been the subject of detailed habitat mapping in the project area. For others, simple conceptual models were developed based upon literature reviews.

The southwestern willow flycatcher is a genetically distinct subspecies (Paxton 2000) of willow flycatcher that inhabits the woody riparian corridors of the desert southwest. Its population has declined significantly because of habitat loss, and it is listed as endangered by the States of Colorado and New Mexico as well as under the Federal Endangered Species Act. The willow and cottonwood riparian habitats necessary for willow flycatcher breeding in the San Luis Valley have been mapped in detail as part of the development of the draft San Luis Valley Habitat Conservation Plan for that species (ERO Resources, unpublished data). The data also capture the gallery cottonwood habitat needed for both the Lewis' woodpecker in this portion of its range and for the breeding habitat of the yellow-billed cuckoo. The existing data were used as core habitat in this prioritization scheme; as a second priority, a 200-meter buffer was used to minimize disturbance of the core habitat (Terry Ireland, USFWS Ecological Services, personal communication, February 2012). These priorities are illustrated in Figure 5.

Canada lynx are federally listed as threatened and State listed in Colorado as endangered. Lynx range through the montane forests of the Rocky Mountains. They are resident in both the San Juan and Sangre de Cristo Mountains, and the junction between the Sangre de Cristo Range and the Culebra Range of the Sangre de Cristo Mountains has been identified as a particularly important corridor for the species (L. Ellwood, USFWS Ecological Services Colorado Field Office, personal communication, January 2012). Its habitat in the project area has already been mapped by Colorado Parks and Wildlife and the U.S. Forest Service. A small portion of the project area in northern New Mexico had not been covered by previous mapping but is known to be actively used by lynx. Therefore,

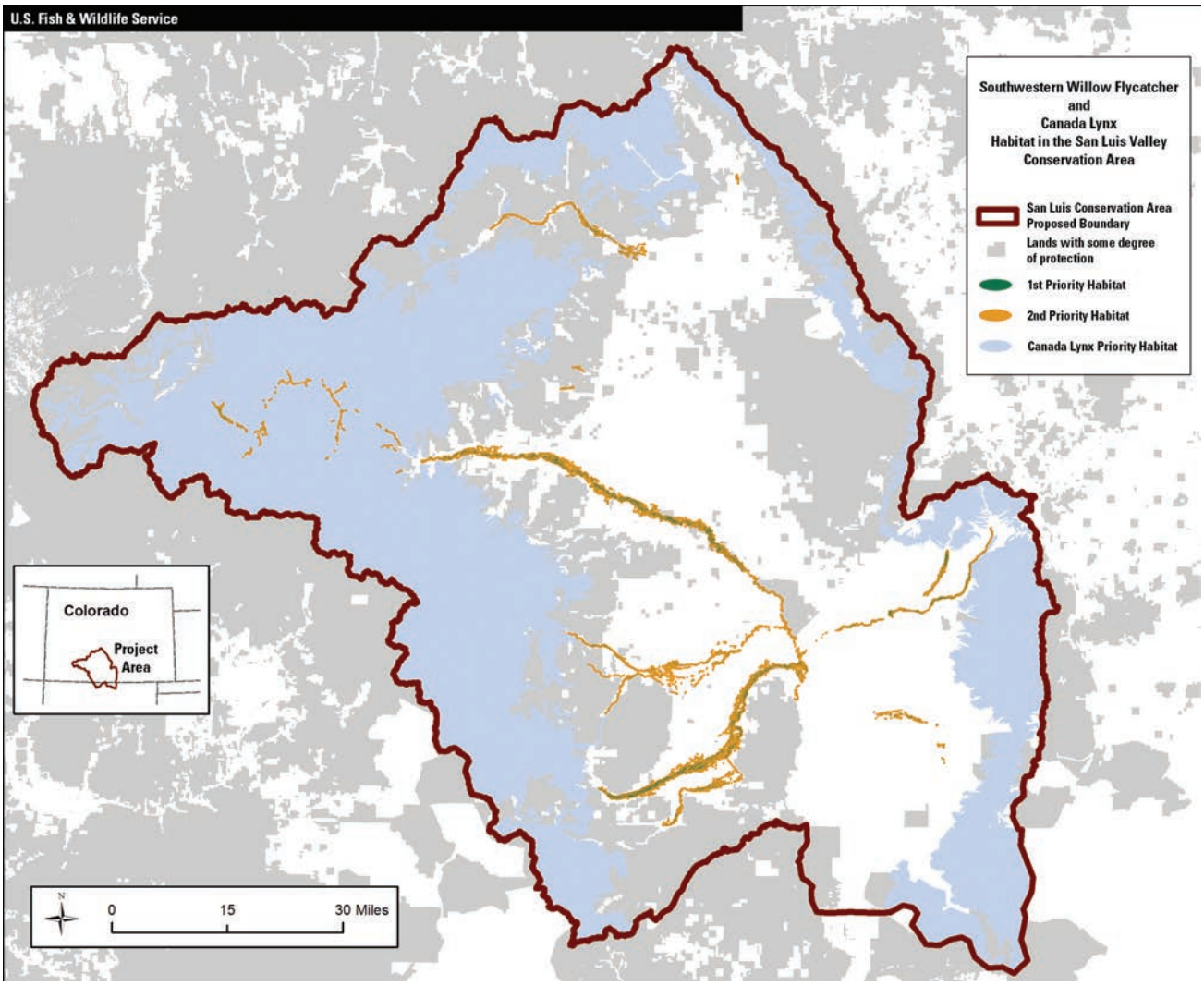

Figure 5. Southwestern Willow Flycatcher and Canada Lynx Habitat in the San Luis Valley Conservation Area.

a minimum convex polygon for this region was created that captured the land cover that largely comprises the Colorado Parks and Wildlife habitat (Rocky Mountain aspen forest and woodland, Rocky Mountain lodgepole pine forest, Southern Rocky Mountain mesic montane mixed conifer forest and woodland, and Rocky Mountain subalpine dry-mesic spruce-fir forest and woodland) using 30-meter Landfire data (USGS 2010). Lynx habitat is identified in Figure 5.

The habitat of the Endangered Species Act candidate Rio Grande cutthroat trout has been mapped throughout the species' range; in addition, information on barriers to fish passage and data on genetic integrity has incorporated into a spatial database. Because interbreeding has been a problem for cutthroat trout species, the signatory parties to the 2009 Rio Grande Cutthroat Trout Conservation Agreement identified populations with less than 10 percent genetic introgression and defined them as conservation populations (Rio Grande Cutthroat Trout Conservation Team 2009). These conservation populations were chosen as representing priority habitat for the species in this land protection plan (Figure 6).

The range of the Gunnison sage-grouse is much more geographically limited than it once was. The Gunnison Sage-Grouse Steering Committee revised earlier, coarser-scale historic range mapping for the species (Schroeder et al. 2004) and identified current and suitable but unoccupied habitat (Gunnison Sage-grouse Rangewide Steering Committee 2005). In the project area, there is a small lek at Poncha Pass, and some adjacent suitable but unoccupied habitat. There is also a large expanse of vacant and/or unknown habitat identified in Costilla County. Current range polygons were selected to represent priority habitat for this species; the historic range is also displayed for reference. (Figure 7).

The San Luis Valley represents a regionally important breeding habitat for the Wilson's phalarope (Scott Miller, San Luis Valley NWR Complex, personal communication, January 2012) as well as habitat for many other species of migratory shorebirds. Because

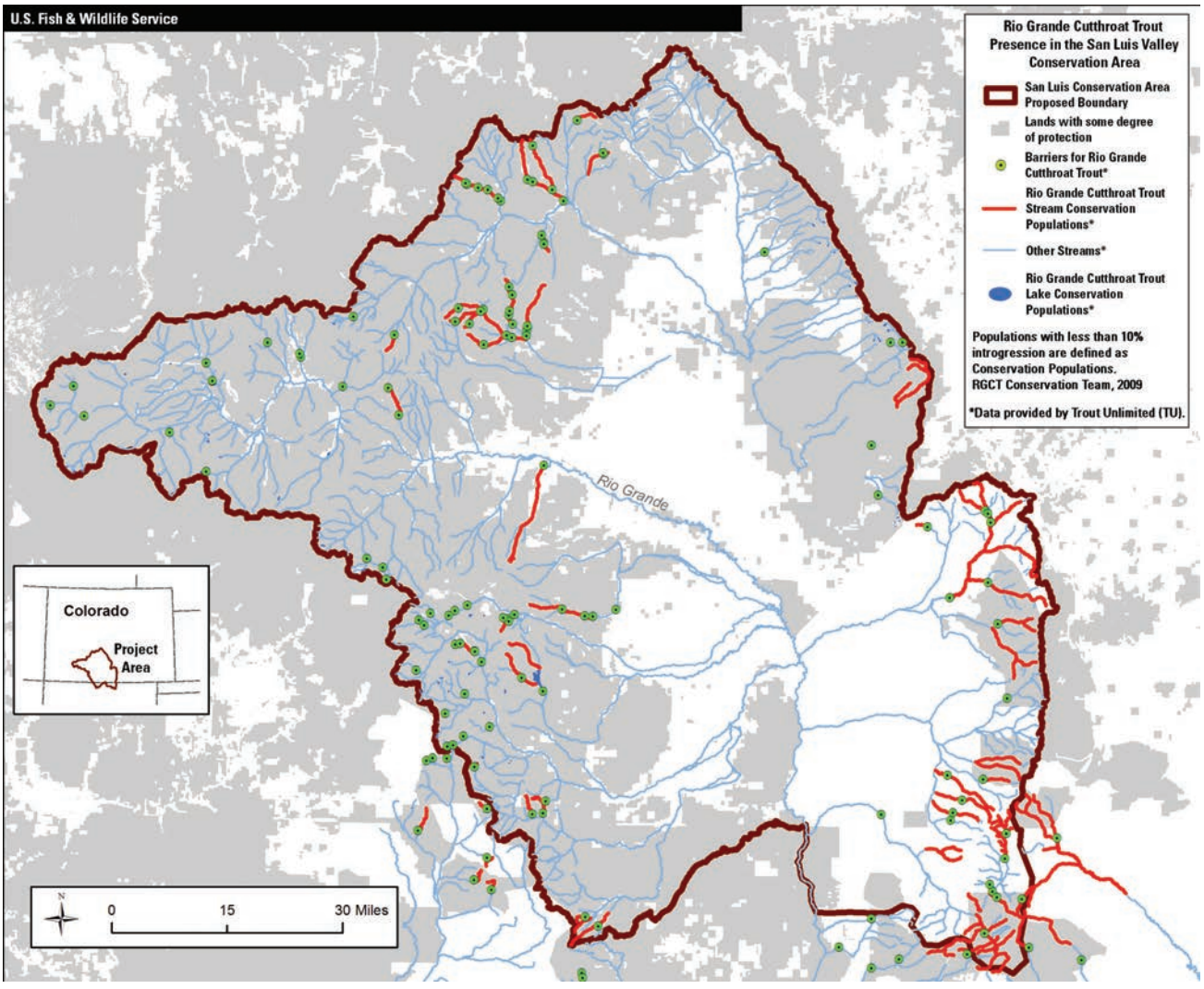

Figure 6. Rio Grande Cutthroat Trout Presence in the San Luis Valley Conservation Area.

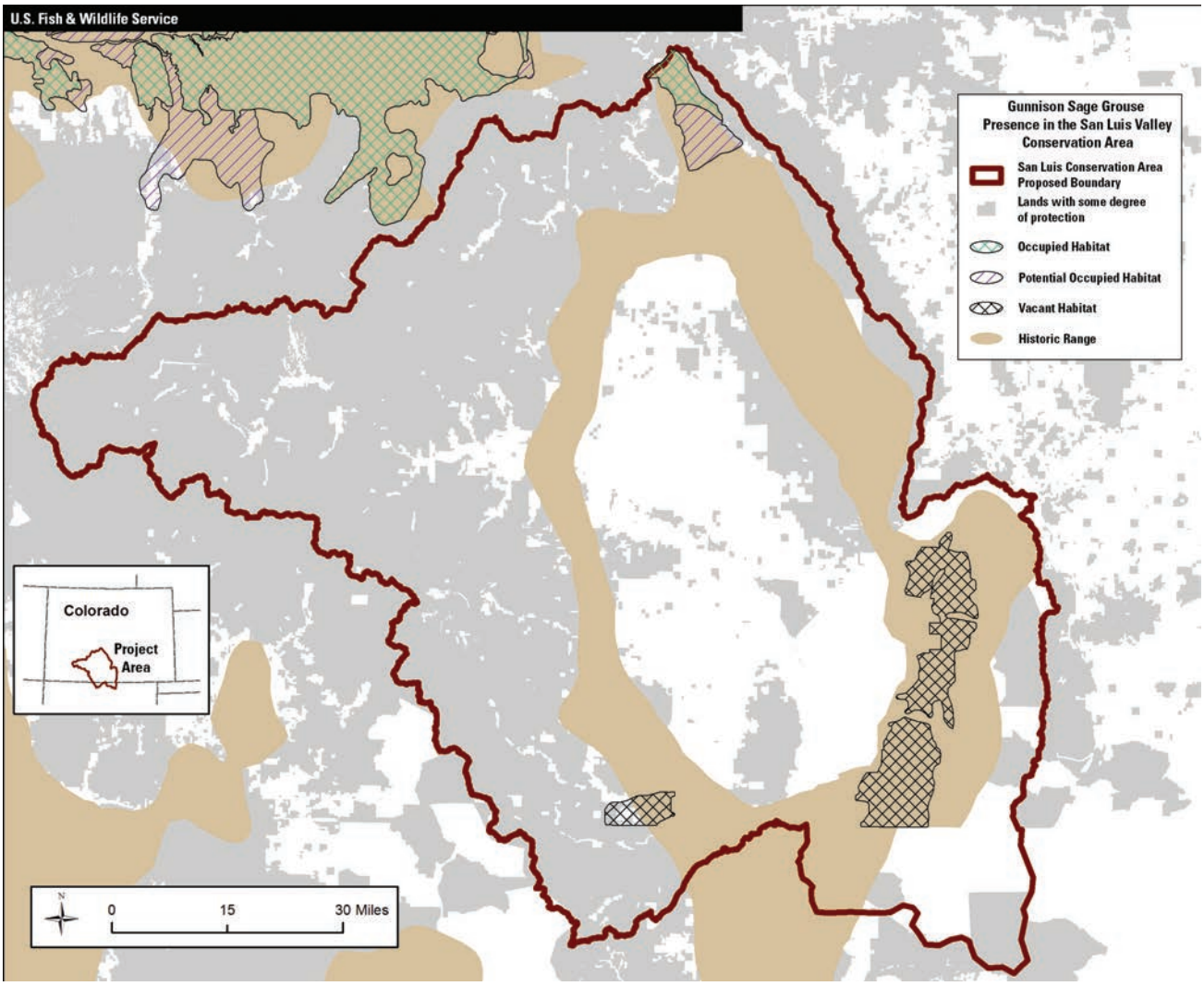

Figure 7. Gunnison Sage Grouse Presence in the San Luis Valley Conservation Area.

an applicable statistical or conceptual model for migratory shorebird breeding in the Southern Rockies was unavailable, a conceptual model based on published habitat associations of Wilson's phalarope was developed. A study of waterbird nesting in the San Luis Valley found that phalaropes preferred seasonal and short emergent wetlands, probably because these habitats have the highest invertebrate biomass of the habitats available to them (Laubhan and Gammonley 2000). Wetlands classified by the National Wetland Inventory as temporary and seasonal were given the highest priority, followed by areas of saturated soils, as these wetland classes most closely match the definitions of seasonal and short emergent. Because Wilson's phalaropes are known to be sensitive to encroachment by woody vegetation (Cunningham and Johnson 2006), wetlands in the first and second priority classes were downgraded to third priority if they occurred within 100 meters of woody vegetation. In Colorado, Wilson's phalaropes typically breed in intermountain valleys between 7,000 and 10,000 feet (Kingsley 1998); however, USFWS Division of Migratory Birds staff believe that most breeding likely occurs below 8,000 feet (S. Jones, USFWS Migratory Birds, personal communication. February 24, 2012), and so more conservative criteria were used for characterizing important phalarope habitat in the SLVCA (Figure 8).

The secretive American bittern is an important representative species for a suite of waterbirds in the project area. Like the Wilson's phalarope, neither San Luis Valley-specific habitat mapping nor applicable modeling from elsewhere were available. A review of American bittern biology demonstrates that the species will nest in a wide variety of wetland and associated upland types (Dechant et al 2004). However, research has consistently shown a preference for tall, dense cover (Duebbert and Lokemoen 1977, Riffell et al. 2001), particularly bulrush- and cattail-dominated wetlands (Azure 1998; Bent 1963; Brininger 1996; Faanes 1981, as cited in Dechant et al. 2004; Weber 1978, Weber et al. 1982). They are also found occasionally in wet meadows (Faanes 1981), particularly those

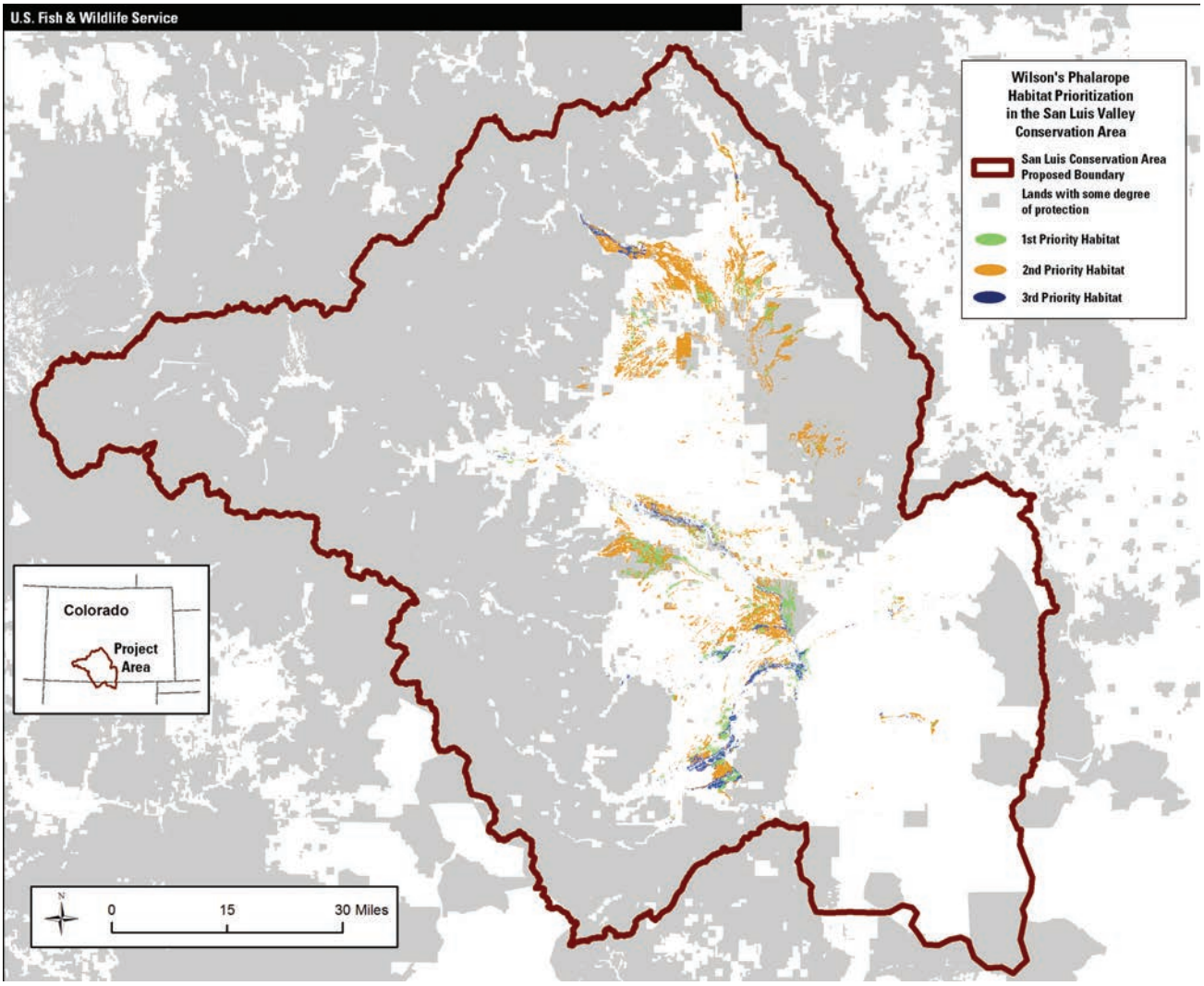

Figure 8. Wilson's Phalarope Habitat Prioritization in the San Luis Valley Conservation Area..

with some cattails (Middleton 1949). Therefore, wetlands that were classified by the National Wetlands Inventory as permanent, semipermanent, or seasonal (those with a tall emergent vegetation component) were selected as the highest priority for American bitterns. Because bitterns are area sensitive (Brown and Dinsmore 1986, Riffel et al. 2001) and prefer wetlands of greater than 3 hectares (Daub 1993, as cited in Dechant et al. 2004), that area was used as a threshold delimiting tall emergent wetlands of first and second priority. Temporary and saturated wetlands, which are often wet meadows, were designated as third priority. In Colorado, American bitterns are residents of marshes between 3,500 and 8.000 feet (Bailey and Niedrach 1967), so the latter elevation was used to constrain bittern habitat in the SLVCA. These priorities are illustrated in Figure 9.

Sage thrasher is a migratory bird that has been declining throughout its range due to habitat loss and degradation, and is a Service Region 6 bird of conservation concern as well as a Migratory Birds focal species. A range-wide conceptual model for the species was developed by the American Bird Conservancy based on Rocky Mountain Bird Observatory sampling data (Beason, Levad, and Leukering 2005) and ReGap land cover data. The population estimates they assign to these land cover classes are further stratified based on the classification of vegetation quality as good, fair, or poor, which was in turn derived from shrub cover density and prevalence of invasive plants. In the absence of data on vegetation quality for the San Luis Valley, the "fair" quality was selected for all land cover types. The model developers determined that Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Montane Sagebrush Steppe, and Colorado Plateau Mixed Low Sagebrush Shrubland would support, on average, 0.0528252 birds per acre; this group of vegetation types was selected as the first priority in the sage thrasher-specific map (Figure 10). Inter-Mountain Basins Mixed Salt Desert Scrub, Inter-Mountain Basins Greasewood Flat, and Inter-Mountain Basins Semi-Desert Shrub Steppe support

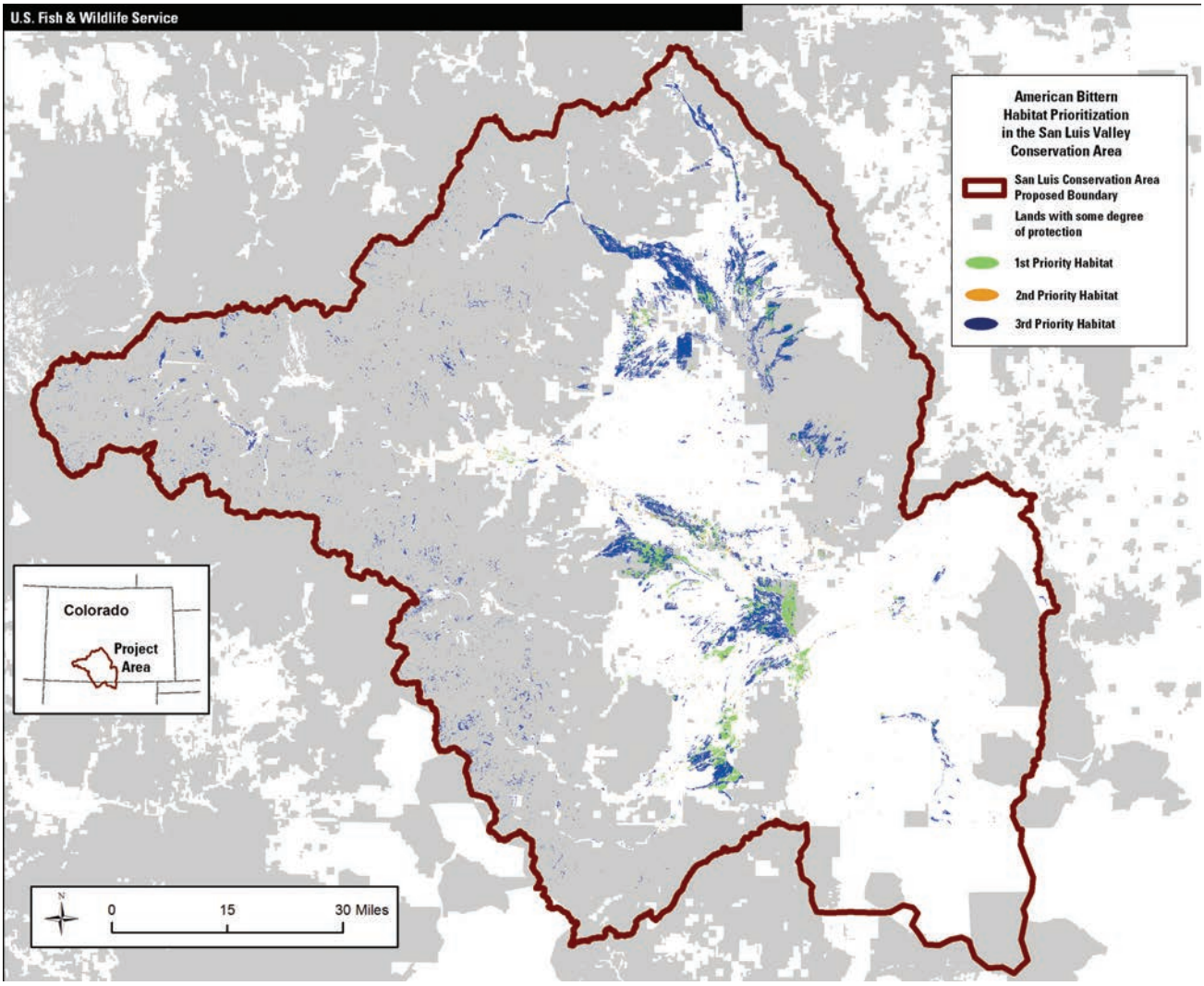

Figure 9. American Bittern Habitat Prioritization in the San Luis Valley Conservation Area.

0.009348 birds per acre; these vegetation classes were selected as the second priority for the species. Within these two priority levels, only polygons greater than 100 hectares in area were included because sage thrasher are known to be somewhat area sensitive and are found most commonly in patches of that size or greater (Knick and Rotenberry 1995).

Landscape Prioritization

The species-specific maps are useful for determining where in the landscape the key habitats are for the identified focal species. However, they do not assist decision makers with determining which areas would provide the most effective conservation returns overall. In addition to the presence or absence of habitat for individual species, it is important to take into account issues such as connectivity, cost, and unequal conservation need for each species. Therefore, the simulated-annealing algorithm implemented in the software package Marxan (Ball, Possingham, and Watts 2009) was used to identify "optimal" solutions for conservation prioritization within the SLVCA. Marxan permits the user to specify individual conservation targets for conservation features (in this case, area of focal species habitat) and species-specific penalties on models that do not meet conservation targets. This allows the user to individually weight features (e.g., upweight penalties for not including enough habitat for species of higher conservation concern, or reduce the amount of land necessary for generalist widespread species). By designating a boundary length modifier, the user can generate a more compact reserve system. The landscape can also be classified by cost, which can be made as simple as land area or more complex and meaningful by accounting for variables like land costs or metrics of the human footprint.

Because of the degree of flexibility allowed by Marxan, the values for these parameters need to be optimized by successive iterations of the program. For this analysis, hexagonal planning units were selected, as these have been shown to result in less fragmented, more efficient reserve networks (Nhancale

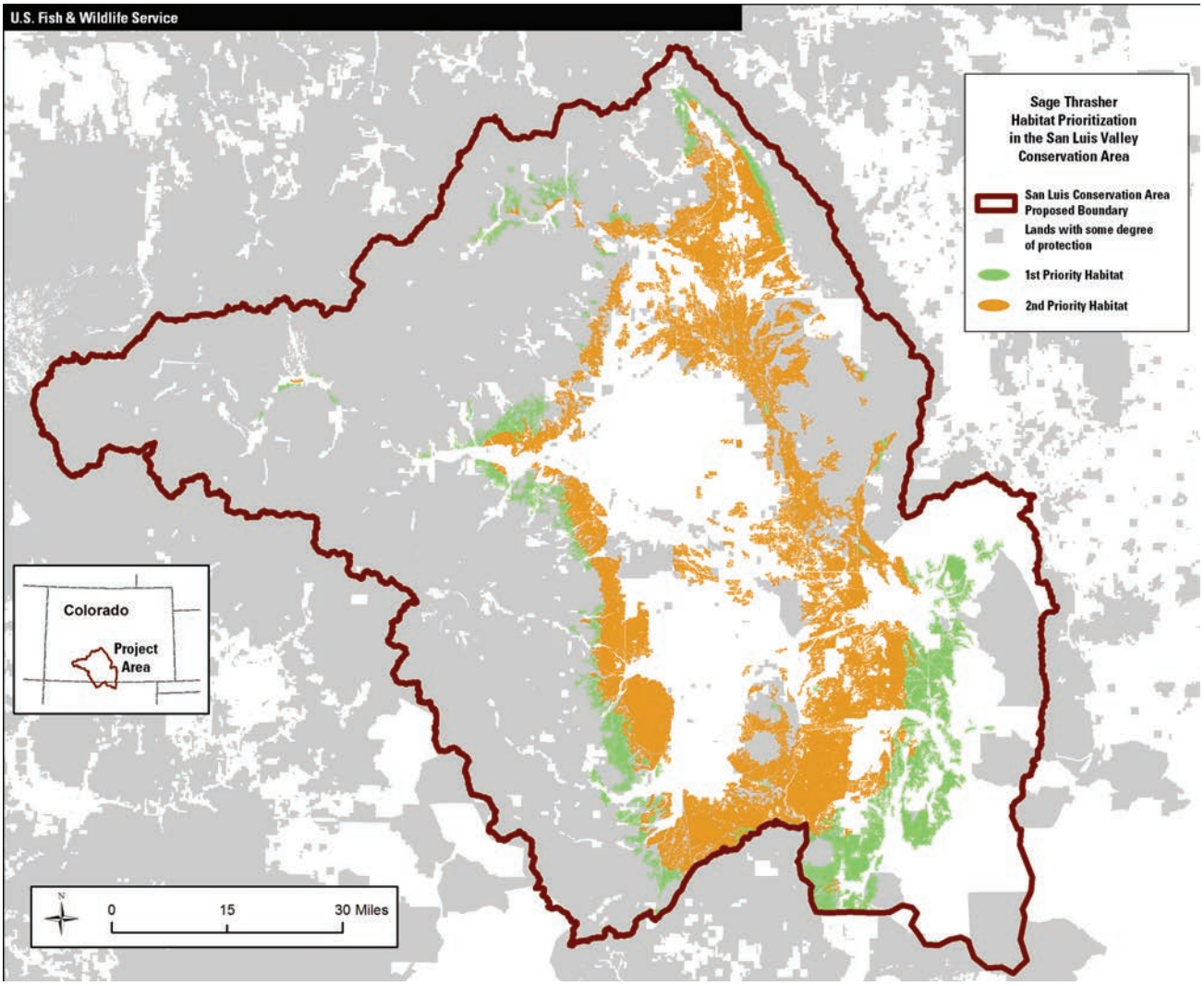

Figure 10. Sage Thrasher Habitat Prioritization in the San Luis Valley Conservation Area.

and Smith 2011). Hexagons were 25 hectares in area, which provides resolution that is sufficient for making land protection decisions while covering the SLVCA in few enough planning units to not be computationally overwhelming. Hexagons already in a permanent protected status were excluded from the model as that status is not likely to change. A boundary length modifier of 0.0001 was used to create a slightly more compact reserve network. Increasing that value to 0.001 oversimplified the reserve network and did not meet the intent of the SLVCA. Targets for protection were set at 50 percent of the private land holding a particular conservation feature. The relative irreplaceability, or frequency with which individual hexagons were selected in the final solution for each of the 100 models, is shown in Figure 11.

Evaluation of Easement Potential

As described in section 1.5, acquisition of conservation easements is not a new tool for achieving conservation objectives within the SLVCA; the NRCS and many nongovernmental organizations hold tens of thousands of acres of easements in the valley. The Service does not currently hold easements in the project area; however, the Service has more than 50 years of experience acquiring conservation easements in other parts of the country.

The landscape modeling described above has generated maps of species-specific conservation priorities for each of the priority species, as well as a consensus map that shows where conservation returns for Federal funds would be maximized for the suite of species examined. Biologists and realty specialists will work cooperatively to use these tools to identify parcels whose conservation will result in the greatest benefit to trust species.

When a willing seller approaches the Service or if the Service wishes to proactively seek out sellers, the following criteria will guide the Service's decision making:

- *Overall conservation value* – Is the property located, in whole or in part, in an area that was selected in

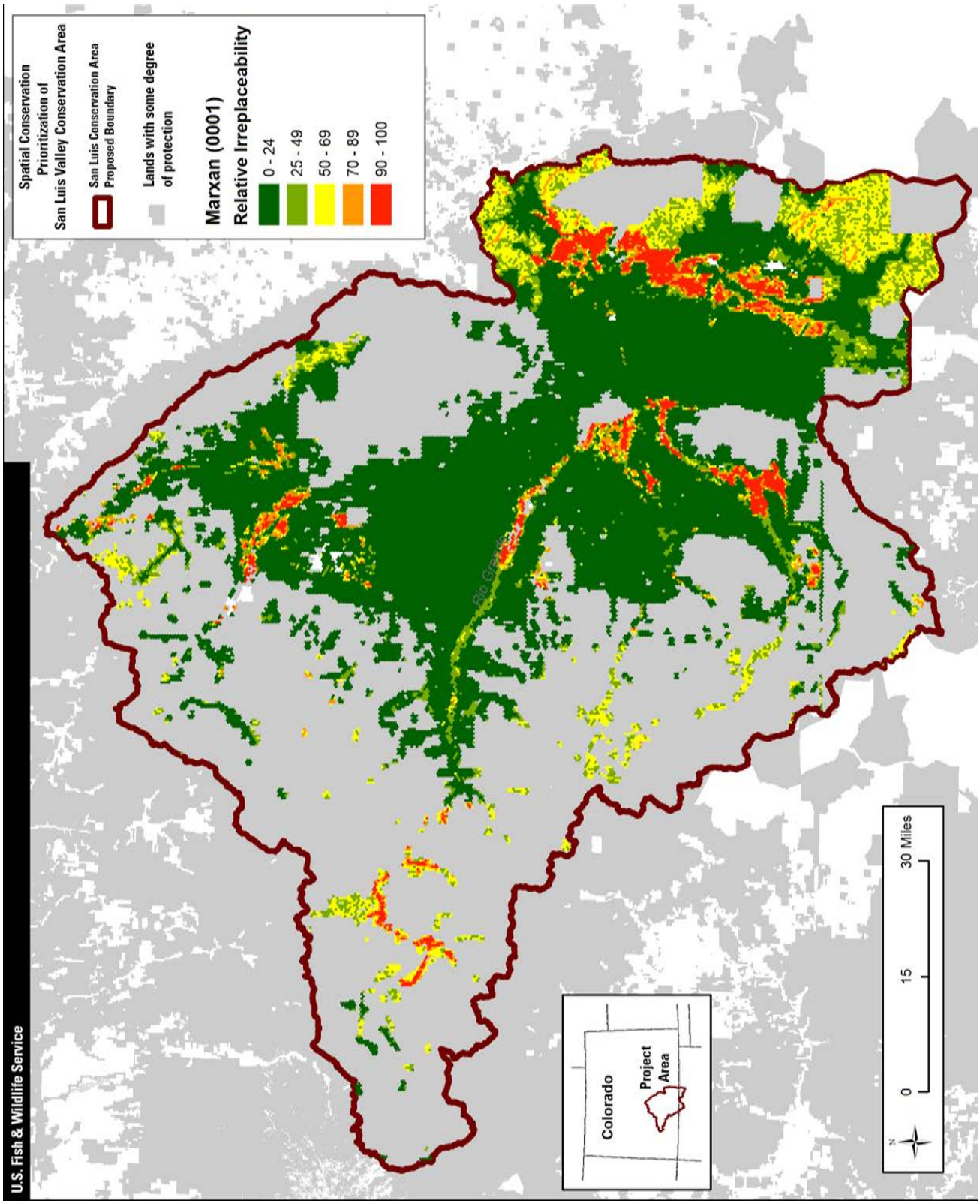

Figure 11. Areas of overall conservation need. Relative irreplaceability indicates what proportion of models in which that particular conservation unit was selected.

70 percent or more of the spatial conservation priority runs in Marxan, as indicated by Figure 11?

- *Trust species value* – Does the parcel contain priority habitat that was identified in any of the species-specific maps in section 4.3?
- *Previously unidentified conservation value* – If neither of the preceding thresholds are reached, is there another compelling reason (for example securing of important water rights, promoting critical habitat connectivity, identification of new species of conservation concern, simplified management of an existing refuge unit, or donation of intact or easily restored habitat) which justifies the property's protection?

Nothing in these guidelines is intended to limit the appropriate exercising of discretion and professional judgment by realty specialists and refuge staff. Acquisition would comply with realty policy and potential acquisitions would be subject to scrutiny to determine that the habitat for which the property was identified as a priority is, in fact, present on the parcel. As mentioned in the third criterion, there may also be additional reasons why acquisition of interest in a parcel is justified, even if it did not rank highly in models for selected priority trust species at the time that this plan was approved.

Ecosystem Management and Landscape Conservation

To carry out the project, the Service will engage the Southern Rockies Landscape Conservation Cooperative, which is intended to deliver applied science to inform resource management decisions on landscape-scale issues such as climate change. The Landscape Conservation Cooperative incorporates State, Federal, nonprofit, and university partners; this planning across agency jurisdictions and boundaries is necessary to ensure that conservation happens at the scale necessary to ensure that wildlife can adapt, migrate, and colonize new areas in response to environmental change. The Southern Rockies Landscape Conservation Cooperative is still in its formative stages, but the framework for collaborative conservation in its area of responsibility, including the SLVCA, has been developed.

Incorporating Science and Strategic Habitat Conservation in the SLVCA

The SLVCA encompasses 5.2 million acres in a region where demand for conservation easements already far exceeds available funding. Given the likelihood that there may be more land available for conservation easements than appropriated funding, it is important to ensure that the money that is available is spent in a way that maximizes returns for trust species and/or helps ensure the connectivity, resiliency, and long-term function of the ecosystems in the project area. Toward this end, the SLVCA will incorporate the elements of strategic habitat conservation. Strategic habitat conservation is based on an adaptive management framework and entails starting with strategic conservation planning, followed by conservation design, conservation delivery, and monitoring/research to assess results.

Strategic Biological Planning

Biological planning requires the identification of specific biological objectives or focal species so that the relative success of a strategy can be assessed following implementation. The focal species identified to guide prioritization of the SLVCA were chosen because of the Service's obligations to them as Federal trust species (candidate, threatened, and endangered species and migratory birds), and because land protection undertaken to benefit these species is likely to have conservation benefits for other species of conservation concern, such as species that are federally or State listed as threatened or endangered, USFWS Region 6 Birds of Conservation Concern, and USFWS Migratory Birds focal species. For example, protection of cottonwood riparian habitat for Lewis' woodpecker, a conspicuous regional bird of conservation concern, may also protect habitat for the more elusive yellow-billed cuckoo, an Endangered Species Act candidate species. Because of a lack of systematic nesting surveys for these species in the project area, assumptions were made based on scientific literature and expert opinion regarding which types of habitat were important for maintaining viable populations of the focal species. In particular, given the limited amount of quality wetland and riparian habitat present compared to pre-settlement conditions, it was assumed that the continued presence of those riparian types was a limiting resource in the life history of species that are thought to be obligate breeders in such habitat.

These focal species were chosen with the knowledge that there are gaps in existing data and that the habitat in the project area is likely to evolve over time in the face of environmental change and changes in human water use. As new data become available or as conditions change to the point that this conservation strategy is no longer effective, biological planning will be revisited.

Conservation Design and Delivery

Preventing loss of habitats identified for the diverse suite of focal species is the goal of the prioritization scheme outlined in section 4.3. Decisions regarding how to rank competing parcels with limited available funds will follow the outline described in that section.

The recovery plan for southwestern willow flycatcher requires a minimum of 50 occupied breeding territories in the San Luis Valley (USFWS 2002), and specific reaches of the Rio Grande and Conejos River were identified to maintain that level.[2] As previously discussed, this habitat will be granted highest priority for land protection, and all easement opportunities within the priority lands for that species should be considered in the interest of providing redundancy to currently occupied habitat.

In the absence of specific population goals for the remaining focal species, no acreage numbers or breeding pair densities have been selected. Following the principle that between 25 and 75 percent of a region must be conserved to meet targets for biodiversity (Noss et al. 2012), the initial targets for easement delivery are to protect 50 percent of existing priority habitat that currently exists on private lands for the other focal species. As survey data for the valley informs the role of the SLVCA in meeting specific regional or continental population objectives for other species, the delivery of easement and limited fee-title acquisition can be adjusted accordingly.

Monitoring and Research

Essential to the success of strategic habitat conservation is an effective monitoring program to ensure that conservation delivery is resulting in net positive benefits for the focal species around which the project was designed. While the consensus conservation model is primarily meant to guide effective easement acquisition, the individual species maps are intended to guide conservation delivery for those species. Monitoring of populations will help ensure the efficacy of the program; if negative population trends for those species are detected within the project area or at a regional or continental scale, then further literature review and/or targeted research can be applied to adjust conservation planning for the SLVCA. Some of the monitoring phase of strategic habitat conservation can be carried out using the capacity of the refuge biologist and Service Inventory and Monitoring assistance. However, it is important to recognize that similar monitoring will be carried out by partner agencies, and communication among these agencies is crucial for effective monitoring in the face of limited personnel and financial resources. Further, Service staff should leverage biological expertise at regional academic institutions in order to facilitate basic and applied research while addressing research gaps as they are identified.

Specifically, monitoring and research should include:

- Developing, improving, and assessing landscape models for priority species. Emphasis will be placed on the highest priority species with the greatest degree of uncertainty regarding limiting factors and the effectiveness of management actions, including acquisition under the SLVCA program, at minimizing and reducing the limiting factors for those species. Data from existing surveys such as the nine Breeding Bird Survey routes in the project area will be evaluated and incorporated into spatial models. When necessary, additional data will be collected to evaluate assumptions used in the modeling process and assessments will be adjusted accordingly. These methods will provide an estimate of the population response of trust species on easement lands and on non-easement properties. Similar modeling approaches may be developed or incorporated for priority nontrust species in cooperation with partners such as State wildlife agencies, nongovernmental organizations, and universities.
- Evaluating assumptions and addressing uncertainties identified through the biological planning, conservation design, and conservation delivery elements. When warranted, assumptions such as increased redundancy of occupied southwestern willow flycatcher habitat through protection of riparian vegetation will be evaluated.
- Identifying appropriate population goals for priority species and assessing the contribution of land protection toward meeting the population goals. This will allow the Service and conservation partners to evaluate the contribution of the program to meeting the population goals and refine conservation delivery to ensure maximum effectiveness.
- Determining how changing environmental conditions may influence the effectiveness of this conservation design as increased evaporation, social and economically driven changes in water use, and evolution of the type and timing of precipitation and runoff influence the hydrology of the SLVCA.

Socioeconomic Considerations

As discussed in detail in section 3.4 of the EA in this volume, the population in the project area is relatively low. Much of the land is cropland or rangeland. Landownership patterns vary widely, from dense 5- to 10-acre parcel subdivisions to ranches of more than 90,000 acres. Some facets of the agricultural economy are likely to be challenged by new ground water augmentation laws. The potential infusion of capital from the SLVCA conservation easement program may provide farmers with resources to invest that would allow them to continue operation. That money will largely

2 FR 76(157): Endangered and Threatened Wildlife and Plants: Designation of Revised Critical Habitat for Southwestern Willow Flycatcher. pp. 50542-50629

be invested within the San Luis Valley, so there will be short-term benefits to the local economy as well. Local governments are supportive of the initiative for these reasons, and because the program is largely easement-based and therefore should not significantly impact revenues.

Because the wildlife resources for which the SLVCA was designed already occur in these agricultural lands, sustaining this cornerstone of the regional economy is important to the mission of the Service. Maintaining these practices will also preserve the rural aesthetic which defines the region's culture and the character of the San Luis Valley.

Public Involvement and Coordination

Scoping

At the beginning of the planning process, the planning for the SLVCA was conducted in tandem with that for the San Luis Valley Refuge Complex CCP. Public scoping meetings were held on March 29, 2011, in Alamosa, Colorado; March 30, 2011, in Monte Vista, Colorado; and March 31, 2011, in Moffat, Colorado. The scoping meetings were attended by approximately 50 people, many of whom provided input for the scoping process. Additionally, 14 written comments were received from organizations and members of the public. A press event and public meeting was held at Adams State College in Alamosa, Colorado, on January 4, 2012, at which the Secretary of the Interior, Ken Salazar, organized the presentation of several complementary initiatives for the San Luis Valley and Sangre de Cristo Mountains. One of these initiatives was landscape-scale conservation, which the Director of the Service presented as being embodied by the SLVCA. Questions were answered and comments taken at a breakout session following the main meeting. The meeting was attended by over 300 members of the public.

Together, these meetings and subsequent feedback helped the Service to identify the questions and concerns of the public, as well as to refine the project boundary.

Distribution and Availability

Copies of the Land Protection Plan and Environmental Assessment were sent to Federal and State legislative delegations, tribes, agencies, landowners, private groups, and other interested individuals. Additional copies of the document are available from the following offices and contacts:

U.S. Fish and Wildlife Service
Region 6 Division of Refuge Planning
P.O. Box 25486-DFC
Denver, CO 80225
303/236 8132
<http://mountain-prairie.fws.gov/planning/lpp.htm>

U.S. Fish and Wildlife Service
San Luis Valley National Wildlife Refuge Complex
8249 Emperius Road
Alamosa, CO 81101
719/589 4021

Glossary

adaptive capacity – The ability of an ecosystem to maintain ecological function while adjusting to long-term changes in the environment, or shifting to a new normal (i.e., climate change, established invasive species)

anthropogenic – Caused by human activity

candidate species – A species of plant or animal for which the USFWS has sufficient information on its biological status and threats to propose it for listing as endangered or threatened under the Endangered Species Act, but for which development of a proposed listing regulation is precluded by other higher priority listing activities

comprehensive conservation plan – A 15-year plan providing overall management guidance to a unit or complex of the National Wildlife Refuge System

conservation easement – A legally enforceable encumbrance or transfer of property rights to a government agency or land trust for the purposes of conservation. Rights transferred could include discretion to subdivide or develop land, to change current land use practices, to sever water rights, or others as appropriate, and are specified by contract between the land owner and the conservation entity

ecological resilience – The ability of an ecosystem to rebound from short-term changes to a landscape (i.e. wildfires, floods, pest outbreaks)

endangered species – A species of plant or animal that is in danger of extinction throughout all or a significant portion of its range

Endangered Species Act – A U.S. law passed by Congress in 1973 with the purpose of protecting and recovering imperiled species and the ecosystems on which they depend

environmental assessment – A National Environmental Policy Act (NEPA) compliance document which analyzes whether to prepare an environmental impact statement or a finding of no significant impact, facilitates compliance when no EIS is necessary, or facilitates preparation of an EIS when one is necessary.

focal species – Species which represent a group of species vulnerable to similar threats

HUC – Hydrologic Unit Code, a hierarchical system created by USGS to identify locations regions by hydrology

land protection plan – A document required by USFWS policy prior to the establishment of new units of the National Wildlife Refuge System, or major expansions of existing units

landscape conservation cooperative – A public-private partnership intended to facilitate cross-political boundary conservation in the face of a changing environment through application of science

Marxan – A software package used as a decision support tool for spatial conservation prioritization

Region 6 – An administrative unit of the Service known as the Mountain-Prairie Region, which covers eight States: Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming

Service – U.S. Fish & Wildlife Service

strategic habitat conservation – An iterative adaptive management framework designed to ensure that decision making and management within the Service is science-based. Consists of four stages: biological planning, conservation design, delivery of conservation action, and monitoring and research.

threatened species – A species of plant or animal that is likely to become endangered in the foreseeable future

trust species – Species for which the Federal government has statutory responsibility, including threatened and endangered species, migratory birds, marine mammals, and interjurisdictional fish

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Appendix A

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Appendix B

Species List of the San Luis Valley Conservation Area

Sources: Colorado Natural Diversity Information Source (NDIS), SLV Refuge Complex Species List, USGS Nonindigenous Aquatic Species Database, NRCS Plants Database
* Non-native (Due to the number of plant species in the project area, introduced plants are not indicated)

Scientific Name	*English Name*	*Status*
Birds		
Recurvirostra americana	American Avocet	
Botaurus lentiginosus	American Bittern	
Fulica americana	American Coot	
Corvus brachyrhynchos	American Crow	
Cinclus mexicanus	American Dipper	
Carduelis tristis	American Goldfinch	
Pluvialis dominica	American Golden Plover	
Falco sparverius	American Kestrel	
Falco peregrinus anatum	American Peregrine Falcon	
Anthus rubescens	American Pipit	
Turdus migratorius	American Robin	
Spizella arborea	American Tree Sparrow	
Pelecanus erythrorhynchos	American White Pelican	
Anas americana	American Wigeon	
Calypte anna	Anna's Hummingbird	
Gavia arctica	Arctic Loon	
Myiarchus cinerascens	Ash-throated Flycatcher	
Calidris bairdii	Baird's Sandpiper	
Haliaeetus leucocephalus	Bald Eagle	SC
Columba fasciata	Band-tailed Pigeon	
Riparia riparia	Bank Swallow	
Tyto alba	Barn Owl	
Hirundo rustica	Barn Swallow	
Bucephala islandica	Barrow's Goldeneye	
Ceryle alcyon	Belted Kingfisher	
Thryomanes bewickii	Bewick's Wren	
Sayornis nigricans	Black Phoebe	
Leucosticte atrata	Black Rosy Finch	
Cypseloides niger	Black Swift	
Chlidonias niger	Black Tern	
Mniotilta varia	Black-and-white Warbler	
Pluvialis squatarola	Black-bellied Plover	
Pica pica	Black-billed Magpie	
Poecile atricapillus	Black-capped Chickadee	
Archilochus alexandri	Black-chinned Hummingbird	

Scientific Name	*English Name*	*Status*
Nycticorax nycticorax	Black-crowned Night-Heron	
Pheucticus melanocephalus	Black-headed Grosbeak	
Himantopus mexicanus	Black-necked Stilt	
Dendroica striata	Blackpoll Warbler	
Dendroica caerulescens	Black-throated Blue Warbler	
Dendroica nigrescens	Black-throated Gray Warbler	
Amphispiza bilineata	Black-throated Sparrow	
Guiraca caerulea	Blue Grosbeak	
Dendragapus obscurus	Blue Grouse	
Cyanocitta cristata	Blue Jay	
Polioptila caerulea	Blue-gray Gnatcatcher	
Anas discors	Blue-winged Teal	
Dolichonyx oryzivorus	Bobolink	
Bombycilla garrulus	Bohemian Waxwing	
Larus philadelphia	Bonaparte's Gull	
Aegolius funereus	Boreal Owl	
Euphagus cyanocephalus	Brewer's Blackbird	
Spizella breweri	Brewer's Sparrow	
Selasphorus platycercus	Broad-tailed Hummingbird	
Certhia americana	Brown Creeper	
Toxostoma rufum	Brown Thrasher	
Leucosticte australis	Brown-capped Rosy Finch	
Molothrus ater	Brown-headed Cowbird	
Bucephala albeola	Bufflehead	
Icterus bullockii	Bullock's Oriole	
Athene cunicularia	Burrowing Owl	ST
Psaltriparus minimus	Bushtit	
Branta hutchinsii	Cackling Goose	
Larus californicus	California Gull	
Stellula calliope	Calliope Hummingbird	
Branta canadensis	Canada Goose	
Aythya valisineria	Canvasback	
Pipilo fuscus	Canyon Towhee	
Catherpes mexicanus	Canyon Wren	
Hydroprogne caspia	Caspian Tern	
Carpodacus cassinii	Cassin's Finch	
Tyrannus vociferans	Cassin's Kingbird	
Aimophila cassinii	Cassin's Sparrow	
Bubulcus ibis	Cattle Egret	
Bombycilla cedrorum	Cedar Waxwing	
Dendroica pensylvanica	Chestnut-sided Warbler	
Corvus cryptoleucus	Chihuahuan Raven	
Spizella passerina	Chipping Sparrow	
Anas cyanoptera	Cinnamon Teal	
Aechmophorus clarkii	Clark's Grebe	
Nucifraga columbiana	Clark's Nutcracker	

Scientific Name	*English Name*	*Status*
Spizella pallida	Clay-colored Sparrow	
Petrochelidon pyrrhonota	Cliff Swallow	
Bucephala clangula	Common Goldeneye	
Quiscalus quiscula	Common Grackle	
Gavia immer	Common Loon	
Mergus merganser	Common Merganser	
Chordeiles minor	Common Nighthawk	
Phalaenoptilus nuttallii	Common Poorwill	
Corvus corax	Common Raven	
Carduelis flammea	Common Redpoll	
Gallinago gallinago	Common Snipe	
Sterna hirundo	Common Tern	
Geothlypis trichas	Common Yellowthroat	
Accipiter cooperii	Cooper's Hawk	
Empidonax occidentalis	Cordilleran Flycatcher	
Junco hyemalis	Dark-eyed Junco	
Spiza americana	Dickcissel	
Phalacrocorax auritus	Double-crested Cormorant	
Picoides pubescens	Downy Woodpecker	
Empidonax oberholseri	Dusky Flycatcher	
Dendragapus obscurus	Dusky Grouse	
Podiceps nigricollis	Eared Grebe	
Tyrannus tyrannus	Eastern Kingbird	
Streptopelia decaocto	Eurasian Collared-Dove*	
Sturnus vulgaris	European Starling*	
Coccothraustes vespertinus	Evening Grosbeak	
Buteo regalis	Ferruginous Hawk	SC
Otus flammeolus	Flammulated Owl	
Sterna forsteri	Forster's Tern	
Passerella iliaca	Fox Sparrow	
Larus pipixcan	Franklin's Gull	
Anas strepera	Gadwall	
Callipepla gambelii	Gambel's Quail	
Larus glaucescens	Glaucous-winged Gull	
Aquila chrysaetos	Golden Eagle	
Regulus satrapa	Golden-crowned Kinglet	
Dendroica graciae	Grace's Warbler	
Ammodramus savannarum	Grasshopper Sparrow	
Dumetella carolinensis	Gray Catbird	
Empidonax wrightii	Gray Flycatcher	
Perisoreus canadensis	Gray Jay	
Leucosticte tephrocotis	Gray-crowned Rosy Finch	
Ardea herodias	Great Blue Heron	
Ardea alba	Great Egret	
Bubo virginianus	Great Horned Owl	
Geococcyx californianus	Greater Roadrunner	

Scientific Name	*English Name*	*Status*
Grus canadensis tabida	Greater Sandhill Crane	SC
Aythya marila	Greater Scaup	
Anser albifrons	Greater White-fronted Goose	
Tringa melanoleuca	Greater Yellowlegs	
Quiscalus mexicanus	Great-tailed Grackle	
Butorides virescens	Green Heron	
Pipilo chlorurus	Green-tailed Towhee	
Anas crecca	Green-winged Teal	
Centrocercus minimus	Gunnison Sage Grouse	SC
Picoides villosus	Hairy Woodpecker	
Empidonax hammondii	Hammond's Flycatcher	
Zonotrichia querula	Harris' Sparrow	
Catharus guttatus	Hermit Thrush	
Larus argentatus	Herring Gull	
Lophodytes cucullatus	Hooded Merganser	
Podiceps auritus	Horned Grebe	
Eremophila alpestris	Horned Lark	
Carpodacus mexicanus	House Finch	
Passer domesticus	House Sparrow*	
Troglodytes aedon	House Wren	
Passerina cyanea	Indigo Bunting	
Baeolophus griseus	Juniper Titmouse	
Charadrius vociferus	Killdeer	
Calcarius lapponicus	Lapland Longspur	
Calamospiza melanocorys	Lark Bunting	
Chondestes grammacus	Lark Sparrow	
Passerina amoena	Lazuli Bunting	
Ixobrychus exilis	Least Bittern	
Empidonax minimus	Least Flycatcher	
Calidris minutilla	Least Sandpiper	
Sternula antillarum	Least Tern	FE, SE
Carduelis psaltria	Lesser Goldfinch	
Aythya affinis	Lesser Scaup	
Tringa flavipes	Lesser Yellowlegs	
Melanerpes lewis	Lewis' Woodpecker	
Melospiza lincolnii	Lincoln's Sparrow	
Egretta caerulea	Little Blue Heron	
Lanius ludovicianus	Loggerhead Shrike	
Numenius americanus	Long-billed Curlew	SC
Limnodromus scolopaceus	Long-billed Dowitcher	
Asio otus	Long-eared Owl	
Oporornis tolmiei	MacGillivray's Warbler	
Eugenes fulgens	Magnificent Hummingbird	
Anas platyrhynchos	Mallard	
Limosa fedoa	Marbled Godwit	
Cistothorus palustris	Marsh Wren	

Scientific Name	*English Name*	*Status*
Falco columbarius	Merlin	
Strix occidentalis lucida	Mexican Spotted Owl	FT, ST
Sialia currucoides	Mountain Bluebird	
Poecile gambeli	Mountain Chickadee	
Charadrius montanus	Mountain Plover	SC
Zenaida macroura	Mourning Dove	
Vermivora ruficapilla	Nashville Warbler	
Cardinalis cardinalis	Northern Cardinal	
Colaptes auratus	Northern Flicker	
Accipiter gentilis	Northern Goshawk	
Circus cyaneus	Northern Harrier	
Mimus polyglottos	Northern Mockingbird	
Parula americana	Northern Parula	
Anas acuta	Northern Pintail	
Glaucidium gnoma	Northern Pygmy-Owl	
Stelgidopteryx serripennis	Northern Rough-winged Swallow	
Aegolius acadicus	Northern Saw-whet Owl	
Anas clypeata	Northern Shoveler	
Lanius excubitor	Northern Shrike	
Seiurus noveboracensis	Northern Waterthrush	
Contopus cooperi	Olive-sided Flycatcher	
Vermivora celata	Orange-crowned Warbler	
Pandion haliaetus	Osprey	
Seiurus aurocapillus	Ovenbird	
Gavia pacifica	Pacific Loon	
Calidris melanotos	Pectoral Sandpiper	
Falco peregrinus	Peregrine Falcon	SC
Podilymbus podiceps	Pied-billed Grebe	
Pinicola enucleator	Pine Grosbeak	
Carduelis pinus	Pine Siskin	
Gymnorhinus cyanocephalus	Pinyon Jay	
Vireo plumbeus	Plumbeous Vireo	
Falco mexicanus	Prairie Falcon	
Porphyrio martinica	Purple Gallinule	
Progne subis	Purple Martin	
Sitta pygmaea	Pygmy Nuthatch	
Loxia curvirostra	Red Crossbill	
Mergus serrator	Red-breasted Merganser	
Sitta canadensis	Red-breasted Nuthatch	
Vireo olivaceus	Red-eyed Vireo	
Aythya americana	Redhead	
Melanerpes erythrocephalus	Red-headed Woodpecker	
Sphyrapicus nuchalis	Red-naped Sapsucker	
Phalaropus lobatus	Red-necked Phalarope	
Buteo jamaicensis	Red-tailed Hawk	
Agelaius phoeniceus	Red-winged Blackbird	

Scientific Name	*English Name*	*Status*
Larus delawarensis	Ring-billed Gull	
Aythya collaris	Ring-necked Duck	
Phasianus colchicus	Ring-necked Pheasant*	
Columba livia	Rock Pigeon*	
Salpinctes obsoletus	Rock Wren	
Pheucticus ludovicianus	Rose-breasted Grosbeak	
Chen rossii	Ross' Goose	
Buteo lagopus	Rough-legged Hawk	
Regulus calendula	Ruby-crowned Kinglet	
Oxyura jamaicensis	Ruddy Duck	
Selasphorus rufus	Rufous Hummingbird	
Aimophila ruficeps	Rufous-crowned Sparrow	
Xema sabini	Sabine's Gull	
Centrocercus urophasianus	Sage Grouse	
Amphispiza belli	Sage Sparrow	
Oreoscoptes montanus	Sage Thrasher	
Calidris alba	Sanderling	
Grus canadensis	Sandhill Crane	
Passerculus sandwichensis	Savannah Sparrow	
Sayornis saya	Say's Phoebe	
Tyrannus forficatus	Scissor-tailed Flycatcher	
Cistothorus platensis	Sedge Wren	
Charadrius semipalmatus	Semipalmated Plover	
Calidris pusilla	Semipalmated Sandpiper	
Accipiter striatus	Sharp-shinned Hawk	
Limnodromus griseus	Short-billed Dowitcher	
Asio flammeus	Short-eared Owl	
Chen caerulescens	Snow Goose	
Egretta thula	Snowy Egret	
Charadrius alexandrinus	Snowy Plover	SC
Tringa solitaria	Solitary Sandpiper	
Melospiza melodia	Song Sparrow	
Porzana carolina	Sora	
Empidonax traillii extimus	Southwestern Willow Flycatcher	FE, SE
Strix occidentalis	Spotted Owl	
Actitis macularia	Spotted Sandpiper	
Pipilo maculatus	Spotted Towhee	
Cyanocitta stelleri	Steller's Jay	
Calidris himantopus	Stilt Sandpiper	
Melanitta perspicillata	Surf Scoter	
Piranga rubra	Summer Tanager	
Buteo swainsoni	Swainson's Hawk	
Catharus ustulatus	Swainson's Thrush	
Melospiza georgiana	Swamp Sparrow	
Vermivora peregrina	Tennessee Warbler	
Picoides tridactylus	Three-toed Woodpecker	

Scientific Name	*English Name*	*Status*
Myadestes townsendi	Townsend's Solitaire	
Dendroica townsendi	Townsend's Warbler	
Tachycineta bicolor	Tree Swallow	
Cygnus columbianus	Tundra Swan	
Cathartes aura	Turkey Vulture	
Ixoreus naevius	Varied Thrush	
Catharus fuscescens	Veery	
Pyrocephalus rubinus	Vermilion Flycatcher	
Pooecetes gramineus	Vesper Sparrow	
Tachycineta thalassina	Violet-green Swallow	
Rallus limicola	Virginia Rail	
Vermivora virginiae	Virginia's Warbler	
Vireo gilvus	Warbling Vireo	
Sialia mexicana	Western Bluebird	
Athene cunicularia	Western Burrowing Owl	
Aechmophorus occidentalis	Western Grebe	
Tyrannus verticalis	Western Kingbird	
Sturnella neglecta	Western Meadowlark	
Calidris mauri	Western Sandpiper	
Otus kennicottii	Western Screech-Owl	
Aphelocoma californica	Western Scrub Jay	
Charadrius alexandrinus nivosus	Western Snowy Plover	
Piranga ludoviciana	Western Tanager	
Contopus sordidulus	Western Wood-Pewee	
Numenius phaeopus	Whimbrel	
Eudocimus albus	White Ibis	
Sitta carolinensis	White-breasted Nuthatch	
Zonotrichia leucophrys	White-crowned Sparrow	
Plegadis chihi	White-faced Ibis	
Calidris fuscicollis	White-rumped Sandpiper	
Lagopus leucurus	White-tailed Ptarmigan	
Zonotrichia albicollis	White-throated Sparrow	
Aeronautes saxatalis	White-throated Swift	
Loxia leucoptera	White-winged Crossbill	
Melanitta fusca	White-winged Scoter	
Meleagris gallopavo	Wild Turkey	
Grus americana	Whooping Crane	FE, SE
Catoptrophorus semipalmatus	Willet	
Sphyrapicus thyroideus	Williamson's Sapsucker	
Empidonax traillii	Willow Flycatcher	
Phalaropus tricolor	Wilson's Phalarope	
Gallinago delicata	Wilson's Snipe	
Wilsonia pusilla	Wilson's Warbler	
Aix sponsa	Wood Duck	
Helmitheros vermivorum	Worm-eating Warbler	
Hylocichla mustelina	Wood Thrush	

Scientific Name	*English Name*	*Status*
Dendroica petechia	Yellow Warbler	
Coccyzus americanus	Yellow-billed Cuckoo	SC
Icteria virens	Yellow-breasted Chat	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	
Dendroica coronata	Yellow-rumped Warbler	
Amphibians		
Bufo boreas boreas	Boreal Toad	SE
Rana catesbeiana	Bullfrog*	
Hyla arenicolor	Canyon Treefrog	
Bufo cognatus	Great Plains Toad	
Spea multiplicata	New Mexico Spadefoot	
Rana pipiens	Northern Leopard Frog	SC
Spea bombifrons	Plains Spadefoot	
Ambystoma tigrinum	Tiger Salamander	
Pseudacris triseriata	Western Chorus Frog	
Bufo woodhousii	Woodhouse's Toad	
Mammals		
Sciurus aberti	Abert's Squirrel	
Taxidea taxus	American Badger	
Castor canadensis	American Beaver	
Cervus elaphus	American Elk	
Martes americana	American Marten	
Ochotona princeps	American Pika	
Eptesicus fuscus	Big Brown Bat	
Ovis canadensis	Bighorn Sheep	
Ursus americanus	Black Bear	
Mustela nigripes	Black-footed Ferret	FE, SE
Lepus californicus	Black-tailed Jackrabbit	
Lynx rufus	Bobcat	
Thomomys bottae	Botta's Pocket Gopher	SC
Tadarida brasiliensis	Brazilian Free-tailed Bat	
Neotoma cinerea	Bushy-tailed Woodrat	
Tamias quadrivittatus	Colorado Chipmunk	
Conepatus mesoleucus	Common Hog-nosed Skunk	
Ondatra zibethicus	Common Muskrat	
Erethizon dorsatum	Common Porcupine	
Canis latrans	Coyote	
Peromyscus maniculatus	Deer Mouse	
Sylvilagus audubonii	Desert Cottontail	
Mustela erminea	Ermine	
Myotis thysanodes	Fringed Myotis	
Spermophilus lateralis	Golden-mantled Ground Squirrel	
Urocyon cinereoargenteus	Gray Fox	
Cynomys gunnisoni	Gunnison's Prairie Dog	
Phenacomys intermedius	Heather Vole	
Lasiurus cinereus	Hoary Bat	

Scientific Name	*English Name*	*Status*
Mus musculus	House Mouse*	
Tamias minimus	Least Chipmunk	
Myotis lucifugus	Little Brown Myotis	
Myotis evotis	Long-eared Myotis	
Myotis volans	Long-legged Myotis	
Microtus longicaudus	Long-tailed Vole	
Mustela frenata	Long-tailed Weasel	
Lynx canadensis	Lynx	FT, SE
Sorex cinereus	Masked Shrew	
Microtus pennsylvanicus	Meadow Vole	
Neotoma mexicana	Mexican Woodrat	
Mustela vison	Mink	
Sorex monticolus	Montane Shrew	
Microtus montanus	Montane Vole	
Alces alces	Moose	
Sylvilagus nuttallii	Mountain Cottontail	
Oreamnos americanus	Mountain Goat	
Felis concolor	Mountain Lion	
Odocoileus hemionus	Mule Deer	
Onychomys leucogaster	Northern Grasshopper Mouse	
Thomomys talpoides	Northern Pocket Gopher	SC
Lutra canadensis	Northern River Otter	
Peromyscus nasutus	Northern Rock Mouse	
Dipodomys ordii	Ord's Kangaroo Rat	
Tamiasciurus hudsonicus	Pine Squirrel	
Perognathus flavescens	Plains Pocket Mouse	
Antilocapra americana	Pronghorn	
Procyon lotor	Raccoon	
Vulpes vulpes	Red Fox	
Bassariscus astutus	Ringtail	
Perognathus flavus	Silky Pocket Mouse	
Lasionycteris noctivagans	Silver-haired Bat	
Lepus americanus	Snowshoe Hare	
Clethrionomys gapperi	Southern Red-backed Vole	
Mephitis mephitis	Striped Skunk	
Spermophilus tridecemlineatus	Thirteen-lined Ground Squirrel	
Plecotus townsendii	Townsend's Big-eared Bat	SC
Sorex palustris	Water Shrew	
Reithrodontomys megalotis	Western Harvest Mouse	
Zapus princeps	Western Jumping Mouse	
Myotis ciliolabrum	Western Small-footed Myotis	
Spilogale gracilis	Western Spotted Skunk	
Odocoileus virginianus	White-tailed Deer	
Lepus townsendii	White-tailed Jackrabbit	
Gulo gulo	Wolverine	SE
Spermophilus elegans	Wyoming Ground Squirrel	

Scientific Name	*English Name*	*Status*
Marmota flaviventris	Yellow-bellied Marmot	
Myotis yumanensis	Yuma Myotis	
Reptiles		
Sceloporus undulatus	Fence Lizard	
Pituophis catenifer	Gopher Snake	
Eumeces multivirgatus	Many-lined Skink	
Crotalus viridis concolor	Midget Faded Rattlesnake	SC
Lampropeltis triangulum	Milk Snake	
Phrynosoma hernandesi	Short-horned Lizard	
Liochlorophis vernalis	Smooth Green Snake	
Eumeces gaigeae	Variable Skink	
Crotalus viridis	Western Rattlesnake	
Thamnophis elegans	Western Terrestrial Garter Snake	
Fish		
Anguilla rostrata	American eel*	
Thymallus arcticus	Arctic grayling*	
Pomoxis nigromaculatus	Black crappie*	
Gymnocorymbus ternetzi	Black tetra*	
Ictalurus furcatus	Blue catfish*	
Oreochromis aureus	Blue tilapia*	
Lepomis macrochirus	Bluegill*	
Culaea inconstans	Brook stickleback*	
Salvelinus fontinalis	Brook trout*	
Salmo trutta	Brown trout*	
Ictalurus punctatus	Channel catfish*	
Oncorhynchus clarkii pleuriticus	Colorado River cutthroat*	
Cyprinus carpio	Common carp*	
Corydoras sp.	Corydoras catfish*	
Oncorhynchus clarkii x mykiss	Cutbow trout (hybrid)*	
Pimephales promelas	Fathead minnow	
Oncorhynchus clarkii carmichaeli	Fine-spotted Snake River cutthroat*	
Pylodictis olivaris	Flathead catfish*	
Platygobio gracilis	Flathead chub*	
Pterophyllum sp.	Freshwater angelfish*	
Oncorhynchus aguabonita	Golden trout*	
Carassius auratus	Goldfish*	
Ctenopharyngodon idella	Grass carp*	
Xiphophorus hellerii	Green swordtail*	
Poecilia reticulata	Guppy*	
Hemigrammus ocellifer	Head-and-taillight tetra*	
Oncorhynchus nerka	Kokanee*	
Salvelinus namaycush	Lake trout*	
Salmo salar sebago	Landlocked Atlantic salmon*	
Micropterus salmoides	Largemouth bass*	
Rhinichthys cataractae	Long-nose dace	
Catostomus catostomus	Longnose sucker*	

Scientific Name	*English Name*	*Status*
Cottus bairdii	Mottled sculpin*	
Oreochromis mossambicus	Mozambique tilapia*	
Paracheirodon innesi	Neon tetra*	
Esox lucius	Northern pike*	
Fundulus zebrinus	Plains killifish*	
Fundulus sciadicus	Plains topminnow*	
Lepomis gibbosus	Pumpkinseed*	
Oncorhynchus mykiss	Rainbow trout*	
Symphysodon discus	Red discus*	
Gila pandora	Rio Grande chub	SC
Oncorhynchus clarki virginalis	Rio Grande cutthroat trout	SC; Candidate
Catostomus plebeius	Rio Grande sucker	SE
Poecilia latipinna	Sailfin molly*	
Poecilia mexicana	Shortfin molly*	
Micropterus dolomieu	Smallmouth bass*	
Xiphophorus maculatus	Southern platyfish*	
Hypostomus sp.	Suckermouth catfish*	
Otocinclus sp.	Suckermouth catfish*	
Tinca tinca	Tench*	
Dorosoma petenense	Threadfin shad*	
Xiphophorus variatus	Variable platyfish*	
Pterygoplichthys disjunctivus	Vermiculated sailfin*	
Sander vitreus	Walleye*	
Lepomis gulosus	Warmouth*	
Oncorhynchus clarkii lewisi	West slope cutthroat*	
Gambusia affinis	Western mosquitofish*	
Catostomus commersonii	White sucker*	
Ameiurus natalis	Yellow bullhead*	
Perca flavescens	Yellow perch*	
Oncorhynchus clarkii bouvieri	Yellowstone cutthroat*	
Plants		
Abies concolor	white fir	
Abies lasiocarpa	subalpine fir	
Abies lasiocarpa var. *arizonica*	corkbark fir	
Abies lasiocarpa var. *lasiocarpa*	subalpine fir	
Acer glabrum	Rocky Mountain maple	
Achillea millefolium	common yarrow	
Achillea millefolium var. *occidentalis*	western yarrow	
Achnatherum ×bloomeri		
Achnatherum hymenoides	Indian ricegrass	
Achnatherum lettermanii	Letterman's needlegrass	
Achnatherum nelsonii	Columbia needlegrass	
Achnatherum nelsonii ssp. *nelsonii*	Columbia needlegrass	
Achnatherum robustum	sleepygrass	
Achnatherum scribneri	Scribner needlegrass	

Scientific Name	*English Name*	*Status*
Aconitum columbianum	Columbian monkshood	
Aconitum columbianum ssp. *columbianum*	Columbian monkshood	
Acroptilon repens	hardheads	
Actaea rubra	red baneberry	
Actaea rubra ssp. *arguta*	red baneberry	
Adoxa moschatellina	muskroot	
Agastache pallidiflora	Bill Williams Mountain giant hyssop	
Agastache pallidiflora ssp. *pallidiflora*	Bill Williams Mountain giant hyssop	
Agastache pallidiflora ssp. *pallidiflora* var. *greenei*	Bill Williams Mountain giant hyssop	
Agoseris aurantiaca	orange agoseris	
Agoseris glauca	pale agoseris	
Agrostis exarata	spike bentgrass	
Agrostis gigantea	redtop	
Agrostis humilis	alpine bentgrass	
Agrostis scabra	rough bentgrass	
Agrostis variabilis	mountain bentgrass	
Aletes anisatus	Rocky Mountain Indian parsley	
Aliciella pinnatifida	sticky gilia	
Alisma gramineum	narrowleaf water plantain	
Alisma triviale	northern water plantain	
Allium cernuum	nodding onion	
Allium geyeri	Geyer's onion	
Allium geyeri var. *tenerum*	bulbil onion	
Almutaster pauciflorus	alkali marsh aster	
Alnus incana	gray alder	
Alnus incana ssp. *tenuifolia*	thinleaf alder	
Alopecurus aequalis	shortawn foxtail	
Alopecurus aequalis var. *aequalis*	shortawn foxtail	
Alopecurus alpinus	boreal alopecurus	
Alyssum simplex	alyssum	
Amaranthus albus	prostrate pigweed	
Amaranthus blitoides	mat amaranth	
Amaranthus retroflexus	redroot amaranth	
Ambrosia acanthicarpa	flatspine bur ragweed	
Amelanchier alnifolia	Saskatoon serviceberry	
Amelanchier alnifolia var. *alnifolia*	Saskatoon serviceberry	
Amelanchier utahensis	Utah serviceberry	
Amelanchier utahensis var. *utahensis*	Utah serviceberry	
Anaphalis margaritacea	western pearly everlasting	
Androsace chamaejasme	sweetflower rockjasmine	
Androsace chamaejasme ssp. *carinata*	sweetflower rockjasmine	
Androsace occidentalis	western rockjasmine	
Androsace septentrionalis	pygmyflower rockjasmine	
Anemone canadensis	Canadian anemone	
Anemone multifida	Pacific anemone	
Angelica ampla	giant angelica	

Scientific Name	*English Name*	*Status*
Angelica grayi	Gray's angelica	
Antennaria anaphaloides	pearly pussytoes	
Antennaria corymbosa	flat-top pussytoes	
Antennaria marginata	whitemargin pussytoes	
Antennaria media	Rocky Mountain pussytoes	
Antennaria microphylla	littleleaf pussytoes	
Antennaria parvifolia	small-leaf pussytoes	
Antennaria rosea	rosy pussytoes	
Antennaria rosulata	Kaibab pussytoes	
Antennaria umbrinella	umber pussytoes	
Apocynum androsaemifolium	spreading dogbane	
Apocynum cannabinum	Indianhemp	
Aquilegia coerulea	Colorado blue columbine	
Aquilegia elegantula	western red columbine	
Arabis ×divaricarpa	spreadingpod rockcress	
Arabis drummondii	Drummond's rockcress	
Arabis fendleri	Fendler's rockcress	
Arabis fendleri var. *fendleri*	Fendler's rockcress	
Arabis gunnisoniana	Gunnison's rockcress	
Arabis hirsuta	hairy rockcress	
Arabis hirsuta var. *pycnocarpa*	creamflower rockcress	
Arabis holboellii	Holboell's rockcress	
Arabis holboellii var. *pinetorum*	Holboell's rockcress	
Arabis lignifera	desert rockcress	
Arabis oxylobula	Glenwood Springs rockcress	
Arctostaphylos uva-ursi	kinnikinnick	
Arenaria fendleri	Fendler's sandwort	
Arenaria fendleri var. *fendleri*	Fendler's sandwort	
Arenaria hookeri	Hooker's sandwort	
Arenaria hookeri ssp. *hookeri*	Hooker's sandwort	
Arenaria lanuginosa	spreading sandwort	
Arenaria lanuginosa ssp. *saxosa*	spreading sandwort	
Argentina anserina	silverweed cinquefoil	
Argyrochosma fendleri	Fendler's false cloak fern	
Aristida purpurea	purple threeawn	
Aristida purpurea var. *longiseta*	Fendler threeawn	
Aristida purpurea var. *purpurea*	purple threeawn	
Arnica chamissonis	Chamisso arnica	
Arnica chamissonis ssp. *foliosa*	Chamisso arnica	
Arnica chamissonis ssp. *foliosa* var. *andina*	Chamisso arnica	
Arnica cordifolia	heartleaf arnica	
Arnica mollis	hairy arnica	
Artemisia biennis	biennial wormwood	
Artemisia biennis var. *biennis*	biennial wormwood	
Artemisia bigelovii	Bigelow sage	
Artemisia campestris	field sagewort	

Scientific Name	*English Name*	*Status*
Artemisia campestris ssp. *borealis*	field sagewort	
Artemisia campestris ssp. *borealis* var. *borealis*	field sagewort	
Artemisia campestris ssp. *borealis* var. *scouleriana*	field sagewort	
Artemisia campestris ssp. *caudata*	field sagewort	
Artemisia cana	silver sagebrush	
Artemisia cana ssp. *cana*	silver sagebrush	
Artemisia carruthii	Carruth's sagewort	
Artemisia dracunculus	tarragon	
Artemisia franserioides	ragweed sagebrush	
Artemisia frigida	prairie sagewort	
Artemisia longifolia	longleaf wormwood	
Artemisia ludoviciana	white sagebrush	
Artemisia ludoviciana ssp. *albula*	white sagebrush	
Artemisia ludoviciana ssp. *incompta*	white sagebrush	
Artemisia ludoviciana ssp. *ludoviciana*	white sagebrush	
Artemisia michauxiana	Michaux's wormwood	
Artemisia parryi	Parry's wormwood	
Artemisia scopulorum	alpine sagebrush	
Artemisia tridentata	big sagebrush	
Artemisia tridentata ssp. *tridentata*	basin big sagebrush	
Artemisia tridentata ssp. *vaseyana*	mountain big sagebrush	
Asclepias hallii	Hall's milkweed	
Asclepias speciosa	showy milkweed	
Asparagus officinalis	garden asparagus	
Asplenium septentrionale	forked spleenwort	
Aster alpinus	alpine aster	
Aster alpinus var. *vierhapperi*	Vierhapper's aster	
Astragalus agrestis	purple milkvetch	
Astragalus allochrous	halfmoon milkvetch	
Astragalus allochrous var. *playanus*	halfmoon milkvetch	
Astragalus alpinus	alpine milkvetch	
Astragalus alpinus var. *alpinus*	alpine milkvetch	
Astragalus bisulcatus	twogrooved milkvetch	
Astragalus bodinii	Bodin's milkvetch	
Astragalus brandegeei	Brandegee's milkvetch	
Astragalus ceramicus	painted milkvetch	
Astragalus ceramicus var. *ceramicus*	painted milkvetch	
Astragalus cerussatus	powdery milkvetch	
Astragalus crassicarpus	groundplum milkvetch	
Astragalus crassicarpus var. *crassicarpus*	groundplum milkvetch	
Astragalus drummondii	Drummond's milkvetch	
Astragalus flexuosus	flexile milkvetch	
Astragalus flexuosus var. *flexuosus*	flexile milkvetch	
Astragalus hallii	Hall's milkvetch	
Astragalus hallii var. *hallii*	Hall's milkvetch	
Astragalus kentrophyta	spiny milkvetch	

Scientific Name	*English Name*	*Status*
Astragalus kentrophyta var. *tegetarius*	mat milkvetch	
Astragalus laxmannii	Laxmann's milkvetch	
Astragalus laxmannii var. *robustior*	prairie milkvetch	
Astragalus miser	timber milkvetch	
Astragalus miser var. *oblongifolius*	timber milkvetch	
Astragalus pattersonii	Patterson's milkvetch	
Astragalus ripleyi	Ripley's milkvetch	
Astragalus scopulorum	Rocky Mountain milkvetch	
Astragalus tenellus	looseflower milkvetch	
Atriplex ×*aptera*	moundscale	
Atriplex argentea	silverscale saltbush	
Atriplex canescens	fourwing saltbush	
Atriplex canescens var. *canescens*	fourwing saltbush	
Atriplex patula	spear saltbush	
Atriplex rosea	tumbling saltweed	
Atriplex truncata	wedgescale saltbush	
Atriplex wolfii	Wolf's saltweed	
Bahia dissecta	ragleaf bahia	
Balsamorhiza sagittata	arrowleaf balsamroot	
Bassia hyssopifolia	fivehorn smotherweed	
Bassia scoparia	burningbush	
Beckmannia syzigachne	American sloughgrass	
Berberis fendleri	Colorado barberry	
Besseya alpina	alpine besseya	
Besseya plantaginea	White River coraldrops	
Betula occidentalis	water birch	
Bidens cernua	nodding beggartick	
Bidens frondosa	devil's beggartick	
Bidens tenuisecta	slimlobe beggarticks	
Bidens vulgata	big devils beggartick	
Blepharoneuron tricholepis	pine dropseed	
Botrychium hesperium	western moonwort	
Botrychium pinnatum	northern moonwort	
Botrychium simplex	little grapefern	
Bouteloua gracilis	blue grama	
Bouteloua simplex	matted grama	
Brassica juncea	India mustard	
Brassica napus	rape	
Brickellia eupatorioides	false boneset	
Brickellia eupatorioides var. *chlorolepis*	false boneset	
Brickellia grandiflora	tasselflower brickellbush	
Bromus ciliatus	fringed brome	
Bromus ciliatus var. *ciliatus*	fringed brome	
Bromus inermis	smooth brome	
Bromus inermis ssp. *inermis*	smooth brome	
Bromus inermis ssp. *inermis* var. *inermis*	smooth brome	

Scientific Name	*English Name*	*Status*
Bromus lanatipes	woolly brome	
Bromus porteri	Porter brome	
Bromus tectorum	cheatgrass	
Calamagrostis canadensis	bluejoint	
Calamagrostis purpurascens	purple reedgrass	
Calamagrostis purpurascens var. *purpurascens*	purple reedgrass	
Calamagrostis stricta	slimstem reedgrass	
Callitriche palustris	vernal water-starwort	
Calochortus gunnisonii	Gunnison's mariposa lily	
Calochortus gunnisonii var. *gunnisonii*	Gunnison's mariposa lily	
Caltha leptosepala	white marsh marigold	
Caltha leptosepala ssp. *leptosepala*	white marsh marigold	
Caltha leptosepala ssp. *leptosepala* var. *leptosepala*	white marsh marigold	
Camelina microcarpa	littlepod false flax	
Campanula parryi	Parry's bellflower	
Campanula parryi var. *parryi*	Parry's bellflower	
Campanula rotundifolia	bluebell bellflower	
Campanula uniflora	arctic bellflower	
Capsella bursa-pastoris	shepherd's purse	
Cardamine cordifolia	heartleaf bittercress	
Cardamine cordifolia var. *incana*	heartleaf bittercress	
Cardaria chalepensis	lenspod whitetop	
Cardaria draba	whitetop	
Cardaria pubescens	hairy whitetop	
Carex albonigra	blackandwhite sedge	
Carex aquatilis	water sedge	
Carex aquatilis var. *aquatilis*	water sedge	
Carex atherodes	wheat sedge	
Carex aurea	golden sedge	
Carex bella	southwestern showy sedge	
Carex brunnescens	brownish sedge	
Carex brunnescens ssp. *sphaerostachya*	brownish sedge	
Carex canescens	silvery sedge	
Carex canescens ssp. *canescens*	silvery sedge	
Carex diandra	lesser panicled sedge	
Carex disperma	softleaf sedge	
Carex douglasii	Douglas' sedge	
Carex duriuscula	needleleaf sedge	
Carex ebenea	ebony sedge	
Carex elynoides	blackroot sedge	
Carex geophila	White Mountain sedge	
Carex geyeri	Geyer's sedge	
Carex hallii	deer sedge	
Carex haydeniana	cloud sedge	
Carex heteroneura	different-nerve sedge	
Carex heteroneura var. *brevisquama*	different-nerve sedge	

Scientific Name	*English Name*	*Status*
Carex heteroneura var. *chalciolepis*	Holm sedge	
Carex inops	long-stolon sedge	
Carex inops ssp. *heliophila*	sun sedge	
Carex microptera	smallwing sedge	
Carex nebrascensis	Nebraska sedge	
Carex nelsonii	Nelson's sedge	
Carex nigricans	black alpine sedge	
Carex norvegica	Norway sedge	
Carex norvegica ssp. *stevenii*	Steven's sedge	
Carex nova	black sedge	
Carex obtusata	obtuse sedge	
Carex occidentalis	western sedge	
Carex parryana	Parry's sedge	
Carex parryana var. *parryana*	Parry's sedge	
Carex pellita	woolly sedge	
Carex perglobosa	globe sedge	
Carex phaeocephala	dunhead sedge	
Carex praegracilis	clustered field sedge	
Carex praticola	meadow sedge	
Carex pyrenaica	Pyrenean sedge	
Carex pyrenaica ssp. *pyrenaica*	Pyrenean sedge	
Carex scopulorum	mountain sedge	
Carex siccata	dryspike sedge	
Carex simulata	analogue sedge	
Carex utriculata	Northwest Territory sedge	
Carex vernacula	native sedge	
Carex vesicaria	blister sedge	
Carex vesicaria var. *vesicaria*	blister sedge	
Carum carvi	caraway	
Castilleja flava	yellow Indian paintbrush	
Castilleja flava var. *flava*	yellow Indian paintbrush	
Castilleja haydenii	Hayden's Indian paintbrush	
Castilleja integra	wholeleaf Indian paintbrush	
Castilleja integra var. *integra*	wholeleaf Indian paintbrush	
Castilleja linariifolia	Wyoming Indian paintbrush	
Castilleja miniata	giant red Indian paintbrush	
Castilleja miniata ssp. *miniata*	giant red Indian paintbrush	
Castilleja occidentalis	western Indian paintbrush	
Castilleja rhexiifolia	splitleaf Indian paintbrush	
Castilleja sulphurea	sulphur Indian paintbrush	
Ceanothus fendleri	Fendler's ceanothus	
Ceanothus velutinus	snowbrush ceanothus	
Ceanothus velutinus var. *velutinus*	snowbrush ceanothus	
Cerastium arvense	field chickweed	
Cerastium arvense ssp. *strictum*	field chickweed	
Cerastium beeringianum	Bering chickweed	

Scientific Name	*English Name*	*Status*
Cerastium beeringianum ssp. *earlei*	Bering chickweed	
Cercocarpus montanus	alderleaf mountain mahogany	
Chaenactis douglasii	Douglas' dustymaiden	
Chaenactis douglasii var. *alpina*	alpine dustymaiden	
Chaetopappa ericoides	rose heath	
Chamaerhodos erecta	little rose	
Chamaerhodos erecta ssp. *nuttallii*	Nuttall's little rose	
Chamaesyce serpyllifolia	thymeleaf sandmat	
Chamaesyce serpyllifolia ssp. *serpyllifolia*	thymeleaf sandmat	
Chamerion angustifolium	fireweed	
Chamerion angustifolium ssp. *circumvagum*	fireweed	
Cheilanthes feei	slender lipfern	
Cheilanthes fendleri	Fendler's lipfern	
Chenopodium album	lambsquarters	
Chenopodium atrovirens	pinyon goosefoot	
Chenopodium berlandieri	pitseed goosefoot	
Chenopodium botrys	Jerusalem oak goosefoot	
Chenopodium desiccatum	aridland goosefoot	
Chenopodium foliosum	leafy goosefoot	
Chenopodium fremontii	Fremont's goosefoot	
Chenopodium fremontii var. *fremontii*	Fremont's goosefoot	
Chenopodium glaucum	oakleaf goosefoot	
Chenopodium graveolens	fetid goosefoot	
Chenopodium leptophyllum	narrowleaf goosefoot	
Chenopodium pratericola	desert goosefoot	
Chenopodium rubrum	red goosefoot	
Chenopodium watsonii	Watson's goosefoot	
Chionophila jamesii	Rocky Mountain snowlover	
Chrysothamnus greenei	Greene's rabbitbrush	
Chrysothamnus vaseyi	Vasey's rabbitbrush	
Chrysothamnus viscidiflorus	yellow rabbitbrush	
Chrysothamnus viscidiflorus ssp. *lanceolatus*	yellow rabbitbrush	
Cicuta maculata	spotted water hemlock	
Cirsium arvense	Canada thistle	
Cirsium canescens	prairie thistle	
Cirsium centaureae	fringed thistle	
Cirsium ochrocentrum	yellowspine thistle	
Cirsium ochrocentrum ssp. *ochrocentrum*	yellowspine thistle	
Cirsium pallidum	pale thistle	
Cirsium parryi	Parry's thistle	
Cirsium parryi ssp. *parryi*	Parry's thistle	
Cirsium scariosum	meadow thistle	
Cirsium scopulorum	mountain thistle	
Claytonia megarhiza	alpine springbeauty	
Claytonia megarhiza var. *megarhiza*	alpine springbeauty	
Clematis columbiana	rock clematis	

Scientific Name	*English Name*	*Status*
Clematis columbiana var. *columbiana*	rock clematis	
Clematis hirsutissima	hairy clematis	
Clematis hirsutissima var. *scottii*	Scott's clematis	
Clematis ligusticifolia	western white clematis	
Clematis ligusticifolia var. *ligusticifolia*	western white clematis	
Cleome multicaulis	slender spiderflower	
Cleome serrulata	Rocky Mountain beeplant	
Collomia linearis	tiny trumpet	
Comandra umbellata	bastard toadflax	
Comandra umbellata ssp. *pallida*	pale bastard toadflax	
Comarum palustre	purple marshlocks	
Conioselinum scopulorum	Rocky Mountain hemlockparsley	
Convolvulus arvensis	field bindweed	
Conyza canadensis	Canadian horseweed	
Corallorhiza maculata	summer coralroot	
Corallorhiza striata	hooded coralroot	
Corallorhiza trifida	yellow coralroot	
Coreopsis tinctoria	golden tickseed	
Coreopsis tinctoria var. *tinctoria*	golden tickseed	
Corispermum americanum	American bugseed	
Corispermum americanum var. *rydbergii*	American bugseed	
Corispermum villosum	hairy bugseed	
Cornus canadensis	bunchberry dogwood	
Cornus sericea	redosier dogwood	
Cornus sericea ssp. *sericea*	redosier dogwood	
Corydalis aurea	scrambled eggs	
Corydalis caseana	Sierra fumewort	
Corydalis caseana ssp. *brandegeei*	Brandegee's fumewort	
Corydalis curvisiliqua	curvepod fumewort	
Corydalis curvisiliqua ssp. *occidentalis*	curvepod fumewort	
Crataegus rivularis	river hawthorn	
Crepis occidentalis	largeflower hawksbeard	
Crepis occidentalis ssp. *occidentalis*	largeflower hawksbeard	
Crepis runcinata	fiddleleaf hawksbeard	
Crepis runcinata ssp. *runcinata*	fiddleleaf hawksbeard	
Cryptantha bakeri	Baker's cryptantha	
Cryptantha cinerea	James' cryptantha	
Cryptantha cinerea var. *jamesii*	James' cryptantha	
Cryptantha cinerea var. *pustulosa*	James' cryptantha	
Cryptantha fendleri	sanddune cryptantha	
Cryptantha minima	little cryptantha	
Cryptantha weberi	Weber's cryptantha	
Cryptogramma acrostichoides	American rockbrake	
Cycloloma atriplicifolium	winged pigweed	
Cymopterus acaulis	plains springparsley	
Cymopterus montanus	mountain springparsley	

Scientific Name	*English Name*	*Status*
Cynoglossum officinale	gypsyflower	
Cyperus squarrosus	bearded flatsedge	
Cystopteris fragilis	brittle bladderfern	
Cystopteris reevesiana	Reeves' bladderfern	
Dalea leporina	foxtail prairie clover	
Danthonia californica	California oatgrass	
Danthonia intermedia	timber oatgrass	
Danthonia parryi	Parry's oatgrass	
Dasiphora fruticosa	shrubby cinquefoil	
Dasiphora fruticosa ssp. *floribunda*	shrubby cinquefoil	
Delphinium alpestre	Colorado larkspur	
Delphinium barbeyi	subalpine larkspur	
Delphinium nuttallianum	twolobe larkspur	
Delphinium ramosum	mountain larkspur	
Delphinium robustum	Wahatoya Creek larkspur	
Deschampsia cespitosa	tufted hairgrass	
Descurainia incana	mountain tansymustard	
Descurainia incana ssp. *incisa*	mountain tansymustard	
Descurainia incana ssp. *viscosa*	mountain tansymustard	
Descurainia pinnata	western tansymustard	
Descurainia pinnata ssp. *filipes*	western tansymustard	
Descurainia ramosissima	Villa Grove tansymustard	
Distichlis spicata	saltgrass	
Dodecatheon pulchellum	darkthroat shootingstar	
Dodecatheon pulchellum ssp. *pulchellum*	darkthroat shootingstar	
Draba aurea	golden draba	
Draba crassa	thickleaf draba	
Draba crassifolia	snowbed draba	
Draba fladnizensis	Austrian draba	
Draba grayana	Gray's draba	
Draba helleriana	Heller's draba	
Draba helleriana var. *helleriana*	Heller's draba	
Draba rectifructa	mountain draba	
Draba smithii	Smith's draba	
Draba spectabilis	showy draba	
Draba streptobrachia	alpine tundra draba	
Draba streptocarpa	pretty draba	
Dracocephalum parviflorum	American dragonhead	
Dryas octopetala	eightpetal mountain-avens	
Dryas octopetala ssp. *hookeriana*	Hooker's mountain-avens	
Dryopteris filix-mas	male fern	
Dyssodia papposa	fetid marigold	
Echinocereus triglochidiatus	kingcup cactus	
Echinocereus triglochidiatus var. *triglochidiatus*	kingcup cactus	
Echinocereus viridiflorus	nylon hedgehog cactus	
Echinocereus viridiflorus var. *viridiflorus*	nylon hedgehog cactus	

Scientific Name	*English Name*	*Status*
Echinochloa crus-galli	barnyardgrass	
Echinocystis lobata	wild cucumber	
Elaeagnus commutata	silverberry	
Eleocharis acicularis	needle spikerush	
Eleocharis palustris	common spikerush	
Eleocharis palustris var. *palustris*	common spikerush	
Eleocharis quinqueflora	fewflower spikerush	
×*Elyhordeum macounii*	Macoun's barley	
Elymus canadensis	Canada wildrye	
Elymus elymoides	squirreltail	
Elymus elymoides ssp. *brevifolius*	squirreltail	
Elymus lanceolatus	thickspike wheatgrass	
Elymus lanceolatus ssp. *lanceolatus*	thickspike wheatgrass	
Elymus repens	quackgrass	
Elymus scribneri	spreading wheatgrass	
Elymus trachycaulus	slender wheatgrass	
Elymus trachycaulus ssp. *trachycaulus*	slender wheatgrass	
Epilobium brachycarpum	tall annual willowherb	
Epilobium ciliatum	fringed willowherb	
Epilobium ciliatum ssp. *glandulosum*	fringed willowherb	
Epilobium halleanum	glandular willowherb	
Epilobium hornemannii	Hornemann's willowherb	
Epilobium hornemannii ssp. *hornemannii*	Hornemann's willowherb	
Epilobium saximontanum	Rocky Mountain willowherb	
Equisetum arvense	field horsetail	
Equisetum hyemale	scouringrush horsetail	
Equisetum hyemale var. *affine*	scouringrush horsetail	
Equisetum laevigatum	smooth horsetail	
Equisetum pratense	meadow horsetail	
Equisetum variegatum	variegated scouringrush	
Equisetum variegatum var. *variegatum*	variegated scouringrush	
Eragrostis pilosa	Indian lovegrass	
Ericameria nauseosa	rubber rabbitbrush	
Ericameria nauseosa ssp. *consimilis*	rubber rabbitbrush	
Ericameria nauseosa ssp. *consimilis* var. *oreophila*	rubber rabbitbrush	
Ericameria nauseosa ssp. *nauseosa*	rubber rabbitbrush	
Ericameria nauseosa ssp. *nauseosa* var. *bigelovii*	rubber rabbitbrush	
Ericameria nauseosa ssp. *nauseosa* var. *glabrata*	rubber rabbitbrush	
Ericameria nauseosa ssp. *nauseosa* var. *nauseosa*	rubber rabbitbrush	
Ericameria parryi	Parry's rabbitbrush	
Ericameria parryi var. *affinis*	Parry's rabbitbrush	
Ericameria parryi var. *parryi*	Parry's rabbitbrush	
Erigeron acris	bitter fleabane	
Erigeron acris ssp. *debilis*	bitter fleabane	
Erigeron acris ssp. *politus*	bitter fleabane	
Erigeron canus	hoary fleabane	

Scientific Name	*English Name*	*Status*
Erigeron colomexicanus	running fleabane	
Erigeron compositus	cutleaf daisy	
Erigeron coulteri	large mountain fleabane	
Erigeron divergens	spreading fleabane	
Erigeron elatior	tall fleabane	
Erigeron engelmannii	Engelmann's fleabane	
Erigeron engelmannii var. *engelmannii*	Engelmann's fleabane	
Erigeron eximius	sprucefir fleabane	
Erigeron flagellaris	trailing fleabane	
Erigeron formosissimus	beautiful fleabane	
Erigeron glabellus	streamside fleabane	
Erigeron leiomerus	rockslide yellow fleabane	
Erigeron lonchophyllus	shortray fleabane	
Erigeron melanocephalus	blackhead fleabane	
Erigeron peregrinus	subalpine fleabane	
Erigeron peregrinus ssp. *callianthemus*	subalpine fleabane	
Erigeron peregrinus ssp. *callianthemus* var. *callianthemus*	subalpine fleabane	
Erigeron philadelphicus	Philadelphia fleabane	
Erigeron philadelphicus var. *philadelphicus*	Philadelphia fleabane	
Erigeron pinnatisectus	featherleaf fleabane	
Erigeron pumilus	shaggy fleabane	
Erigeron pumilus ssp. *pumilus*	shaggy fleabane	
Erigeron simplex	onestem fleabane	
Erigeron speciosus	aspen fleabane	
Erigeron speciosus var. *speciosus*	aspen fleabane	
Erigeron subtrinervis	threenerve fleabane	
Erigeron subtrinervis var. *subtrinervis*	threenerve fleabane	
Erigeron ursinus	Bear River fleabane	
Erigeron vetensis	early bluetop fleabane	
Erigeron vreelandii	Vreeland's erigeron	
Eriodictyon angustifolium	narrowleaf yerba santa	
Eriogonum alatum	winged buckwheat	
Eriogonum alatum var. *alatum*	winged buckwheat	
Eriogonum cernuum	nodding buckwheat	
Eriogonum cernuum var. *cernuum*	nodding buckwheat	
Eriogonum coloradense	Colorado buckwheat	
Eriogonum effusum	spreading buckwheat	
Eriogonum effusum var. *effusum*	spreading buckwheat	
Eriogonum jamesii	James' buckwheat	
Eriogonum jamesii var. *flavescens*	James' buckwheat	
Eriogonum jamesii var. *jamesii*	James' buckwheat	
Eriogonum jamesii var. *xanthum*	James' buckwheat	
Eriogonum lachnogynum	woollycup buckwheat	
Eriogonum microthecum	slender buckwheat	
Eriogonum racemosum	redroot buckwheat	
Eriogonum umbellatum	sulphur-flower buckwheat	

Scientific Name	*English Name*	*Status*
Eriogonum umbellatum var. *aureum*	sulphur-flower buckwheat	
Eriogonum umbellatum var. *majus*	sulphur-flower buckwheat	
Eriogonum umbellatum var. *umbellatum*	sulphur-flower buckwheat	
Eriophorum angustifolium	tall cottongrass	
Eriophorum angustifolium ssp. *angustifolium*	tall cottongrass	
Eritrichium nanum	arctic alpine forget-me-not	
Erysimum capitatum	sanddune wallflower	
Erysimum capitatum var. *capitatum*	sanddune wallflower	
Erysimum cheiranthoides	wormseed wallflower	
Erysimum inconspicuum	shy wallflower	
Erysimum inconspicuum var. *inconspicuum*	shy wallflower	
Escobaria vivipara	spinystar	
Escobaria vivipara var. *vivipara*	spinystar	
Euphorbia brachycera	horned spurge	
Euthamia graminifolia	flat-top goldentop	
Euthamia graminifolia var. *graminifolia*	flat-top goldentop	
Euthamia occidentalis	western goldentop	
Fallugia paradoxa	Apache plume	
Festuca arizonica	Arizona fescue	
Festuca brachyphylla	alpine fescue	
Festuca brachyphylla ssp. *coloradensis*	Colorado fescue	
Festuca earlei	Earle's fescue	
Festuca idahoensis	Idaho fescue	
Festuca idahoensis ssp. *idahoensis*	Idaho fescue	
Festuca minutiflora	smallflower fescue	
Festuca rubra	red fescue	
Festuca saximontana	Rocky Mountain fescue	
Festuca sororia	ravine fescue	
Festuca thurberi	Thurber's fescue	
Fragaria vesca	woodland strawberry	
Fragaria vesca ssp. *bracteata*	woodland strawberry	
Fragaria virginiana	Virginia strawberry	
Fragaria virginiana ssp. *glauca*	Virginia strawberry	
Frasera speciosa	elkweed	
Gaillardia aristata	blanketflower	
Galium boreale	northern bedstraw	
Galium trifidum	threepetal bedstraw	
Galium trifidum ssp. *subbiflorum*	threepetal bedstraw	
Gaura coccinea	scarlet beeblossom	
Gayophytum diffusum	spreading groundsmoke	
Gayophytum diffusum ssp. *parviflorum*	spreading groundsmoke	
Gayophytum ramosissimum	pinyon groundsmoke	
Gentiana affinis	pleated gentian	
Gentiana algida	whitish gentian	
Gentiana fremontii	moss gentian	
Gentiana parryi	Parry's gentian	

Scientific Name	*English Name*	*Status*
Gentiana prostrata	pygmy gentian	
Gentianella amarella	autumn dwarf gentian	
Gentianella amarella ssp. *acuta*	autumn dwarf gentian	
Gentianella amarella ssp. *heterosepala*	autumn dwarf gentian	
Gentianella tenella	Dane's dwarf gentian	
Gentianella tenella ssp. *tenella*	Dane's dwarf gentian	
Gentianopsis barbellata	perennial fringed gentian	
Gentianopsis thermalis	Rocky Mountain fringed gentian	
Geranium caespitosum	pineywoods geranium	
Geranium caespitosum var. *caespitosum*	pineywoods geranium	
Geranium richardsonii	Richardson's geranium	
Geum aleppicum	yellow avens	
Geum macrophyllum	largeleaf avens	
Geum macrophyllum var. *perincisum*	largeleaf avens	
Geum rivale	purple avens	
Geum rossii	Ross' avens	
Geum rossii var. *turbinatum*	Ross' avens	
Geum triflorum	old man's whiskers	
Geum triflorum var. *triflorum*	old man's whiskers	
Glaux maritima	sea milkwort	
Glyceria grandis	American mannagrass	
Glyceria grandis var. *grandis*	American mannagrass	
Glyceria striata	fowl mannagrass	
Glycyrrhiza lepidota	American licorice	
Gnaphalium uliginosum	marsh cudweed	
Goodyera oblongifolia	western rattlesnake plantain	
Goodyera repens	lesser rattlesnake plantain	
Gratiola neglecta	clammy hedgehyssop	
Grindelia decumbens	reclined gumweed	
Grindelia decumbens var. *decumbens*	reclined gumweed	
Grindelia nuda	curlytop gumweed	
Grindelia nuda var. *aphanactis*	curlytop gumweed	
Grindelia squarrosa	curlycup gumweed	
Gutierrezia sarothrae	broom snakeweed	
Gymnocarpium dryopteris	western oakfern	
Hackelia floribunda	manyflower stickseed	
Halogeton glomeratus	saltlover	
Hedysarum occidentale	western sweetvetch	
Helianthella parryi	Parry's dwarf-sunflower	
Helianthella quinquenervis	fivenerve helianthella	
Helianthus annuus	common sunflower	
Helianthus nuttallii	Nuttall's sunflower	
Helianthus petiolaris	prairie sunflower	
Heliomeris multiflora	showy goldeneye	
Heliotropium curassavicum	salt heliotrope	
Heliotropium curassavicum var. *obovatum*	seaside heliotrope	

Scientific Name	*English Name*	*Status*
Heracleum maximum	common cowparsnip	
Hesperostipa comata	needle and thread	
Hesperostipa comata ssp. *comata*	needle and thread	
Hesperostipa neomexicana	New Mexico feathergrass	
Heterotheca fulcrata	rockyscree false goldenaster	
Heterotheca pumila	alpine false goldenaster	
Heterotheca villosa	hairy false goldenaster	
Heterotheca villosa var. *minor*	hairy false goldenaster	
Heterotheca villosa var. *nana*	hairy false goldenaster	
Heterotheca villosa var. *villosa*	hairy false goldenaster	
Heuchera parvifolia	littleleaf alumroot	
Heuchera parvifolia var. *parvifolia*	littleleaf alumroot	
Hieracium gracile	slender hawkweed	
Hieracium gracile var. *gracile*	slender hawkweed	
Hierochloe hirta	northern sweetgrass	
Hierochloe hirta ssp. *arctica*	northern sweetgrass	
Hoffmannseggia glauca	Indian rushpea	
Holodiscus dumosus	rockspirea	
Hordeum brachyantherum	meadow barley	
Hordeum brachyantherum ssp. *brachyantherum*	meadow barley	
Hordeum jubatum	foxtail barley	
Hordeum jubatum ssp. *jubatum*	foxtail barley	
Humulus lupulus	common hop	
Humulus lupulus var. *neomexicanus*	common hop	
Hydrophyllum fendleri	Fendler's waterleaf	
Hydrophyllum fendleri var. *fendleri*	Fendler's waterleaf	
Hymenopappus filifolius	fineleaf hymenopappus	
Hymenopappus filifolius var. *cinereus*	fineleaf hymenopappus	
Hymenopappus filifolius var. *parvulus*	fineleaf hymenopappus	
Hymenopappus newberryi	Newberry's hymenopappus	
Hymenoxys helenioides	Intermountain rubberweed	
Hymenoxys hoopesii	owl's-claws	
Hymenoxys richardsonii	pingue rubberweed	
Hymenoxys richardsonii var. *richardsonii*	pingue rubberweed	
Hyoscyamus niger	black henbane	
Hypericum scouleri	Scouler's St. Johnswort	
Hypericum scouleri ssp. *nortoniae*	Norton's St. Johnswort	
Ipomopsis aggregata	scarlet gilia	
Ipomopsis aggregata ssp. *candida*	scarlet gilia	
Ipomopsis aggregata ssp. *collina*	scarlet gilia	
Ipomopsis longiflora	flaxflowered ipomopsis	
Ipomopsis longiflora ssp. *longiflora*	flaxflowered ipomopsis	
Ipomopsis multiflora	manyflowered ipomopsis	
Iris missouriensis	Rocky Mountain iris	
Iva axillaris	povertyweed	
Ivesia gordonii	Gordon's ivesia	

Scientific Name	*English Name*	*Status*
Jamesia americana	fivepetal cliffbush	
Jamesia americana var. *americana*	fivepetal cliffbush	
Juncus arcticus	arctic rush	
Juncus arcticus ssp. *littoralis*	mountain rush	
Juncus bufonius	toad rush	
Juncus bufonius var. *bufonius*	toad rush	
Juncus castaneus	chestnut rush	
Juncus castaneus ssp. *castaneus*	chestnut rush	
Juncus castaneus ssp. *castaneus* var. *castaneus*	chestnut rush	
Juncus drummondii	Drummond's rush	
Juncus interior	inland rush	
Juncus longistylis	longstyle rush	
Juncus longistylis var. *longistylis*	longstyle rush	
Juncus mertensianus	Mertens' rush	
Juncus saximontanus	Rocky Mountain rush	
Juncus torreyi	Torrey's rush	
Juniperus communis	common juniper	
Juniperus communis var. *depressa*	common juniper	
Juniperus scopulorum	Rocky Mountain juniper	
Kalmia microphylla	alpine laurel	
Kobresia myosuroides	Bellardi bog sedge	
Koeleria macrantha	prairie Junegrass	
Krascheninnikovia lanata	winterfat	
Lactuca tatarica	blue lettuce	
Lactuca tatarica var. *pulchella*	blue lettuce	
Lappula occidentalis	flatspine stickseed	
Lappula occidentalis var. *occidentalis*	flatspine stickseed	
Lathyrus eucosmus	bush vetchling	
Lathyrus lanszwertii	Nevada pea	
Lathyrus lanszwertii var. *leucanthus*	Nevada pea	
Lathyrus latifolius	perennial pea	
Lemna minuta	least duckweed	
Lemna turionifera	turion duckweed	
Lepidium alyssoides	mesa pepperwort	
Lepidium alyssoides var. *alyssoides*	mesa pepperwort	
Lepidium densiflorum	common pepperweed	
Lepidium latifolium	broadleaved pepperweed	
Lepidium ramosissimum	manybranched pepperweed	
Leptochloa fusca	Malabar sprangletop	
Leptochloa fusca ssp. *fascicularis*	bearded sprangletop	
Leptosiphon nuttallii	Nuttall's linanthus	
Leptosiphon nuttallii ssp. *nuttallii*	Nuttall's linanthus	
Lesquerella montana	mountain bladderpod	
Levisticum officinale	garden lovage	
Lewisia pygmaea	alpine lewisia	
Leymus ambiguus	Colorado wildrye	

Scientific Name	*English Name*	*Status*
Leymus cinereus	basin wildrye	
Leymus triticoides	beardless wildrye	
Liatris punctata	dotted blazing star	
Ligusticum porteri	Porter's licorice-root	
Ligusticum porteri var. *porteri*	Porter's licorice-root	
Limosella aquatica	water mudwort	
Linanthus pungens	granite prickly phlox	
Linnaea borealis	twinflower	
Linnaea borealis ssp. *americana*	twinflower	
Linum australe	southern flax	
Linum australe var. *australe*	southern flax	
Linum lewisii	Lewis flax	
Linum lewisii var. *lewisii*	prairie flax	
Listera cordata	heartleaf twayblade	
Listera cordata var. *nephrophylla*	heartleaf twayblade	
Lithophragma tenellum	slender woodland-star	
Lithospermum incisum	narrowleaf stoneseed	
Lithospermum multiflorum	manyflowered stoneseed	
Lloydia serotina	common alplily	
Lloydia serotina var. *serotina*	common alplily	
Lonicera involucrata	twinberry honeysuckle	
Lonicera involucrata var. *involucrata*	twinberry honeysuckle	
Lupinus argenteus	silvery lupine	
Lupinus bakeri	Baker's lupine	
Lupinus bakeri ssp. *bakeri*	Baker's lupine	
Lupinus caespitosus	stemless dwarf lupine	
Lupinus caespitosus var. *caespitosus*	stemless dwarf lupine	
Lupinus caudatus	tailcup lupine	
Lupinus kingii	King's lupine	
Lupinus pusillus	rusty lupine	
Lupinus pusillus ssp. *pusillus*	rusty lupine	
Lupinus sericeus	silky lupine	
Lupinus sericeus ssp. *sericeus*	silky lupine	
Luzula parviflora	smallflowered woodrush	
Luzula spicata	spiked woodrush	
Lycopus asper	rough bugleweed	
Lygodesmia juncea	rush skeletonplant	
Machaeranthera bigelovii	Bigelow's tansyaster	
Machaeranthera bigelovii var. *bigelovii*	Bigelow's tansyaster	
Machaeranthera canescens	hoary tansyaster	
Machaeranthera canescens ssp. *glabra*	hoary tansyaster	
Machaeranthera canescens ssp. *glabra* var. *glabra*	hoary tansyaster	
Machaeranthera coloradoensis	Colorado tansyaster	
Machaeranthera coloradoensis var. *coloradoensis*	Colorado tansyaster	
Machaeranthera parviflora	smallflower tansyaster	
Machaeranthera pinnatifida	lacy tansyaster	

Scientific Name	*English Name*	*Status*
Machaeranthera pinnatifida ssp. *pinnatifida*	lacy tansyaster	
Machaeranthera pinnatifida ssp. *pinnatifida* var. *pinnatifida*	lacy tansyaster	
Machaeranthera tanacetifolia	tanseyleaf tansyaster	
Mahonia repens	creeping barberry	
Maianthemum racemosum	feathery false lily of the valley	
Maianthemum racemosum ssp. *amplexicaule*	feathery false lily of the valley	
Maianthemum stellatum	starry false lily of the valley	
Malva neglecta	common mallow	
Marsilea vestita	hairy waterclover	
Medicago sativa	alfalfa	
Medicago sativa ssp. *sativa*	alfalfa	
Melilotus officinalis	sweetclover	
Mentha arvensis	wild mint	
Mentzelia albicaulis	whitestem blazingstar	
Mentzelia multiflora	Adonis blazingstar	
Mentzelia multiflora var. *multiflora*	Adonis blazingstar	
Mentzelia nuda	bractless blazingstar	
Mentzelia rusbyi	Rusby's blazingstar	
Mentzelia speciosa	jeweled blazingstar	
Menyanthes trifoliata	buckbean	
Mertensia alpina	alpine bluebells	
Mertensia brevistyla	shortstyle bluebells	
Mertensia ciliata	tall fringed bluebells	
Mertensia ciliata var. *ciliata*	tall fringed bluebells	
Mertensia franciscana	Franciscan bluebells	
Mertensia lanceolata	prairie bluebells	
Mertensia lanceolata var. *lanceolata*	prairie bluebells	
Mertensia oblongifolia	oblongleaf bluebells	
Mimulus floribundus	manyflowered monkeyflower	
Mimulus glabratus	roundleaf monkeyflower	
Mimulus guttatus	seep monkeyflower	
Minuartia obtusiloba	twinflower sandwort	
Minuartia rubella	beautiful sandwort	
Mirabilis linearis	narrowleaf four o'clock	
Mirabilis multiflora	Colorado four o'clock	
Mirabilis oxybaphoides	smooth spreading four o'clock	
Mitella pentandra	fivestamen miterwort	
Mitella stauropetala	smallflower miterwort	
Mitella stauropetala var. *stenopetala*	drywoods miterwort	
Moehringia lateriflora	bluntleaf sandwort	
Moehringia macrophylla	largeleaf sandwort	
Monarda fistulosa	wild bergamot	
Monarda fistulosa ssp. *fistulosa*	wild bergamot	
Monarda fistulosa ssp. *fistulosa* var. *menthifolia*	mintleaf bergamot	
Monarda pectinata	pony beebalm	

Scientific Name	*English Name*	*Status*
Moneses uniflora	single delight	
Monolepis nuttalliana	Nuttall's povertyweed	
Monotropa hypopithys	pinesap	
Montia chamissoi	water minerslettuce	
Muhlenbergia andina	foxtail muhly	
Muhlenbergia asperifolia	scratchgrass	
Muhlenbergia brevis	short muhly	
Muhlenbergia filiculmis	slimstem muhly	
Muhlenbergia filiformis	pullup muhly	
Muhlenbergia minutissima	annual muhly	
Muhlenbergia montana	mountain muhly	
Muhlenbergia pungens	sandhill muhly	
Muhlenbergia richardsonis	mat muhly	
Muhlenbergia torreyi	ring muhly	
Munroa squarrosa	false buffalograss	
Myriophyllum sibiricum	shortspike watermilfoil	
Nassella viridula	green needlegrass	
Nasturtium officinale	watercress	
Neoparrya lithophila	Bill's neoparrya	
Noccaea montana	alpine pennycress	
Noccaea montana var. *montana*	alpine pennycress	
Nuphar lutea	yellow pond-lily	
Nuphar lutea ssp. *polysepala*	Rocky Mountain pond-lily	
Oenothera albicaulis	whitest evening primrose	
Oenothera caespitosa	tufted evening primrose	
Oenothera caespitosa ssp. *caespitosa*	tufted evening primrose	
Oenothera coronopifolia	crownleaf evening primrose	
Oenothera elata	Hooker's evening primrose	
Oenothera elata ssp. *hirsutissima*	Hooker's evening primrose	
Oenothera flava	yellow evening primrose	
Oenothera flava ssp. *flava*	yellow evening primrose	
Oenothera pallida	pale evening primrose	
Oenothera pallida ssp. *runcinata*	pale evening primrose	
Oenothera villosa	hairy evening primrose	
Oenothera villosa ssp. *strigosa*	hairy evening primrose	
Opuntia polyacantha	plains pricklypear	
Opuntia polyacantha var. *polyacantha*	hairspine pricklypear	
Oreochrysum parryi	Parry's goldenrod	
Oreoxis alpina	alpine oreoxis	
Oreoxis alpina ssp. *alpina*	alpine oreoxis	
Oreoxis alpina ssp. *puberulenta*	alpine oreoxis	
Oreoxis bakeri	Baker's alpineparsley	
Orobanche fasciculata	clustered broomrape	
Orthilia secunda	sidebells wintergreen	
Orthocarpus luteus	yellow owl's-clover	
Oryzopsis asperifolia	roughleaf ricegrass	

Scientific Name	*English Name*	*Status*
Osmorhiza depauperata	bluntseed sweetroot	
Oxypolis fendleri	Fendler's cowbane	
Oxyria digyna	alpine mountainsorrel	
Oxytropis campestris	field locoweed	
Oxytropis deflexa	nodding locoweed	
Oxytropis deflexa var. *sericea*	blue nodding locoweed	
Oxytropis lambertii	purple locoweed	
Oxytropis lambertii var. *lambertii*	purple locoweed	
Oxytropis parryi	Parry's oxytrope	
Oxytropis sericea	white locoweed	
Oxytropis sericea var. *sericea*	white locoweed	
Oxytropis splendens	showy locoweed	
Packera cana	woolly groundsel	
Packera crocata	saffron ragwort	
Packera dimorphophylla	splitleaf groundsel	
Packera dimorphophylla var. *intermedia*	splitleaf groundsel	
Packera fendleri	Fendler's ragwort	
Packera neomexicana	New Mexico groundsel	
Packera neomexicana var. *mutabilis*	New Mexico groundsel	
Packera pseudaurea	falsegold groundsel	
Packera pseudaurea var. *pseudaurea*	falsegold groundsel	
Packera streptanthifolia	Rocky Mountain groundsel	
Packera tridenticulata	threetooth ragwort	
Packera werneriifolia	hoary groundsel	
Parietaria pensylvanica	Pennsylvania pellitory	
Parnassia palustris	marsh grass of Parnassus	
Parnassia palustris var. *montanensis*	mountain grass of Parnassus	
Paronychia pulvinata	Rocky Mountain nailwort	
Paronychia sessiliflora	creeping nailwort	
Parthenium tetraneuris	Arkansas River feverfew	
Pascopyrum smithii	western wheatgrass	
Pastinaca sativa	wild parsnip	
Paxistima myrsinites	Oregon boxleaf	
Pectis angustifolia	lemonscent	
Pectis angustifolia var. *angustifolia*	narrowleaf pectis	
Pedicularis canadensis	Canadian lousewort	
Pedicularis canadensis ssp. *fluviatilis*	Canadian lousewort	
Pedicularis crenulata	meadow lousewort	
Pedicularis groenlandica	elephanthead lousewort	
Pedicularis parryi	Parry's lousewort	
Pedicularis parryi ssp. *parryi*	Parry's lousewort	
Pedicularis procera	giant lousewort	
Pedicularis racemosa	sickletop lousewort	
Pedicularis racemosa ssp. *alba*	sickletop lousewort	
Pediocactus simpsonii	mountain ball cactus	
Penstemon barbatus	beardlip penstemon	

Scientific Name	*English Name*	*Status*
Penstemon caespitosus	mat penstemon	
Penstemon griffinii	Griffin's beardtongue	
Penstemon hallii	Hall's beardtongue	
Penstemon procerus	littleflower penstemon	
Penstemon procerus var. *procerus*	pincushion beardtongue	
Penstemon rydbergii	Rydberg's penstemon	
Penstemon secundiflorus	sidebells penstemon	
Penstemon strictus	Rocky Mountain penstemon	
Penstemon unilateralis	oneside penstemon	
Penstemon whippleanus	Whipple's penstemon	
Pericome caudata	mountain tail-leaf	
Petasites frigidus	arctic sweet coltsfoot	
Petasites frigidus var. *sagittatus*	arrowleaf sweet coltsfoot	
Phacelia alba	white phacelia	
Phacelia bakeri	Baker's phacelia	
Phacelia glandulosa	glandular phacelia	
Phacelia glandulosa var. *glandulosa*	glandular phacelia	
Phacelia heterophylla	varileaf phacelia	
Phacelia heterophylla ssp. *heterophylla*	varileaf phacelia	
Phacelia sericea	silky phacelia	
Phacelia sericea ssp. *sericea*	silky phacelia	
Phalaris arundinacea	reed canarygrass	
Phleum alpinum	alpine timothy	
Phleum pratense	timothy	
Phlox austromontana	mountain phlox	
Phlox condensata	dwarf phlox	
Phlox hoodii	spiny phlox	
Phlox pulvinata	cushion phlox	
Physaria floribunda	pointtip twinpod	
Physocarpus monogynus	mountain ninebark	
Picea engelmannii	Engelmann spruce	
Picea engelmannii var. *engelmannii*	Engelmann spruce	
Picea pungens	blue spruce	
Picradeniopsis oppositifolia	oppositeleaf bahia	
Pinus aristata	bristlecone pine	
Pinus edulis	twoneedle pinyon	
Pinus flexilis	limber pine	
Pinus ponderosa	ponderosa pine	
Pinus ponderosa var. *brachyptera*	ponderosa pine	
Pinus ponderosa var. *scopulorum*	ponderosa pine	
Pinus strobiformis	southwestern white pine	
Piptatherum micranthum	littleseed ricegrass	
Piptatherum pungens	mountain ricegrass	
Plagiobothrys scouleri	Scouler's popcornflower	
Plagiobothrys scouleri var. *hispidulus*	sleeping popcornflower	
Plantago eriopoda	redwool plantain	

Scientific Name	*English Name*	*Status*
Plantago major	common plantain	
Platanthera dilatata	scentbottle	
Platanthera dilatata var. *albiflora*	scentbottle	
Platanthera obtusata	bluntleaved orchid	
Platanthera obtusata ssp. *obtusata*	bluntleaved orchid	
Platanthera sparsiflora	sparse-flowered bog orchid	
Platanthera sparsiflora var. *ensifolia*	sparse-flowered bog orchid	
Poa alpina	alpine bluegrass	
Poa annua	annual bluegrass	
Poa arctica	arctic bluegrass	
Poa arctica ssp. *aperta*	arctic bluegrass	
Poa compressa	Canada bluegrass	
Poa fendleriana	muttongrass	
Poa glauca	glaucous bluegrass	
Poa glauca ssp. *rupicola*	timberline bluegrass	
Poa leptocoma	marsh bluegrass	
Poa lettermanii	Letterman's bluegrass	
Poa nemoralis	wood bluegrass	
Poa nemoralis ssp. *interior*	inland bluegrass	
Poa palustris	fowl bluegrass	
Poa pratensis	Kentucky bluegrass	
Poa pratensis ssp. *pratensis*	Kentucky bluegrass	
Poa reflexa	nodding bluegrass	
Poa secunda	Sandberg bluegrass	
Podistera eastwoodiae	Eastwood's podistera	
Polemonium brandegeei	Brandegee's Jacob's-ladder	
Polemonium confertum	Rocky Mountain Jacob's-ladder	
Polemonium foliosissimum	towering Jacob's-ladder	
Polemonium occidentale	western polemonium	
Polemonium occidentale ssp. *occidentale*	western polemonium	
Polemonium pulcherrimum	Jacob's-ladder	
Polemonium pulcherrimum ssp. *delicatum*	Jacob's-ladder	
Polemonium viscosum	sticky polemonium	
Polygonum amphibium	water knotweed	
Polygonum amphibium var. *emersum*	longroot smartweed	
Polygonum arenastrum	oval-leaf knotweed	
Polygonum argyrocoleon	silversheath knotweed	
Polygonum bistortoides	American bistort	
Polygonum douglasii	Douglas' knotweed	
Polygonum pensylvanicum	Pennsylvania smartweed	
Polygonum persicaria	spotted ladysthumb	
Polygonum viviparum	alpine bistort	
Populus ×*acuminata*	lanceleaf cottonwood	
Populus angustifolia	narrowleaf cottonwood	
Populus tremuloides	quaking aspen	
Portulaca oleracea	little hogweed	

Scientific Name	*English Name*	*Status*
Potamogeton alpinus	alpine pondweed	
Potamogeton foliosus	leafy pondweed	
Potamogeton foliosus ssp. *foliosus*	leafy pondweed	
Potamogeton nodosus	longleaf pondweed	
Potamogeton pusillus	small pondweed	
Potamogeton pusillus ssp. *pusillus*	small pondweed	
Potentilla ambigens	silkyleaf cinquefoil	
Potentilla concinna	elegant cinquefoil	
Potentilla concinna var. *concinna*	elegant cinquefoil	
Potentilla diversifolia	varileaf cinquefoil	
Potentilla diversifolia var. *diversifolia*	varileaf cinquefoil	
Potentilla gracilis	slender cinquefoil	
Potentilla hippiana	woolly cinquefoil	
Potentilla hippiana var. *hippiana*	woolly cinquefoil	
Potentilla norvegica	Norwegian cinquefoil	
Potentilla norvegica ssp. *monspeliensis*	Norwegian cinquefoil	
Potentilla paradoxa	Paradox cinquefoil	
Potentilla pensylvanica	Pennsylvania cinquefoil	
Potentilla pensylvanica var. *pensylvanica*	Pennsylvania cinquefoil	
Potentilla plattensis	Platte River cinquefoil	
Potentilla pulcherrima	beautiful cinquefoil	
Potentilla rivalis	brook cinquefoil	
Potentilla subjuga	Colorado cinquefoil	
Potentilla uniflora	oneflower cinquefoil	
Primula angustifolia	alpine primrose	
Primula parryi	Parry's primrose	
Prunella vulgaris	common selfheal	
Prunella vulgaris ssp. *lanceolata*	lance selfheal	
Prunus pensylvanica	pin cherry	
Prunus pensylvanica var. *pensylvanica*	pin cherry	
Prunus virginiana	chokecherry	
Prunus virginiana var. *melanocarpa*	black chokecherry	
Psathyrostachys juncea	Russian wildrye	
Pseudocymopterus montanus	alpine false springparsley	
Pseudotsuga menziesii	Douglas-fir	
Pseudotsuga menziesii var. *glauca*	Rocky Mountain Douglas-fir	
Psoralidium lanceolatum	lemon scurfpea	
Pteridium aquilinum	western brackenfern	
Pteridium aquilinum var. *pubescens*	hairy brackenfern	
Pterospora andromedea	woodland pinedrops	
Pteryxia hendersonii	Henderson's wavewing	
Puccinellia nuttalliana	Nuttall's alkaligrass	
Pulsatilla patens	eastern pasqueflower	
Pulsatilla patens ssp. *multifida*	cutleaf anemone	
Pyrola asarifolia	liverleaf wintergreen	
Pyrola asarifolia ssp. *asarifolia*	liverleaf wintergreen	

Scientific Name	*English Name*	*Status*
Pyrola chlorantha	greenflowered wintergreen	
Pyrola minor	snowline wintergreen	
Pyrrocoma clementis	tranquil goldenweed	
Pyrrocoma clementis var. *clementis*	tranquil goldenweed	
Pyrrocoma lanceolata	lanceleaf goldenweed	
Pyrrocoma lanceolata var. *lanceolata*	lanceleaf goldenweed	
Pyrrocoma uniflora	plantain goldenweed	
Pyrrocoma uniflora var. *uniflora*	plantain goldenweed	
Quercus gambelii	Gambel oak	
Quercus gambelii var. *gambelii*	Gambel oak	
Ranunculus abortivus	littleleaf buttercup	
Ranunculus alismifolius	plantainleaf buttercup	
Ranunculus alismifolius var. *montanus*	waterplantain buttercup	
Ranunculus cardiophyllus	heartleaf buttercup	
Ranunculus cymbalaria	alkali buttercup	
Ranunculus gmelinii	Gmelin's buttercup	
Ranunculus hyperboreus	high northern buttercup	
Ranunculus inamoenus	graceful buttercup	
Ranunculus macauleyi	Rocky Mountain buttercup	
Ranunculus macounii	Macoun's buttercup	
Ranunculus sceleratus	cursed buttercup	
Ranunculus sceleratus var. *multifidus*	cursed buttercup	
Ranunculus sceleratus var. *sceleratus*	cursed buttercup	
Ranunculus trichophyllus	threadleaf crowfoot	
Ranunculus trichophyllus var. *trichophyllus*	threadleaf crowfoot	
Ranunculus uncinatus	woodland buttercup	
Redfieldia flexuosa	blowout grass	
Rhinanthus minor	little yellow rattle	
Rhinanthus minor ssp. *minor*	little yellow rattle	
Rhodiola integrifolia	ledge stonecrop	
Rhodiola rhodantha	redpod stonecrop	
Rhus trilobata	skunkbush sumac	
Rhus trilobata var. *trilobata*	skunkbush sumac	
Ribes aureum	golden currant	
Ribes cereum	wax currant	
Ribes cereum var. *pedicellare*	whisky currant	
Ribes inerme	whitestem gooseberry	
Ribes inerme var. *inerme*	whitestem gooseberry	
Ribes laxiflorum	trailing black currant	
Ribes leptanthum	trumpet gooseberry	
Ribes montigenum	gooseberry currant	
Ribes wolfii	Wolf's currant	
Rorippa alpina	alpine yellowcress	
Rorippa curvipes	bluntleaf yellowcress	
Rorippa curvipes var. *curvipes*	bluntleaf yellowcress	
Rorippa curvipes var. *truncata*	bluntleaf yellowcress	

Scientific Name	*English Name*	*Status*
Rorippa palustris	bog yellowcress	
Rorippa palustris ssp. *hispida*	hispid yellowcress	
Rorippa sinuata	spreading yellowcress	
Rorippa sphaerocarpa	roundfruit yellowcress	
Rosa acicularis	prickly rose	
Rosa acicularis ssp. *sayi*	prickly rose	
Rosa woodsii	Woods' rose	
Rosa woodsii var. *ultramontana*	Woods' rose	
Rubus deliciosus	delicious raspberry	
Rubus idaeus	American red raspberry	
Rubus idaeus ssp. *strigosus*	grayleaf red raspberry	
Rubus parviflorus	thimbleberry	
Rubus parviflorus var. *parviflorus*	thimbleberry	
Rudbeckia hirta	blackeyed Susan	
Rudbeckia hirta var. *pulcherrima*	blackeyed Susan	
Rudbeckia laciniata	cutleaf coneflower	
Rudbeckia laciniata var. *ampla*	cutleaf coneflower	
Rumex aquaticus	western dock	
Rumex aquaticus var. *fenestratus*	western dock	
Rumex densiflorus	denseflowered dock	
Rumex maritimus	golden dock	
Rumex salicifolius	willow dock	
Rumex salicifolius var. *mexicanus*	Mexican dock	
Rumex venosus	veiny dock	
Sagina saginoides	arctic pearlwort	
Sagittaria cuneata	arumleaf arrowhead	
Salix amygdaloides	peachleaf willow	
Salix bebbiana	Bebb willow	
Salix brachycarpa	shortfruit willow	
Salix brachycarpa var. *brachycarpa*	shortfruit willow	
Salix drummondiana	Drummond's willow	
Salix exigua	narrowleaf willow	
Salix geyeriana	Geyer willow	
Salix ligulifolia	strapleaf willow	
Salix lucida	shining willow	
Salix lucida ssp. *caudata*	greenleaf willow	
Salix monticola	park willow	
Salix nivalis	snow willow	
Salix orestera	Sierra willow	
Salix petrophila	alpine willow	
Salix planifolia	diamondleaf willow	
Salix planifolia ssp. *planifolia*	diamondleaf willow	
Salix scouleriana	Scouler's willow	
Salix wolfii	Wolf's willow	
Salsola tragus	prickly Russian thistle	
Salvia reflexa	lanceleaf sage	

Scientific Name	*English Name*	*Status*
Sambucus racemosa	red elderberry	
Sambucus racemosa var. *racemosa*	red elderberry	
Sarcobatus vermiculatus	greasewood	
Saxifraga bronchialis	yellowdot saxifrage	
Saxifraga bronchialis ssp. *austromontana*	matted saxifrage	
Saxifraga caespitosa	tufted alpine saxifrage	
Saxifraga caespitosa ssp. *delicatula*	tufted alpine saxifrage	
Saxifraga cernua	nodding saxifrage	
Saxifraga chrysantha	goldbloom saxifrage	
Saxifraga flagellaris	whiplash saxifrage	
Saxifraga flagellaris ssp. *crandallii*	Crandall's saxifrage	
Saxifraga odontoloma	brook saxifrage	
Saxifraga rhomboidea	diamondleaf saxifrage	
Saxifraga rivularis	weak saxifrage	
Schedonnardus paniculatus	tumblegrass	
Schizachyrium scoparium	little bluestem	
Schizachyrium scoparium var. *scoparium*	little bluestem	
Schkuhria multiflora	manyflower false threadleaf	
Schoenocrambe linearifolia	slimleaf plainsmustard	
Schoenoplectus acutus	hardstem bulrush	
Schoenoplectus acutus var. *acutus*	hardstem bulrush	
Schoenoplectus maritimus	cosmopolitan bulrush	
Schoenoplectus pungens	common threesquare	
Schoenoplectus pungens var. *longispicatus*	common threesquare	
Schoenoplectus tabernaemontani	softstem bulrush	
Scirpus microcarpus	panicled bulrush	
Scirpus nevadensis	Nevada bulrush	
Scrophularia lanceolata	lanceleaf figwort	
Scutellaria galericulata	marsh skullcap	
Sedum lanceolatum	spearleaf stonecrop	
Sedum lanceolatum ssp. *lanceolatum*	spearleaf stonecrop	
Selaginella densa	lesser spikemoss	
Selaginella weatherbiana	Weatherby's spikemoss	
Senecio amplectens	showy alpine ragwort	
Senecio amplectens var. *amplectens*	showy alpine ragwort	
Senecio amplectens var. *holmii*	Holm's ragwort	
Senecio atratus	tall blacktip ragwort	
Senecio bigelovii	nodding ragwort	
Senecio bigelovii var. *hallii*	Hall's ragwort	
Senecio crassulus	thickleaf ragwort	
Senecio eremophilus	desert ragwort	
Senecio eremophilus var. *kingii*	King's ragwort	
Senecio fremontii	dwarf mountain ragwort	
Senecio fremontii var. *blitoides*	dwarf mountain ragwort	
Senecio pudicus	bashful ragwort	
Senecio soldanella	Colorado ragwort	

Scientific Name	*English Name*	*Status*
Senecio spartioides	broom-like ragwort	
Senecio spartioides var. *multicapitatus*	broom-like ragwort	
Senecio taraxacoides	dandelion ragwort	
Senecio triangularis	arrowleaf ragwort	
Senecio wootonii	Wooton's ragwort	
Sesuvium verrucosum	verrucose seapurslane	
Setaria viridis	green bristlegrass	
Setaria viridis var. *viridis*	green bristlegrass	
Shepherdia canadensis	russet buffaloberry	
Sibbaldia procumbens	creeping sibbaldia	
Sidalcea candida	white checkerbloom	
Sidalcea neomexicana	salt spring checkerbloom	
Sidalcea neomexicana ssp. *neomexicana*	salt spring checkerbloom	
Silene acaulis	moss campion	
Silene acaulis var. *subacaulescens*	moss campion	
Silene drummondii	Drummond's campion	
Silene drummondii var. *drummondii*	Drummond's campion	
Silene menziesii	Menzies' campion	
Silene menziesii ssp. *menziesii*	Menzies' campion	
Silene menziesii ssp. *menziesii* var. *menziesii*	Menzies' campion	
Silene scouleri	simple campion	
Silene scouleri ssp. *hallii*	simple campion	
Sisymbrium altissimum	tall tumblemustard	
Sisyrinchium demissum	stiff blue-eyed grass	
Sisyrinchium montanum	strict blue-eyed grass	
Sisyrinchium montanum var. *montanum*	strict blue-eyed grass	
Sisyrinchium pallidum	pale blue-eyed grass	
Sium suave	hemlock waterparsnip	
Smelowskia calycina	alpine smelowskia	
Smelowskia calycina var. *americana*	American false candytuft	
Solanum triflorum	cutleaf nightshade	
Solidago canadensis	Canada goldenrod	
Solidago missouriensis	Missouri goldenrod	
Solidago multiradiata	Rocky Mountain goldenrod	
Solidago multiradiata var. *scopulorum*	manyray goldenrod	
Solidago simplex	Mt. Albert goldenrod	
Solidago simplex ssp. *simplex*	Mt. Albert goldenrod	
Solidago simplex ssp. *simplex* var. *simplex*	Mt. Albert goldenrod	
Solidago velutina	threenerve goldenrod	
Sonchus arvensis	field sowthistle	
Sonchus arvensis ssp. *uliginosus*	moist sowthistle	
Sophora nuttalliana	silky sophora	
Spartina gracilis	alkali cordgrass	
Sphaeralcea coccinea	scarlet globemallow	
Sphaeralcea coccinea ssp. *coccinea*	scarlet globemallow	
Sphaerophysa salsula	alkali swainsonpea	

Scientific Name	*English Name*	*Status*
Sphenopholis obtusata	prairie wedgescale	
Spiranthes romanzoffiana	hooded lady's tresses	
Sporobolus airoides	alkali sacaton	
Sporobolus contractus	spike dropseed	
Sporobolus cryptandrus	sand dropseed	
Stachys pilosa	hairy hedgenettle	
Stachys pilosa var. *pilosa*	hairy hedgenettle	
Stellaria calycantha	northern starwort	
Stellaria crassifolia	fleshy starwort	
Stellaria crassifolia var. *crassifolia*	fleshy starwort	
Stellaria longifolia	longleaf starwort	
Stellaria longifolia var. *longifolia*	longleaf starwort	
Stellaria longipes	longstalk starwort	
Stellaria longipes ssp. *longipes*	chickweed, starwort	
Stellaria umbellata	umbrella starwort	
Stephanomeria pauciflora	brownplume wirelettuce	
Streptopus amplexifolius	claspleaf twistedstalk	
Streptopus amplexifolius var. *chalazatus*	tubercle twistedstalk	
Suaeda calceoliformis	Pursh seepweed	
Suaeda moquinii	Mojave seablite	
Swertia perennis	felwort	
Symphoricarpos occidentalis	western snowberry	
Symphoricarpos rotundifolius	roundleaf snowberry	
Symphoricarpos rotundifolius var. *rotundifolius*	roundleaf snowberry	
Symphyotrichum ascendens	western aster	
Symphyotrichum boreale	northern bog aster	
Symphyotrichum eatonii	Eaton's aster	
Symphyotrichum ericoides	white heath aster	
Symphyotrichum ericoides var. *ericoides*	white heath aster	
Symphyotrichum falcatum	white prairie aster	
Symphyotrichum falcatum var. *falcatum*	white prairie aster	
Symphyotrichum foliaceum	alpine leafybract aster	
Symphyotrichum frondosum	short-rayed alkali aster	
Symphyotrichum lanceolatum	white panicle aster	
Symphyotrichum lanceolatum ssp. *hesperium*	white panicle aster	
Symphyotrichum lanceolatum ssp. *hesperium* var. *hesperium*	white panicle aster	
Symphyotrichum spathulatum	western mountain aster	
Symphyotrichum spathulatum var. *spathulatum*	western mountain aster	
Taraxacum lyratum	harp dandelion	
Taraxacum officinale	common dandelion	
Taraxacum officinale ssp. *ceratophorum*	common dandelion	
Tetradymia canescens	spineless horsebrush	
Tetraneuris acaulis	stemless four-nerve daisy	
Tetraneuris acaulis var. *acaulis*	stemless four-nerve daisy	
Tetraneuris acaulis var. *caespitosa*	caespitose four-nerve daisy	

Scientific Name	*English Name*	*Status*
Tetraneuris brandegeei	Brandegee's four-nerve daisy	
Tetraneuris grandiflora	graylocks four-nerve daisy	
Teucrium canadense	Canada germander	
Teucrium canadense var. *occidentale*	western germander	
Thalictrum alpinum	alpine meadow-rue	
Thalictrum fendleri	Fendler's meadow-rue	
Thalictrum fendleri var. *fendleri*	Fendler's meadow-rue	
Thalictrum sparsiflorum	fewflower meadow-rue	
Thalictrum sparsiflorum var. *saximontanum*	fewflower meadow-rue	
Thelesperma filifolium	stiff greenthread	
Thelesperma filifolium var. *intermedium*	stiff greenthread	
Thelesperma subnudum	Navajo tea	
Thelesperma subnudum var. *subnudum*	Navajo tea	
Thermopsis divaricarpa	spreadfruit goldenbanner	
Thermopsis montana	mountain goldenbanner	
Thermopsis montana var. *montana*	mountain goldenbanner	
Thermopsis rhombifolia	prairie thermopsis	
Thlaspi arvense	field pennycress	
Tonestus pygmaeus	pygmy goldenweed	
Townsendia eximia	tall Townsend daisy	
Townsendia exscapa	stemless Townsend daisy	
Townsendia grandiflora	largeflower Townsend daisy	
Townsendia hookeri	Hooker's Townsend daisy	
Townsendia leptotes	common Townsend daisy	
Tragopogon porrifolius	salsify	
Trautvetteria caroliniensis	Carolina bugbane	
Trautvetteria caroliniensis var. *occidentalis*	western bugbane	
Trifolium attenuatum	Rocky Mountain clover	
Trifolium brandegeei	Brandegee's clover	
Trifolium dasyphyllum	alpine clover	
Trifolium dasyphyllum ssp. *dasyphyllum*	alpine clover	
Trifolium hybridum	alsike clover	
Trifolium longipes	longstalk clover	
Trifolium longipes ssp. *pygmaeum*	pygmy clover	
Trifolium nanum	dwarf clover	
Trifolium parryi	Parry's clover	
Trifolium parryi ssp. *salictorum*	Parry's clover	
Trifolium repens	white clover	
Trifolium wormskioldii	cows clover	
Triglochin maritima	seaside arrowgrass	
Triglochin palustris	marsh arrowgrass	
Tripterocalyx micranthus	smallflower sandverbena	
Trisetum spicatum	spike trisetum	
Trollius laxus	American globeflower	
Trollius laxus ssp. *albiflorus*	American globeflower	
Typha latifolia	broadleaf cattail	

Scientific Name	*English Name*	*Status*
Urtica dioica	stinging nettle	
Urtica dioica ssp. *gracilis*	California nettle	
Utricularia ochroleuca	yellowishwhite bladderwort	
Vaccinium cespitosum	dwarf bilberry	
Vaccinium myrtillus	whortleberry	
Vaccinium scoparium	grouse whortleberry	
Valeriana acutiloba	sharpleaf valerian	
Valeriana acutiloba var. *acutiloba*	sharpleaf valerian	
Valeriana arizonica	Arizona valerian	
Valeriana edulis	tobacco root	
Valeriana edulis var. *edulis*	tobacco root	
Veratrum tenuipetalum	Colorado false hellebore	
Verbena bracteata	bigbract verbena	
Verbena macdougalii	MacDougal verbena	
Verbesina encelioides	golden crownbeard	
Verbesina encelioides ssp. *encelioides*	golden crownbeard	
Verbesina encelioides ssp. *exauriculata*	golden crownbeard	
Veronica americana	American speedwell	
Veronica peregrina	neckweed	
Veronica peregrina ssp. *xalapensis*	hairy purslane speedwell	
Veronica serpyllifolia	thymeleaf speedwell	
Veronica serpyllifolia ssp. *humifusa*	brightblue speedwell	
Veronica wormskjoldii	American alpine speedwell	
Veronica wormskjoldii var. *wormskjoldii*	American alpine speedwell	
Vicia americana	American vetch	
Vicia americana ssp. *americana*	American vetch	
Vicia sativa	garden vetch	
Vicia sativa ssp. *nigra*	garden vetch	
Viola adunca	hookedspur violet	
Viola adunca var. *adunca*	hookedspur violet	
Viola biflora	arctic yellow violet	
Viola biflora ssp. *biflora*	arctic yellow violet	
Viola canadensis	Canadian white violet	
Viola canadensis var. *scopulorum*	Canadian white violet	
Viola labradorica	alpine violet	
Viola macloskeyi	small white violet	
Viola macloskeyi ssp. *pallens*	smooth white violet	
Viola nephrophylla	northern bog violet	
Viola renifolia	white violet	
Woodsia oregana	Oregon cliff fern	
Woodsia oregana ssp. *cathcartiana*	Oregon cliff fern	
Woodsia scopulina	Rocky Mountain woodsia	
Yucca glauca	soapweed yucca	
Zigadenus elegans	mountain deathcamas	
Zigadenus elegans ssp. *elegans*	mountain deathcamas	